



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

FEB 22 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 (RSER/EE/CA) for C-Area Groundwater Operable Unit (U) (SRNS-RP-2017-00365, Revision 1, February 2018), Savannah River Site Responses to Regulatory Comments on the Revision 0 Document, and Draft Action Memorandum, CERCLIS Number: 82

In accordance with the terms of the Federal Facility Agreement, the U. S. Department of Energy (DOE) is submitting the subject 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 November 27, 2017 and December 5, 2017, respectively. Draft Savannah River Site (SRS) responses to the comments were submitted electronically to EPA and SCDHEC on January 31, 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 C-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 Federal Project Director, Ms. Karen Adams, at (803) 952-7871.

Sincerely,

A handwritten signature in black ink, appearing to read "BHennessey".

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

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Ms. Susan Fulmer
Mr. Jon Richards

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Enclosures:

1. **Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis (RSER/EE/CA) for C-Area Groundwater Operable Unit (U) (SRNS-RP-2017-00365, Revision 1, January 2018) CERCLIS Number: 82**
2. **SRS Responses to EPA Comments on the Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis (RSER/EE/CA) for C-Area Groundwater Operable Unit (U) (SRNS-RP-2017-00365, Revision 0, September 2017) CERCLIS Number: 82**
3. **SRS Responses to SCDHEC Comments on the Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis (RSER/EE/CA) for C-Area Groundwater Operable Unit (U) (SRNS-RP-2017-00365, Revision 0, September 2017) CERCLIS Number: 82**
4. **Draft Action Memorandum and Responsiveness Summary for the Non-Time Critical Removal Action for the for the C-Area Groundwater Operable Unit**

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 U.S. Environmental Protection Agency Comments on Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis (RSER/EE/CA) for C-Area Groundwater Operable Unit (U), CERCLIS Number: 82, SRNS-RP-2017-00365, Revision 0, September 2017, Savannah River Site, South Carolina

Page 1 of 6

Comments Received 12/5/2017

TECHNICAL REVIEW COMMENTS

1. The last bullet in Section 5.4 Costs, Page 17 of 34 of the hard copy of the Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis (RSER/EE/CA) for the C-Area Groundwater Operable Unit (EE/CA) indicates the monitoring approach for Alternative 3 is the same as for Alternative 2. As such, it would be expected the Direct O&M Costs for groundwater monitoring in Alternative 2 and Alternative 3 would be the same. However, a review of the detailed costs provided in Appendix B, Cost Estimates on Page B-1 for Alternative 2 and Page B-2 for Alternative 3 indicates the groundwater monitoring costs are not the same. For example, Page B-1 indicates the Direct O&M Costs for Alternative 2 is \$272,830.00 versus \$353,312.00 for Alternative 3 on Page B-2. The difference in costs between the groundwater monitoring approach for Alternative 2 and Alternative 3, including the difference in costs for preparation of the removal action report/interim post closure report (RAR/IPCR) of \$30,000.00 versus \$50,000.00, respectively, should be explained in the text. For clarity and completeness, revise the RSER/EE/CA to address this issue.

Response: Clarification/Agree.

The estimates (Attached) in Appendix B will be revised to indicate the two alternatives have the same monitoring approach. The removal action report (RAR) for Alternative 3 will cost slightly more due to 2 rounds of ISCO injections and wells are required for the injection, while the emulsified oil can be emplaced using a single DPT injection. The cost estimates will be revised throughout the document. The revised estimates for the two alternatives are included below (after the comment responses).

Contact: Terry Killeen, 803-952-6850 (terry.killeen@srs.gov)

2. In Figure 6, CAGW OU TCE Plume, 2016, Page 31 of 34 of the hard copy of the EE/CA, the enlarged view of the C-Reactor (105-C) located in the upper right corner of the figure depicts several red circles drawn in the electrical resistivity heating-soil vapor extraction (ERH-SVE) remediation area. However, the meaning or purpose of the red circles is unclear as they were not defined in the figure legend. For clarity and completeness, revise the figure to address this issue.

Response: Agree.

The red circles in Figure 6 indicate the zones of influence of the SVE wells used during and after the electrical resistance heating (ERH) for remediation of TCE in the vadose zone. Figure 6 (see attached) will be revised to identify the ERH-SVE zone of influence on the map and in the legend with a blue cross-hatched pattern as requested in other reports.

SRS Responses to U.S. Environmental Protection Agency Comments on Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis (RSER/EE/CA) for C-Area Groundwater Operable Unit (U), CERCLIS Number: 82, SRNS-RP-2017-00365, Revision 0, September 2017, Savannah River Site, South Carolina

Page 2 of 6

Comments Received 9/21/2017

Contact: Terry Killeen, 803-952-6850 (terry.killeen@srs.gov)

3. In Figure 8, CAGW OU Distal TCE Groundwater Plume ISCO Treatment Area, Page 33 of 34 of the hard copy of the EE/CA the well location symbol (e.g., purple star) for upgradient Phase 2 well "CRW024C" is not visible in the figure. It appears the upgradient well label CAGW 02 for proposed "Phase 2 DPT" groundwater sample is covering well location CRW024C. For clarity and completeness, revise the figure to address this issue.

Response: Agree.

Figure 8 (see attached) will be revised to show the symbol for well CRW024C.

Contact: Terry Killeen, 803-952-6850 (terry.killeen@srs.gov)

4. In the hard copy version of the RSER/EE/CA, Appendix B, Page B-2 of B-2 is mistitled as "Appendix C: Cost Estimates..." Revise the title to state "Appendix B: Cost Estimates..." in the hard copy version.

Response: Agree.

Appendix B, Page B-2 of B-2 will be revised so the title states "Appendix B: Cost Estimate".

Contact: Terry Killeen, 803-952-6850 (terry.killeen@srs.gov)

SRS Responses to U.S. Environmental Protection Agency Comments on Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis (RSER/EE/CA) for C-Area Groundwater Operable Unit (U), CERCLIS Number: 82, SRNS-RP-2017-00365, Revision 0, September 2017, Savannah River Site, South Carolina

Comments Received 9/21/2017

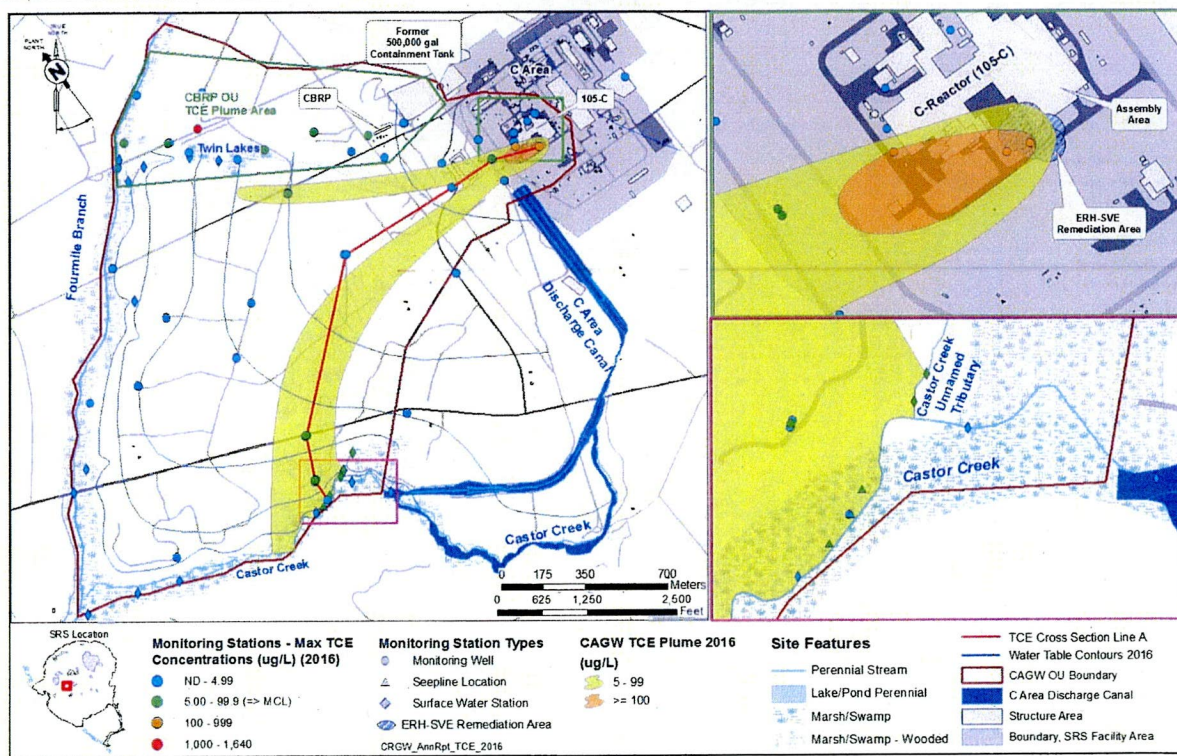


Figure 6. CAGW OU TCE Plume, 2016

SRS Responses to U.S. Environmental Protection Agency Comments on Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis (RSER/EE/CA) for C-Area Groundwater Operable Unit (U), CERCLIS Number: 82, SRNS-RP-2017-00365, Revision 0, September 2017, Savannah River Site, South Carolina

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Comments Received 9/21/2017

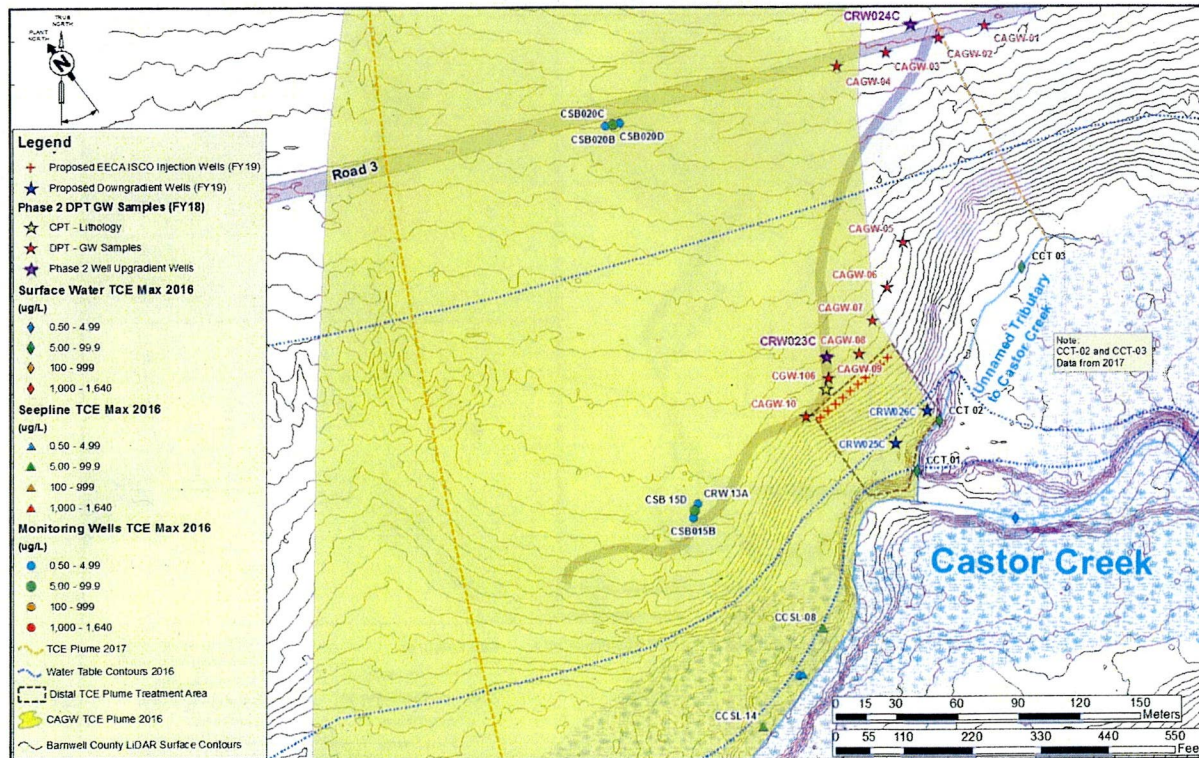


Figure 8. CAGW OU Distal TCE Groundwater Plume ISCO Treatment Area

**SRS Responses to South Carolina Department of Health and Environmental Control
Comments on: Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis
(RSER/EE/CA) for C-Area Groundwater Operable Unit (U), CERCLIS Number: 82
(SRNS-RP-2017-00365, Revision 0, September 2017) received September 29, 2017.
Page 1 of 6**

Comments Received 11/27/17

Specific Comments

1. Section 2.5 Nature and Extent of Contamination, page 6, second paragraph. This paragraph states that the 'current' TCE concentrations in surface water at station CCT-03 was 15 ug/L and station CCT-01 was 13 ug/L and does not mention CCT-02 sample results. Figure 7, page 32, and Figure 8, page 33, have a note stating that sample results from CCT-02 and CCT-03 were from the 2017 sampling event. Also, Figure 7 and Figure 8 indicate that TCE concentrations in CCT-01, CCT-02 and CCT-03 were greater than MCL. Please clarify.

Response: Agree/Clarification.

In 2017, surface water stations CCT-02 and CCT-03 were observed to be above the MCL (5 µg/L) for TCE, indicating the CAGW OU TCE plume may have shifted to the east. The first sentence in the fourth paragraph of Section 2.5 Nature and Extent of Contamination will be revised as follows:

"In 2017, TCE is currently present was above the MCL (5.0 µg/L) in three surface water at stations: CCT-03 (15 µg/L), CCT-02 (8.7 µg/L), and CCT-01 (13.0 µg/L).; both—These three stations both are located on a small unnamed tributary that discharges to Castor Creek."

Contact: Terry Killeen, 803-952-6850 (terry.killeen@srs.gov)

2. Section 7.0, Implementation Schedule, page 19. Although it is noted in the scoping summary, a footnote should be inserted into the schedule noting that the annual groundwater report for the CAGW OU will be suspended until the effectiveness monitoring of the removal action is reported. Please comply.

Response: Agree.

The following footnote will be added to the Implementation Schedule in Section 7.0:

" a) The annual groundwater report for the CAGW OU will be suspended until the effectiveness monitoring of the removal action is reported."

Contact: Terry Killeen, 803-952-6850 (terry.killeen@srs.gov)

3. Figures 4, 6-8, pages 29, 31-33. The TCE concentration data points (5 ug/L-99 ug/L) are the same color of the TCE plume and are difficult to see. Please consider choosing a different color for the data points.

**SRS Responses to South Carolina Department of Health and Environmental Control
Comments on: Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis
(RSER/EE/CA) for C-Area Groundwater Operable Unit (U), CERCLIS Number: 82
(SRNS-RP-2017-00365, Revision 0, September 2017) received September 29, 2017.**

Page 2 of 6

Comments Received 11/27/17

Response: Agree.

Figures 4, 6, 7 and 8 (see attached) will be revised to use a bright green color for TCE concentration data points between 5 µg/L and 99 µg/L.

Contact: Terry Killeen, 803-952-6850 (terry.killeen@srs.gov)

4. Figure 5, page 30. Please match the colors of the C-Area TCE Cross-Section A-A' to the colors in the Stratigraphy Legend.

Response: Clarification.

The polygons for each stratigraphic section in the cross-section are the same color as the stratigraphic sections in the legend, but they are 50% transparent to show other features in the cross-section. The cores/CPTs depicting the stratigraphic sections are not transparent and are the same colors as the stratigraphic sections in the legend. No changes to Figure 5 are proposed.

Contact: Terry Killeen, 803-952-6850 (terry.killeen@srs.gov)

**SRS Responses to South Carolina Department of Health and Environmental Control Comments on:
 Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis (RSE/EE/CA)
 for C-Area Groundwater Operable Unit (U), CERCLIS Number: 82
 (SRNS-RP-2017-00365, Revision 0, September 2017) received September 29, 2017.
 Page 3 of 6**

Comments Received 11/27/17

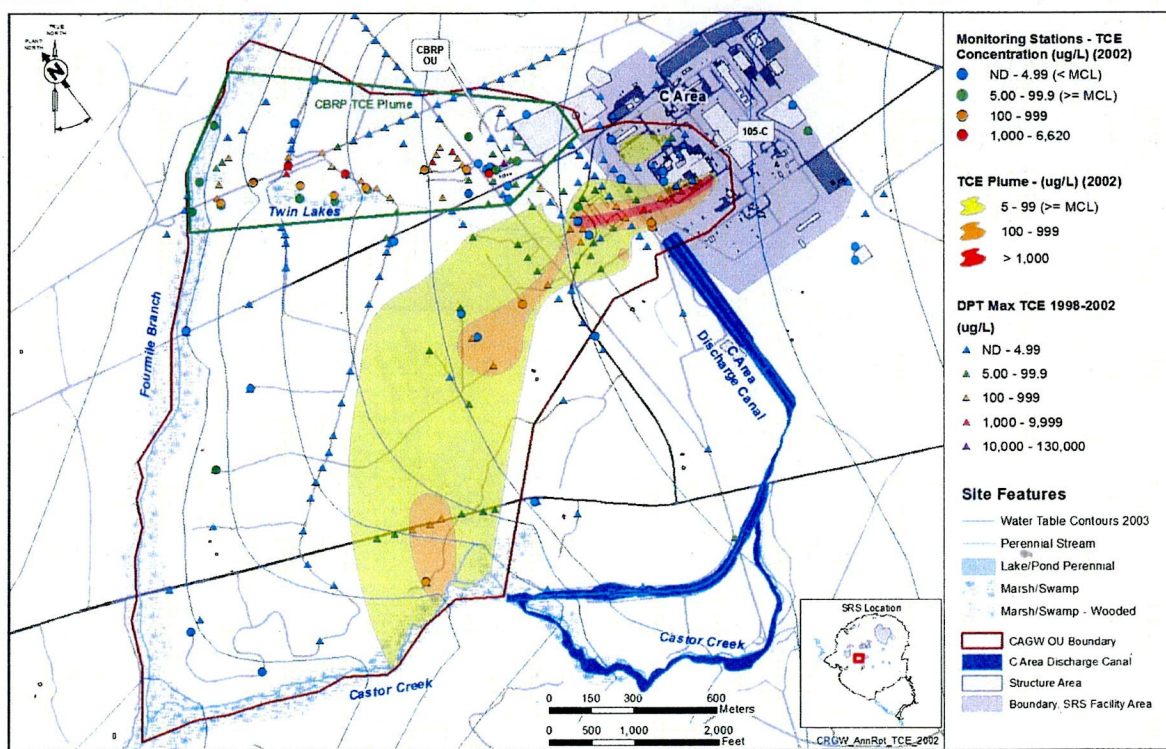


Figure 4. CAGW OU TCE Plume, 1998 to 2002

**SRS Responses to South Carolina Department of Health and Environmental Control Comments on:
Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis (RSER/EE/CA)
for C-Area Groundwater Operable Unit (U), CERCLIS Number: 82
(SRNS-RP-2017-00365, Revision 0, September 2017) received September 29, 2017.
Page 4 of 6**

Comments Received 11/27/17

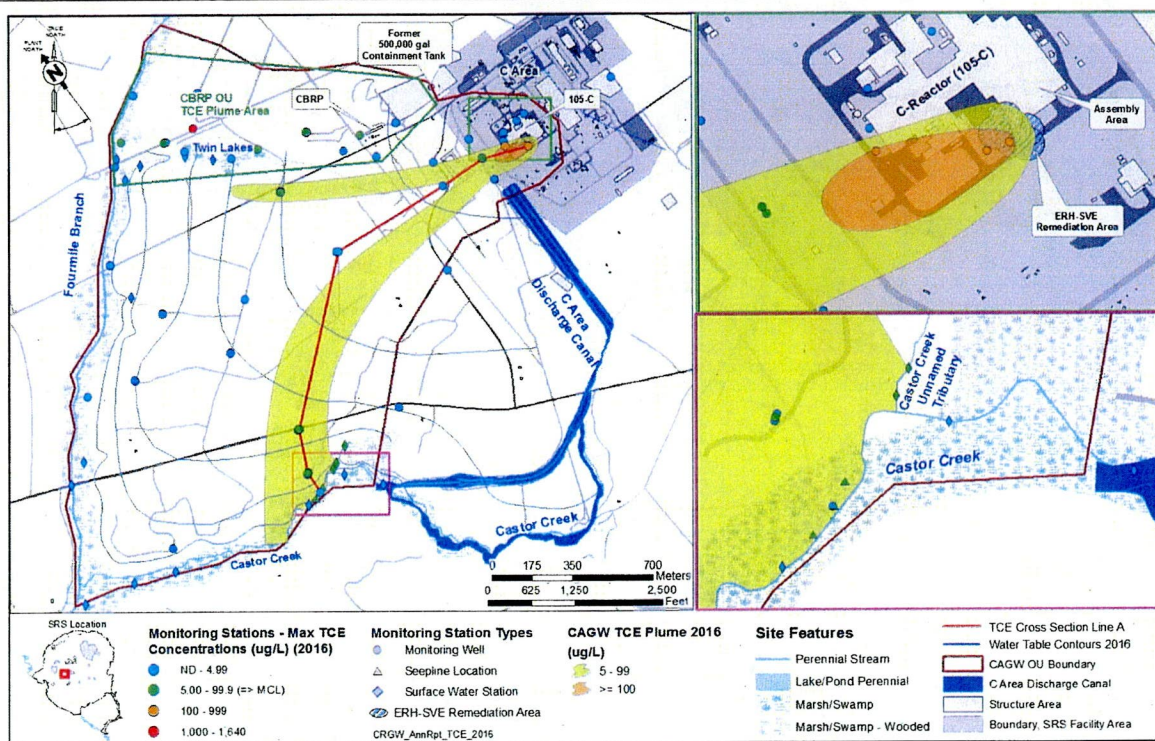


Figure 6. CAGW OU TCE Plume, 2016

**SRS Responses to South Carolina Department of Health and Environmental Control Comments on:
Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis (RSER/EE/CA)
for C-Area Groundwater Operable Unit (U), CERCLIS Number: 82
(SRNS-RP-2017-00365, Revision 0, September 2017) received September 29, 2017.
Page 5 of 6**

Comments Received 11/27/17

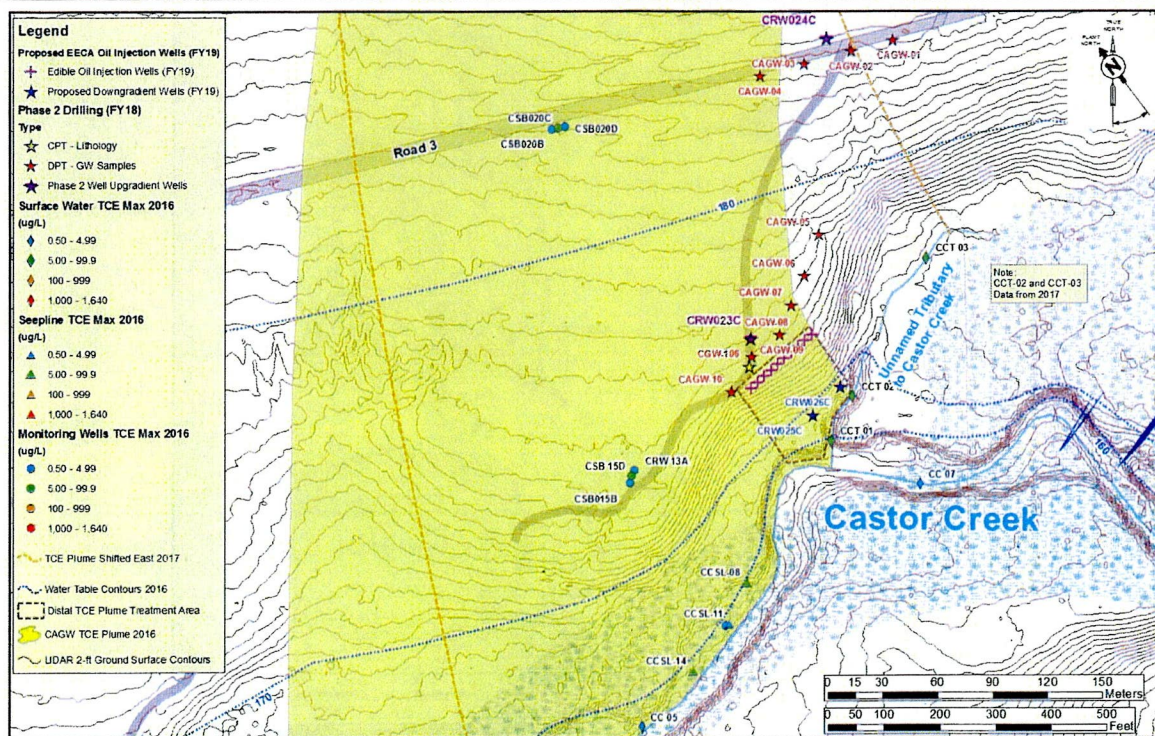


Figure 7. CAGW OU Distal TCE Groundwater Plume with Treatment Barrier

**SRS Responses to South Carolina Department of Health and Environmental Control Comments on:
Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis (RSER/EE/CA)
for C-Area Groundwater Operable Unit (U), CERCLIS Number: 82
(SRNS-RP-2017-00365, Revision 0, September 2017) received September 29, 2017.
Page 6 of 6**

Comments Received 11/27/17

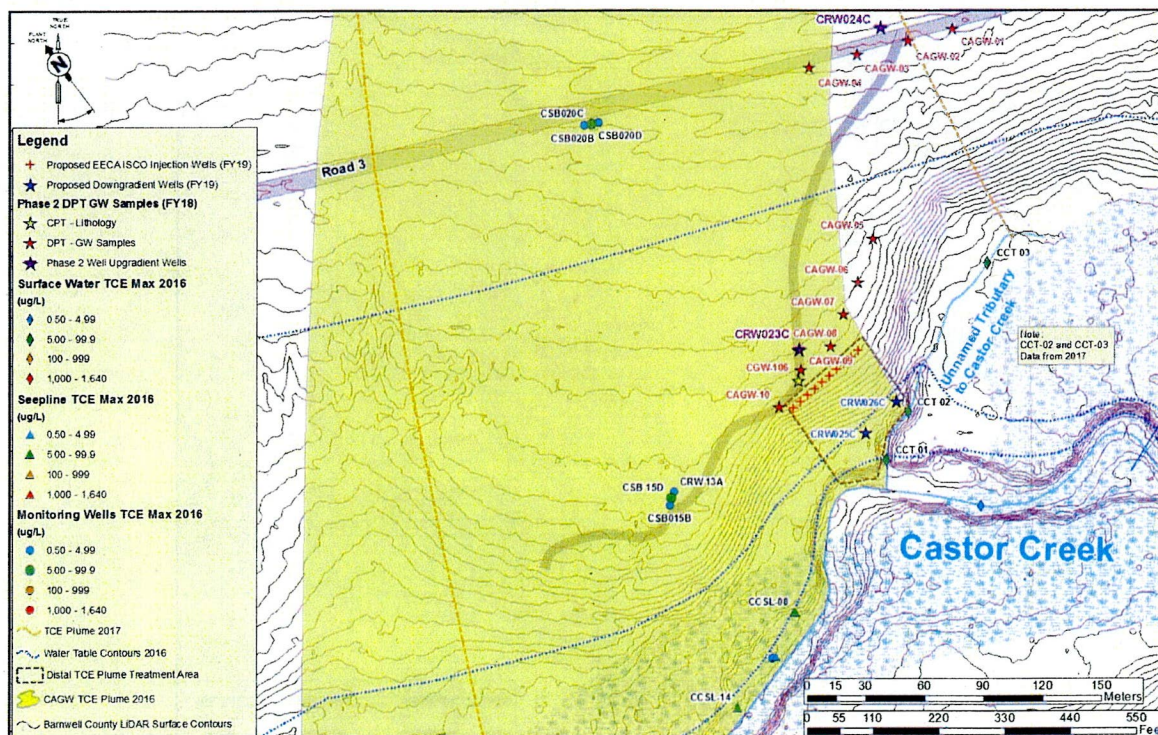


Figure 8. CAGW OU Distal TCE Groundwater Plume ISCO Treatment Area

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Ms. Susan B. Fulmer, P. G., Manager
Federal Remediation Section
Division of Site Assessment, Remediation and Revitalization
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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 C-Area Groundwater Operable Unit (U), CERCLIS Number: 63

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 C-Area Groundwater Operable Unit (SRNS-RP-2017-00365, Revision 1, Month Day, 2018) CERCLIS Number: 82. The scope of this removal action is to treat the trichloroethylene (TCE) groundwater plume in the distal portion of the C Area Groundwater Operable Unit (OU) that exceeds the maximum contaminant levels (MCL) for TCE prior to discharging into an unnamed tributary to Castor Creek. The regulatory review of the Revision 0 RSER/EE/CA occurred from September 29, 2017 to December 5, 2017.

The Savannah River Site (SRS) received comments from the South Carolina Department of Health and Environmental Control (SCDHEC) on November 27, 2017 and the U.S. Environmental Protection Agency (EPA) on December 5, 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.

The C Area Groundwater OU is located within the Fourmile Branch watershed and encompasses groundwater beneath C Area, which flows west to Fourmile Branch and south to Castor Creek. The C Area is situated near the center of the SRS. The primary SRS facility in C Area was the C-Reactor, which operated between 1955 and 1985. Known sources such as the C-Reactor Seepage Basins (904-66G, -67G, -68G), C-Reactor Area Trichloroethylene (TCE) Vadose Zone Source, C-Reactor Purification Area Tritium Source, and non-specified sources associated with reactor operations have resulted in tritium and volatile organic compounds (VOCs) contamination to groundwater. Groundwater flow is generally towards the west and southwest from

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C-Reactor area. CAGW OU includes a VOC groundwater plume containing primarily TCE with minor quantities of tetrachloroethylene, and a larger tritium groundwater plume.

The scope of the removal action is to reduce the TCE flux from groundwater to surface water so that the MCL is no longer exceeded in the unnamed tributary to Castor Creek. The groundwater upgradient of the tributary has been found to be contaminated with TCE exceeding the MCL (5 µg/L). The distal portion of the CAGW OU TCE groundwater plume for this removal action covers an area of approximately 2,733 square meters (m²) (29,418 square feet [ft²]). The TCE groundwater concentrations in this area are expected to exceed 50 µg/L.

The removal action objective to protect human health and the environment include the following:

- Protect human health and the environment by reducing the discharge of groundwater contaminated with TCE to the surface water so that the MCL (5 µg/L) is no longer exceeded.

The three cleanup alternatives that were evaluated based on effectiveness, ease of implementation, and cost were: Alternative 1) No Action, Alternative 2) Treatment Barrier Using Emulsified Edible Oil, and Alternative 3) In Situ Chemical Oxidation Using Sodium Persulfate. The selected removal action for the CAGW OU is Alternative 2, Treatment Barrier Using Emulsified Edible Oil for the distal portion of the CAGW OU TCE groundwater plume. A mixture of emulsified edible oil, water and buffer solution will be injected into the groundwater at the areas of highest TCE concentrations in the distal portion of the CAGW OU TCE groundwater plume. The emulsified edible oil will provide a carbon source for the microbes already present within the area that will aid in the biodegradation of the TCE. The emulsified oil also acts to adsorb the TCE as the water flows through the injection zone, thus reducing TCE transport. This alternative will not preclude any additional remediation of the CAGW OU and is expected to be consistent with the expected final remedial actions at the CAGW OU. The selected alternative will comply with all action- and location-specific ARARs identified in Table A-1 of the enclosed RSER/EE/CA.

Removal activities are scheduled to commence January 3, 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 Federal Project Director, Ms. Karen Adams, at (803) 952-7871.

Sincerely,

Brian T. Hennessey
SRS Remedial Project Manager
Area Completion Project

IACD-18-xxx

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Ms. Susan Fulmer
Mr. Jon Richards

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Enclosure:

**Responsiveness Summary for the Non-Time Critical Removal Action for C-Area Groundwater Operable Unit
CERCLIS Number: 82 (ERD-EN-2017-xxx, Revision 0, Month Year)**

cc w/o encl:

D. Scaturo, SCDHEC-Columbia
S. French, SCDHEC-Columbia
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G. K. Taylor, SCDHEC-Columbia
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