Department of Energy
Savannah River Operations Office
P.O. Box A
Aiken, South Carolina 29802

MAR 27 2018

Ms. Susan B. Fulmer, P. G., Manager
Federal Remediation Section
Division of Site Assessment, Remediation and Revitalization
Bureau of Land and Waste Management
South Carolina Department of Health and Environmental Control
2600 Bull Street
Columbia, South Carolina 29201

Mr. Jon Richards
Acting Savannah River Site Remedial Project Manager
Superfund Division
U. S. Environmental Protection Agency, Region 4
61 Forsyth Street, SW
Atlanta, Georgia 30303

Dear Ms. Fulmer and Mr. Richards:

SUBJECT: Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis for Trichloroethylene Plumes Discharging to Steel Creek in P-Area Groundwater Operable Unit (NBN) (U) (SRNS-RP-2017-00372, Revision 1, March 2018), Savannah River Site's Responses to Regulatory Comments on the Revision 0 Document, and Draft Action Memorandum, CERCLIS Number: 81

In accordance with the terms of the Federal Facility Agreement, the U. S. Department of Energy (DOE) is submitting the subject Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis (RSER/EE/CA) for your files. The South Carolina Department of Health and Environmental Control's (SCDHEC) and U. S. Environmental Protection Agency's (EPA) comments on the Revision 0 RSER/EE/CA were received on December 13, 2017. Draft Savannah River Site (SRS) responses to the comments were submitted electronically to EPA and SCDHEC on January 17, 2018 with a comment resolution conference call held on February 12, 2018. The final SRS responses to EPA's and SCDHEC's comments, which are included with this submittal, were incorporated into the Revision 1 RSER/EE/CA.

The submittal also includes a draft Action Memorandum for the Non-Time Critical Removal Action for the for P-Area Groundwater Operable Unit for your review and comment. Please review the draft Action Memorandum and provide your comments within thirty (30) days of receipt.

Questions from you or your staff may be directed to me at (803) 952-8365, or the DOE Program Manager, Mr. Phillip Prater, at (803) 952-9333.

Sincerely,

Brian T. Hennessey
SRS Remedial Project Manager
Infrastructure and Area Completion Division

IACD-18-139

MAR 27 2018

Enclosures:
1. Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis for Trichloroethylene Plumes Discharging to Steel Creek in P-Area Groundwater Operable Unit (NBN) (U) (SRNS-RP-2017-00372, Revision 1, March 2018) CERCLIS Number: 81
2. SRS Responses to EPA Comments on the Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis for Trichloroethylene Plumes Discharging to Steel Creek in P-Area Groundwater Operable Unit (NBN) (U) (SRNS-RP-2017-00372, Revision 0, October 2017) CERCLIS Number: 81
3. SRS Responses to SCDHEC Comments on: Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis for Trichloroethylene Plumes Discharging to Steel Creek in P-Area Groundwater Operable Unit (NBN) (U) (SRNS-RP-2017-00372, Revision 0, October 2017) CERCLIS Number: 81
4. Draft Action Memorandum and Responsiveness Summary for the Non-Time Critical Removal Action for the for the P-Area Groundwater Operable Unit (U), CERCLIS Number: 81

cc w/o encl:
D. Scaturo, SCDHEC-Columbia
S. French, SCDHEC-Columbia
M. D. Wilson, SCDHEC-Columbia
G. K. Taylor, SCDHEC-Columbia
T. Fuss, SCDHEC–Aiken Environmental Affairs Office
R. H. Pope, EPA-Atlanta

cc w/ encl:
J. Tufts, EPA-Atlanta
M. McRae, TechLaw, Inc.

SRS Responses to
South Carolina Department of Health and Environmental Control
Comments on:
Removal Site Evaluation Report / Engineering Evaluation / Cost Analysis for Trichloroethylene Plumes Discharging to Steel Creek in P-Area Groundwater Operable Unit (NBN) (U), CERCLIS Number: 81 (SRNS-RP-2017-00372, Revision 0, October 2017)

Comments Received 12/13/2017

General Comments

1. It is stated in the Scoping Summary for the P-Area Groundwater Operable Unit (ERD-EN-2013-0009, May 2017) that "additional characterization is needed at the elbow portion of the cVOC plume to better define the impact to Steel Creek and extent of groundwater contamination in the distal area." The Department request that this additional characterization be completed prior to the submittal of the RSER/EE/CA for public comment. Although this characterization is mentioned in the RSER/EE/CA, it is imperative that it be completed before the public comment period and submittal of the Action Memorandum so that the appropriate remedial action can be selected. Please revise the implementation schedule to accommodate this characterization.

   Response: Clarification.

   The May 2017 scoping meeting included discussion of the projected funding availability to support the PAGW OU removal action and the need to remain within the funding profile associated with the Wetlands Dunbarton Bay project scheduled for FY2019. The Wetlands at Dunbarton Bay project was rescheduled to create the opportunity to implement the PAGW OU removal action and the C-Area Groundwater OU removal action.

   DOE understood that the removal action alternative evaluation in the RSER/EE/CA would address both the neck and distal (elbow) source areas. In the event that the characterization data was not available in time for the issuance of the Action Memorandum (scheduled submittal date April 11, 2018), the additional options defined in the RSER/EE/CA provides a mechanism for the Core Team to consider a future Action Memorandum to address the distal (elbow) area if warranted.

   SCDHEC has recently approved the SRS Hydrogeologic and Geotechnical Projects Program Plan for the Elbow and Steel Creek Characterization of the TCE Groundwater Plumes at the PAOU (ER-HGPP-2017-00007) (SRNS-J2000-2017-00650, dated December 20, 2017) that provides detail for extensive characterization of the distal (elbow) plume area which began at the end of January 2018. This characterization will not be completed in time to support the Action Memorandum based on the current schedule. Provided that the expected characterization is completed during the 3Q of FY2018, a removal action based on the additional characterization data could start no earlier than 4Q FY2020. For planning purposes, a detailed alternate schedule was developed to show the approximate schedule of activities leading up to the execution of the removal action if that action was delayed until characterization activities are completed. The alternate schedule below relies on several assumptions, including that characterization results continue to support use of the PRB as the appropriate technology, albeit at a different location.

Characterization data available	9/13/18
Complete evaluation of characterization data	10/11/18
Conduct scoping meeting to discuss characterization data	12/15/18
Submit revised RSER/EE/CA addressing scoping mtg agreement(s)	3/1/19
EPA/SCDHEC complete review of RSER/EE/CA (assumes 60/30 schedule rather than 30/30)	5/1/19
Complete revision of and submit RSER/EE/CA with draft Action Memo to address regulatory comments	6/1/19
Start 30-day Public Comment Period	6/15/19
Complete 30-day Public Comment of revised RSER/EE/CA	7/15/19
EPA/SCDHEC complete review of draft action memorandum	7/15/19
Submit final action memorandum and responsiveness summary	8/15/19
Complete Public Notice of Action Memorandum	9/1/19
Complete revision of PRB SOW (assumes removal action scope agreed to in scoping meeting)	3/1/19
Issue PRB RFP (at risk prior to EE/CA approval)	5/15/19
Complete evaluation of proposals	7/15/19
Award PRB Subcontract	8/19/19
PRB Subcontractor completes design data collection (if needed)	12/12/19
SRS submit Rev 0 of Removal Action Design Plan/EMP (Assumes design received, pre-construction plan approved and permits secured)	5/15/20
EPA and SCDHEC complete review of RADP/EMP Rev 0	7/15/20
SRS Submit Rev 1 of RADP/EMP	8/15/20
EPA and SCDHEC Approve Rev 1 of RADP/EMP	9/15/20
PRB Subcontractor completes mobilization/Removal Action Start	10/15/20

Please note that sufficient data is available to support the proposed removal action (i.e., permeable reactive barrier [PRB]) in the neck area). DOE will schedule a Core Team scoping meeting towards the end of 2018 to discuss the data generated from the distal plume characterization.

No changes to the EE/CA text are proposed.

Contact: Mike Griffith, 803-952-9183 (mike.griffith@srs.gov)

2. Section 5.5 Comparison of Removal Action Alternatives, Page 25. In Section 5.5, Comparison of Removal Action Alternatives, the PRB's are considered the most favorable alternative from the standpoint of implementability and are also rated the highest by effectiveness score. However, from the previous Section 5.4, Cost, Alternative 3 has an estimated cost of $9.09M, while Alternatives 2A and 2B have a combined estimated cost of $10.64M. Due to the effectiveness scores derived in Section 5.5, Comparison of Removal Action Alternatives, the Department suggests that Alternatives 2A and 2B both be considered in order to deplete the concentrations of TCE in both the areas above the neck Area from the source area and in the distal area where a significant mass of TCE contaminates groundwater and leaches into the surface water of Steel Creek.

Response: Clarification.

SRS acknowledges the favorable effectiveness evaluation for the PRB in the distal area. However, this evaluation was based on a presumption that similar hydrogeologic conditions would be present in the distal area. Considering (a) the hydrogeologic conditions at the neck area featuring a narrow plume in a very transmissive zone that support a PRB technology; (b) the current level of uncertainty in the hydrogeologic setting at the distal (elbow) area, and (c) the availability of funding for the preferred alternative in FY2019, DOE believes implementing the removal action (i.e., PRB) at the neck area is a better choice for a first response action and best accommodates the other commitments and plans for FFA program implementation in the near term (2-5 years). If appropriate based on the distal area characterization, the RSER/EE/CA supports consideration of a second Action Memorandum to address the distal (elbow) area. DOE commits to, after having evaluated two years of PRB performance data, reconvening the Core Team in a Scoping Meeting to discuss the applicability and potential benefit of another removal action in the distal portion of the plume.

Contact: Jeff Ross, 803-952-6897 (j.ross@srs.gov)

Specific Comments

1. Section 2.5, Nature and Extent of Contamination, Groundwater Contamination Summary, page 8. In the first paragraph, it is stated that, "The source area represents the majority of the groundwater contamination and is centered north of the P-RBC within the P Area facility area." However, Figure 16, Cross Section A-A' of TCE Groundwater Plumes from East of P Area West towards Steel Creek (page 49), as drawn, appears to contradict this statement. If known, please provide volume estimates of the groundwater contamination in the neck and distal areas of the plume.

   Response: Clarification.

   The cross section in Figure 16 is a two-dimensional slice through the plumes and is provided to illustrate the extent of groundwater contamination based on data derived from previous investigations and current groundwater monitoring well data. Figure 12 provides the plan view extent of contamination in the Lower Aquifer Zone (LAZ) and demonstrates that the source area represents the majority of the contamination. As represented in Figure 17, the estimated volume of contaminated groundwater in UAZ and LAZ combined in the source, neck, and distal areas of the plumes are about 32.8 M, 3.4 M and 16.5 M gallons, respectively. The volume estimate assumes a 70' thick Upper Aquifer Zone including the Tan Clay confining zone thickness, a 35' thick LAZ, 0.3 effective porosity, and the 1 ppm isoconcentration contour. Due to the limited number of permanent monitoring wells in the distal portion of the plumes, this estimate has significant uncertainty, and thus was not provided in the RSER/EE/CA text.

   The text in Section 2.5, *Groundwater Contamination Summary*, will be revised as follows: "...The cVOC groundwater plumes can be described in three parts: 1) source area, 2) neck area, and 3) distal area (Figures 16 and 17). <u>As represented in Figure 17, the estimated volume of contaminated groundwater above 1 ppm TCE combined in the UAZ and LAZ is 124 million (M) liters (32.8 M gallons) in the source area, 12.9 M liters (3.4 M gallons) in the neck area, and 62.6 M liters (16.5 M gallons) in the distal area.</u> The source area represents the majority of the groundwater contamination and is centered north of the P-RBC within the P Area facility area. The neck area....."

   Contact: Mark Amidon, 803-725-8251 (mark.amidon@srs.gov)

2. Section 5.2, Identification of Applicable or Relevant and Appropriate Requirements (ARARs), second paragraph, page 18 of 58. Please complete the definition of 'applicable requirements' as defined in 40 CFR § 300.5 by adding the second sentence of the definition. The second sentence of the definition states, "Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable."

   Response: Agree.

   The text will be revised to include the complete definition of applicable requirements.

   Contact: Monique Rabin, 803-952-6695 (monique.rabin@srs.gov)

3. Section 5.4 Cost, page 24, second paragraph. Please include the number of injection wells and monitoring wells, and the time period for multiple injections for Alternative 3A in the cost discussion.

   Response: Agree.

   The text will be revised to indicate that Alternative 3A included an estimate of 36 injection wells and 10 monitoring wells, with three additional injections. The text for Alternative 3B will be revised to indicate that the estimated number of additional injections is five.

   Contact: Monique Rabin, 803-952-6695 (monique.rabin@srs.gov)

4. Section 6.0, Preferred Removal Action Alternative, page 26. The middle of the first paragraph of this section states that Alternative 2A will ultimately allow surface water concentrations in Steel Creek to achieve the MCL once the remnant plumes have attenuated. If possible, please provide a time estimate for how long this may take.

   Response: Clarification.

   Since the alternatives presented in the RSER/EE/CA were not modeled to quantitively determine impact on base case TCE fate and transport, a time frame to reach the maximum contaminant level (MCL) in Steel Creek was not included in the text. A rough estimate can be made using earlier groundwater modeling results and empirical experience with TCE plumes at SRS. The base case TCE transport times (based on multiple modeled particle tracks) from the location of the PRB to discharge in Steel Creek are estimated to range from 5-15 years. However, there is also residual TCE present in the lower permeability zones of the

aquifers (i.e. tan clay confining zone). Thus, it will likely take longer than this time period for the residual TCE to migrate (diffuse) into the more permeable aquifer zones. The location of the distal PRB is about halfway between the neck area and surface water location SC-03 where the TCE is currently observed. By comparison, the time to reach the MCL at SC-03 with a distal PRB is estimated to take about half the time as the PRB in the neck area.
No change to the document is proposed.

Contact: Jeff Ross, 952-6897 (j.ross@srs.gov)

SRS Responses to
United States Environmental Protection Agency
Comments on the
Removal Site Evaluation Report / Engineering Evaluation / Cost Analysis for Trichloroethylene Plumes Discharging to Steel Creek in P-Area Groundwater Operable Unit (NBU), CERCLIS Number: 81, SRNS-RP-2017-00372, Revision 0, October 2017, Savannah River Site, South Carolina

Comments Received 12/13/2017

GENERAL COMMENTS

1. The last paragraph in Section 5.2, Identification of Applicable or Relevant and Appropriate Requirements (ARARs), on Page 19 of 58 of the Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis for the P-Area Groundwater Operable Unit (RSER/EE/CA) states "Implementation of the proposed removal action would have a negligible impact on Savannah River Site (SRS) archeological, cultural, historical, or natural resources." Although implementation of Alternatives 2 or 3 would reduce concentrations of chlorinated volatile organic compounds (cVOCs) including tetrachloroethylene (PCE), trichloroethylene (TCE), and cis-1,2 dichloroethylene (DCE) in groundwater at the area of application, the cVOC plumes downgradient of the treatment will continue to discharge to Steel Creek. It is unclear from the RSER/EE/CA the amount of cVOCs mass remaining in groundwater, the mass that will be treated for each alternative, and additionally, the mass of cVOCs that will be allowed to continue to discharge to Steel Creek in exceedance of the maximum contaminant levels (MCL). The impact of the continued discharge of cVOCs above the MCL to Steel Creek is not evaluated in the RSER/EE/CA under the alternatives. As such, it is not clear how the basis of the assertion that an 80 percent (%) or greater TCE mass flux reduction should achieve the MCL in Steel Creek was determined. For clarity and completeness, revise the RSER/EE/CA to address this issue.

   Response: Clarification.

   SRS interprets the referenced text (Section 5.2, page 19) to address potential construction impacts related to the implementation of the removal action, rather than the effectiveness of the removal action in addressing the affected media (in this case surface water as referred to in the comment).

   The basis for the assertion that an 80 percent (%) or greater TCE mass flux reduction should achieve the MCL in Steel Creek is based on mass balance as related to concentration. The recent TCE concentrations in Steel Creek at location SC-03 are averaging 20 ug/L, thus an 80% reduction would reduce concentrations to ~ 4 ug/L or less that the MCL of 5 ug/L. The actual TCE mass in portions of the aquifer are not well known, but it is known that nearly 100% of the mass reaching Steel Creek passed through the neck area. The actual impact of the alternatives to Steel Creek would be realized once the remnant downgradient portions of the plumes have discharged, but in the short term the effectiveness of treatment across the permeable reactive barrier (PRB) can be measured. The basis for the 80% reduction will be added to the text on page 9, where this concept is discussed.

   Contact: Jeff Ross, 803-952-6897 (j.ross@srs.gov)

2. The text in the last paragraph in Section 6.0, Preferred Removal Action Alternative, on Page 27 of 58, states that "The field application and effectiveness of the preferred action could be evaluated to consider applying this technology at a much larger scale at the elbow portion of the distal area of the plumes at a later time, subsequent to additional characterization of that area." During our May 2017 scoping meeting, the FFA parties agreed that before the neck or elbow source area is selected for treatment, the nature and extent of groundwater contamination in the elbow area would be determined. The investigation will provide information regarding the magnitude and extent of TCE mass and proximity to Steel Creek. The additional information will be used by the FFA parties to determine which area should be treated first as part of this action, and which area will be treated as part of a subsequent action. Please include language in the RSER/EE/CA that indicates the nature and extent of groundwater contamination in the elbow area will be characterized, and the FFA parties will review investigation results before the treatment area location is selected.

Response: Clarification.

The May 2017 scoping meeting included discussion of the projected funding availability to support the PAGW OU removal action and the need to remain within the funding profile associated with the Wetlands Dunbarton Bay project scheduled for FY2019. The Wetlands at Dunbarton Bay project was rescheduled to create the opportunity to implement the PAGW OU removal action and the C-Area Groundwater OU removal action.

DOE understood that the removal action alternative evaluation in the RSER/EE/CA would address both the neck and distal (elbow) source areas. In the event that the characterization data was not available in time for the issuance of the Action Memorandum (scheduled submittal date April 11, 2018), the additional options defined in the RSER/EE/CA provide a mechanism for the Core Team to consider a future Action Memorandum to address the distal (elbow) area if warranted.

SCDHEC has recently approved the SRS Hydrogeologic and Geotechnical Projects Program Plan for the Elbow and Steel Creek Characterization of the TCE Groundwater Plumes at the PAOU (ER-HGPP-2017-00007) (SRNS-J2000-2017-00650, dated December 20, 2017) that provides detail for extensive characterization of the distal (elbow) plume area which began at the end of January 2018. This characterization will not be completed in time to support the Action Memorandum based on the current schedule. Provided that the expected characterization is completed during the 3Q of FY2018, a removal action based on the additional characterization data could start no earlier than 4Q FY2020. For planning purposes, a detailed alternate schedule was developed to show the approximate schedule of activities leading up to the execution of the removal action if that action was delayed until characterization activities are completed. The alternate schedule below relies on several assumptions, including that

characterization results continue to support use of the PRB as the appropriate technology, albeit at a different location.

Characterization data available	9/13/18
Complete evaluation of characterization data	10/11/18
Conduct scoping meeting to discuss characterization data	12/15/18
Submit revised RSER/EE/CA addressing scoping mtg agreement(s)	3/1/19
EPA/SCDHEC complete review of RSER/EE/CA (assumes 60/30 schedule rather than 30/30)	5/1/19
Complete revision of and submit RSER/EE/CA with draft Action Memo to address regulatory comments	6/1/19
Start 30-day Public Comment Period	6/15/19
Complete 30-day Public Comment of revised RSER/EE/CA	7/15/19
EPA/SCDHEC complete review of draft action memorandum	7/15/19
Submit final action memorandum and responsiveness summary	8/15/19
Complete Public Notice of Action Memorandum	9/1/19
Complete revision of PRB SOW (assumes removal action scope agreed to in scoping meeting)	3/1/19
Issue PRB RFP (at risk prior to EE/CA approval)	5/15/19
Complete evaluation of proposals	7/15/19
Award PRB Subcontract	8/19/19
PRB Subcontractor completes design data collection (if needed)	12/12/19
SRS submit Rev 0 of Removal Action Design Plan/EMP (Assumes design received, pre-construction plan approved and permits secured)	5/15/20
EPA and SCDHEC complete review of RADP/EMP Rev 0	7/15/20
SRS Submit Rev 1 of RADP/EMP	8/15/20
EPA and SCDHEC Approve Rev 1 of RADP/EMP	9/15/20

PRB Subcontractor completes mobilization/Removal Action Start **10/15/20**

Please note that sufficient data is available to support the proposed removal action (i.e., permeable reactive barrier [PRB]) in the neck area).

Considering (a) the hydrogeologic conditions at the neck area featuring a narrow plume in a very transmissive zone that support a PRB technology; (b) the current level of uncertainty in the hydrogeologic setting at the distal (elbow) area, and (c) the availability of funding for the preferred alternative in FY2019, DOE believes implementing the removal action (i.e., PRB) at the neck area is a better choice for a first response action and best accommodates the other commitments and plans for FFA program implementation in the near term (2-5 years). DOE will schedule a Core Team scoping meeting towards the end of 2018 to discuss the data generated from the distal plume characterization. DOE will also commit to, after having evaluated two years of PRB performance data, reconvening the Core Team in a Scoping Meeting to discuss the applicability and potential benefit of another removal action in the distal portion of the plume.

No changes to the EE/CA text are proposed.

Contact: Mike Griffith, 803-952-9183 (mike.griffith@srs.gov)

3. The text in the first paragraph in Section 6.0, Preferred Removal Action Alternative, on Page 28 of 58, indicates the permeable reactive barrier (PRB) alternative is preferred over the in situ chemical oxidation (ISCO) technology because of its proven success at other waste sites outside of SRS and minimal operations and maintenance (O&M) activities (sampling and reporting) and associated costs. The text further indicates the O&M for ISCO would be much higher as multiple injections with continued procurement of chemicals and injection equipment would be required. As such, the PRB remedy alternative assumes only a single pass of zero valent iron (ZVI) injections will be required. However, although the success of the PRB technology has been proven at other waste sites outside of SRS, no additional site specific data or information is presented to support the assertion that only a single pass of ZVI would be sufficient. As such, the overall impacts to remedy effectiveness and costs would be negative if post injection performance monitoring indicates additional ZVI injections are necessary. Revise the RESER/EE/CA to address this issue.

Response: Clarification.

Unlike ISCO, a PRB can be constructed of varying thicknesses so that the travel time through/contact time with the reactive media is sufficient to destroy the cVOCs. The O&M

period for alternative comparison is ten years. It is highly unlikely that emplacement of additional ZVI will be required over that time frame. The Statement of Work for the design/build subcontract to install the PRB will include performance criteria including an expectation of 25-year longevity. No change to the document is proposed.

Contact: Monique Rabin, 803-952-6695 (monique.rabin@srs.gov)

SPECIFIC COMMENTS

1. **Section 5.5, Comparison of Removal Action Alternatives, Page 25 of 58:** Section 5.5 states, "While the effectiveness of Alternative 2B was considered to be high, there is greater uncertainty associated with the conceptual design due to lack of characterization data in this area"; however, it is unclear if associated costs for additional characterization data required in the elbow portion of the distal area are included in the cost estimates for both Alternative 2B and 3B as found in Appendix B – Detailed Cost Estimates. Revise the RSER/EE/CA to address this issue.

   Response: Agree.

   The text in Sections 5.4 and 5.5 will be revised to indicate that the estimated cost of alternatives 2B and 3B did not include the cost of the additional characterization.

   Contact: Monique Rabin, 803-952-6695 (monique.rabin@srs.gov)

2. **Figure 5, UAZ Potentiometric Surface at the PAGW OU and Figure 6, LAZ Potentiometric Surface at the PAGW OU, Pages 38 and 39 of 58:** Figures 5 and 6 depict the potentiometric surfaces of the upper aquifer zone (UAZ) and lower aquifer zone (LAZ), respectively; however, the data used to construct the potentiometric surfaces is not included on the figures. Revise Figures 5 and 6 to include the groundwater elevation data and well nomenclature for each well location used to develop the potentiometric surface for the UAZ and LAZ. Additionally, the data used to construct the figures is from 2010. Revise the Figures 5 and 6 using more recent data, if available to reflect the most current understanding of the site.

   Response: Agree.

   The potentiometric surfaces were created using modeled heads from the 2010 baseline groundwater model in order to smooth the data for presentation. SRS will revise the figures to

reflect the empirical 2016 data.

Contact: Mark Amidon, 803-725-8251 (mark.amidon@srs.gov)

3. **Appendix B, Detailed Cost Estimates, Pages B-2 through B-6:** The direct operation and maintenance (O&M) costs for Alternatives 2 and 3 are provided; however, it is unclear what sampling frequency is proposed with these associated costs. Revise the RSER/EE/CA to include the groundwater sampling frequency for each alternative with direct O&M costs.

   Response: Agree.

   The assumptions for groundwater sampling frequencies for each of the alternatives range from monthly at the beginning of year 1 to biannually beginning in year 3. This text will be added to Section 5.4 of the document.

   Contact: Mark Amidon, 803-725-8251 (mark.amidon@srs.gov)

MINOR COMMENTS

1. The titles of Figures 17, 18, 19, and 20 are different than what is listed in the Table of Contents. For example, Figure 17 is entitled "Principal Areas within the TCE Groundwater Plumes"; however, the table of contents indicates the title of Figure 17 is "Principal Areas within the cVOC Groundwater Plumes". Furthermore, Figure 18 is entitled "Alternative 2A: PRB in the Neck Area of the TCE Plumes"; however, the Table of Contents lists the title of this figure as "Alternative 2A: PRB in the Neck Area of the Plumes". For clarity and completeness, revise the RSER/EE/CA to address these issues.

   Response: Agree.

   The document will be revised to reflect the correct figure titles in the Table of Contents.

   Contact: Monique Rabin, 803-952-6695 (monique.rabin@srs.gov)

SRS Responses to
United States Environmental Protection Agency
Comments on the
Removal Site Evaluation Report / Engineering Evaluation / Cost Analysis for Trichloroethylene Plumes Discharging to Steel Creek in P-Area Groundwater Operable Unit (NBU),
CERCLIS Number: 81, SRNS-RP-2017-00372, Revision 0, October 2017,
Savannah River Site, South Carolina

Comments Received 12/13/2017

2. Appendix B, Cost Estimates: The abbreviation "CPT" is used within the text of the cost estimates for Alternatives 2 and 3; however, it is not defined in the text, or in the "List of Abbreviations and Acronyms." Revise the RSER/EE/CA to include "CPT" in the List of Abbreviations and Acronyms.

   Response: Agree.

   The document will be revised to add "cone penetrometer testing" to the acronym list and defined in the document text the first time the CPT acronym is used.

   Contact: Monique Rabin, 803-952-6695 (monique.rabin@srs.gov)

DRAFT

Ms. Susan B. Fulmer, P. G., Manager
Federal Remediation Section
Division of Site Assessment, Remediation and Revitalization
Bureau of Land and Waste Management
South Carolina Department of Health and Environmental Control
2600 Bull Street
Columbia, South Carolina 29201

Mr. Jon Richards
Acting Savannah River Site Remedial Project Manager
Superfund Division
U. S. Environmental Protection Agency, Region 4
61 Forsyth Street, SW
Atlanta, Georgia 30303

Dear Ms. Fulmer and Mr. Richards:

SUBJECT: Action Memorandum and Responsiveness Summary for the Non-Time Critical Removal Action for the P-Area Groundwater Operable Unit (U), CERCLIS Number: 81

Pursuant to the National Oil and Hazardous Substances Pollution Contingency Plan [40 CFR Section 300.415(b)(2)(i)] that states removal actions shall be considered when there is "*Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants*", the U.S. Department of Energy (DOE) prepared a Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis (RSER/EE/CA) for Trichloroethylene Plumes Discharging to Steel Creek in P-Area Groundwater Operable Unit (SRNS-RP-2017-00372, Revision 1, Month Day, 2018) CERCLIS Number: 81. The scope of this removal action is to treat the P-Area Groundwater (PAGW) Operable Unit (OU) trichloroethylene (TCE) groundwater plume(s) prior to discharging into Steel Creek. The regulatory review of the Revision 0 RSER/EE/CA occurred from October 31, 2017 to December 13, 2017.

The Savannah River Site (SRS) received comments from the South Carolina Department of Health and Environmental Control (SCDHEC) and the U.S. Environmental Protection Agency (EPA) on December 13, 2017. The SRS responses to the EPA's and SCDHEC's comments were incorporated into the Revision 1 RSER/EE/CA, which was made available for public review and comment from Month Day, 2018 to Month Day, 2018. Comments received during the public comment period are addressed in the enclosed Responsiveness Summary, which will be made part of the Administrative Record. In addition, a notice will be filed in the Environmental Bulletin within two (2) weeks of submittal of the Action Memorandum and Responsiveness Summary to the Administrative Record File/Information Repository File.

P-Area is located within the central portion of SRS ~4.0-km (2.5 mi) east-southeast of the geographical center of SRS and about 6.4 km (4 mi) west of the nearest site boundary. P-Area consists of a closed nuclear reactor building complex and several support facilities that were characterized and

identified as sources to soil and groundwater contamination during facility operations between 1954 and 1991. The PAGW OU encompasses the groundwater beneath P-Area, northwest to Steel Creek, northeast toward PAR Pond and SRS Road F, and southeast to Meyers Branch. PAGW OU includes a volatile organic compound (VOC) groundwater plume containing primarily TCE with minor quantities of tetrachloroethylene, and a larger tritium groundwater plume. Tritium will be addressed in a separate, future decision and is not addressed as part of this removal action.

Groundwater contamination associated with TCE contamination is primarily exhibited in a narrow band north of the P-Reactor and extends west to Steel Creek. The VOC groundwater plumes can be described in three parts based on location: 1) source area, 2) neck area, and 3) distal area.

- Source Area: The source area represents the majority of the VOC groundwater contamination and is centered north of the P-Reactor within the P Area facility area.

- Neck Area: The neck area defines the location where the VOC groundwater plumes are controlled by a buried geologic feature which is believed to have been a stream bed at one time. This buried geologic feature creates a defined narrowing of the groundwater plumes, located west of the P Area facility area, and acts as a transport corridor between the source area and the distal area of the plumes.

- Distal Area: The distal area defines the area of the plumes that are closest to Steel Creek, and is referred to as the "elbow portion" of the distal plume area.

Alternatives associated with treating at the neck and distal areas of the plumes are focused on addressing the higher TCE concentrations (above ~5,000 µg/L).

The removal action objective for the NTC removal action is to reduce the TCE mass in the groundwater plumes so that the mass flux to Steel Creek will ultimately be reduced to a concentration less than the maximum contaminant level (MCL) (<5 µg/L) in surface water. Two portions of the groundwater plume with elevated TCE concentrations, the neck area and the elbow portion of the distal area, were evaluated to determine the best location for a removal action.

To determine the preferred remedy, both Permeable Reactive Barrier (PRB) and In Situ Chemical Oxidation (ISCO) technologies were evaluated as part of the RSER/EE/CA. The analysis for both of these remedial technologies include the performance monitoring of the groundwater conditions evaluate the effectiveness of the treatment. The PRB technology involves the emplacement of zero-valent iron into the subsurface barrier to intercept and treat the TCE and any other associated VOCs as they flow through the zone of iron emplacement. The iron is a reactive medium that degrades the TCE into nontoxic dehalogenated organic compounds and inorganic chloride. ISCO technology involves the injection(s) of a chemical oxidant (sodium persulfate), an activator (if needed), and pH buffer. Sodium persulfate oxidizes the TCE in the groundwater plumes and converts the contaminant to non-toxic compounds. Multiple injections may be necessary for the ISCO based on the effectiveness of the initial treatment.

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The cleanup alternatives using these technologies that were evaluated based on effectiveness, ease of implementation, and cost were:

Alternative	Description
Alternative 1	No Action
Alternative 2A	PRB in the Neck Area of the TCE Groundwater Plume
Alternative 2B	PRB in the Elbow Portion of the Distal Area of the TCE Plume
Alternative 3A	ISCO Using Sodium Persulfate in the Neck Area of the TCE Plume
Alternative 3B	ISCO Using Sodium Persulfate in the Elbow Portion of the Distal Area of the TCE Plume

The selected removal action for the PAGW OU is Alternative 2A, PRB in the Neck Area of the TCE groundwater plume. The installation of a PRB in the well-defined highly permeable sediments in the neck area of the TCE plume will cut off the source area of the plume and prevent TCE migration in groundwater past the treatment zone, reduce contaminant mass, and provide long term effectiveness by ultimately reducing the TCE mass flux to Steel Creek above the MCL. This alternative will not preclude any additional remediation of the PAGW OU and is expected to be consistent with the expected final remedial actions at the PAGW OU. The selected alternative will comply with all action- and location-specific ARARs identified in Table A-1 of the enclosed RSER/EE/CA.

Field activities associated with the Removal Action are anticipated to commence by April 30, 2019. Upon conclusion of the removal action, a Removal Action Report that summarizes the work will be prepared and submitted to document the completion of the removal action.

Questions from you or your staff may be directed to me at (803) 952-8365, or the DOE Project Manager, Mr. Philip Prater, at (803) 952-9333.

Sincerely,

Brian T. Hennessey
SRS Remedial Project Manager
Area Completion Project

IACD-18-xxx

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Enclosure:
Responsiveness Summary for the Non-Time Critical Removal Action for C-Area Groundwater Operable Unit CERCLIS Number: 81 (ERD-EN-2017-xxx, Revision 0, Month Year)

cc w/o encl:
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