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

SEP 10 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: Sampling and Analysis Plan Addendum for the P-Area Groundwater Operable Unit (U) (SRNS-RP-2018-00261, Revision 1, August 2018) (Clean Copy and Redline Pages) and the Savannah River Site's Responses to the Regulatory Comments on the Revision 0 Document, CERCLIS Number: 81

The U. S. Department of Energy (DOE) is submitting the subject document for your review and approval. The U. S. Environmental Protection Agency (EPA) and South Carolina Department of Health and Environmental Control (SCDHEC) provided comments on the Revision 0 document in their letters dated May 4, 2018 and May 24, 2018, respectively. Please review the enclosures and provide your comments or 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. Phillip Prater, at (803) 952-9333.

Sincerely,

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

IACD-18-173

Enclosure:
1. Sampling and Analysis Plan Addendum for the P-Area Groundwater Operable Unit (U) (SRNS-RP-2018-00261, Revision 1, August 2018) CERCLIS Number: 81 (Clean Copy and Redline Pages)
2. SRS Responses to U.S. Environmental Protection Agency Comments on the Sampling and Analysis Plan Addendum for the P-Area Groundwater Operable Unit (U) (SRNS-RP-2018-00261, Revision 0, February 2018) CERCLIS Number: 81
3. SRS Responses to South Carolina Department of Health and Environmental Control Comments on the Sampling and Analysis Plan Addendum for the P-Area Groundwater Operable Unit (U) (SRNS-RP-2018-00261, Revision 0, February 2018) 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
G. N. O'Quinn, SCDHEC–Aiken Environmental Affairs Office
R. Pope, EPA-Atlanta

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

Comments Received: 5/4/2018

I. SPECIFIC COMMENTS

1. **Section 3.1.8, Develop the Plan for Obtaining the Data (Project Quality Objectives, Page 29 of 154:**

The first paragraph of Section 3.1.8 on Page 29 of 154 of the Draft Sampling and Analysis Plan Addendum for the P-Area Groundwater Operable Unit (Draft SAP Addendum) states, "To support long-term monitoring of plume migration, impact to surface water in Steel Creek, and development of concentration trends, existing surface water and groundwater monitoring wells will be sampled annually." However, it is unclear from the Draft SAP Addendum if the proposed sampling frequency is a deviation from the original SAP and if it is appropriate for the purpose of long-term groundwater monitoring and trend analysis at the P-Area Groundwater Operable Unit (PAGW OU). For clarity and completeness, revise the Draft SAP Addendum to address these issues.

Response: Clarification. As part of the original Sampling and Analysis Plan (SAP), sampling would be performed at newly installed wells, proposed new wells, and existing wells and surface water locations for data consistency and completeness. After one year of monitoring, the analyte list and monitoring network would be re-evaluated. However, further work associated with the PAGW OU after 2013 was negotiated to a later time and as such no follow-up was held with the Core Team. The current SAP Addendum evaluated that dataset along with reviewing historical data and trends and proposed a reduced analyte list, surface water locations, and well list to support appropriate long-term monitoring and trending at the PAGW OU.

The annual sampling frequency proposed in the SAP Addendum is appropriate for monitoring since the source units to groundwater have been remediated, groundwater flow is slow, and changes in groundwater plume concentrations are slow to develop. Any changes to contaminant concentrations and subsequent plume configuration associated with the groundwater removal action will be monitored as part of the effectiveness monitoring plan (EMP) associated with that action and reported separately until such time the EMP is rolled up into the overall PAGW OU long-term monitoring program.

The text following the bulleted list in Section 3.1.8 will be revised as follows:

"To support long-term monitoring of plume migration, impact to surface water in Steel Creek, and development of concentration trends, existing surface water and groundwater monitoring wells will be sampled annually. Annual sampling is proposed since all groundwater source units have been addressed and are no longer contributing to groundwater contamination, overall groundwater flow is relatively slow, any change to plume orientation will be slow to develop, and changes in groundwater VOC and tritium concentrations are slow to develop. Any new wells and appropriate surface water locations completed as an outcome of the SAP Addendum will be added to the list."

Responsible Party: Mark Amidon (803)725-8251 (mark.amidon@srnl.doe.gov)

2. **Section 4.2, Groundwater Investigation, Page 31 of 154:**

The second paragraph of Section 4.2 of the Draft SAP Addendum states, "The extent of the VOC [volatile organic compound] groundwater plumes in the distal area is defined by limited groundwater monitoring well and previous CPT [cone penetrometer technology] data." Additionally, the third paragraph in Section 4.2 states, "Characterization of the distal area of the VOC groundwater plumes, with primary focus in the elbow portion, will consist of performing headspace sampling on core collected from 21 m (70 ft) to 61 m (200 ft) bls [below land surface] or until the Gordon Confining Unit (Green Clay) is encountered at 26 borehole locations." However, the Draft SAP Addendum does not clearly state how soil screening and soil analytical data will be used to determine the extent of VOC groundwater contamination in the distal area of the groundwater plumes. For clarity, revise the Draft SAP Addendum to address this issue.

Response: Clarification. Volatile organic compounds (VOCs), even in the dilute state in groundwater, tend to sorb to soil particles and are in equilibrium with groundwater concentrations through diffusion. SRS has conducted soil headspace sampling for many years and this process has demonstrated a strong correlation in defining the presence of VOCs and extent of groundwater contamination. Additionally, this method allows for a higher density of samples to be collected over traditional depth-discrete groundwater sampling, especially in low permeability soils (e.g., silts and clays) where VOCs tend to accumulate and diffuse out in to groundwater over time where traditional groundwater sampling is not effective.

Headspace sampling involves the collection of 2 cc of soil via a plunger which is then placed in a 20 ml vial that contains 5 ml of deionized water. In the lab, the gas chromatograph collects a sample from each vial headspace to determine the concentration of the VOCs contained in the soil. The premise, based on Henry's Law, is that the VOC concentration in the soil is proportional to the equilibrium in the gas (e.g., headspace) at a constant temperature. This is due to the VOCs being volatile and dissolving/diffusing into the water and headspace until equilibrium is achieved. Therefore, the concentration of VOCs in the headspace is equivalent to the concentration of VOCs in the soil.

The analytical method involves the analysis of the gas (e.g., headspace) collected from the sample vial. To determine the concentration in groundwater, the gas concentration is then calculated back to a liquid (e.g., groundwater) concentration based on the soil weight and known water volume for each sample vial.

SRS has successfully applied this approach during characterization of other VOC contaminated operable units. This approach allows for a higher density of samples to be collected in a short amount of time with a high confidence level in determined VOC concentrations.

Since the headspace sampling uses a small volume of soil as compared to a groundwater sample, which is typically representative of a ten (10) foot vertical screened interval, there is obviously some uncertainty in direct correlation. However, if multiple samples across a screen zone (typically sands) are compared the results are typically within a factor of 5x.

The third paragraph of Section 4.2 will be revised as follows:

"Characterization of the distal area of the VOC groundwater plumes, with primary focus in the elbow portion, will consist of performing headspace sampling on core collected from 21 m (70 ft) to 61 m (200 ft) bls or until the Gordon Confining Unit (Green Clay) is encountered at 26 borehole locations (Figure 26).

Soil sampling for headspace analysis is proposed because previous work at SRS has demonstrated that VOCs, even in the dilute state in groundwater, tend to sorb to soil particles and are in equilibrium with groundwater concentrations through diffusion. ~~A~~ This method allows for collection of a greater density of samples ~~can be collected~~over traditional depth-discrete groundwater sampling, even in lower permeable sediments that normally don't yield groundwater for sampling, ~~traditional depth-discrete groundwater sampling.~~ ~~This~~ The soil headspace sampling approach allows for ~~a~~ detailed characterization in determining the extent of groundwater contamination. Up to 50 samples will be collected and submitted to SRNL for VOC analysis as identified on Table 12. Four (4) contingent locations are planned in the event the extent of the VOC groundwater plumes is not defined."

Responsible Party: Mark Amidon (803)725-8251 (mark.amidon@srnl.doe.gov)

3. **Section 4.2, Groundwater Investigation, Page 32 of 154:**

The first paragraph on Page 32 of 154 of Section 4.2 states, "Based on the results of the headspace data, two (2) wells, one in the UAZ [upper aquifer zone] and LAZ [lower aquifer zone], will be installed for long-term monitoring (Figure 26) in the elbow portion." However, the decision criteria for where the two (2) proposed wells to be installed based on the results of the headspace data is not included in the Draft SAP Addendum. For clarity and completeness, revise the Draft SAP Addendum to include the decision criteria which will be used to determine the placement of the two (2) additional wells to be installed in the UAZ and LAZ.

Response: Agree. The last paragraph in Section 4.2 will be revised as follows:

"Based on the result of the headspace data, two (2) wells, one in the UAZ and LAZ, will be installed for long-term monitoring (Figure 26) in the elbow portion. The proposed well locations as shown on Figure 26 are based on existing groundwater data and estimated location of the groundwater plumes, and may be refined based on the borehole headspace results. The decision on where each well screen will be installed vertically will be based on the observed VOC concentrations within the UAZ and LAZ and the stratigraphic horizon (targeting higher VOC levels and permeable zones that will produce sufficient water to support sampling activities). These wells will be sampled annually for specific VOCs and tritium as identified on Table 13."

Responsible Party: Mark Amidon (803)725-8251 (mark.amidon@srnl.doe.gov)

4. **Section 4.3.2, Groundwater, Page 33 of 154:**

The first paragraph on Page 33 of 154 states, "The selected groundwater monitoring wells will be sampled annually in conjunction with Steel Creek surface water and shallow groundwater well sampling. Semi-annual synchronous water level measurements will also be collected." Additionally, the third paragraph on Page 33 of 154 states, "A groundwater report will be prepared and submitted biennially (every two years) that provides at a minimum current location of the groundwater plumes, time-trends for key constituents (e.g., tritium and TCE [trichloroethylene]), hydrographs, data summary tables, and review of the impact to Steel Creek." However, the Draft SAP Addendum does not state how annual sampling and semi-annual water level measurements will accurately capture potential seasonal variations typically observed during quarterly or semi-annual groundwater sampling events. Revise the Draft SAP Addendum to address this issue.

Response: Clarification. Many of the groundwater wells at P Area have been monitored since 2002 and some even long before then. Seasonal variability is insignificant as precipitation is relatively uniform in the region. Therefore, SRS does not believe that an increased sampling frequency from that proposed provides any added value.

No change to the text is proposed.

Responsible Party: Mark Amidon (803)725-8251 (mark.amidon@srnl.doe.gov)

II. MINOR COMMENTS

1. **Section 2.1.4, Groundwater Monitoring, Page 13 of 154:**

The last sentence in Section 2.1.4 states "seven (5) radionuclides". Revise Section 2.1.4 to address this discrepancy.

Response: Agree. Text will be revised to "seven (75) radionuclides".

Responsible Party: Mark Amidon (803)725-8251 (mark.amidon@srnl.doe.gov)

2. **Section 3.1.2, Identify the Goals of the Study, Page 20 of 154:**

The word "evaluation" is misspelled in the first sentence of Section 3.1.2 as "evaluatoin". Revise Section 3.1.2 to correct this misspelling.

Response: Agree. Text will be revised to correct the misspelling.

Responsible Party: Mark Amidon (803)725-8251 (mark.amidon@srnl.doe.gov)

Comments Received: 5/24/2018

SPECIFIC COMMENTS

1. Section 2.1.2, Depth-Discrete Groundwater Samples, pages 7 and 8. The last sentence of page 7 indicates that the primary flow of contamination from monitoring well PRGW087 in the UAZ is to the west. However, the last sentence on page 8 states that flow direction of the PCE plume from this monitoring well is to the east towards an unnamed tributary to PAR Pond. Figures 13 and 19 indicate an eastward groundwater flow as well. Please correct this discrepancy.

   Response: Agree with clarification. Prior to sampling of PRGW087, previous groundwater investigation conducted in 2010 did not indicate the presence of tetrachloroethylene (PCE) contamination beyond P Area to the east and was locally defined near the source area. Groundwater flow at P Area is to the west and east due to the presence of a groundwater divide in the shallow aquifers as indicated on Figures 13 and 14. At sampling location PRGW087, groundwater flow is to the east. The 2010 groundwater investigation did find that PCE groundwater contamination extended to the west co-mingled with TCE groundwater contamination.

   The last two sentences in Section 2.1.2, third paragraph will be revised as follows:

   "~~Previous groundwater investigation (2010) of PCE contamination in P Area determined the plumes to be localized within the P Area facility with primary flow of the contamination to the west.~~ Groundwater flow from this sampling location is to the east towards an unnamed tributary to PAR Pond. The presence of PCE groundwater contamination found at PRGW087 is not associated with the source area located in P Area and is supported by previous groundwater investigation conducted in 2010. The result of the investigation did not determine PCE contamination beyond P Area to the east. However, the investigation did determine PCE groundwater contamination to the west and was co-mingled with the TCE groundwater plume (Figure 19). Therefore, the elevated concentration of PCE determined at ~~this~~ location PRGW087 are not associated with a known source area and ~~are~~ not associated with existing PCE groundwater plumes in P Area."

   Responsible Party: Mark Amidon (803)725-8251 (mark.amidon@srnl.doe.gov)

2. Section 2.1.3, MicroCED, page 11. The first paragraph of this page states that seven detected constituents during the additional sampling for the MicroCED treatability study exceeded MCLs or RSLs; the rest of this paragraph and Table 5 list eight. Please correct.

   Response: Agree. The text in Section 2.1.3, third paragraph will be revised to state that eight (8) constituents exceeded the MCLs or RSLs as follows:

   "Of the detected constituents, eight (8)~~seven (7)~~ exceeded MCLs or RSLs."

Responsible Party: Mark Amidon (803)725-8251 (mark.amidon@srnl.doe.gov)

3. Section 3.1.3, Identify Information Inputs, page 22. The second bullet under the Steel Creek discussion states that installation of a well near SC-02 may not be possible due to significant riprap in the general area. A contingency location for this well should be considered if this is the case.

   Response: Clarification. Proposed well (PSC001D2) is located in an area that contains extensive amount of riprap that extends from surface water location SC-02 to the next proposed well location (PSC002) and covers the area from bank to bank. The riprap was emplaced to act as an energy diffuser during reactor water discharges and consists of large granite boulders. Because of the elevation difference, presence of the riprap, depth to water in this area, and installation via hand-augering, successful installation of proposed well PSC001D2 may be problematic. Every effort will be made to install the proposed well (PSC001D2).

   In the event proposed well PSC001D2 cannot be installed, SRS believes that proposed well site (PSC002), which is approximately 100 ft downgradient of proposed well PSC001D2, will be adequate for groundwater monitoring due to its location at the base of the riprap, shallow depth to groundwater, and location associated with contaminated groundwater discharge.

   No changes to the text are proposed.

   Responsible Party: Mark Amidon (803)725-8251 (mark.amidon@srnl.doe.gov)

4. Section 3.1.3, Identify Information Inputs, page 23. The last sentence of the first bullet under the Groundwater discussion states that four contingent locations are proposed and will only be sampled if the extent of the VOC groundwater plumes are not defined. The conditions for sampling these contingency locations should be more clearly defined in this section (i.e., what constitutes "defined" pertaining to the VOC plumes - no detections of VOCs above MCLs at upgradient sampling locations from the contingency locations?).

   Response: Agree. The text in Section 3.1.3, Groundwater, last sentence of the first bullet will be revised to state the following:

   "The four (4) continent locations are proposed and will only be sampled if ~~the extent of the~~ data from the nearby boring does not indicate the presence of VOC ~~groundwater plumes are not~~ defined contamination above MCLs."

   Responsible Party: Mark Amidon (803)725-8251 (mark.amidon@srnl.doe.gov)

5. Section 4.1, Steel Creek Investigation, page 30, third paragraph. Four existing surface water locations (SC-02, -03, -04, and -07) will be sampled with the proposed new surface

water locations. Figure 3 on page 46 includes SC-05 and SC-06 and appear to be outside the PAGW OU HCM; however, Figure 25, page 68, indicates that proposed water locations SC003D and SC003E also fall outside the PAGW OU HCM. Please clarify why SC-05 and SC-06 are not sufficient for sampling in determining the extent of VOC contamination in the distal area and impact to Steel Creek.

Response: Clarification. The HCM [hydrogeologic conceptual model] boundary does include the entire floodplain of upper Steel Creek but was drawn at a large scale that did not include some of the specific locations. To make it clear that locations SC003D and SC003E are part of the PAGW OU, the HCM boundary will be redrawn to include these locations (see attached revised Figure 25).

Locations SC-05 and SC-06 are located significantly downgradient of where the groundwater plumes are discharging to Steel Creek and thus do not provide unique data from SC-07 and SC-08. The new locations SC003D and SC003E were proposed as part of the SAP to provide specific data regarding TCE concentrations up and down stream of a natural dam in the creek. No additional detail to the text is proposed.

Responsible Party: Mark Amidon (803)725-8251 (mark.amidon@srnl.doe.gov)

6. Figure 27, Proposed Steel Creek Surface Water Monitoring Locations, PAGW OU, page 70. Please include new location SC-08 on this figure, as indicated in the Surface Water discussion on page 23.

Response: Agree. Surface water location SC-08 will be added to Figure 27 (see attached revised Figure 27).

Responsible Party: Mark Amidon (803)725-8251 (mark.amidon@srnl.doe.gov)

7. Table 6, CSIA Data Summary, page 86. The "Result Units" and concentration entries for 3 of the analytes listed on this table appear to be typos (0/00 and negative concentration values). Please correct.

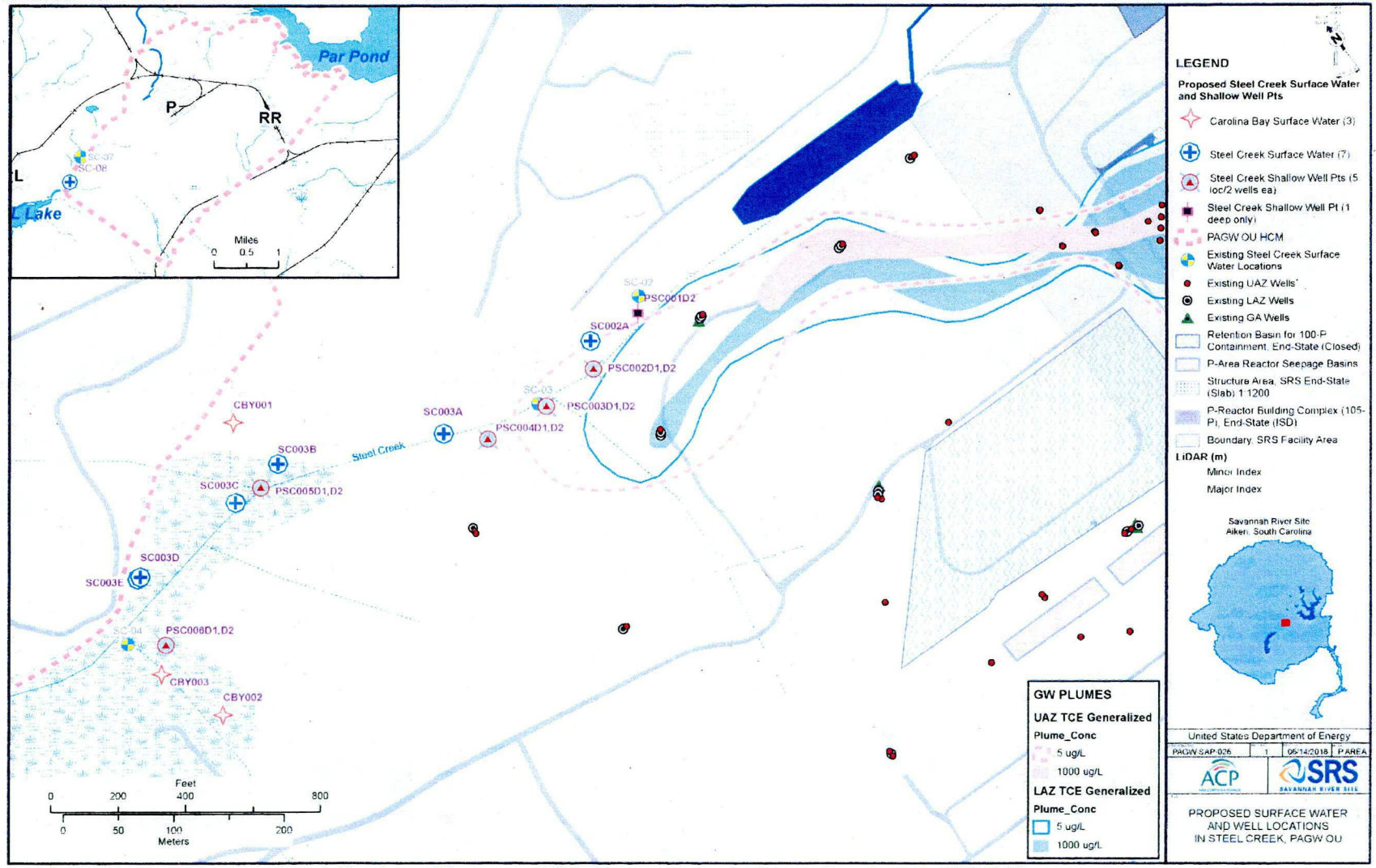
Response: Clarification. As indicated in the legend for Table 6, "0/00" represents units of part per thousand. Compound Specific Isotope Analysis (CSIA) is a detailed analysis of biodegradation processes to further establish if degradation of PCE/TCE is occurring. One method of determining this is by looking at the isotopic fractionation difference between carbon-13 and carbon-12 on the VOC molecule. During degradation, the lighter carbon-12 bond is broken leaving the heavier carbon-13 bonded to the VOC molecule. The extent of degradation can be determined from the change in the ratio of the isotopes by the reported specific VOC-carbon data such as with trichloroethylene (TCE)-carbon results. The units for the ratio is part per thousand (0/00) and is reported as a negative result. The larger the negative result

the more the difference is between the ratio of carbon-12 and carbon-13 thus indicating degradation is occurring.

No changes to the text are proposed.

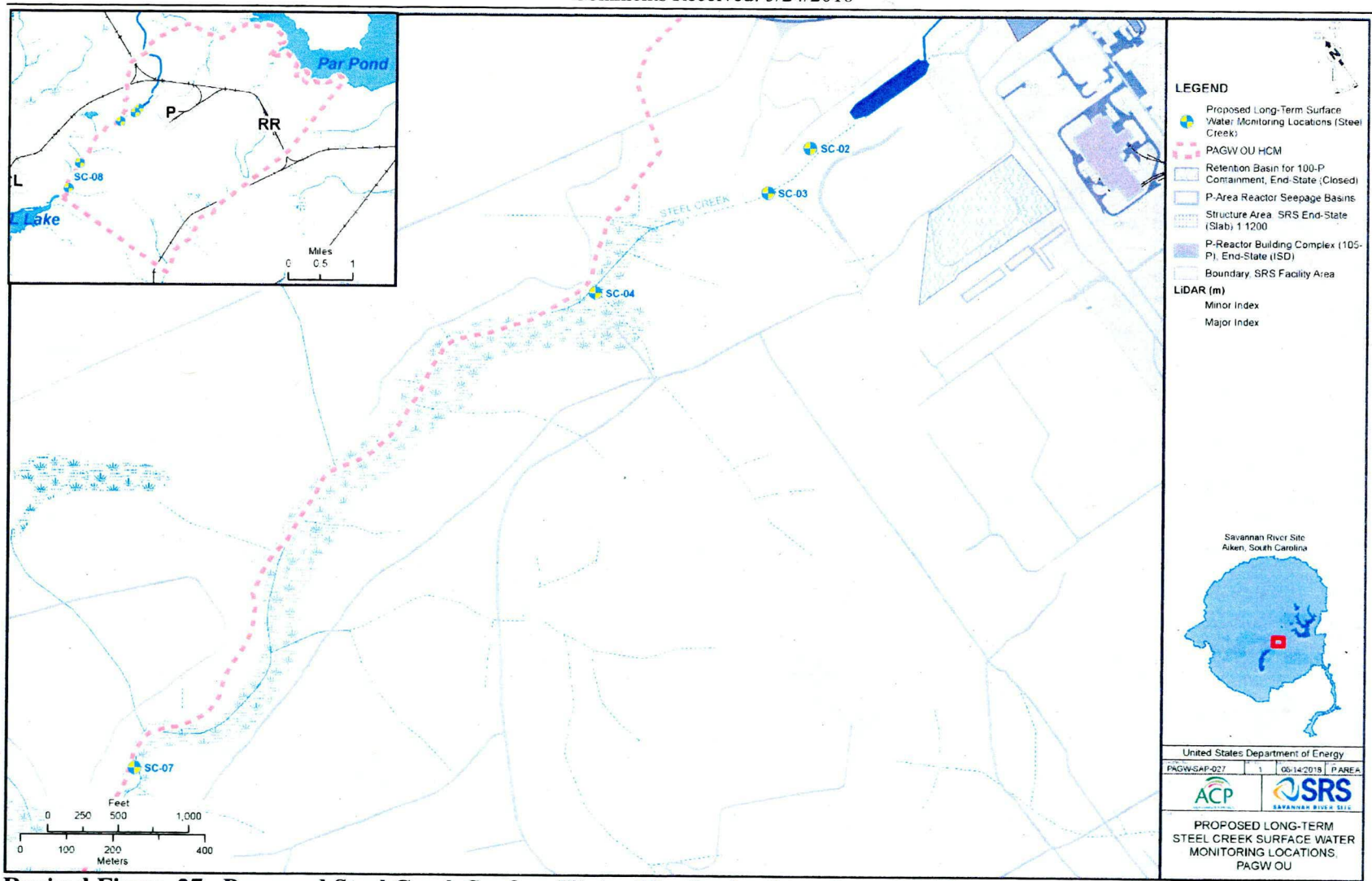
Responsible Party: Mark Amidon (803)725-8251 (mark.amidon@srnl.doe.gov)

Comments Received: 5/24/2018



Revised Figure 25. Proposed Surface Water and Well Locations in Steel Creek, PAGW OU

Comments Received: 5/24/2018



Revised Figure 27. Proposed Steel Creek Surface Water Monitoring Locations, PAGW OU