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DISPOSAL OF COOLING COIL GROUTING LIQUID WITHIN TANK 16

Introduction

The purpose of this memo is to evaluate the proposed activity of disposing of cooling coil grouting liquid within Tank 16 versus assumptions contained within the H-Area Tank Farm (HTF) Performance Assessment (PA) (SRR-CWDA-2010-00128). This proposed activity would allow liquid displaced from cooling coil grouting to be added to the waste tank while the primary waste tank is being grouted. With respect to the PA, the proposed activity primarily impacts assumptions regarding tank grout. The activity does not increase the radionuclide inventory evaluated in the PA, but could increase the assumed chemical constituents inventory (i.e., by increasing the assumed Cr inventory).

Background

Filling a cleaned tank with grout supports long term stability of the closed facility and reduces water intrusion into the tank over time. Reducing the amount of water allowed to enter a closed tank retards the migration of residual contaminants from the tank to the environment. Testing has demonstrated the chemical and physical characteristics of the grout formula used at SRS. Tank closure activities use reducing grout that has the ability to reduce redox sensitive contaminants (such as technetium) and minimize their mobility after closure. All grout formulas are alkaline because grout is a cement-based material that naturally has a high pH which is compatible with the carbon steel waste tank liner. The tank fill grout also has high compressive strength and low saturated hydraulic conductivity, enhancing its ability to limit the migration of infiltrating water, and thus contaminants after closure.

The general approach to Tank 16 grouting is addressed in the Tank 16 H Grout Strategy document. [SRR-LWE-2014-00013] The waste tank grout fill formulation specifications (C-SPP-F-00055, Rev. 4) are designed to ensure the cured grout meets the HTF PA assumptions. The HTF PA contains assumptions regarding both mechanical and chemical properties of the tank fill grout. These assumptions pertain to

the waste tank grout's performance with respect to 1) grout chemical properties, 2) waste tank stability, and 3) tank flow modeling. The proposed activity would not create conditions different from those assumed in the PA and experienced during past tank grouting operations.

To account for the possibility that any residual chromate that exists in the Tank 16 cooling coils will be reintroduced into the tank, an additional 6.52 kg of chromium (Cr) will be added to the Tank 16 primary residual inventory in the Tank 16 Special Analysis. The estimated amount of Cr added to the tank during grouting of the cooling coils (6.52 kg) is based on forty-four cooling coils being totally full of chromate. [M-CLC-H-03244] Since the Cr inventory increase will be addressed in the Tank 16 Special Analysis, it will not be addressed again in this memo.

Proposed Activity Details

The proposed activity involves allowing liquid displaced during grouting of the tank cooling coils to be added to Tank 16, potentially impacting primary waste tank grouting. The Type II tanks are equipped with 44 cooling coils [SRR-CWDA-2010-00128, Rev. 1]. Per M-CLC-H-03244, the coils in a Type II tank can hold 5,125 gallons of liquid, meaning each coil can hold approximately 120 gallons. The intact cooling coils and cooling coils with pinhole leaks will be grouted from the inlet. Coils having a guillotine failure will be grouted from each end until the portion that can be grouted is indicated to be full.

The cooling coils may not be flushed prior to coil grouting (for the purpose of this evaluation they are assumed not to be flushed). The intact cooling coils and cooling coils with pinhole leaks will be grouted to the extent practical, with grout added from the inlet. 70% of the estimated volume of the cooling coil liquid displaced from the coils by grout will be returned to an operational waste tank. The remaining 30% of the estimated volume of the cooling coil liquid will be returned to Tank 16. When grout is visually detected at the cooling coil outlet, additional grout shall be introduced into the cooling coils to ensure the coil is filled past the interface layer (~35 gallons). Coils having a guillotine failure shall be grouted from each end until indicated to be full. It will not be possible to collect any residual water from these types of coils during the grouting, such that liquid displaced from the coils will remain in Tank 16. There may be sections of coils with guillotined breaks not connected to the coil inlets and/or outlets. These intermediate sections of coils with guillotined breaks may not be filled with grout internally due to their configuration, and are not considered in the proposed activity. Therefore, the proposed activity includes returning 30% of the estimated volume of the cooling coil liquid (36 gallons of cooling coil liquid) plus 35 gallons of grout to Tank 16.

Assuming a maximum cooling coil grouting rate of one coil per hour, the proposed activity could add 36 gallons of cooling coil liquid per hour to Tank 16, with the total amount of liquid added capped at 1584 gallons (assuming all 44 coils are grouted). The proposed activity could add an additional 35 gallons of cooling coil grout per hour to Tank 16, with the total amount of grout added capped at 1540 gallons (assuming all 44 coils are grouted). The proposed activity could impact the bulk fill grout used in the HTF Waste Tanks, primarily by altering the grout water content (if standing water in the tank was allowed to interact with the added grout). The bulk fill grout added to the waste tanks is required to meet the

grout fill formulation specifications (C-SPP-F-000055). While tank grout meeting the grout fill formulation specifications will inherently meet the HTF PA assumptions, the fact that grout did not meet the specifications does not necessarily lead to the grout not meeting the HTF PA assumptions, since the PA assumptions revolve around the final cured grout properties, not around the grout testing methods.

Assumed Grout Properties in the HTF PA and Impact of Proposed Activity

Filling a cleaned tank with grout supports long term stability of the closed facility and reduces water intrusion into the tank over time. Reducing the amount of water allowed to enter a closed tank retards the migration of residual contaminants from the tank to the environment. Testing has demonstrated the chemical and physical characteristics of the grout formula used at SRS. HTF closure activities will use reducing grout which serves to minimize the mobility of redox sensitive radionuclides after closure. All grout formulas are alkaline because grout is a cement-based material that naturally has a high pH which is compatible with the carbon steel waste tank liner. The tank fill grout will have high compressive strength and low saturated hydraulic conductivity, enhancing its ability to limit the migration of contaminants after closure. (SRR-CWDA-2010-00128)

The proposed activity would allow additional water to be present (i.e., the cooling coil liquid disposed of in the tank) while grout is being added to the tank. The net effect of these actions would be a water volume overage in excess of that allowed per Section 3.1.1.4 of bulk fill grout procurement specification C-SPP-F-00055. Section 3.1.1.4 of the bulk fill grout procurement specification states that "the total quantity of water in any batch does not exceed the quantity specified in the grout mixes [48.5 gallons per cubic yard]". The allowed water overage in the grout was based on ASTM C94/C94M limits of +/- 3% of the target value.

The HTF closure documents contain assumptions regarding both mechanical and chemical properties of the tank fill grout. These assumptions pertain to the waste tank grout's performance with respect to 1) grout chemical properties, 2) waste tank stability, and 3) tank flow modeling. These grout performance areas and their implications with respect to assumed performance are addressed in additional detail below.

Grout Chemical Properties

The HTF PA models assume that the chemical properties (e.g., reducing capacity) of the fill grout changes as a function of pore volume flushing. Once enough water flows through the pore volumes of the grouted waste tank, these models assume that the fill grout chemical properties transition from reducing to oxidizing. Because the timing of these transitions is determined based on grout formulation, the grout components (e.g., slag quantity) were developed with specific chemistry impacts (e.g., extended reducing capacity) in mind. The additional 1540 gallons of liquid in the tank during grouting would not impact the grout components that impact the chemical properties (e.g., slag quantity) and therefore would not affect the PA assumptions regarding grout chemical properties.

Waste Tank Stability

Section 3.2.1.5 of the HTF PA states that "the entire tank is assumed to be filled with grout, therefore structural failure (i.e., collapse) is not considered." The PA assumes the grout has adequate compressive strength (i.e., 2,000 psi, per HTF PA Table 3.2-9) to withstand the overburden load on the tank at closure. The additional 1540 gallons of liquid in the tank during grouting could impact the grout materials overall functionality with regards to tank stability, since this total liquid might be outside of the allowed water volume overage, depending on the rate of liquid addition. The stability requirements could be met if the proposed activity could be controlled to ensure that the cooling coil grout liquid additions were within the total water overage specifications (taking allowed overages into account). If the liquid additionss were controlled such that individual grout lifts continued to meet required grout specifications, the stability assumptions would not be adversely affected.

Tank Flow Modeling

The tank grout minimizes the flow of water from the tank top to the contamination zone at the bottom of the tank. The HTF PA describes the assumed grout material properties in PA Section 4.2.3.2.3. The properties assumed in the modeling were selected from the testing described in WSRC-STI-2007-00369 and SRNL-STI-2011-00551, and are shown in PA Table 4.2-31 and PA Figure 4.2-25. The grout formula was developed to meet the assumed material properties (SRNL-STI-2011-00551), with conformance to the grout formulation validated through adherence to the grout specification requirements.
The additional 1540 gallons of liquid in the tank during grouting could impact the grout materials overall functionality with regards to tank stability, since this total liquid volume would be outside of the allowed water volume overage. The flow modeling assumptions could be met if the proposed activity could be controlled to ensure that the cooling coil grout liquid additions were within the water overage specifications, with the total water content taking all allowed overages into account. The properties used in tank flow modeling were based on test results from grout with properties like those captured in the grout fill specification. If the liquid adds were controlled such that individual grout lifts continued to meet required grout specifications, the flow modeling assumptions would not be adversely affected.

Conclusion

Disposing of cooling coil grouting liquid within H-Tank Farm waste tanks is consistent with the inputs and assumptions contained within the HTF PA, and could be carried out in compliance with the HTF Performance Objectives detailed within the PA, if liquid additions were controlled such that grout water overage specifications continued to be met. Water overages of up to plus 3% for individual grout lifts can be shown to be within the assumptions of the HTF PA.

References

1. SRR-CWDA-2010-00128, Rev. 1, *H-Area Tank Farm Performance Assessment,* Savannah River Site, Aiken, SC, November 2012.
2. SRR-LWE-2014-00013, Rev. 0, Walters, C. D., *Tank 16H Grout Strategy,* Savannah River Site, Aiken, SC, March 2014.
3. C-SPP-F-00055, Rev. 4, Langton, C. A., *Furnishing and Delivery of Tank Closure Grout*, Savannah River Site, Aiken, SC, December 2012.
4. M-CLC-H-03244, Rev. 0, Voegtlen, R.O., *Determination of Potential Quantities of Chromate Cooling Water, Chromate, and Chromium Addition to Tank 16 Due to Coil Grouting*, Savannah River Site, Aiken, SC, February 2014.
5. ASTM C94/94M-13a, *Standard Specification for Flow Ready Mix Concrete,* ASTM International, West Conshohocken, PA.
6. NCR 2013-NCR-15-WFC-0006, Rev. 4, Whisnant, M., Savannah River Site, Aiken, SC, October 2013.
7. SRNL-STI-2011-00551, Rev. 1, Langton, C. A. and Stefanko. D. B., *Tanks 18 and 19-F Structural Flowable Grout Fill Material Evaluation and Recommendations*, Savannah River Site, Aiken, SC, April, 2013.
8. WSRC-STI-2007-00369, Rev. 0, Dixon, K. L., et al., *Hydraulic and Physical Properties of Tank Grouts and Base Mat Surrogate Concrete for FTF Closure*, Savannah River Site, Aiken, SC, October 2007.

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