Safety Basis Strategy

Defense Waste Processing Facility Alternate Reductant Project

U-SBS-S-00003

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Revision 3 of this document is a complete rewrite, and therefore does not contain revision bars.

1.0 Purpose

This Safety Basis Strategy (SBS) addresses the safety basis (SB) considerations for the Alternate Reductant Project as well as the resolution of three Defense Waste Processing Facility (DWPF) Potential Inadequacies in the Safety Analysis (PISAs). The three PISAs include the Melter Feed Rate (PI-2014-0009), Retained Hydrogen (PI-2014-0013), and Antifoam Degradation Products (PI-2015-0009). Other than the work performed regarding the three PISAs, all activities to date have been limited to those activities deemed necessary to implement the Alternate Reductant Project.

The purpose of the SBS is to provide a common understanding of the management expectations, scope, roles and responsibilities, strategy and methods to be used for Alternate Reductant Project SB considerations incorporated with the final resolution of the aforementioned PISAs. The SBS is prepared in accordance with Manual 11Q, Procedure 1.10, Safety Basis Strategy (Ref. 1).

2.0 Description of Project

The Nitric-Formic Acid flowsheet is currently used at the U.S. Department of Energy (DOE) Savannah River Site (SRS) for preparing feed for the DWPF melter. A byproduct of using formic acid is the creation of considerable hydrogen, which is generated from the interaction of formic acid and trace quantities of noble metals. As a result, flammability controls are required for Chemical Process Cell (CPC) vessels, as well as the melter and melter offgas vessels, to manage the hazard of hydrogen (and other flammables) production. The key chemical steps in sludge feed preparation include: concentration of the raw radioactive waste, acid/base neutralization reactions, reduction and removal of mercury with formic acid, and adjustment of the reduction-oxidation (REDOX) state of the melter feed.

Late in the DWPF Nitric-Formic Acid flowsheet development, it was discovered that the flowsheet produces catalytic hydrogen in sufficient quantities to create a flammable gas concern in the CPC. Therefore, prior to facility start-up in 1996, extensive modifications to the process ventilation systems were required to dilute catalytic hydrogen produced from formic acid in the presence of noble metals (rhodium, ruthenium, palladium, and silver). In addition to the increased purge required, gas chromatographs (GCs) were required to monitor hydrogen to ensure that flammability limits were not exceeded.

The Alternate Reductant Project was initiated by Savannah River Remediation, LLC (SRR) to explore options for the replacement of the nitric-formic acid flowsheet used for the CPC at DWPF. The primary goal of the Alternate Reductant Project is to reduce operational hazards. The Alternate Reductant Project will replace formic acid in the CPC with ~70 wt.% glycolic acid and sufficient nitric acid for initial neutralization of the sludge feed, reduction of mercury, and to ensure melter REDOX (Fe^{II}/Fe^{tot}) is between 0.09 and 0.33 (existing range). The replacement of formic acid with glycolic acid will significantly reduce catalytic hydrogen generation in the CPC. Glycolic acid's role in the CPC will be sufficiently similar to that of formic acid that physical modifications will be minimal. Some additional benefits from the new flowsheet include: potential reduction of the required process vessel purges, potential downgrading of the functional

classification (or elimination) of the GCs, more favorable rheology (and consequently more concentrated feed to the melter), less surge of non-condensable gases from the melter cold cap, less foaming in the SRAT and SME, and more favorable flammability controls for both the melter and the CPC.

Three flammability-related PISAs were identified at DWPF in 2014-2015. The resolution approach of these PISAs will be discussed in this SBS. The three PISAs are listed below:

- Melter Feed Rate Temperature Correlation Basis (PI-2014-0009): this PISA existed because of inadequate representation of melter bubblers in the melter flammability model. Prior to implementation of the 2016 DWPF SB Annual Update, the melter flammability model was based on a melter feed rate, which was indirectly protected by a low melter vapor space temperature interlock. The basis for this interlock setpoint was a heat model that was performed by Savannah River National Laboratory using assumptions that were validated before the installation of the melter bubblers but were determined to be non-conservative under bubbled operations.

- Retained Hydrogen in the Vessels (PI-2014-0013): retention of hydrogen (due to lack of agitation) in DWPF vessels that contain sludge was not being adequately addressed or accounted for in the DWPF safety analysis prior to implementation of the 2016 DWPF SB Annual Update.

- Impact of Antifoam Degradation on Flammability (PI-2015-0009): degradation of antifoam used in DWPF processing to produce organic components was not evaluated in the DWPF CPC vessel flammability analysis prior to implementation of the 2016 DWPF SB Annual Update.

Prior to implementation of the 2016 DWPF SB Annual Update, the PISAs were addressed by compensatory measures given in the Evaluation of the Safety of the Situation (ESS) for the retained hydrogen (U-ESS-S-00002, Rev 2) and melter (U-ESS-S-00001, Rev 2) PISAs, and in the Justification of Continued Operations (JCO) (U-JCO-S-00002, Rev 1) for the antifoam PISA.

Replacing formic acid with glycolic acid is anticipated to aid in the final resolution of the PISAs, since the alternate flowsheet will dramatically reduce the primary flammability concern in the facility. Specifically, the reduction in catalytic hydrogen generation is expected to provide sufficient margin to account for the additional flammables that have been considered as part of the final PISA resolutions.

The JCO controls for the antifoam PISA designated Zone 1 Ventilation system as the 1st Level of Control (LOC) to mitigate waste release upon vessel explosion with the preventative controls for these explosion events as 2nd LOC in some scenarios. To incorporate the JCO controls and the ESS compensatory measures into the DSA in the 2016 SB Annual Update, the project team developed the technical basis to support the controls. This work included additional analysis of vessel explosions demonstrating that the Zone 1 Ventilation system would continue to perform its safety function of confining and directing contamination through the sand filter. However, this analysis also indicated that these vessel explosions could cause significant damage to other

structures, systems, and components in the vitrification building that could have a long-term impact on the ability of DWPF to perform its mission. Therefore, the controls in the 2016 DSA/TSR Annual Update which credit Zone 1 as a 1st LOC will be in place only until full implementation of the Glycolic Acid flowsheet (i.e., implementation of the Final Glycolic change in section 4.1 below) restores the preventative controls as a 1st LOC. Revision 3 of this SBS reflects a strategy that restores the preventive controls to 1st LOC and relegates Zone 1 Ventilation as a mitigative 2nd LOC.

It is important to note that this project is expected to involve limited physical design changes and is primarily a chemical process change.

3.0 Roles/Responsibilities

Design Authority (DA) is responsible for:

- Approving the SBS,
- Performing technical reviews and approval of the safety analysis and documents covered by this SBS,
- Providing technical inputs, participating in development, and overseeing the technical content of the documentation associated with the SBS, and
- Ensuring appropriate technical agencies are involved.

Project Manager is responsible for:

- The direction/scope of the activities covered by this SBS,
- Providing support to the Safety Basis Regulatory Authority (SBRA) in preparing the SBS,
- Defining facility/project boundaries,
- Providing support to the SBRA in defining process inputs and assumptions, and
- Providing support to the SBRA in defining project/schedule milestones

The DWPF Engineering Manager, or designee, is responsible for:

- Acting as the Design Agency representative,
- Management and review of facility inputs and assumptions for calculations and other documents that support the safety analysis required by the scope of this SBS, and
- Approving the SBS.

SBRA, or designee, is responsible for:

- Preparing the SBS and
- Ensuring the SBS gets the appropriate reviews and approvals

DWPF Facility Manager is responsible for:

- Providing the required knowledgeable resources to support the scheduled activities covered by this SBS and
- Providing review and responses to support the scheduled activities covered by this SBS.

4.0 SBS Overview

4.1. Goals and Objectives

The objective of this document is to define the SBS for Alternate Reductant Project implementation along with the resolution of the three DWPF PISAs. A summary of the three SB changes to complete all project items and PISA closures are given below:

1. The first SB change occurred as part of the 2016 Annual Update and designated Zone 1 Ventilation system as the 1st Level of Control (LOC) to mitigate waste release upon vessel explosion with the preventative controls for these explosion events as 2nd LOC in some scenarios. This control strategy relies on a reduction in design basis waste compositions. This project item is complete.

2. The second, or Interim Glycolic, SB change will allow for the use of formic, glycolic, or a combination of the two acids during processing under the current controls (see Assumption 1 in Section 5.2), including the controls incorporated in "1" above. This allows for a transition from formic acid to glycolic acid in DWPF.

3. The third, or Final Glycolic, SB change will account for the use of glycolic acid and the elimination of formic acid in processing. This SB change will make the necessary changes to return to design basis waste compositions or redefine design basis waste compositions to support projected operations. In addition, this Final Glycolic SB change will restore preventive control strategies (i.e., melter off-gas flammability control, antifoam addition control, and retained hydrogen program) as the 1st LOC with the Zone 1 Ventilation as a 2nd LOC mitigator.

For the 2016 Annual Update, a new Consolidated Hazard Analysis (CHA, Ref. 26) was developed by combining existing CHAs, and included hazards specific to the DWPF melter, antifoam additions in the DWPF, and retained hydrogen in DWPF vessels. For the Interim Glycolic SB changes, the CHA will be assessed by a CHA team per SCD-11 (Ref. 2) to identify the hazards associated with Interim Glycolic Acid implementation. The CHA (Ref. 26) will be amended to include the necessary changes. For the Final Glycolic SB change, a new CHA (Ref. 27) has been created and is currently on hold for implementation. This document was created to support a project milestone for 2016. However, it may be revised to reflect necessary changes (e.g., impact of glycolate thermolysis and radiolytic hydrogen generation rate (HGR)).

For the Final Glycolic SB change, several supporting calculations will be revised or developed for the purge analysis and consequence analysis. These will be coordinated with the Salt Waste Processing Facility (SWPF) project's purge/consequence calculations as appropriate (see Ref. 22). The consequence analysis will be revised to include new methodology for the dispersion data as described in Reference 13. The new methodology includes usage of the DOE-STD-1189 χ/Q value for the onsite receptor as well as a new χ/Q value for the offsite receptor based on 95th percentile meteorological data and 160-cm surface roughness (Refs. 13 and 14). Changes to the DWPF facility and any required controls identified in the CHAs will be documented in a change to the DWPF Final Safety Analysis Report (FSAR) and/or Technical Safety Requirement (TSR).

The Concentration, Storage, and Transfer Facilities (CSTF) and Saltstone Facility may require SB changes to support transition to the glycolic flowsheet due to impact of glycolate on radiolytic and thermolytic hydrogen generation rates. CHAs, Waste Acceptance Criteria (WAC) revisions, and flammability and consequence calculation revisions will be needed (See Section 5.2, Input 3).

4.2. Schedule and Milestones

Activities for the Alternate Reductant Project and PISA resolutions will be tracked in the project schedule. The declaration the HGR PISA (Ref. 20) necessitated a change in the order of SB submittals as well as additional technical basis documents to be developed to support the Gylcolic Acid flowsheet change. Thus, the Initial SWPF SB changes will be based on the current Formic Acid flowsheet. A 24-Month Nuclear Work Scope schedule, which includes major milestones associated with Alternate Reductant and SWPF, is featured in Reference 21. The SWPF SBS is discussed in detail per Reference 22.

Once the Interim Glycolic SB package is implemented, and several batches have been processed to reasonably remove formic acid from the system, it is expected that the Final Glycolic SB package will be implemented shortly thereafter. The schedule includes logic for activities necessary to determine potential control revisions including supporting vessel purge and consequence calculation revisions.

Any changes or additions to the activities will be handled through the project schedule and may require revision of the SBS. A change control process will be used to manage scope changes. Addition of new scope, significant changes to the existing scope, strategy, or assumptions outlined in this document including schedule changes will be documented, reviewed, and authorized by the Alternate Reductant Project Manager and the DWPF Engineering Manager, or designee. The need to revise this SBS will be at the discretion of the DWPF Engineering Manager.

5.0 SBS Approach

5.1. Hazard Review and Controls Identification

The CHAs performed in the project thus far, as well as future CHAs, have been and will be facilitated by a trained Consolidated Hazard Analysis Process (CHAP) Lead using an integrated team approach employing the appropriate hazard evaluation method. The CHA will be performed in accordance with DOE-STD-3009-94 (Ref. 7) following the methods outlined in SCD-11 (Ref. 2). Functional classification in the CHAPs to support the 2016 Annual Update and Interim Glycolic SB change have followed, and will continue to follow, the Code of Record used by the previous (pre-Annual Update) SB while the Final Glycolic SB change will be based on the current revision of Manual E7, Procedure 2.25A (Ref. 6) for the changes driven by the Project. The CHAP will include hazard identification, facility hazard categorization, screening of common industrial hazards, unmitigated and mitigated Hazard Analysis (HA), functional classification of Structures, Systems or Components (SSCs), and programs employed as controls for the associated hazards.

5.1.1. Hazard Categorization

The primary purpose of the Facility Hazard Categorization activity is to identify hazardous material inventories and to establish the facility Hazard Category (HC) per DOE-STD-1027-92 (Ref. 4) so that appropriate safety documentation can be prepared. Alternate Reductant Project and PISA resolution changes will primarily take place in the DWPF CPC and melter and potentially affect downstream activities. The DWPF CPC and melter are in a HC-2 segment of the DWPF facility. In addition to the impacts to the Vitrification building and downstream processes, the glycolic acid will be stored in the Cold Chemical Feed Storage Facility (422-S). These changes made in the Cold Chemical Feed Storage Facility will not challenge its hazard categorization of HC-3. Alternate Reductant Project and PISA resolution activities will not alter the Hazard Category or attempt to further segment the DWPF. The project is not expected to impact downstream HCs.

5.1.2. Controls Identification

This SBS is based on the assumption that the current formic acid flowsheet controls are bounding for the glycolic acid flowsheet. Therefore, there is no need for an intermediate set of Alternate Reductant controls with the exception of a potential change to the Melter Feed Contents control. (See Section 5.2 Assumption 1) The control set for the Final Glycolic submittal is expected to restore a preventive 1st LOC over the Zone 1 mitigator. The following controls are identified as having a high potential for revision or removal in the Final Glycolic submittal. Since the required CHAs have not been completed, this list may not be all-inclusive.

1. DWPF LCO 3.1.1 CPC Flammability Monitoring – The GCs are currently required to be operable per LCO 3.1.1. The operation will potentially no longer be required and the hydrogen concentration will be shown to be acceptable via calculation without the possibility of exceeding limits. This would be a potential opportunity for a reduction in controls. The GCs may no longer be needed.
2. DWPF LCO 3.1.3, 3.1.4, 3.1.5, 3.4.3 Purge Flows – Reduced catalytic hydrogen generation and potential inclusion of additional flammables may require changes to the purge flows. The lower HGR is a result of the removal of formic acid from the process. Surveillance Requirements (SRs) would similarly change.
3. DWPF LCO 3.1.6, 3.4.5 Purge Source –Changes to the purge flows will result in changes to the nitrogen inventory requirement. This would result in changes to LCO Conditions and SRs.
4. Melter Off-Gas Flammability Control Program (DWPF AC 5.8.2.37) – The resolution of the Melter Feed Rate PISA resulted in the change of an LCO-based control to a programmatic control. This change has been incorporated in the 2016 Annual Update. The transition to glycolic acid, as well as restoring a preventer as the 1st LOC, may require changes to the melter flammability strategy.
5. CSTF SAC 5.8.2.15 WAC – Addition of glycolate limit to the CSTF (and possibly Saltstone) WAC.

6. DWPF SAC 5.8.2.11 WAC – A more restrictive Inhalation Dose Potential (IDP) limit was implemented in the 2016 Annual Update in support of the ESS and JCO incorporation. The restriction will be removed or design basis IDP redefined upon implementation of the Final Glycolic SB change.
7. DWPF LCO 3.7.1 Zone 1 Ventilation – As part of the 2016 Annual Update submittal for incorporation of the ESS and JCO compensatory measures, the Zone 1 Ventilation System became a 1st LOC to mitigate the consequences from vessel explosions in the Vitrification Building. The advantage of employing a robust, engineered system as a 1st LOC was deemed preferable to a 1st LOC that was solely dependent on models and administrative programs. However, the control strategy for vessel explosions will utilize both controls. To support Zone 1 Ventilation as a 1st LOC, LCO 3.7.1 requires the operability of three Zone 1 Exhaust Fans. This operability requirement is reflected in the TSRs and was incorporated directly into the FSAR in the 2016 Annual Update. Use of a restricted IDP allows Zone 1 to remain SS even as a 1st LOC. Upon further development of preventive control strategies (i.e. melter off-gas flammability control, antifoam addition control, and retained hydrogen program) the control strategy for the Final Glycolic SB will restore a preventive 1st LOC over the Zone 1 mitigator. Also, SRR will evaluate removing the additional redundancy for the diesel generators and Zone 1 fans during the Final Glycolic SB implementation.
8. DWPF LCO 3.9.1 Standby Electrical Power - To support Zone 1 Ventilation as a 1st LOC, the LCO 3.9.1 requires the operability of both diesel generators at all times versus a single diesel as previously required. In addition, both air receiver pressure indicators must be operable, and the lube oil storage tanks must have an inventory of at least 25%. These operability requirements are reflected in the TSRs and were incorporated directly into the FSAR in the 2016 Annual Update. Upon further development of preventive control strategies (i.e. melter off-gas flammability control, antifoam addition control, and retained hydrogen program) the control strategy for the Final Glycolic SB will restore a preventive 1st LOC over the Zone 1 mitigator.
9. DWPF Administrative Control (Required by Retained Hydrogen ESS) – In order to protect DWPF vessels from flammable conditions due to the release of retained hydrogen, a quiescent time (or q-time) program was implemented during the 2016 Annual Update. The program allows for up to 13 days of non-agitation in DWPF CPC vessels before deliberate actions must be taken to prevent a potentially significant release of hydrogen from the waste from reaching LFL (or CLFL) in the vessel, mainly restoring agitation. Other actions include extending the q-time with additional engineering evaluation or managing the vessel vapor space with diffusion of the flammable gases into the CPC vapor space. The 13-day q-time bounded all conditions in the CPC vessels when processing Sludge Batch 8. The 13-day Q-time was later justified for Sludge Batch 9 (Ref. 19). Currently for Low Point Pump Pit vessels, minimum q-times are calculated based on sludge batch specific hydrogen generation rates, per Reference 17.

5.2. Process Inputs and Assumptions

The inputs and assumptions necessary to support the decisions made by the CHAP team will be documented in the CHAs. These will be validated as the project matures. Prior to issuance of the

final CHAs, the final design will be reviewed to ensure the CHA inputs and assumptions are accurate.

The inputs and assumptions for this SBS include:

1. As part of the Interim Glycolic SB change, the formic acid flowsheet controls are assumed to bound the glycolic acid flowsheet and no new intermediate control set will be required. This assumption is based on the formic acid controls remaining in place until heels containing formic acid are worked off and a transition to glycolic controls can be made. This assumption is reasonable as testing has shown low hydrogen generation from the glycolic acid flowsheet (Ref. 9). The current calculations determining the purge flows will be reviewed to ensure that the formic controls will be bounding. Additionally, testing to date has shown the surges of non-condensable gases from the melter cold cap are less than the surges under Formic Acid during bubbled operations (Ref. 15).
2. Formic acid is an impurity generally present in glycolic acid. This is due to the presence of formic acid in the production process. It is assumed that this quantity is negligible and poses no threat to the facility. This is based on testing performed to date which shows that the formic acid concentration in the glycolic acid is negligible (Ref. 9).
3. Several reports were written to address the impact of the Alternate Reductant Project on downstream facilities (Refs. 10, 11, 12, 18). These reports revealed that only minor CSTF and Saltstone CHAs/WAC changes would be needed to address the presence of glycolate. However, a PISA (Ref. 20) was declared in February 2017 that showed a potentially inadequate recognition of the effects of organics (e.g. formate) on hydrogen generation rate (HGR). This PISA demonstrated that the effect of formate on the assumed HGR (from both radiolysis and thermolysis) was being potentially underreported. Although this PISA was declared for the formic flowsheet only (since glycolic was not yet implemented), the same principle mechanisms of HGR (radiolysis/thermolysis) would need to be evaluated for glycolic as well. Therefore, the Interim and Final Glycolic Safety Bases will incorporate results from testing for glycolate impact to HGR in the DWPF, CSTF, and Saltstone. A separate SBS (Ref. 21) will address the strategy to incorporate formic-flowsheet HGR PISA closure activities into a SB submittal. The glycolic flowsheet submittals will build from this submittal, and will utilize glycolic-specific HGR R&D (Ref. 23) to update SB documentation (CHAs, WACs, flammability and consequence calcs, controls, etc) as necessary.
4. As part of the Final Glycolic SB change, the supporting calculations will need to be revised. Purge analysis will be revised to account for changes in the potential flammables, e.g., lower catalytic hydrogen generation rate, amount of organic antifoam degradation products present, etc. The consequence analysis will also be revised for any changes in the potential flammables as well as updates to the dispersion methodology per Reference 13 (for onsite and offsite receptors). In addition, there is the potential to redefine the current vessel explosion scenario in which one vessel explosion in the CPC propagates to all the vessels causing them to explode as well.
5. Chemical consequence analysis will be performed as necessary for the introduction of glycolic acid into the DWPF process. However, no additional controls are anticipated for chemical consequences.

6. Waste stream composition changes as a result of the SWPF will be considered in relation to the final control selection for the Alternate Reductant Project and PISA resolutions. During the CHAP discussions and calculation development for the Final Glycolic SB changes, the higher waste streams from Full SWPF will be considered. Reference 22 discusses this integration as well.

5.3. Documentation and Analysis

Changes to the existing DWPF FSAR/TSR and CSTF/Saltstone SB documents will be developed to incorporate the description, analyses, and controls, as applicable. The FSAR/TSR and any other SB changes will be produced in accordance with Manual 11Q, Procedure 1.01, Generation, Revision, Review, and Approval of SB Documents (Ref. 5), and supporting procedures. Several controls will likely require revisions as indicated in Section 5.1.2.

A Major Modification Evaluation (see Attachment A) was performed and concluded that the Alternate Reductant Project is not a Major Modification. Therefore, no Preliminary Documented Safety Analysis (PDSA) will be required.

The Alternate Reductant Project and PISA resolutions may require descriptive text changes to the criticality and fire protection analysis of DWPF. It is anticipated that the changes for the Alternate Reductant Project and PISAs will impact the DWPF Emergency Preparedness Hazards Assessment (EPHA) and possibly the criticality analysis of the 2H evaporator system. Revisions to criticality evaluations will be in accordance with SCD-3 (Ref. 8).

In Reference 24 the Department of Energy – Savannah River (DOE-SR) committed to ensure that significant new activities do not perpetuate the use of existing gaps until the DWPF and CSTF DSAs are upgraded to DOE-STD-3009-2014 (Ref. 25). Reference 24 also defined "significant new activities" in this context as:

> *"(a) physical modifications that involve new unit operations or flowsheet changes that involve significantly increased hazards, (b) represent Unreviewed Safety Questions (USQs), and (c) involve hazards that represent safety class concerns (i.e., the focus scope in OE-1:2015-1)."*

None of the scope of this SBS, either separately or in a cumulative fashion, warrants invoking the requirements of DOE-STD-3009-2014 earlier than currently projected in the next contract.

6.0 References

1. Manual 11Q, Procedure 1.10, Rev. 5, Safety Basis Strategy.
2. SCD-11, Rev. 14, Consolidated Hazard Analysis Process (CHAP) Program & Methods Manual.
3. Deleted.
4. DOE-STD-1027-92, Change Notice 1, Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports.

5. Manual 11Q, Procedure 1.01, Rev. 19, Generation, Revision, Review, and Approval of SB Documents.
6. Manual E7, Conduct of Engineering and Technical Support, Procedure, 2.25A, Rev. 1.
7. DOE-STD-3009-94, Change Notice 3, Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analysis.
8. SCD-3, Revision 29, Nuclear Criticality Safety Manual.
9. SRNL-STI-2013-00343, Rev. 0, FY13 Glycolic-Nitric Acid Flowsheet Demonstrations of the DWPF Chemical Process Cell with Simulants.
10. SRNL-STI-2013-00322, Rev. 0, Actual Waste Testing of Glycolate Impacts on the SRS Tank Farm.
11. SRNL-STI-2013-00166, Rev. 1, Simulated Waste Testing of Glycolate Impacts on the 2H Evaporator System.
12. SRNL-STI-2012-00218, Rev. 1, Determination of the Impact of Glycolate on ARP and MCU Operations.
13. U-SBS-G-00002, Rev. 0, Safety Basis Strategy Updated Total Effective Dose Factors.
14. S-ESR-G-00033, Rev. 0, Dispersion Modeling Project Implementation.
15. SRNL-STI-2014-00355, Rev. 0, DWPF Melter Off-Gas Flammability Model for the Nitric-Glycolic Acid Flowsheet.
16. DELETED
17. X-CLC-S-00329, Rev. 4, Quiescent Times for the Recycle Pump Tank and Sludge Pump Tank.
18. SRR-WSE-2015-00060, January 2016, Summary of Research and Development Testing Completed for Downstream Facilities for the DWPF Alternate Reductant Project.
19. X-ESR-S-00292, Rev. 0, Continued Application of 13-day Q-time for Sludge Batch 9 Considering Retention Rate
20. PI-2017-0004, Potentially Inadequate Recognition of the Effect of Organics on Hydrogen Gas Generation Rates in DWPF Process Vessels
21. U-SBS-G-00005, Rev 0, Safety Basis Strategy Liquid Waste Operations Safety Basis Changes
22. U-SBS-G-00004, Rev 1, Safety Basis Strategy Salt Waste Processing Facility Integration Project
23. X-TTR-S-00060, Evaluation of Glycolate Impact to Tank Farm and Radiolytic Hydrogen Generation
24. OSQA-17-0009, Dec 7, 2016, “Savannah River Site Evaluation of Environmental Management (EM) Facilities Per Operating Experience (OE-1): 2015-1, DOE-STD-3009-2014 Evaluation.”

25. DOE-STD-3009, Change Notice 3, DOE Standard Preparation of Nonreactor Nuclear Facility Documented Safety Analysis, November 2014.
26. U-CHA-S-00006, Rev 0, Consolidated Hazards Analysis for Defense Waste Processing Facility (DWPF)
27. U-CHA-S-00007, Rev 0, Consolidated Hazards Analysis for Defense Waste Processing Facility (DWPF) Under the Glycolic Flowsheet

Attachment A:

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	DWPF is an existing HC-2 nuclear facility. The Alternate Reductant Project does not introduce any new radiological material to the facility. There is no impact to the facility hazard categorization based on this project. The quantity of material at risk will not be increased.
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 facility will be using Formic Acid Tank 2 as the hold tank for glycol solution. This tank has been empty because there was no need for a backup tank for formic acid additions. The footprint will be maintained the same and there will be no adverse effect to any SC/SS safety function.
3	Change an existing process or add a new process resulting in the need for a safety basis change requiring DOE approval?	Yes	The goal of the project is to reduce the hydrogen generation rate in the process vessels. Changes to the process include replacing formic acid with glycolic acid as a reductant and removing formic acid from Process Frit. This will impact the TSRs for CPC Flammability Monitoring, Flammability Control and Melter Feed Contents. The vessel purge controls will remain, but the required purge flows will be reduced. Also, the Melter Feed Contents LCO will retain the existing format, but will contain equations that account for glycolic acid. These changes will result in a safety basis change requiring DOE Approval.
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	Although the constituent of glycol will be new to the DWPF flowsheet chemistry, the use of glycol is well understood in the industry and throughout the DOE complex. Glycol has been used as a decontamination agent and clarifier. The project has identified another use for the solution that is in line with previous utilization throughout the complex.
5	Create the need for new or revised safety SSCs?	Yes	The introduction of glycol will reduce the hydrogen generation rate in the process vessels. Currently hydrogen is measured by Safety Significant Gas Chromatographs (GCs) to determine if its concentration is above the TSR limit. The hydrogen will be reduced to almost non-detectable. This may result in the GC systems being removed from service.
6	Involve a hazard not previously evaluated in the Documented Safety Analysis (DSA)?	No	The generation of hydrogen and the effects to the DWPF process are already analyzed in the FSAR. The introduction of glycol and the removal of formic acid create a condition whereby hazards previously evaluated could be eliminated or significantly reduced. The current project will provide the conditions for elimination of the hazard and management of the residual hydrogen formation.
	Is the modification a Major Modification as defined in DOE-STD-1189?	No	

Summary and Recommendations

Although criteria 3 and 5 were tripped, this evaluation determined that this project is not a Major Modification. Changes to the process include replacing formic acid with glycolic acid as a reductant and removing formic acid from Process Frit. The changes to the process may also result in removing the GCs. This would only be done after laboratory testing has confirmed the elimination of the catalytic hydrogen hazard. Description of these changes along with any resulting changes in controls will result in a safety basis change requiring DOE Approval. However, the overall hazards associated with the DWPF process will be reduced by this project. The vessel purge controls will remain the same but the required purge flows will be reduced. Additionally there will be some changes to the Melter Feed Contents TSR to account for the glycolic flowsheet and the elimination of formic acid. It is concluded that there is not a significant Safety Basis risk associated with this project, therefore there is no need for a PDSA. The changes to the existing DSA/TSR to reflect this project will be made following the normal DSA/TSR change process. Therefore, the project is not a Major Modification.

Design Authority Peter Flores L0499	Date 11/20/2014
Safety Basis Regulatory Authority	Date 11-20-14