DHEC Response to NRC Staff Comments on: "Industrial Wastewater Closure Module For The Liquid Waste Tanks 5F and 6F F-Area Tank Farm, Savannah River Site," SRR-CWDA-2012-00071, Revision 0, January 2013

<u>GENERAL COMMENTS</u> – Note: In some cases comments are grouped where response is similar.	
GC-1	The Tanks 5 and 6 closure module (SRR-CWDA-2012-00071, Rev. 0) provides a well-documented and comprehensive description of DOE efforts to retrieve waste from Type I Tanks 5 and 6 at F-Area Tank Farm facility (or FTF) to a relatively small residual heel volume.
<u>RESPONSE GC-1:</u> Thank you for your comment.	
GC-2	NRC staff recognizes the challenges associated with the waste retrieval process particularly in light of the complex infrastructure associated with Type I tanks such as Tanks 5 and 6. Cleaning campaigns are iterative in nature with subsequent campaigns building on the existing knowledge base and previous lessons learned that are reflected in technology advancements and optimization of operational parameters over time. It was apparent from NRC staff's review, that there are numerous lessons to be learned from the Tanks 5 and 6 waste retrieval process that would likely improve the efficiency and effectiveness of future tank cleaning campaigns at FTF and H-Area Tank farm facility (HTF).
GC-3	With regard to lessons learned from Tank 5 and 6 tank cleaning campaigns, NRC staff thinks a separate, comprehensive evaluation of (i) the effectiveness and limitations of various cleaning technologies employed during Tanks 5 and 6 waste retrieval campaigns, and (ii) alternative technologies that could be developed to overcome these limitations to facilitate future tank closures would be instructive. This would include a detailed evaluation of the following: a. An evaluation of the effectiveness of Submersible Mixing Pumps (SMPs) with respect to residual heel removal. b. A comparison of SMP efficiency and effectiveness to previously used technologies or readily available technologies. c. A comparison of efficiency and effectiveness of chemical sludge removal campaigns in Tanks 5 and 6, versus other tanks such as Tank 16 at the HTF. d. Development of lessons learned from chemical sludge removal campaigns including issues associated with oxalic acid (OA) to sludge heel ratios, OA concentrations, pH; waste agitation and mixing; OA residence times; equipment failures; and tank waste variability. e. An evaluation of tank waste transfer system capability and efficiency.
GC-4	Based on NRC staff's review of the Tanks 5 and 6 closure module, DOE should consider the following prior to future tank cleaning: a. DOE should consider analyzing tank waste samples prior to chemical sludge removal to enable a more thorough and accurate analysis of key radionuclide[1] removal. b. DOE should consider conducting a more thorough analysis of operational parameters important to chemical sludge removal in the field including optimization of the quantity, rate, and characteristics of chemical additions; tank waste agitation and mixing; residence times; waste transfer technology; and waste processing. c. DOE should consider performing a comprehensive comparative analysis of various sluicing and waste transfer technologies to improve the effectiveness and efficiency of residual heel removal in future cleaning campaigns. d. DOE should continue to evaluate new and emerging technologies that may improve waste retrieval efforts in the future.

[1] NRC uses the term "key radionuclide" synonymously with the term "highly radioactive radionuclide" used in the National Defense Authorization Act for Fiscal Year 2005 (NDAA).

RESPONSE GC-2 through GC-4:

General Comments GC-2 through GC-4 provide several observations to be considered as DOE moves forward with waste removal efforts on future tanks. SCDHEC has protocol in place to ensure that DOE implements the most appropriate, up to date technology for each tank to support waste removal actions. As required by the approved FTF General Closure Plan, SCDHEC is kept informed through annual technology reviews, during the preliminary waste removal briefings and during review of Closure Modules. In addition, quarterly updates required by the Federal Facility Agreement allow for continual dialogue throughout the process concerning items of interest to SCDHEC and EPA (e.g., detailed sampling discussion, oxalic acid flowsheet review). The Department agrees with your overall observations regarding lessons learned. DOE has been actively engaged in continuous improvements through lessons learned from Tanks 5 and 6 that could be used on future tanks.

GC-5	NRC will evaluate the arguments presented in the Tanks 5 and 6 Closure Module with respect to the costs and benefits of additional radionuclide removal within the context of the Tanks 5 and 6 Special Analysis (SRR-CWDA-2012-00106, Revision 1) and other documentation to determine the extent to which closure of Tanks 5 and 6 are consistent with as low as reasonably achievable (ALARA) requirements in 10 CFR 61.41 under Monitoring Factor 1.5 listed in NRC staff's FTF monitoring plan (ML12212a192). A separate technical review memorandum will be developed to document NRC staff's findings in this area.

RESPONSE GC-5:

SCDHEC acknowledges NRC's monitoring role under Section 3116(b) of the NDAA. To coordinate with SCDHEC, as required by the National Defense Authorization Act (NDAA), NRC's perspective related to conclusions of reasonable assurance of compliance is valued. The Department looks forward to your continued input as we oversee closure of tanks.

DETAILED COMMENTS – Note: In some cases comments are grouped where response is similar.

DC-1	SRR-CWDA-2012-00071, Rev. 0 (page 37)[2] provides details related to the effective cleaning radius of Submersible Mixing Pumps (SMPs) used to retrieve waste from Tanks 5 and 6. Prior testing indicated that the effective cleaning radius (ECR) of an SMP would be 50 feet (15 m) (M-CLC-G-00349). SRR-CWDA-2012-00071, Rev. 0 (page 75) indicates that the ECR for the SMPs is closer to 30 foot (9 m). Given the apparent underperformance of two (2) SMPs in retrieving waste from Tanks 5 and 6, DOE should provide a separate evaluation discussing whether it is cost-effective to continue to use SMPs for heel removal or if other technologies (or sets of technologies) could be more effectively deployed in the future. a. SMPs were expected to be an improvement over slurry pumps that had previously been used to retrieve tank waste. LWO-LWE-2007-00017 indicates that four (4) slurry pumps took six (6) hours to get the sludge level down to 1 to 2 inches (3 to 5 cm) with a water to waste ratio of 5:1. Although it was estimated that two (2) SMPs would be just as effective as four (4) slurry pumps in Type I tanks, after the SMPs were deployed it became clear that 3 to 4 SMPs were actually needed in Tanks 5 and 6 to mobilize the residual heel from all areas of the tank floors. It is not clear that the SMPs out-performed the slurry pumps or if other factors contributed to underperformance of the SMPs. b. Reference documentation indicates that a minimum liquid level of around 30-45 inches (0.8 to 1.1 m) is needed to prevent cavitation and aerosolization of waste during SMP operation. It would be helpful if DOE differentiated the relative effectiveness of SMPs to other types of slurry pumps for (i) bulk sludge removal, versus, (ii) residual heel removal. c. Hydrolancing of Tank 6 is discussed briefly in SRR-CWDA-2012-00071, Rev. 0 (page 77). Additional details could be provided regarding the effectiveness (or lack thereof) of hydrolancing. If hydrolancing was relatively ineffective, DOE should indicate if hydrolancing might be improved and utilized in the future or if other sluicing technologies are available to mobilize residual heels. DOE should also indicate if improvements to the waste transfer system could be made in the future to increase the effectiveness of sluicing technologies.

[2] Page numbers pertain to the Tanks 5 and 6 closure module (SRR-CWDA-2012-00071, Rev. 0) unless otherwise noted.

	d. It would be helpful for DOE to discuss what types of pumps were used in Tank 16 chemical sludge removal or other factors that may have contributed to more efficient waste retrieval in Tank 16 versus in Tanks 5 and 6. e. SRR-CWDA-2012-00071, Rev. 0 (page 57) indicates that waste aerosolization may occur above a liquid level of 30 inches for SMPs. Because the SMPs could not be operated at lower liquid levels, ineffective mixing during acid strike 2 in Tanks 5 and 6 appears to have contributed to the formation of solids during chemical cleaning. DOE should clarify if other types of pumps are available during chemical cleaning to increase mixing and mitigate solids formation during chemical sludge removal in the future.
DC-2	SRR-CWDA-2012-00071, Rev. 0 (page 37) indicates that the SMP installed in Riser 1 could not be lowered to the tank floor due to interference with existing cooling coils that were covered by a sludge mound at the time of installation. The cooling coil cutter was not implemented and the pump was left suspended directly above the sludge level. The SMP was later lowered to the horizontal cooling coil level (around 13 inches) to slurry the sludge after the mound under Riser 1 was mobilized to an area near Risers 3 and 5 (page 40). Although installation of the SMP under Riser 1 was credited with lowering the large mound under Riser 1 during mechanical sludge removal, the height of the SMP above the tank floor may have affected final solids accumulation following mechanical feed and bleed. LWO-LWE-2006-00128 indicates that the SMP design calls for placement 8 inches above or on the tank bottom. SRR-CWDA-2012-00071, Rev. 0 (page 59) indicates that the 16 inches between the SMP pump and the bottom of the tank during mechanical feed and bleed may be responsible for the solids accumulation under Riser 1. It would be helpful for DOE to comment on the feasibility (including the expected benefit) of cutting the cooling coils under Riser 1 to allow the pump to be lowered to the tank floor during final stages of cleaning.
DC-3	SRR-CWDA-2012-00071, Rev. 0 (page 47) indicates that the mechanical sludge removal campaigns using SMPs in Tank 5 had been optimized to the extent practicable and a new cleaning technology, oxalic acid, was implemented to reduce the sludge volume further. It is not clear that additional waste removal would not have occurred if an SMP was installed under riser 5. It would be helpful for DOE to provide additional information regarding the practicality of installing an SMP or other pump under Riser 5 including a discussion of any related challenges. Page 152 provides only a brief mention of the practicality of the addition of a fourth SMP including mention of financial and schedule costs and uncertain benefit. Additional details regarding the practicality of installation of a fourth SMP would be helpful. Mechanical sludge removal campaigns in Tank 6 were accomplished with two (2) SMPs. Mounds remained under Risers 1 and 5 following the mechanical sludge removal phase due to the limited effective cleaning radius of the SMPs. A decision was made to add a third SMP to facilitate waste retrieval in Tank 5. It is not clear why an additional SMP or two SMPs were not added to Tank 6 to facilitate waste retrieval during mechanical sludge removal. SRR-CWDA-2012-00071, Rev. 0 (page 94) indicates that a third SMP was added to Tank 6 later, during mechanical feed and bleed. It would be useful if DOE could provide criteria for limiting/expanding the use of SMPs in various circumstances.
DC-4	SRR-CWDA-2012-00071, Rev. 0 (page 47) discusses testing of oxalic acid with Tank 16 waste. This testing was the basis for DOE initial estimates that oxalic acid would be effective in removing the residual heel of tanks treated with oxalic acid in FTF to 1/16 inch (0.2 cm) or approximately 150 gallons (570 L) of waste in Type I tanks. Although volume reduction may not be a good indicator of oxalic acid effectiveness, the volume of waste prior to and following oxalic acid treatments in Tanks 5 remained relatively unchanged at around 3500 gallons (13 m^3). Although oxalic acid treatment appeared to be relatively more effective in Tank 6 compared to Tank 5 owing to a lower effective pH following the first acid strike in Tank 6, the volume remaining in Tank 6 following oxalic acid treatment was similarly around 3500 gallons (13 m^3). WSRC-TR-2003-00401 provides information on the types of waste streams from F and H Canyons. Tank 5 and 6 waste is expected to be primarily PUREX high heat waste header (HHW), while Tank 16 waste is H-Canyon Modified (HM) waste. The high effectiveness of oxalic acid treatment in Tank 16 appears to be quite different than that for Tanks 5 and 6. DOE reasons that factors such as higher than expected pH following acid addition, extent of mixing, equipment failures, etc. may have led to less than optimal treatment of Tanks 5 and 6 waste with oxalic acid. a. SRR-CWDA-2012-00071, Rev. 0, and supporting references refer to use of sludge simulants and cleaning demonstrations prior to Tanks 5 and 6 chemical sludge removal. It would be helpful if DOE summarized or provided references to work conducted to specifically study and optimize oxalic acid dissolution of Tanks 5 and 6 waste components including dissolution of various non-radiological and radiological constituents present in Tank

	5 and 6 waste. For example, NRC obtained WSRC-STI-2007-00192 that characterizes Tank 5 waste prior to chemical treatment in an internet search. b. If DOE intends to continue to use oxalic acid to treat tank wastes, DOE should perform additional testing of oxalic acid effectiveness in treating the specific type of waste expected to be present in tanks targeted for chemical sludge removal with oxalic acid. c. If DOE intends to continue to use oxalic acid to treat tank wastes, DOE should continue to optimize field parameters important to oxalic acid performance. A critical evaluation of the differences in oxalic acid delivery, waste agitation, waste transfer, and other factors that led to more successful use of oxalic acid in Tank 16 compared to Tank 5 and 6 would be informative.

RESPONSE DC-1 through DC-4:

As stated in the response to General Comments GC-2 through GC-4, the Department will ensure that DOE addresses lessons learned and applies them to future waste removal and tank cleaning activities, as appropriate. SCDHEC intends to monitor future activities to ensure continuous improvement though lessons learned.

DC-5	Has DOE performed additional evaluation of chemical cleaning since WSRC-TR-2003-00401 was issued? For example, WSRC-TR-2003-00401 notes (page 30) that Savannah River Technology Center (SRTC) conducted additional studies utilizing actual tank waste sludge at high cleaning solution to sludge ratios but that the work resides in draft (unissued) documents awaiting additional funding to complete. Additionally, several presentations were made at the Waste Processing Technology Exchange in Atlanta, Georgia in November 2010 related to chemical cleaning. A list of the work performed since the 2003 report or a reference summarizing this work would be helpful in understanding the state of technology advancement and potential deployment.

RESPONSE DC-5:

Based on clarification from DOE, chemical cleaning development has been revisited several times since the 2003 report was issued. V-ESR-G-00003, *Waste Removal Technology Baseline: Technology Development Description*, Rev. 1, issued in June 2011, includes, in Appendix A, a chronology of chemical cleaning developments and investigations conducted from 1977 through 2010. This document was included as a reference to the Tanks 5 and 6 Closure Module.

DC-6	SRR-CWDA-2012-00071, Rev. 0 (page 49) discusses effectiveness of oxalic acid on removal of key radionuclides. "Unlike the MSR campaigns, heel removal with chemical techniques may selectively remove certain species. If the chemical sludge removal (CSR) campaigns removed only inert material and left the radionuclides behind it would not be beneficial to waste removal. As a result of the testing in 1977, it was found that Strontium-90 dissolved in OA at about the same rate as sludge. This was important because Strontium-90 made up a large percentage of the radioactivity in the sludge. Testing also showed that Plutonium-239 was largely insoluble in the sludge, but small sample sizes made this testing difficult." WSRC-TR-2003-00401 cites results from the Tank 16 demonstration study (DPSP-80-17-23) that found that Sr-90 concentrations in the residual heel following chemical cleaning were 3 times higher than the original sludge prior to chemical cleaning (Pu-239 concentrations were 2 times higher). a. Did DOE evaluate the concentrations of key radionuclides in residual sludge directly prior to and following chemical cleaning to provide a more accurate estimate of the effectiveness of oxalic acid treatment in removing individual key radionuclides? Note: NRC staff is aware of the mass balance estimates provided in SRNL-STI-2009-00492 that is based on process samples (liquid waste transfers from Tank 6 and a single solid sample from Tank 5) taken during and following chemical sludge removal. b. SRR-CWDA-2012-00071, Rev. 0 (page 53) discusses removal estimates based on process sampling results from SRNL-STI-2009-00492; however, the estimates are expected to be fairly uncertain. Does DOE have plans to sample tanks prior to chemical cleaning in the future to provide better estimates chemical sludge removal effectiveness and removal efficiencies?

RESPONSE DC-6:

The Department has confirmed with DOE that:

a) before-and-after samples of the sludge were not obtained to determine the effectiveness of chemical cleaning in the removal of key radionuclides due to cost, schedule, worker dose and ALARA considerations. Process history and operational data were used to monitor performance.

b) DOE intends to improve the process to provide better estimates of the effectiveness of chemical sludge removal. SCDHEC will monitor DOE to ensure that lessons learned will be applied in future actions.

DC-7	SRR-CWDA-2012-00071, Rev. 0 (page 50) discusses the addition of well water and oxalic acid in Tank 5. An equivalent of 4 weight percent oxalic acid was used in lieu of the WSRC-TR-2003-00401 recommended 8 weight percent. A lower weight percent resulted from use of additional water to ensure a sufficient liquid level for SMP operation while maintaining an acid to sludge ratio less than 20:1 as required by the operating plan. The quantity of water added to the tank is thought to have resulted in a less than optimal pH and chemical treatment campaign. It would be helpful for DOE to comment on whether it would be feasible to use another pumping technology with less stringent liquid level constraints or if the acid to heel ratio could be increased in future cleaning campaigns.

RESPONSE DC-7:

Based on clarification from DOE, development of a low volume mixing pump has been evaluated to support chemical cleaning, but it is not available at this time. SCDHEC will continue to monitor lessons learned in the selection of waste removal technology for future tank closure activities.

DC-8	With regard to chemical cleaning of Tank 5, it is not clear why the SMP in Riser 1 was not run after the first chemical strike (SRR-CWDA-2012-00071, Rev. 0, page 50). LWO-LWE-2008-00227 indicates that the SMP associated with Riser 1 was not electrically connected during chemical cleaning, but no further explanation is provided.

RESPONSE DC-8:

Based on clarification from DOE, only 4 SMPs total can be connected at any one time in this area of FTF. After the first chemical cleaning in Tank 5, chemical cleaning was being conducted in both tanks simultaneously. Since two other SMPs were being used in Tank 5 and two SMPs were being used in Tank 6 and all four were connected to the electrical skid, the Riser 1 SMP in Tank 5 was electrically disconnected.

DC-9

SRR-CWDA-2012-00071, Rev. 0 (page 52) discusses chemical sludge removal campaign 2 in Tank 5.

a. The basis for the 13:1 oxalic acid to heel ratio used in campaign 2 in lieu of the 20:1 ratio used in campaign 1 is not clear. U-ESR-F-00024 provides the operational plan for Tank 5 chemical sludge removal but a basis for the lower ratio of oxalic acid to heel volume does not appear to be provided in this reference.
b. It is not clear why the operating plan (U-ESR-F-00024) calls for no SMP mixing in campaign 2. If it is due to lower liquid level in campaign 2 that prevented SMP operation, are other pumps available to handle lower liquid levels or could liquid additions be made to the tank to allow SMP operation, if needed?
c. It is not clear from the closure module why the heel was soaked for 54 days with oxalic acid prior to transfer to Tank 7. LWO-LWE-2008-00428, Rev. 2 (page 5) indicates that equipment failure in Tank 7 delayed the transfer. It would be helpful for DOE to provide details regarding the equipment failure in Tank 7 in the closure module. It would also be helpful with respect to future planning if DOE could comment on whether contingencies could be put in place to handle equipment failures that might compromise the effectiveness of cleaning campaigns in the future.
d. It would be helpful for DOE to comment on whether it would be feasible to make adjustments to the operating plan for chemical sludge removal when campaigns are less effective than anticipated (e.g., much less than the expected 70 percent waste removal estimate was achieved after oxalic acid strike 1 in Tank 5 but no adjustments appear to have been made in subsequent strikes). A discussion of DOE's use of contingency plans to handle equipment failures and other potential problems that might arise would be helpful.

RESPONSE DC-9:

Based on clarification from DOE:

a) At 20:1 the flowsheet predicted there would be excess acid present once all reactions were completed. The 13:1 ratio was employed to limit the excess acid that would be present to minimize the oxalates that may form. [LWO-PIT-2006-00066, document already referenced in the Tanks 5 and 6 Closure Module]

b) The amount of acid added during campaign 2 did not provide enough tank level to run the pumps (see DC-7 response). Addition of liquid to the tank would have diluted the acid beyond what the flowsheet recommended.

c) and d) DOE does contingency planning and revises operating plans, as needed, and lessons learned from chemical cleaning of Tanks 5 and 6 have been factored into plans for Tank 12.

SCDHEC will continue to monitor the lessons learned program for continuous improvement.

DC-10	SRR-CWDA-2012-00071, Rev. 0 (page 116) discusses characterization of cooling coils. Residual inventory is based on surface area of the cooling coils (SRR-CWDA-2012-0002) and analysis of two discrete samples taken from the tanks. NRC is concerned that the samples used to estimate the inventory of the cooling coils may not be representative of the 4 miles of cooling coils estimated to be present in the tanks. If sludge build-up occurs or is otherwise concentrated on certain discrete sections of the cooling coils that are not represented in the sampling, then the cooling coil inventory may be significantly underestimated. WSRC-TR-2003-00401 discusses treatment of cooling coils with oxalic acid coated with sludge and presents dose rate information for samples taken from Tank 16. It is not clear how the samples taken from Tank 5 compare to the samples taken from Tank 16. Similarly, it is not clear how DOE confirms that no sludge build-up exists on the miles of cooling coils present in the tanks. It would be helpful if DOE could provide additional detail regarding the effectiveness of oxalic acid washing or other technologies used to remove residual waste from cooling coils and how it confirms the effectiveness of deployment of these technologies. This should include a discussion on how DOE confirms damaged cooling coils are effectively cleaned to remove residual sludge that may be contained within the damaged cooling coils.

RESPONSE DC-10:

Based on clarification from DOE, there is confidence that the tank internal surface area inventory is negligible based on three factors: visual inspection of the internal surface area, acid treatment of the tank material and surfaces, and the relative surface area inventory to the tank floor inventory. The visual inspection of the internal surface area was accomplished by review of videos and photos. The videos and photos were taken from various locations and elevations providing multiple views of the tank surfaces. The quality of the photos was significantly better than those initially used in Tanks 18 and 19. During this review, there was no build-up observed. The second factor providing confidence is the process used to treat the tank floor residual material with oxalic acid. During this process, oxalic acid was sprayed on the internal tank surfaces. This helped to remove any build-up present on the cooling coils and tank wall. The third factor was the comparison of the surface area inventory to the floor inventory. The cooling coil samples' analysis results were used to calculate an internal surface area inventory. This calculation used the total length of cooling coils in addition to the tank wall. This calculation showed that the surface area inventories for all but one analyzed constituent were less than 1 % of the total tank inventory. Furthermore, most of the constituents' relative inventories were approximately 0.1 %.

With respect to comparisons to the Tank 16 treatment, there were no cooling coil samples taken before oxalic acid cleaning in Tank 5. Therefore, a similar before and after comparison could not be carried out with Tank 5.

With respect to the damaged cooling coils, the residual material contained within the damaged coils would have been exposed to the same treatment process as the floor material. Post-chemical cleaning, damaged coils were flushed into the primary tank. In addition, the quantity of the material expected to be contained within any damaged coils would be relatively small as compared to the floor material quantity due to the coil dimensions.

CLARIFYING COMMENTS

CC-1

SRR-CWDA-2012-00071, Rev. 0 (page 41) discusses the effectiveness of a 3rd SMP installed under Riser 1 in MSR Campaign 4 and 5. It is not clear why the addition of the 3rd SMP under Riser 1 was not as effective in MSR Campaign 3 and suddenly became effective essentially in MSR Campaign 5 (Campaign 4 was curtailed due to a tornado watch). See figure below. It would be helpful for DOE to comment on the uncertainty in the heel estimates and if the uncertainty could partially explain the relative effectiveness of MSR Campaign 5 compared to Campaign 3. Any additional insights on the increased effectiveness of Campaign 5 compared to Campaign 3 would be helpful.

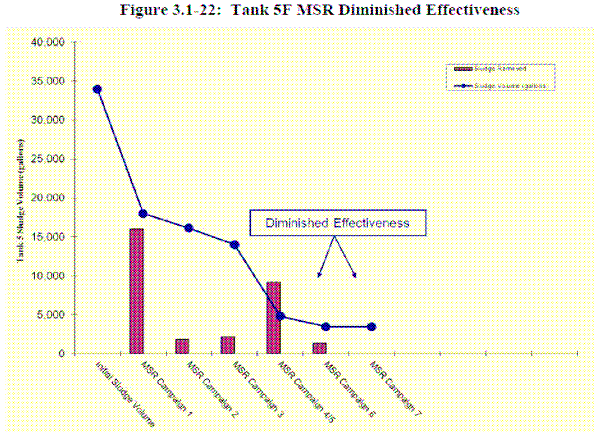

Figure 3.1-22: Tank 5F MSR Diminished Effectiveness

[SRR-CWDA-2010-00157]

Figure 3.1-32 (page 46) of SRR-CWDA-2012-00071, Rev. 0.

RESPONSE CC-1:

Based on clarification from DOE, during the 3rd campaign, there was an issue with cooling in the tank and the SMPs had to be slowed down. There was also an electrical issue with one of the SMPs that required it to be shut down prematurely. During the transfer with the other 2 SMPs running, the tank temperature reached the maximum for SMP operation and required the 2 operating SMPs to be shut down earlier in the transfer sequence than desired. Sludge was mounded under the first pump shutdown. During the 4th and 5th campaign, all three SMPs ran without issue for the required duration.

CC-2

SRR-CWDA-2012-00071, Rev. 0 (page 50, Figure 3.1-26), illustrates oxalic acid treatment steps. The criteria for SMP mixing is not clear. A footnote indicates that SMP mixing will occur, if planned. If mixing is not planned, steps that discuss mixing will be skipped. When is SMP mixing planned?

RESPONSE CC-2:

Based on clarification from DOE, the operating plan called for no mixing in the second chemical removal campaign because of the low volume of acid (i.e., tank liquid level was below the minimum level to run the mixing pumps). The second campaign occurred simultaneously in Tanks 5 and 6. Lessons learned indicate the increase in the solids volume due to oxalate formation. These lessons learned will be applied to future chemical cleaning activities.

CC-3

Recommendations are provided in SRNL-STI-2009-00492 and SRNL-STI-2009-00493 related to chemical sludge removal in Tanks 5 and 6 including the need for sludge washing to lower ionic strength prior to acid strikes. It is not clear how the efforts to dilute the sludge prior to oxalic acid addition in Tanks 5 and 6 differ from the recommendations

	in the SRNL reports.

RESPONSE CC-3:

Based on clarification from DOE, the recommendations of the reports listed are consistent with what was done for Tanks 5 and 6 and for what is planned for future tank chemical cleaning activities.

CC-4	SRR-CWDA-2012-00071, Rev. 0 (page 105) discusses annular cleaning of Tank 6. Similar activities were not performed in Tank 5 due to the significantly lower levels of contamination. It is not clear what quantity of annular contamination warrants cleaning.

RESPONSE CC-4:

Based on clarification from DOE, as described in individual closure modules, each tank is considered on a case-by-case basis. Many factors (e.g., relative quantities of annulus and tank material, dose impacts, material composition, system impacts) are considered in determining whether cleaning is warranted. Therefore, there is no defined quantity that warrants cleaning.