



Department of Energy
 Savannah River Operations Office
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APR - 6 2020

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 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: Savannah River Site's Responses to the Regulatory Comments on the Effectiveness Monitoring Report for the Monitored Natural Attenuation (MNA) at the Chemicals, Metals, and Pesticides (CMP) Pits Operable Unit (OU) (U) March 2018 through March 2019 (SRNS-RP-2019-00274, Revision 0, June 2019) SEMS Number: 24

In accordance with the terms of the Federal Facility Agreement, the U. S. Department of Energy (DOE) is submitting the subject comment responses for your review. The South Carolina Department of Health and Environmental Control (SCDHEC) and the U. S. Environmental Protection Agency (EPA) provided comments on the report on October 15, 2019 and January 9, 2020, respectively. The report will not be revised; however, all comment responses will be included and/or addressed in the next report, as applicable. Please review these responses and provide your approval thirty (30) days from receipt. The time and effort 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 Federal Project Director, Karen Adams, at (803) 952-7871.

Sincerely,

BRIAN HENNESSEY

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 HENNESSEY
 Date: 2020.04.02 13:06:34 -04'00'

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

IACD-20-136

APR - 6 2020

Ms. Susan Fulmer
Mr. Jon Richards

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Enclosures:

1. SRS Responses to EPA Comments on the Effectiveness Monitoring Report for the Monitored Natural Attenuation (MNA) at the Chemicals, Metals, and Pesticides (CMP) Pits Operable Unit (OU) (U) March 2018 through March 2019 (SRNS-RP-2019-00274, Revision 0, June 2019) SEMS Number: 24
2. SRS Responses to SCDHEC Comments on the Effectiveness Monitoring Report for the Monitored Natural Attenuation (MNA) at the Chemicals, Metals, and Pesticides (CMP) Pits Operable Unit (OU) (U) March 2018 through March 2019 (SRNS-RP-2019-00274, Revision 0, June 2019) SEMS Number: 24

cc w/o encl:

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SRS Responses to SCDHEC Comments on the Effectiveness Monitoring Report for the Monitored Natural Attenuation (MNA) at the Chemicals, Metals, and Pesticides (CMP) Pits Operable Unit (U) March 2018 through March 2019

SRNS-RP-2019-00274; Rev.0, Dated June 2019

Comments received October 15, 2019

SCDHEC Specific Comment:

1. Section 2.2.4, Additional Data from Independent Analysis, pages 21 and 22, and Figures 32 and 33. The last sentence of page 21, which discusses c-1,2-DCE surface water sampling results, refers to Figure 32 which shows PCE results. Also, the first sentence of page 22 mentions VC surface water results and references Figure 33, which shows c-1,2-DCE results. There is no figure provided that shows VC surface water results. Please correct.

Response: Agree/Clarification

The c-1,2-DCE map should have been provided as Figure 32 and a VC map should have been supplied in Figure 33. Errors will attempt to be avoided in future reports.

A map of 2018 results of VC is provided on the next page. SCSU VC data can also be seen in Table 6 and Table 7. No changes to the 2019 EMR are proposed.

Contact: Ashley Shull (803)952-7090 ashley.shull@srs.gov

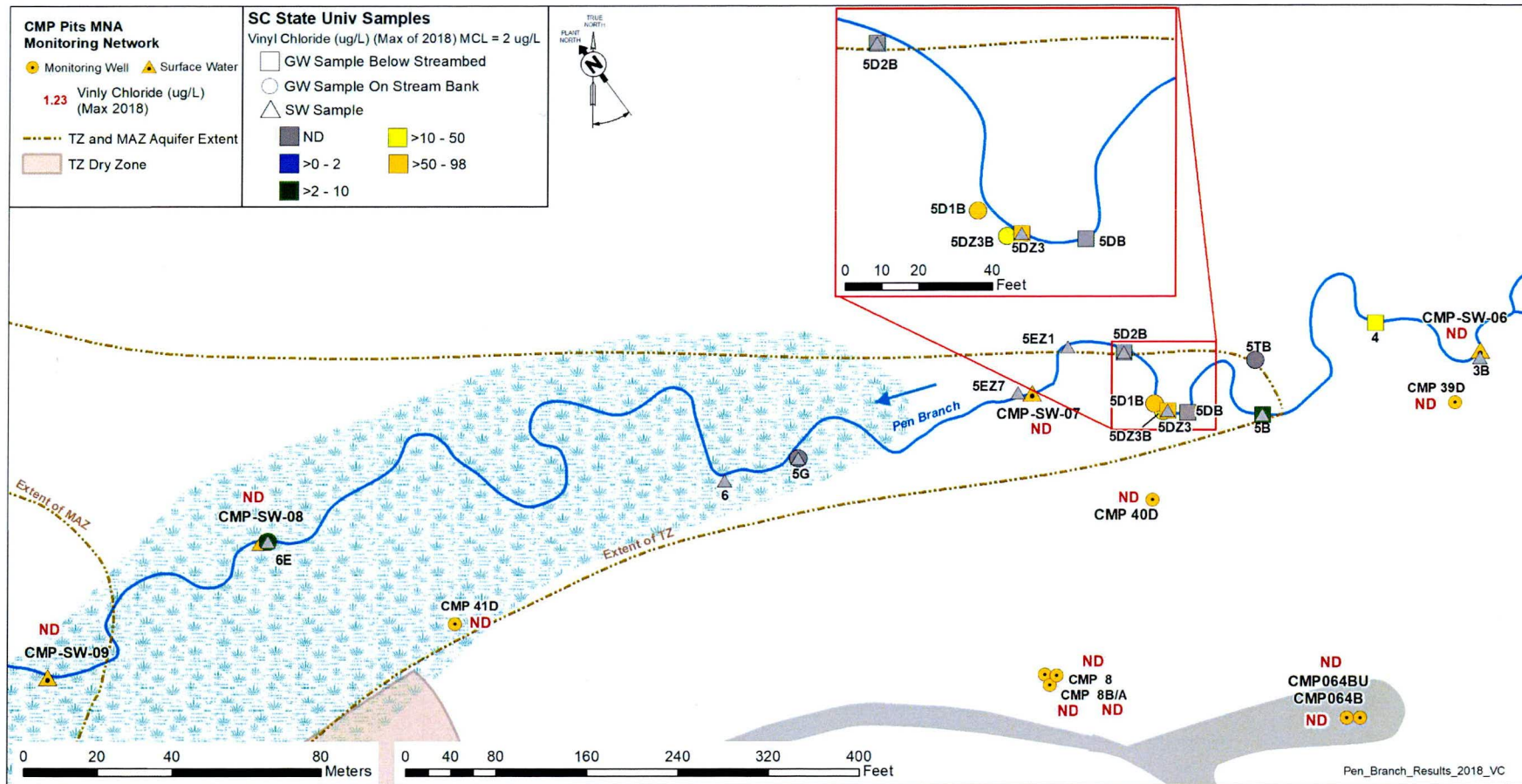


Figure of Independent Pen Branch Sampling Area and Summary of 2018 Results for VC

EPA Comments:

1. Page 3, Section 1.2 Nature and Extent of Contamination:

There have been multiple working hypothesis for several years on the CMP OU since the groundwater surface was re-interpreted several years ago. The multiple working hypothesis have attempted to explain the plume geometry and site contaminant levels over time and have ranged from one large plume to the current interpretation of 2 separate plumes with multiple hypothesis for this different plume interpretation which have ranged from differing sources of contamination to complex hydrogeology to depleted source and with varying contaminant levels. The varied hypothesis are outlined below.

- a) 1st hypothesis: 2 different and separate sources of contamination
 - A drainage ditch may have been used as dumping location prior to CMP Pits and the CMP Pits itself
 - This hypothesis is supported by particle tracking (WSRC 2002) toward and from NE Plume suggests different sources for NE Plume vs the Main Plume
- b) 2nd hypothesis: vadose zone source now depleted
 - This hypothesis is supported by additional characterization work performed during the RFI/ RI (WSRC 2003) which followed the ERH treatment
 - EPA Note: Contradiction within 2019 EMR: 2017 Modeling and report text indicate the presence of additional source
- c) 3rd hypothesis: original main plume; separated into 2 plumes over time
 - This hypothesis is supported by outlining the complex hydrologic conditions (perched zones) that have been documented over time such as the dry zones in TZ along with some dry zones in MAZ which is asserted may have resulted in one plume separating into 2 plumes over time

The CMP OU Conceptual Site Model (CSM) has not been updated for many years. An updated CSM following the ERH treatment and re-interpretation of onsite groundwater would be helpful, especially when there is a large degree of uncertainty associated with site characterization. EPA requests that the CMP CSM be updated to ensure that all CMP site complexities have been captured thereby enabling the implementation of a cohesive plan/path forward for the CMP OU.

Response: Agree

SRS will update the CSM in the 2020 EMR to include all hypothesized sources of contamination, including residual vadose zone sources. No change to the June 2019 EMR is proposed.

Contact: Ashley Shull (803)952-7090 ashley.shull@srs.gov

- 2. The CMP EMR for Monitored Natural Attenuation (MNA) should evaluate the efficacy of the MNA remedy and should follow EPA's MNA Guidance: *Use of Monitored Natural Attenuation***

at *Superfund, RCRA Corrective Action, and Underground Storage Tank Sites*, OSWER Directive Number 9200.4-17P, dated April 21, 1999.

Natural attenuation is generally evaluated using a "lines of evidence" approach. This approach forms the basis for all current protocols and guidance documents.

The suggested lines of evidence include:

- I. Documented reduction of contaminant mass at the site: Typically, the first line of evidence is documented by reviewing historical trends in contaminant concentration and distribution in conjunction with site geology and hydrogeology to show that a reduction in the total mass of contaminants is occurring at the site.
- II. Presence and distribution of geochemical and biochemical indicators of natural Attenuation: The second line of evidence is documented by examining changes in the concentrations and distributions of geochemical and biochemical indicator parameters that have been shown to be related to specific natural attenuation processes.
- III. Direct microbiological evidence: The third line of evidence (i.e., microbiological evidence) is documented through laboratory microcosm studies and is used to: 1) confirm specific chlorinated solvent biodegradation processes that cannot be conclusively demonstrated with field data alone and/or 2) estimate site-specific biodegradation rates that cannot be conclusively demonstrated with field data alone. These can include: Co-metabolism, Degradation, Dechlorination, Electron Acceptor (measurement of oxygen, nitrate, sulfate, iron and carbon dioxide), Electron Donor, Growth Substrate, Metabolic Intermediate, Metabolism, Methanogen, Microcosm, Primary Substrate, Reductive Dechlorination.
 - a) Based on the information submitted to date, the first line of evidence has been demonstrated by decreases in contaminants over time following ERH treatment.
 - b) Additional information and discussion within the report text is requested to support the second line of evidence.
 - c) If the first and second lines of evidence are sufficiently supported then the third line of evidence may not need to be quantified.

Response: Agree/Clarification

SRS has been following the required sampling of VOCs and field parameters as was agreed upon in the Effectiveness Monitoring Plan. Previous investigations at CMP Pits have determined that biodegradation at CMP Pits is not a major contributing factor throughout most of the plume and the NA mechanisms identified at CMP Pits are dispersion, advection, and adsorption as documented in the ROD during the selection of the MNA remedy after source remedial actions occurred. SRS proposes a Core Team meeting after submittal of the 2020 EMR (June 2020) to discuss recent data and an appropriate path forward, including the type of alternatives evaluation that should be conducted.

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3. **The information below is not indicative of Natural Attenuation and indicates that additional remedial action may be necessary in the future:**
- a) Groundwater contamination continues to migrate vertically
 - b) Plume size and configurations have not changed over the last 8 years of MNA
 - c) The horizontal extent of groundwater contamination has not been adequately delineated, to date, as indicated by data gaps
 - d) The 2017 Model indicated that the groundwater plume would remain above MCLs for ~100 years
 - e) Lindane contaminant values increased
 - f) Very little biodegradation with exception of wetland areas
 - g) Still have high contaminant values – CMP 35 D
 - PCE – 1,150 µg/L
 - TCE – 685 µg/L

Please suggest actions to address the concerns outlined above

Response: Agree/Clarification

Due to increasing trends in a portion of the original source area within the TZ and based on more recent data collected after submittal of the 2019 EMR, SRS agrees that a Core Team meeting should be held to discuss this additional data and an appropriate path forward, including the type of alternatives evaluation that should be conducted. SRS proposes to meet after submittal of the 2020 EMR (to be submitted in June 2020) which will contain all the most recent data and figures.

Contact: Ashley Shull (803)952-7090 ashley.shull@srs.gov

4. **EPA requests that site specific Natural Attenuation (NA) data collection be performed during the next sampling event at the CMP Pits OU. Please collect:**
- a) Parameters indicative of NA processes should be collected and specific analyses conducted for: dissolved oxygen, Nitrate, Iron (II), Sulfate, Methane, ORP, pH, TOC, Temperature, Carbon Dioxide, Alkalinity, Chloride Hydrogen, PCE/TCE along with all associated daughter products in order to assess the presence/absence of an anaerobic environment
 - b) The parameters should be collected at several specified key monitor well points: Several background, source, center and side gradient monitor wells in each geologic aquifer and media (sand, silt, clay) and environment (swamp, fluvial) present onsite
 - c) Identify any areas that may need amendments (carbon source) to enhance onsite biodegradation and thereby ensuring that onsite remedial objectives are met within a reasonable time frame. Reductive dechlorination is more likely to occur in an

- environment with a pH greater than 5 and less than 9.
- d) An isopleth map should be constructed for each environmental parameter (dissolved oxygen, Nitrate, Iron (II), Sulfate, Methane, ORP, pH, TOC, Temperature, Carbon Dioxide, Alkalinity, Chloride Hydrogen) along with a plume configuration map for PCE/TCE and each associated daughter product to demonstrate the distribution of the site specific parameters within the CMP study area.
 - e) Did the 2017 modeling effort include a fate and transport model to estimate the timeframe for NA processes onsite?
 - f) Did the 2017 modeling effort include an estimate of the plume size/configuration within a specified timeframe?
 - g) If any areas are identified where NA processes may be uncertain or unlikely, contingency measures should be suggested

Response: Disagree/Clarification

Five of the above mentioned field parameters (dissolved oxygen, ORP, pH, temperature, and alkalinity) are already being monitored and are reported in Table 3 of the 2019 EMR. It has long been understood that substantial VOC biodegradation is not occurring in much of the SRS aquifers, including CMP Pits. Previous investigations at CMP Pits have determined that biodegradation at CMP Pits is not a major contributing factor throughout most of the plume and the measurable NA mechanisms identified at CMP Pits are dispersion, advection, and adsorption as documented in the ROD. VOC results alone, as presented in Table 3, demonstrate this without the need for additional analyses. The 2017 modeling effort (*Groundwater Flow and Solute Transport Model of the CMP Pits OU (U)*, SRNS-TR-2017-00312, Rev 0, December 2017 (which was submitted with SRS's Responses to EPA's Conditional Approval Comments on the EMR for MNA at the CMP Pits OU June 2017 EMR, December 12, 2017 submittal) conservatively did not account for any biodegradation since it is not a major factor throughout most of the plume and only used the NA mechanisms of dispersion and advection. The modeling effort also displayed projected plume configurations in multiple aquifers during multiple years for PCE (Figure 5.2 & 5.5 – year 2040, Figure 5.3 & 5.6 – year 2060, Figure 5.4 & 5.7 – year 2116) and TCE (Figure 5.12– year 2040, Figure 5.13– year 2060, Figure 5.14– year 2116).

Since groundwater has been contaminated for 40+ years, a significant amount of the contaminants have moved through the aquifer and widespread treatment of the entire plume is likely unfeasible due to VOC sorption to clays. However, due to increasing trends in a portion of the original source area within the TZ and based on more recent data collected

after submittal of the 2019 EMR, SRS agrees that a Core Team meeting should be held to discuss this additional data and an appropriate path forward, including the type of alternatives evaluation that should be conducted. SRS proposes to meet after submittal of the 2020 EMR (to be submitted in June 2020) which will contain all the most recent data and figures.

Contact: Ashley Shull (803)952-7090 ashley.shull@srs.gov

5. Page 25, Section 3.0, Summary:

EPA disagrees with DOE-SRS plan to discontinue surface water sampling at CMP-SW-21.

- a) This location is a sampling location that is at the upper most eastern portion of Pen Branch where the TZ is incised by Pen Branch and may be an early indicator for potential surface water contamination from the TZ. Furthermore, the TZ, as indicated within the report text, has large portions of the TZ monitoring area that are dry and as a result, the MWs don't always produce enough water for sampling purposes which makes the TZ surface water monitoring locations of importance, especially since Pen Branch is a gaining stream.
- b) In Section 3, Summary, the report text asserts there is no surface water contamination in Pen Branch. However, the report text also outlines that previous surface water sampling data has indicated that VOC detections have been identified above MCLs and the 2017 modeling results demonstrate an expectation of a future VOC discharge to Pen Branch above MCLs.
- c) There is a lack of delineation, as indicated by the dashed potentiometric contour lines present in Figure 6.

Please continue surface water sampling at CMP-SW-21.

Response: Agree

SRS will continue to monitor VOCs at surface water station CMP-SW-21. Sampling at the CMP-SW-21 location will be included in the 2Q2020 sampling event.

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6. Section 1.4 Observed Hydrology at the CMP Pits OU, Page 6 of 102:

The next to last paragraph indicates the hydraulic conductivity constants 60 feet per day (ft/day), 50 ft/day and 20 ft/day for the Transmissive Zone (TZ), Middle Aquifer Zone (MAZ) and Lower Aquifer Zone (LAZ), respectively and the porosity value of 30% was used for each aquifer zone in the calculation taken from the modeling efforts (WSRC 2003 & SRNS 2017). Given the porosity value of 30% was used for each TZ, MAZ and LAZ in the velocity calculation, it is unclear how the respective hydraulic conductivity values were determined (i.e., site specific or modeling). As the

velocity calculation is sensitive to varying hydraulic conductivities, Please revise the EMR to address this issue.

Response: Agree/Clarification

Hydraulic conductivity constants were initially based on conditions found in the UTRA units at SRS and were used in the 2002 model and the 2017 model. In the 2017 model, these numbers were used as initial parameters and were treated as calibration parameters in the model as described in Section 3.3 of the 2017 model report (SRNS-TR-2017-00312). During calibration of the 2017 model, the final calibrated values for hydraulic conductivity were 8, 50, and 30 for the TZ, MAZ, and LAZ, respectively. In future reports, these values will be used in the groundwater velocity calculations. A statement will also be added in future EMRs to Section 1.4 *Observed Hydrology at the CMP Pits OU* stating that the hydraulic conductivities were determined based on conditions found in the UTRA units at SRS and adjusted based on calibrations of the latest model. No changes to the June 2019 EMR are proposed.

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7. Section 2.1, CMP Pits Vadose Zone Remedial Action, Page 8 of 102:

The second paragraph indicates the soil confirmation sample results were below the remedial goal (RG) for tetrachloroethene (PCE) of 36 milligrams per kilogram (mg/kg). However according to the *Fifth Five-Year Remedy Review Report for the Savannah River Site Operable Units with Groundwater Remedies (U)* Aiken, South Carolina, SRNS-RP-2015-00419, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC, 2017, the RG for PCE contaminated soil is 30.7 mg/kg. Please revise the EMR to address this discrepancy in the reported PCE RG for soil.

Response: Agree

SRS will correct the PCE RG value (30.7 mg/kg) in the upcoming EMR to be submitted in June 2020. No changes to the June 2019 EMR are proposed.

Contact: Ashley Shull (803)952-7090 ashlev.shull@srs.gov

8. Section 2.1, CMP Pits Vadose Zone Remedial Action, Page 8 of 102:

The text in the last paragraph states “Even though the RA was successful and confirmation samples were below RGs, there is a possibility that residual contamination trapped within clay horizons and/or pore space in the vadose zone, in or out of the ERH/SVE zone, could act as a secondary source for groundwater contamination.” Additionally, according to the text in Section 2.2.1 Groundwater Aquifers, Page 9 of 102, the “...updated groundwater model (SRNS 2017) added sorption and continuing VOC sources in clays and estimated the plumes would remain above MCLs for approximately 100 years (~2117).” Furthermore, the text in Subsection Lower Aquifer Zone,

Page 14 of 102 indicates increasing concentrations in the LAZ over time are expected. As such, based on the increased cleanup time attributed to sorption, and on the continued plume migration/instability based on the increases in VOC concentrations in the LAZ, additional source zone characterization and/or controls will be necessary to ensure the effectiveness and long-term protectiveness of the monitored natural attenuation (MNA) remedy. When this issue is addressed, please include suggestions to mitigate/address the remaining source contamination in the future.

Response: Agree/Clarification

Due to increasing shallow groundwater trends beneath a portion of the original source area and based on more recent data collected after submittal of the 2019 EMR, SRS agrees that a Core Team meeting should be held to discuss this additional data and an appropriate path forward, including the type of alternatives evaluation that should be conducted. SRS proposes to meet in FY2020 after submittal of the 2020 EMR (to be submitted in June 2020) which will contain all the most recent data and figures.

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9. Subsection Middle Aquifer Zone, Page 13 of 102:

The last paragraph in this section states the plume footprint expanded horizontally with data points collected in 2016. It is noted the plume footprint expanded due to additional characterization addressing data gaps in the horizontal extent of contamination on the east side of the plume. As seen in Figure 9, 2018 PCE Plume and Groundwater and Surface Water Results for the TZ and MAZ, Page 43 of 102 and Figure 16, 2018 TCE Plume and Groundwater and Surface Water Results in the TZ and MAZ, Page 57 of 102, data gaps remain in the horizontal extent of PCE and TCE contamination in the MAZ to the east as indicated by the dashed plume iso-concentration contours inferring delineation.

- a) Please include specific actions to address the above mentioned data gaps in the future
- b) Please restate “plume footprint expanded due to additional characterization.....” the plume footprint didn’t expand but was instead identified due to additional characterization.
- c) Please revise the EMR to ensure the data gaps identified with the horizontal extent of contamination in Figure 9 and Figure 16 are adequately addressed to delineate the plume(s).

Response: Agree/Clarification

a. & c. Clarification

Additional monitoring wells to the east of the plume will provide minimal added value because groundwater flow, including regional flow, throughout the UTRA does not flow towards the east as shown in Figure 5 (regional) and Figure 6 (TZ and MAZ). Additionally, easterly well cluster CMP062 remains clean supporting a more northerly/northwestward

groundwater and contaminant flow direction. Finally, the dashed/inferred contour lines are reasonable based on the contamination seen in the LAZ. Further discussion with the Core Team is proposed following submittal of the 2020 EMR (see the responses to comments 2, 3, 4, and 8). SRS agrees to continue monitoring the surface water station CMP-SW-21 as documented in the response to comment #5 as an early indicator for potential surface water contamination discharging from the TZ. No changes to the 2019 EMR are proposed.

b. Agree

SRS will update Section 2.2.2.1, PCE and TCE, MAZ subsection, last paragraph in future EMRs including the June 2020 EMR, to restate that “the plume was further defined towards the east due to additional characterization. “No changes to the 2019 EMR are proposed.

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10. Section 2.2.4 Additional Data from Independent Analysis, Page 21 of 102:

The text in the second paragraph states groundwater samples were collected using passive diffusion bags (PDBs). However, it is noted the PDB sampler is a low-density polyethylene bag filled with deionized water. VOCs in groundwater will diffuse across the PDB until contaminant concentrations within the bag reach equilibrium with concentrations in the surrounding groundwater. Therefore, no actual groundwater samples are collected utilizing PDB. Revise the text to address this issue.

Response: Agree

Descriptions of how PDB bags are used to indicate groundwater and/or surface water contaminant conditions will be clarified in future reports if applicable. No changes to the 2018 EMR are proposed.

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11. Section 2.2.4 Additional Data from Independent Analysis, Page 21 of 102:

It is not clearly understood if the 2017 groundwater model considers contaminated groundwater to discharge and mix with Pen Branch surface water. For example, the text in the third paragraph on Page 21 of 102 states “...contaminant discharges are thin or discrete which quickly mix with clean surface water, as surface water is not contaminated with PCE or TCE above MCLs.” It is noted the EMR indicates the 2002 groundwater model was updated in 2017 and that the current plume behavior is as predicted by the model. As such, groundwater modeling that incorporates contaminated groundwater discharges mixing with clean surface water would be inconsistent with *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites*, OSWER Directive Number 9200.4-17P, dated April 21, 1999 (MNA Guidance), particularly to support demonstration of plume shrinkage and/or stability. Please revise the EMR to address this issue to ensure the effectiveness and long-term protectiveness of the MNA remedy.

Response: Clarification

The model did not incorporate or indicate mixing of groundwater in surface water. The model identifies contaminant discharges above MCLs only. The analysis of groundwater and surface water data collected by SRS and SCSU has made the conclusion that these discharges are not abundant enough or of a magnitude to impact the surface water quality of Pen Branch. No changes to the 2019 EMR are proposed.

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12. Figure 7, 2018 Potentiometric Surface for the LAZ and GA, Page 39 of 102:

- a) As seen in the figure, no groundwater elevation contours are prepared for the Gordon Aquifer (GA). As such, the flow direction arrow depicted in the figure is not drawn based on GA groundwater elevation contours and therefore the flow direction is uncertain. Please revise figure 7 or within the text of the EMR to address this issue.
- b) It is noted that two additional GA wells will be installed to adequately monitor plume detections and potential migration in the GA. When installed, please ensure the new GA wells are appropriately surveyed so the groundwater elevations in the GA can be contoured and flow direction arrows can be drawn relative to the elevation contours in future reports.

Response: Agree

Due to the relatively flat potentiometric surface and linear orientation of the wells, SRS elected to simply post the sample results and add a general flow direction arrow. All monitoring wells at SRS are surveyed with professional GPS survey equipment to provide accurate elevations and GPS coordinates. The new GA wells and sample data collected will be included in the upcoming 2020 EMR data tables and figures, and groundwater elevation contours will be provided. No changes to the 2019 EMR are proposed.

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13. Figure 10, 2018 PCE Plume and Groundwater Results for the LAZ and GA, Page 45 of 102 and Figure 17, 2018 TCE Plume and Groundwater Results for the LAZ and GA, Page 59 of 102:

As seen in the figures, data gaps remain for delineating the horizontal extent of PCE and TCE contamination to the east in the LAZ, as indicated by the dashed plume iso-concentration contours inferring delineation.

- a) Please include specific actions to address the above mentioned data gaps in the future
- b) Please revise the EMR to ensure the data gaps identified with the horizontal extent of contamination in Figure 10 and Figure 17 are adequately addressed to delineate the plume(s)

SRS Responses to USEPA Comments on the Effectiveness Monitoring Report for the Monitored Natural Attenuation (MNA) at the Chemicals, Metals, and Pesticides (CMP) Pits Operable Unit (U) March 2018 through March 2019

SRNS-RP-2019-00274; Rev.0, Dated June 2019

Comments received January 8, 2020

Response: Clarification

Additional monitoring wells to the east of the plume will provide minimal added value because groundwater flow, including regional flow, throughout the UTRA does not flow towards the east as is shown in Figure 5 (regional) and Figure 7 (LAZ and GA). Additionally, easterly wells CMP062B, CMP 50B, CMP065B remain below MCLs supporting a more westerly groundwater flow direction in the LAZ. Further discussion with the Core Team is proposed following submittal of the 2020 EMR (see the responses to comments 2, 3, 4, and 8). No changes to the 2019 EMR are proposed.

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