



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

NOV 18 2020

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  
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 Action Report for the P-Area Groundwater Operable Unit Non-Time Critical Removal Action (U) (SRNS-RP-2020-00021, Revision 1, November 2020) (Redline Pages and Clean Copy) and Savannah River Site's Responses to the Regulatory Comments on the Revision 0 Document, SEMS Number: 81

As stated in the *Removal Action Design Plan (RADP) with Effectiveness Monitoring Plan (EMP) for the P-Area Groundwater (PAGW) Operable Unit (OU)* (SRNS-RP-2019-00105, Revision 1, July 2019), the U. S. Department of Energy (DOE) is submitting the subject document for your review. The South Carolina Department of Health and Environmental Control (SCDHEC) and U. S. Environmental Protection Agency (EPA) provided comments on the Revision 0 report on September 25, 2020 and October 9, 2020, respectively. The enclosed final Savannah River Site's responses have been incorporated into the revised document. Please review the enclosures and provide your approval within thirty (30) days of receipt. The effort and time that the SCDHEC and the EPA have given on the subject operable unit are greatly appreciated.

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

Sincerely,

A handwritten signature in black ink, appearing to read "Brian T. Hennessey".

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

NOV 18 2020

Ms. Susan Fulmer  
Mr. Jon Richards

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Enclosures:

1. Removal Action Report for the P-Area Groundwater Operable Unit Non-Time Critical Removal Action (U) (SRNS-RP-2020-00021, Revision 1, November 2020) SEMS Number: 81 (Redline Pages and Clean Copy)
2. SRS Responses to EPA Comments on the Removal Action Report for the P-Area Groundwater Operable Unit Non-Time Critical Removal Action (U) (SRNS-RP-2020-00021, Revision 0, July 2020) SEMS Number: 81
3. SRS Responses to SCDHEC Comments on the Removal Action Report for the P-Area Groundwater Operable Unit Non-Time Critical Removal Action (U) (SRNS-RP-2020-00021, Revision 0, July 2020) SEMS Number: 81

cc w/o encl:

J. Blalock, SCDHEC-Columbia  
S. French, SCDHEC-Columbia  
M. Reece, SCDHEC-Columbia  
G. K. Taylor, SCDHEC-Columbia  
T. R. Fuss, SCDHEC – Aiken Environmental Affairs Office  
G. O'Quinn, SCDHEC - Aiken Environmental Affairs Office  
B. Cameron, 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 the**  
***Removal Action Report for the P-Area Groundwater Operable Unit Non-Time Critical Removal Action (U)***  
**SEMS Number: 81, SRNS-RP-2020-00021, Revision 0, July 2020,**  
**Savannah River Site, Aiken, South Carolina**  
**Comments Received September 25, 2020**

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**SPECIFIC COMMENTS**

1. **Table 10, Comparison of Pre- and Post-Construction HPIT Data, page 71.** The average values for K (ft day<sup>-1</sup>), K (cm sec<sup>-1</sup>), S<sub>s</sub>, and Groundwater Flow Velocity for the Post-Construction HPIT are incorrect; it appears that they were inadvertently copied and pasted from the Pre-Construction HPIT Average Groundwater Flow Velocity. The correct values should be 3.48E+01, 1.23E-02, 1.49E-05, 1.22E+00, respectively. Please correct.

**Response: Agree**

**The values on Table 10 will be corrected as suggested.**

**Responsible Party: Adam Willey, (803) 646-4944, [adam.willey@srs.gov](mailto:adam.willey@srs.gov)**

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SRS Responses to  
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
Comments on the  
*Removal Action Report for the P-Area Groundwater Operable Unit Non-Time Critical Removal Action (U)*  
SEMS Number: 81, SRNS-RP-2020-00021, Revision 0, July 2020,  
Savannah River Site, Aiken, South Carolina

Comments Received October 9, 2020

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**COMMENTS**

1. **Section 5.1.2, Field Observations, Page 30 of 78:** Section 5.1.2 states, “Visual evidence can be in the form of surface cracks along the ZVI-PRB alignment, although none were observed for this project, or through PPR [pore pressure relief];” however, it is unclear if any surfacing of amendment occurred during the amendment injections. Please clarify if any surfacing of amendment occurred during the injections.

**Response: Agree with Clarification**

Throughout the zero-valent iron injections, amendment was observed coming to surface through adjacent injection wells as intended. Injection wells adjacent to the well currently being injected into, were left open to atmosphere and the observation of material coming to surface through these opened wells provided evidence of pore pressure relief (PPR) and continuity of the induced fracture between wells. The wells which experienced PPR were noted in Appendix F.

Aside from this intended surfacing, there were no observed bypasses, short-circuiting, daylighting, or breaches to the surface of amendment through any abandoned or active wells or boreholes or surface expansion. The following revision is proposed for Section 5.1.2:

Section 5.1.2, Page 30, Following Last Paragraph:

“... for the entire length of the barrier.

Throughout the construction of the ZVI-PRB, there were no observed bypasses, short-circuiting, daylighting, or breaches to the surface of amendment through any abandoned or active wells or boreholes or surface expansion.”

Responsible Party: Adam Willey, (803) 646-4944, [adam.willey@srs.gov](mailto:adam.willey@srs.gov)

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2. **Section 5.1.4, Post-Construction, Pages 31-32 of 78; Table 10, Comparison of Pre- and Post-Construction HPIT Data; and, Appendix G, Hydraulic Pulse Interference Testing Data:** It does not appear that any pre-construction hydraulic pulse interference testing (HPIT) plots were provided in Appendix G. As a result, insufficient information is provided to verify pre-PRB HPIT statements in Section 5.1.4 or Table 10. Also, there is insufficient information regarding how calculations were conducted (e.g., where did the curve that was matched come from, at what point during each test were the other parameters measured, and what were the results). Also, it should be noted that Table 10 indicates that there was a one to two order of magnitude apparent increase in hydraulic conductivity between the pre- and post-HPIT which should be discussed in the RAR. Please provide the pre-construction HPIT plots in Appendix G. Also, clarify calculations and to discuss the increase in hydraulic conductivity between the pre- and post-HPIT.

**Response: Clarification**

Pre-construction Hydraulic Pulse Interference Testing (HPIT) plots will be added as Appendix G.1 (Post-construction HPIT changed to G.2). Calculations were provided for the HPIT in Appendix G.2, starting on page 9. Information on the HPIT applicability and usefulness is provided in the Removal Action Design Plan (RADP) and was considered to be unnecessary for this report, however a reference will be added to Section 5.1.4 as shown below:

Section 5.1.4, Page 31, Paragraph 3: “The hydraulic conductivity and storativity values computed for each well pair are detailed in Table 10 for comparison between pre- and post-construction HPIT results. Background into the application and usefulness of HPIT is provided in the RADP (SRNS 2019a). The hydraulic conductivity calculated for the . . .”

For ideal HPIT conditions, groundwater flow direction is parallel to the tested well pair and the screen intervals are stratigraphically consistent. Groundwater flow at the ZVI-PRB site travels 30 to 85 degrees across the well pairs used for HPIT. In addition, the well pairs are not all screened in the same stratigraphic depth interval. For these reasons, the results of the pre- and post-construction HPIT should be analyzed qualitatively and not quantitatively. The conclusion that there was a one to two order of magnitude increase in hydraulic conductivity between the pre- and post-construction HPIT results is not supported based on the observed results and complications with the study, as discussed above, and in Section 5.1.4.

However, the observed responses in post-construction HPIT support the conclusion that communication between the well pairs was maintained following ZVI-PRB installation. Post-construction HPIT curves are provided in Appendix G.2, where responses can be observed.

Responsible Party: Adam Willey, (803) 646-4944, [adam.willey@srs.gov](mailto:adam.willey@srs.gov)

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
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3. **Section 7.1, Removal Action Effectiveness Monitoring, Page 34 of 78:** According to Section 7.1, “Sampling will be conducted for five years and results will be reported annually in an Effectiveness Monitoring Report (EMR);” however, it is unclear why monitoring is limited to five years. At some point, the ZVI in the PRB may become ineffective (i.e., passivated), so it is important to monitor PRB performance long-term. Please clarify that long-term monitoring of the PRB will be conducted until groundwater remedial objectives are met.

**Response: Agree with Clarification**

The monitoring frequency and schedule were approved in the Removal Action Design Plan (RADP) with Effectiveness Monitoring Plan (EMP) for the P-Area Groundwater (PAGW) Operable Unit (OU) (SRNS-RP-2019-00105). The purpose of this monitoring plan is to assess the effectiveness of the Non-Time Critical Removal Action technology and the sustainability of the zero-valent iron over time. Monitoring results from in-wall wells are expected to show significant decrease in TCE mass flux to meet the groundwater remedial objective for this Removal Action.

As shown in the RADP, RAR, and at the July 15<sup>th</sup> Core Team meeting, a significant portion of the contaminants are contained within low-permeability sediments at, and downgradient of, the PRB. Groundwater flow is relatively slow at the PRB and it will take some time for the higher-permeable layers near the PRB to “flush” out as cleaner groundwater moves through the groundwater system. At this time, diffusion will become the primary driver in moving contaminants from the low permeability to more permeable layers where ancillary effectiveness of the PRB downgradient can be better evaluated. It is anticipated that five years will give sufficient time for the effectiveness of the technology to be evaluated.

In addition to the Effectiveness Monitoring Report specific to this Non-Time Critical Removal Action, a Groundwater Monitoring Report is submitted biennially for the P-Area Groundwater Operable Unit. Long-term monitoring of the Zero-Valent Iron Permeable Reactive Barrier will continue as necessary and will be reported in this document. Section 7.1 will be revised as follows:

**Section 7.1, Page 34, End of Second Paragraph:**

“... PAGW OU NTC RA will evaluate the overall effectiveness of the NTC RA in reducing TCE mass flux in the contaminated groundwater as well as the sustainability of the ZVI-PRB. After five years of effectiveness monitoring and reporting as part of the NTC RA Effectiveness Monitoring Plan, long-term monitoring of the ZVI-PRB will continue as necessary and will be reported in the Biennial PAGW Groundwater Monitoring Report. Any potential future actions will be...”

Responsible Party: Adam Willey, (803) 646-4944, [adam.willey@srs.gov](mailto:adam.willey@srs.gov)

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