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

JAN 23 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
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 Biennial Effectiveness Monitoring Report (EMR) for Monitored Natural Attenuation (MNA) at the C-Area Burning/Rubble Pit (131-C) and Old C-Area Burning/Rubble Pit (NBN) Operable Unit (U) January 2017 through December 2018 (SRNS-RP-2019-00327, Revision 0, June 2019) SEMS Number: 31

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's (SCDHEC) and U. S. Environmental Protection Agency's (EPA) comments were received on October 24, 2019 and October 30, 2019 respectively. This report will not be revised; however, all comment responses will be included in the next EMR, as applicable. Please review these responses and provide your approval within 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, Ms. Karen Adams, at (803) 952-7871.

Sincerely,

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

IACD-20-126

Enclosures:

1. SRS Responses to EPA comments on the Biennial Effectiveness Monitoring Report (EMR) for Monitored Natural Attenuation (MNA) at the C-Area Burning/Rubble Pit (131-C) and Old C-Area Burning/Rubble Pit (NBN) Operable Unit (U) January 2017 through December 2018 (SRNS-RP-2019-00327, Revision 0, June 2019) SEMS Number: 31
2. SRS Responses to South Carolina Department of Health and Environmental Control's Comments on the Biennial Effectiveness Monitoring Report (EMR) for Monitored Natural Attenuation (MNA) at the C-Area Burning/Rubble Pit (131-C) and Old C-Area Burning/Rubble Pit (NBN) Operable Unit (U) January 2017 through December 2018 (SRNS-RP-2019-00327, Revision 0, June 2019) SEMS Number: 31

cc w/o encl:
D. Scaturo, 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

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

SRS Responses to EPA comments on the Biennial Effectiveness Monitoring Report (EMR) for Monitored Natural Attenuation (MNA) at the C-Area Burning/Rubble Pit (131-C) and Old C-Area Burning/Rubble Pit (NBN) Operable Unit (U), January 2017 through December 2018, SEMS Number: 31, SRNS-RP-2019-00327, Revision 0, June 2019, Savannah River Site NPL Site, South Carolina

Comments Received 10/30/2019

COMMENTS

1. The conclusions regarding the effectiveness of the remedy provided in Biennial Effectiveness Monitoring Report (EMR) for Monitored Natural Attenuation (MNA) at the C-Area Burning/Rubble Pit (131-C) and Old C-Area Burning/Rubble Pit (NBN) Operable Unit (U), January 2017 through December 2018, SEMS Number: 31, SRNS-RP-2019-00327, Revision 0, June 2019 (Biennial Report) are not fully supported. In Section 5.0, Summary, the text on Page 18 of 32 states that during the 2017-2018 sampling period, overall VOC concentrations continued to decrease in most monitoring wells. A statistically significant demonstration of the data is not provided to support such a statement. For example, although time-series plots are provided, best-fit trend lines showing an increase or decrease of concentrations over time are not presented. In addition, statements regarding trend should be supported by a statistical analysis of the data per EPA guidance (i.e., Data Quality Assessment: Statistical Methods for Practitioners, EPA QA/G-9S, U.S. EPA 2006). Revise the Biennial Report to include best-fit trend lines on time-series plots and identify statistically significant trends using methods (e.g., Mann-Kendall) per the guidance referenced above.

   Response: Clarification.

   The addition of trendlines to the time-series plots will provide very limited additional value to understanding of the overall plume behavior over time. This is due to what is likely a complex release history over time from the source zone, spatial heterogeneity in the dissolved contaminant plume, and ongoing physical processes such as back diffusion from low permeability zones. It is important to note that as the TCE hot spot created in 1998 moves through the aquifers TCE concentrations at monitoring wells (e.g. CRP 20CU) will increase and then decrease similar to that observed in well CRP 3D. Most trendline formulas do not fit these data very well (Figures 1 and 2).

   The CBRP OU is now in the long-term monitoring phase of MNA, which is being conducted consistent with Section 2.8 of the EPA Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater. The simplistic natural attenuation estimate (41 years) in the 2019 CBRP OU EMR is consistent with the more rigorous 2008 CBRP OU ROD estimate that MCLs will be met in approximately 70 years, based on a calibrated groundwater flow model. No changes are proposed for the 2019 CBRP OU EMR.

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

2. Section 5.0, Summary, the text on Page 18 of 32 states the increasing trend of degradation products cis-1,2-dichloroethene (c-1,2-DCE) and vinyl chloride (VC) are evidence that the portion of the plume with elevated trichloroethene (TCE) is moving through the CRP 50 well cluster. It is noted the degradation products listed above are more soluble and

therefore more mobile in groundwater, indicating that the source of the TCE degradation products is upgradient of the CRP 50 well cluster. In addition, Figure 8, CBRP Plume Cross Section, Fourth Quarter 2018 illustrates the highest TCE concentrations detected in 2018 are located at the CRP 20 well cluster and not the CRP-50 well cluster. Revise the Biennial Report to state that the increasing trend of cis-1,2-DCE and VC seen at the CRP 50 well cluster is evidence of degradation of TCE upgradient of this location.

Response: Agree/Clarification.

The site conceptual model for the CBRP OU TCE plume is that very little if any biodegradation is occurring in the aquifers (UAZ, MAZ and LAZ), which is why we see predominantly TCE, a little cis-1,2-DCE and essentially no VC at well cluster CRP 20. In contrast, the majority of biodegradation occurs as the TCE moves through the organic-rich anoxic wetland sediments along Twin Lakes and Fourmile Branch. This is why we see very little TCE and proportionally greater amounts of cis-1,2-DCE, VC and ethylene in the CRP 50 well cluster.

The 2021 CBRP OU EMR will be revised to state the following:

"The increasing trends of cis-1,2-DCE and VC seen at the CRP 50 well cluster are evidence of biodegradation of elevated TCE groundwater concentrations upgradient of CRP 50A and CRP 50B. ~~This indicates a portion of the plume with elevated TCE concentrations ("Plume Hotspot") is moving through the CRP 50 well cluster, which results in higher concentrations of biodegradation products.~~"

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

3. The Biennial Report indicates the data yield a time estimate of 41 years for all areas of the VOC plume to be below the respective MCLs. This estimate is based on the 2018 maximum TCE concentration for the plume of 2,600 µg/L. While it is noted the time estimate of 41 years is based upon a simplistic evaluation using the current data, the time-series plots for several wells demonstrate contaminant concentration trends are stable and greater than the respective MCLs, indicating that attainment of MCLs would take longer than 41 years. For example, the TCE detection of 2,600 µg/L was measured in well CRP 20CU in 2018. As seen in the time-series plot presented in Figure C-108, Appendix C, Page C-110 of C-128, the trend of TCE concentrations has been upward over time. The time-series plot in Figure C-102 does not illustrate trending that would indicate MCLs will be achieved within 41 years. A similar issue is noted with CRP 5C where the trend of PCE concentrations has been stable above the MCL since 1996 as seen in Figure C-70, Appendix Page C-72 of C-128. Also, the trend of TCE concentrations in monitoring well CRP 18C have remained relatively stable above the MCL since 2000. Finally, the trend of vinyl chloride concentrations in MNA well CRP-50B has been greater than the MCL since 2000 and has an increasing trend as seen in Figure C-28, Page Appendix C-30 of C-128. Currently, it is uncertain whether all areas of the VOC plume will be below their

respective MCLs within 41 years, or whether the estimated timeframe will be reasonable based on future monitoring data. As such, revise the Biennial Report to include additional text discussing how the long-term stable and/or increasing contaminant trends impact the reasonableness of the overall cleanup timeframe estimates.

Response: Agree/Clarification.

As acknowledged and stated in the text, the estimated time frame presented is simplistic and will have a high degree of uncertainty when considering the plume entirety. This is due to many factors including contaminant distribution heterogeneity, aquifer heterogeneities affecting flow velocity and VOC "sorption" sites resulting in back diffusion, etc. Based on the empirical data observed over the last twenty years, the estimated timeframe of 70 years based on the groundwater modeling and presented in the ROD is reasonable. The increase in TCE at well CRP 20CU is expected as the elevated portion of the TCE plume moves through this well. Based on particle track estimates, it may take up to 63 years for the plume hot-spot, which was created in 1998, to move completely through the aquifer and discharge to FMB. This time frame (1998 + 63 years = 2061) is consistent with the 2003 calibrated groundwater model prediction that MCLs will be met in 71 years (2074). The simplistic time estimate (2018 + 41 years = 2059) in the CBRP OU 2019 EMR is to be compared against the 2008 CBRP OU ROD that predicts MCLs will be met in approximately 70 years, as an indication that nothing has drastically changed (e.g. new source TCE) in the overall CBRP OU groundwater system.

A time frame was provided in the report based on 2013 EPA comments to do so, and the provided text was determined to be acceptable. The current text recognizes that fluctuations in TCE concentrations in the downgradient wells are expected to occur. The slow decline in PCE groundwater concentrations at well CRP 5C are very likely is due to back-diffusion of PCE from fine-grained sediments in the TCCZ into the LAZ. The current (10/23/2019) PCE groundwater concentration at well CRP 5C is 7.80 µg/L, which is about half of the maximum PCE concentration (14.2 µg/L) observed at CRP 5C in May 2007. The increasing TCE groundwater concentrations at CRP 18C from 2009 to 2018 indicates the slow progression of TCE from the UAZ through the TCCZ fine-grained sediments and into the LAZ. It is expected that monitoring wells (e.g. CRP 50 well cluster) down-gradient of CRP 20CU will have increases/fluctuations in TCE concentrations as the TCE hot spot continues moving towards FMB and Twin Lakes. Likewise, groundwater at well clusters along Twin Lakes and FMB will exhibit increases/fluctuations in biodegradation products (cis-1,2-DCE, VC and ethylene). Additional discussion of these issues will be included in the 2021 CBRP EMR. No changes to the text are proposed for the 2019 CBRP OU EMR.

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

Comments Received 10/30/2019

4. It is noted the Biennial Report does not include the analysis of many common MNA parameters or follow or reference appropriate MNA guidance documents (e.g., U.S. EPA Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater, September 1998; U.S. EPA Ground Water Issue – Calculation and Use of First-Order Rate Constants for Monitored Natural Attenuation Studies, 2002). Currently, it is uncertain whether all areas of the VOC plume will be below their respective MCLs within 41 years, or whether the estimated timeframe will be reasonable based on future monitoring data. As such, the evaluation and discussion of MNA efficacy per the listed EPA guidance could provide additional lines of evidence that either support the reasonableness of the overall cleanup timeframe estimates, or that indicate an issue due to the long-term stable and/or increasing contaminant trends noted. Revise the Biennial Report to address this issue.

Response: Clarification.

SRNS acknowledges that a comprehensive suite of MNA parameters as indicated in EPA guidance documents are not being analyzed for. Biodegradation was extensively studied from 2000 to 2008 along Twin Lakes and FMB using the *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater*. The data generated by those efforts were used to select MNA as part of the remedy for the CBRP OU. In the 2009 EMP the constituents that best indicated active biodegradation were selected for the different types of stations: monitoring well samples receive VOC analyses (PCE, TCE, 1,1-DCE, cis-1,2-DCE, t-1,2-DCE, VC, and DCM); MNA and surface water samples receive these VOC analyses plus ethylene and additional field measurements (ORP and DO). In addition, samples from seven upgradient monitoring wells also receive ORP and DO field measurements. The presence of TCE degradation products indicates biodegradation is continuing along Twin Lakes and FMB. FMB samples have never been above MCLs for TCE or TCE degradation products, and Twin Lakes samples have been below MCLs for TCE or TCE degradation products since 2015. The 41-year estimate was not intended as a precise measure of when MCLs would be achieved throughout the plume, it was derived from empirical data in one monitoring well and is consistent with other empirical data and the overall model estimated timeframe to achieve MCLs. SRS believes that providing additional lines of evidence that will have high uncertainties associated with them, as expected given site heterogeneities, will provide very limited additional value to the information currently collected and presented in the EMR. No changes are proposed for the 2019 CBRP OU EMR.

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

5. The potentiometric surface maps prepared for the 2017 and 2018 monitoring events depict flow lines indicating the relative flow direction based on the potentiometric surface.

However, it appears the flow lines shown are based on the particle tracking Figure 5, CBRP OU Groundwater Model Particle Tracks (WSRC-TR-2001-00298), and are not drawn perpendicular to the groundwater elevation contours. For example, Figures E-1 through E-4 in Appendix E incorrectly indicates groundwater flows around Twin Lakes and not towards it as the groundwater elevation contours indicate. Revise the potentiometric surface figures to accurately display groundwater flow direction perpendicular to the groundwater elevation contours based on data obtained in 2017 and 2018.

Response: Agree.

The groundwater flow lines will be drawn to be perpendicular to the groundwater elevation contours in the 2021 CBRP OU EMR.

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

Comments Received 10/30/2019

This page intentionally left blank.

Comments Received 10/30/2019

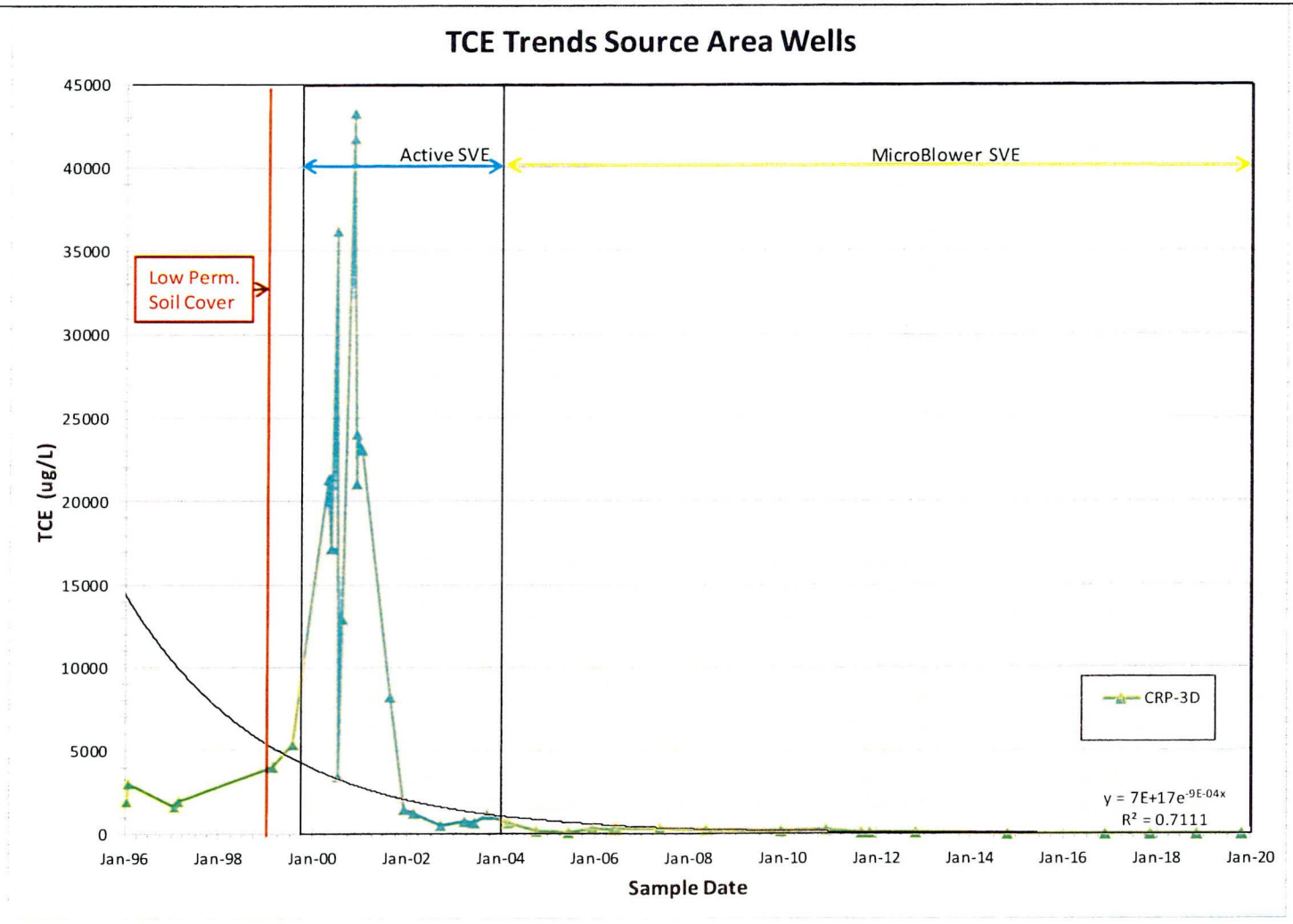


Figure 1. CRP 3D TCE Trends

Comments Received 10/30/2019

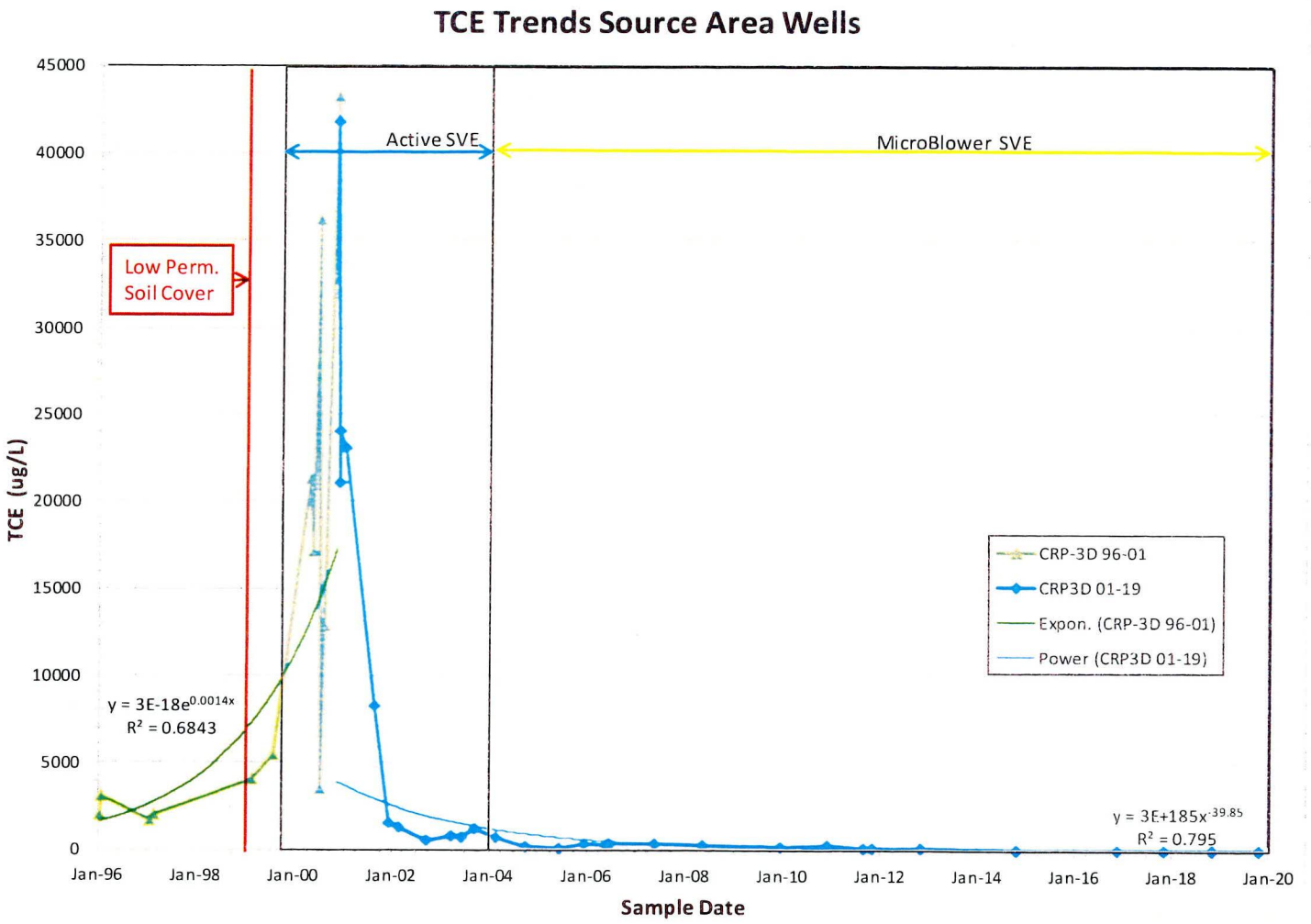


Figure 2. CRP 3D TCE Increasing/Decreasing Trends

SRS responses to the SCDHEC Comments on the Biennial Effectiveness Monitoring Report (EMR) for Monitored Natural Attenuation (MNA) at the C-Area Burning/Rubble Pit (131-C) and Old C-Area Burning/Rubble Pit (NBN) Operable Unit (U) – January 2017 through December 2019, SEMS Number: 31 (SRNS-RP-2019-00327, Revision 0, June 2019) received June 28, 2019.

Received October 24, 2019

General Comment

1. The EMR discusses the Conceptual Site Model for the CBRP OU TCE plume on page 6 and elsewhere in the document, yet there is no figure provided showing a CSM. Additionally, the significance/explanation of trigger levels for designated monitoring stations is not discussed anywhere throughout the document. The EMR should be updated to include these.

Response: Agree.

Section 4.2 of the CBRP OU EMR discusses the three components of the CBRP OU CSM as summarized below:

1) **MicroBlower™ SVE system and the low-permeability soil cover have achieved source control;**
2) **Attenuation from volatilization, sorption, dilution, dispersion, and diffusion, but not from biodegradation, occurs during groundwater transport from the former CBRP OU Pit to the Twin Lakes and Fourmile Branch (FMB); and**
3) **As groundwater travels through the organic-rich wetland soils of Twin Lakes and FMB, biodegradation of TCE occurs.**

A figure similar to the modified Figure 2.2 (attached) from the groundwater model report (WSRC-TR-2002-00383) will be included in the 2021 CBRP OU EMR to show these three components of the CBRP OU MNA CSM.

The CBRP OU EMP identifies TCE concentrations at selected wells that will "trigger" action by the Core Team. For example, well CRW10CU exceeded its trigger level, and the Core Team determined additional wells (CRP 6DR and CRP 8D) were needed to better delineate the CBRP OU plume. These wells and trigger levels are shown in attached Table 3 from the 2019 CBRP OU EMR. Table 3 and the following discussion will be included in Section 4.4 of the 2021 CBRP OU EMR:

"If TCE exceeds a trigger level for any of the stations in listed in Table 3, then the Core Team will be convened to determine a path forward."

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

SRS responses to the SCDHEC Comments on the Biennial Effectiveness Monitoring Report (EMR) for Monitored Natural Attenuation (MNA) at the C-Area Burning/Rubble Pit (131-C) and Old C-Area Burning/Rubble Pit (NBN) Operable Unit (U) – January 2017 through December 2019, SEMS Number: 31 (SRNS-RP-2019-00327, Revision 0, June 2019) received June 28, 2019.

Received October 24, 2019

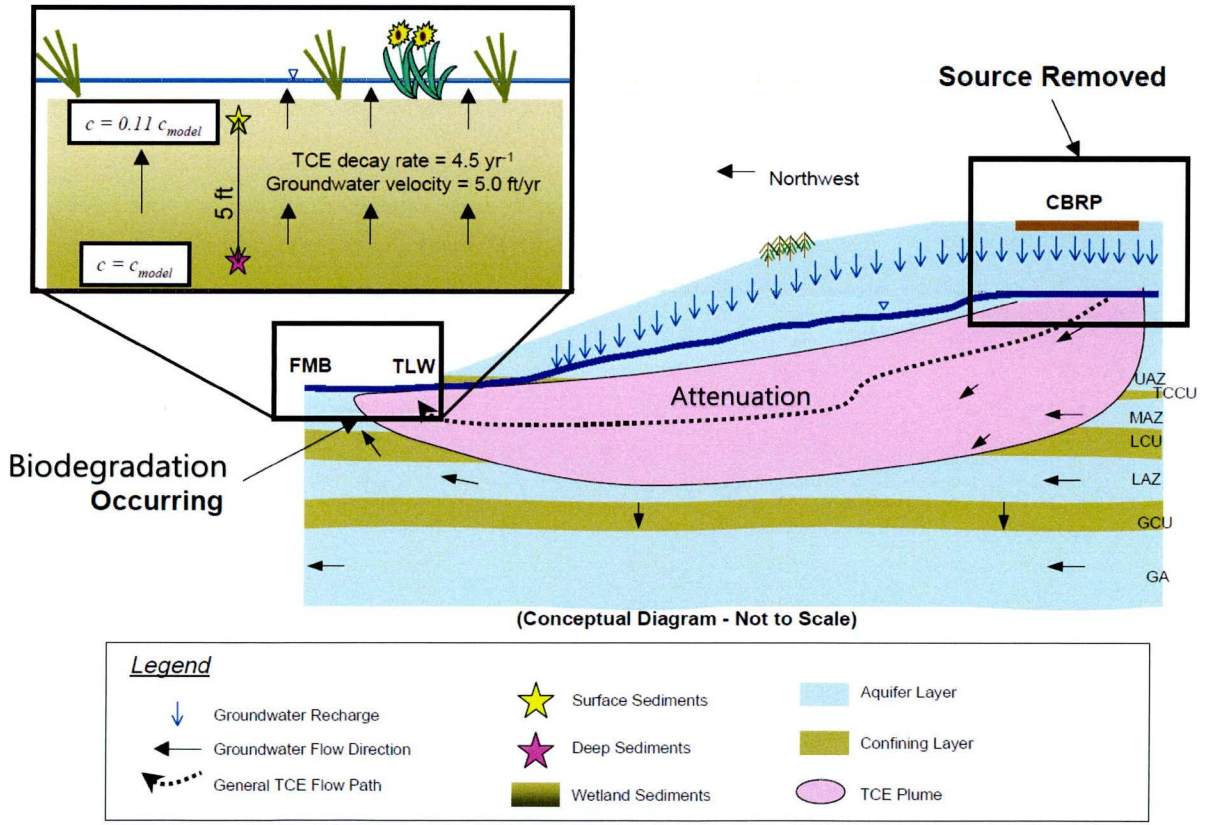
Specific Comment

1. Figure 3, CBRP OU LUC Boundary, page 25. Monitoring well CRP 6DR is labeled on this figure, but the well location is not marked. Please include.

   Response: Agree.

   The well marker symbol will be included on the equivalent Figure 3 in the 2021 CBRP OU EMR.

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



Modified Figure 2.2 Conceptual Diagram of CBRP OU TCE Plume.

SRS responses to the SCDHEC Comments on the Biennial Effectiveness Monitoring Report (EMR) for Monitored Natural Attenuation (MNA) at the C-Area Burning/Rubble Pit (131-C) and Old C-Area Burning/Rubble Pit (NBN) Operable Unit (U) – January 2017 through December 2019, SEMS Number: 31 (SRNS-RP-2019-00327, Revision 0, June 2019) received June 28, 2019.

Received October 24, 2019

Table 3. Groundwater and Surface Water TCE Trigger Levels

Station ID	Well Type	Compliance Use	Station Maximum 2017 – 2018 (µg/L)	TCE Trigger Level
CRP 3D	Monitoring Well	KSZ Monitoring Well	11.9	459 µg/L
CRW 10A	Monitoring Well	LUC Boundary Well	<EQL (5)	13.6 µg/L
CRW 10C	Monitoring Well	LUC Boundary Well	12.3	13.6 µg/L
CRW010CU	Monitoring Well	LUC Boundary Well	14.9 [a]	13.6 µg/L
CRW 12A	Monitoring Well	LUC Boundary Well	<EQL (5)	>5 µg/L (MCL)
CRW 12C	Monitoring Well	LUC Boundary Well	<EQL (5)	>5 µg/L (MCL)
CRW 12D	Monitoring Well	LUC Boundary Well	<EQL (5)	>5 µg/L (MCL)
TL 04	Surface Water	MNA POC	1.43	>5 µg/L (MCL)

KSZ = Key Source Zone
LUC = Land Use Control
POC = Pont of Compliance
MCL = Maximum Contaminant Level

EQL = Estimated Quantitation Limit
a) Obtained during 4/23/18 CAGW OU sampling event. The highest result for CBRP OU sampling event during this period was 14.7 µg/L on 11/6/17.