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

JAN - 9 2024

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: 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 2021 through December 2022 (SRNS-RP-2023-00648, Revision 0, June 2023) 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 U.S. Environmental Protection Agency (EPA) and the South Carolina Department of Health and Environmental Control (SCDHEC) provided comments on the report on October 12, 2023. 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) 952-7805, or the DOE Operable Unit Manager, Karen Adams, at (803) 952-7871.

Sincerely,

AVERY HAMMETT

Digitally signed by AVERY HAMMETT
Date: 2024.01.08 13:59:54 -05'00'

Avery G. Hammett
FFA Project Manager, DOE-Savannah River
Remediation and Deactivation & Decommissioning Division

RDDD-24-117

JAN - 9 2024

Enclosures:
1. SRS Responses to South Carolina Department of Health and Environmental Control 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 2021 through December 2022 (SRNS-RP-2023-00648, Revision 0, June 2023) SEMS Number: 31
2. SRS Responses to United States Environmental Protection Agency 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 2021 through December 2022 (SRNS-RP-2023-00648, Revision 0, June 2023) SEMS Number: 31

cc w/o encl:
J. Blalock, SCDHEC-Columbia
S. French, SCDHEC-Columbia
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SRS Responses to USEPA 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 2021 through December 2022, SEMS Number: 31, SRNS-RP-2023-00648, Revision 0, June 2023

Comments Received 10/12/2023

GENERAL COMMENTS

1. It is unclear whether the wells recommended for replacement of CRW 010 well cluster (i.e., CRW10CU, CRW10C and CRW 10A) are sufficient to monitor the southwest boundary of the C-Area Burning/Rubble Pit (CBRP). The text recommends removal of CRW 010 from the sampling program, as contamination observed in this well is likely from the C-Area Groundwater (CAGW) Operable Unit (OU), instead of the CBRP plume. The EMR recommends monitoring wells CRP 6DR and CRP 8D as replacement wells to delineate the plume; however, these two wells are located east of CRW 010 and north of the intermittent stream and are not sufficient to delineate and monitor the southwestern behavior of the plume. In order to remove CRW 010 from the monitoring plan, a new southwestern boundary well should be recommended to address the data gap, as the southern boundary of the trichloroethylene (TCE) plume in the Upper Aquifer Zone and Middle/Lower Aquifer Zone is currently not defined (see Appendix D, Figure D-3, 2022 TCE Concentrations in the Upper Aquifer Zone of the Upper Three Runs Aquifer, and D-4, 2022 TCE Concentrations in the Middle/Lower Aquifer Zone of the Upper Three Runs Aquifer). Please revise the text to recommend an additional well in the southwest as a replacement of CRW 010 boundary well cluster.

   Response: Agree with Clarification.

   A viable flow path from the CBRP OU pit and to wells CRW010CU, CRW 10A, and CRW 10C has not been identified. EMR Figure 8 demonstrates that TCE contamination in the CRW 010 well cluster is from the C-Area reactor area. The 2001 CBRP OU Groundwater Model (WSRC-TR-2001-00298) particle tracks indicate TCE from the CBRP OU pit will travel toward Twin Lakes and Fourmile Branch, rather than to well cluster CRW 10 (EMR Figure 9). Prior to installation of the soil cover in January 1999, large rain events in 1997 (59.67 in.) and 1998 (54.5 in.) resulted in a large increase in TCE groundwater concentrations at the CBRP OU pit. This spike in TCE groundwater concentrations (51,400 ug/L at AS 1 in 1999 and 43,200 ug/L at CRP 3D in 2000) has followed the particle tracks predicted by the 2001 groundwater model from 1999 (first detection) to the present (2023). In contrast, the 2001 C-Area Groundwater OU Model (WSRC-TR-2001-00206) particle tracks indicate TCE from the C-Area reactor area will travel to well cluster CRW 10 (EMR Figure 10).

   Well CDB 3D, which is the nearest downgradient well to the CBRP OU pit has high TCE concentrations and low tritium concentrations, which yield high TCE to tritium ratios in the groundwater. In contrast, wells CRW 10C and CRW010CU have higher tritium concentrations relative to TCE, which yield low TCE to tritium ratios (Attached Figure of TCE-Tritium Ratios Select C-Area Wells). The low TCE to tritium ratios in the CRW 10 well cluster are indicative of a CAGW OU source because tritium contamination in

the groundwater is sourced from the C-Area Reactor and the C-Reactor Seepage Basins.

Based on the particle tracks and TCE groundwater data, the Twin Lakes wetlands and the associated intermittent stream are the southern-most boundary of the CBRP OU TCE plume, and the Twin Lakes wetlands are the northern-most boundary of the CAGW OU TCE plume.

Well CRP 8D lies directly between wells CRP 3D and CRW 10CU, -C, and -A (Attached Hypothetical Flow Path figure from CRP 3D to CRW010CU). Well CRP 8D is screened in the same aquifer zone as CRP 3D, which is the Transmissive Zone of the Upper Aquifer Zone of the Upper Three Runs Aquifer. In contrast, wells CRW 10C and CRW010CU are screened in the lower portion and upper portion of the Lower Aquifer Zone (LAZ), respectively, while CRW010A is screened in the Gordon Aquifer (Attached Hypothetical Flow Path from CRP 3D to CRW010CU Cross Section). CRP 8D is much closer to CRP 3D than CRP 18D, and both CRP 8D and CRP18D are screened at the same depth and aquifer zone as CRP 3D (EMR Figures 5-7). If a flow path existed between wells CRP 3D and CRW010CU, then well CRP 8D would be expected to have a similar historical TCE concentration trend to well CRP 18D, which lies in the CBRP OU flow path to FMB. High levels (> MCL) of contamination have never been observed at well CRP 8D. No changes are proposed to the current report.

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

2. It is unclear whether any monitoring wells have been analyzed for emerging contaminant, 1,4-dioxane. 1,4-dioxane was used as a solvent stabilizer and is frequently associated with TCE; as such, any site with significant TCE releases should also be analyzed for 1,4-dioxane. Section 4.4 (Groundwater and Surface Water Compliance) indicates well samples are analyzed for seven constituents, including 1,1-dichloroethylene (1,1-DCE), cis-1,2-dichloroethylene (cis-1,2-DCE), trans-1,2-dichloroethylene (trans-1,2-DCE), vinyl chloride (VC), tetrachloroethylene (PCE), TCE, and dichloromethane (DCM); however, the text does not indicate whether 1,4-dioxane has been investigated. Please clarify whether the site has been investigated for 1,4-dioxane.

Response: Clarification.

Due to the presence of chlorinated solvents at the site, SRS performed a review of groundwater data in C Area (including CBRP OU) in 2010 and 2011. As documented in the Fourth Five-Year Remedy Review Report (SRNS-2012-00011, Rev 1.1, Appendix F, November 2013), 98 groundwater and surface wells were analyzed using a low detection limit method (EPA8260BSIM) for 1,4-dioxane. Five results were above detection with three of the results from surface water samples in Fourmile Branch associated with an

upgradient OU. Based on the low frequency of results above the detection limit, the scattered locations of those results, and the very low levels of the results, 1,4-dioxane was not identified as a contaminant of concern (COC) for the CBRP OU and no additional monitoring for 1,4-dioxane was required. No change to the current report is proposed.

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

3. The EMR does not provide a figure that depicts all detections of site constituents of concern (COCs). Although Appendix D (TCE Plume Maps) contains TCE exceedance figures for each aquifer, it would be useful to also include a figure depicting all COC detections in support of the conceptual site model (CSM). Please revise the EMR to include a figure depicting all detections of COCs.

Response: Agree/Clarification.

A 2021 VOC pie chart figure is attached to these responses that shows the primary PCE-TCE degradation compounds depicting the results above detection for each CBRP station in 4Q21. Similar figures were created in earlier CBRP OU reports to identify areas of biodegradation. SRS will generate a figure similar to the attached VOC pie chart figure in future reports. No changes are proposed to the current report.

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

4. The text does not discuss the results of the monitored natural attenuation (MNA) parameters, e.g., dissolved oxygen (DO), oxidation reduction potential (ORP), and alkalinity, in terms of conditions favorable to biodegradation. It is noted the text indicates the wetlands provide conditions more favorable to biodegradation, and Table A-1 (CBRP OU Monitoring Results) includes MNA parameter results; however, the text should summarize the results of MNA parameters, including a discussion of the ranges of MNA parameter monitoring results and the wells that fall within optimal ranges to evaluate MNA efficacy at the site. Please revise the text to discuss the results of the MNA parameter monitoring.

Response: Agree/Clarification.

SRS proposes expanding Section 4.6.7 MNA Summary to include a discussion of DO, ORP, pH, and alkalinity results and how they pertain to biodegradation of TCE in the next CBRP OU EMR. Sections similar to the following are examples of what would be included in future reports.

"Dissolved Oxygen (DO)
Low DO concentrations are conducive to anaerobic biodegradation. Wells CRP022A,

CRP 51A, CRP 51B and CRP52A had the lowest DO concentrations ranging from 1.87 mg/L to 2.93 mg/L (Appendix A, Table A-1). Oxygen concentrations less than 1 mg/L generally indicate an anaerobic pathway (EPA 1998), so these wells may be near anoxic areas but not directly within anoxic regions. In 2012 and 2014, elevated levels of methane were observed at all of the wetland MNA stations, indicating these wells are near regions of anaerobic microbial activity. The presence of methane above background concentrations in areas with chlorinated solvents is an indication that the groundwater geochemical conditions are favorable for anaerobic reductive dechlorination, and stable methane concentrations over three sample events indicate more optimal conditions for anaerobic biodegradation (USAF 2007).

Groundwater with oxygen levels greater than 1 mg/L in C Area can support aerobic microbes capable of TCE, cis-1,2-DCE, and VC cometabolism as documented near Castor Creek south of C Area (Hazen 2010 and SRNS 2022).

Oxidation-reduction potential (ORP)

The ORP of groundwater influences and is influenced by the nature of the biologically mediated degradation of contaminants (EPA 1998). ORP (expressed as Eh) of groundwater may range from more than 800 mV to less than -400 mV. An ORP of less than 50 mV indicates reductive dechlorination is possible. Wetland MNA stations CRP 45A, CRP 46B, CRP 48B, CRP50A, CRP 50B, and CRP 52B had one or more samples with an ORP between 53 mV and -30 mV in 2021 and 2022 (Appendix A, Table A-1).

pH

A pH range of 5 to 9 is optimal for both anaerobic and aerobic microbes. The 12 wetland MNA stations CRP 45A through CRP 52B had pH ranges between 5.1 and 6.4, with the exception of CRP 48A (pH 4.5 November 2021 sample) and CRP 52A (pH 4.7 November 2021 sample) (Appendix A, Table A-1).

Alkalinity

Alkalinity is related to pH, in that groundwater in C Area with higher levels of alkalinity will tend to have pH values nearer to neutral while groundwater with low or no alkalinity will tend to have low (acidic) pH values. The lower aquifer zone (LAZ) has more calcium carbonate material in it than the upper aquifer zone (UAZ), which tends to increase alkalinity and pH in the LAZ groundwater relative to the UAZ groundwater (Appendix A, Table A-1)."

The following four references will also be added to future reports as appropriate.

"USEPA, 1998. *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water*, EPA/600/R-98/128, September 1998, United States

Environmental Protection Agency, Office of Research and Development, Washington, DC 20460

Hazen, 2010. ***Cometabolic Bioremediation*****, Terry Hazen, 2010, Handbook of Hydrocarbon and Lipid Microbiology, DOI 10.1007/978-3-540-77587-4-185, Lawrence Berkeley National Laboratory, Berkeley, CA, USA**

SRNS, 2022. ***Effectiveness Monitoring Report (EMR) for the C-Area Groundwater (CAGW) Operable Unit Removal Action (U), July 2021 through June 2022*****, SRNS-RP-2022-00530, Revision 0, September 2022, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC**

USAF, 2007. ***Protocol for In Situ Bioremediation of Chlorinated Solvents Using Edible Oil*****, October 2007, Air Force Center for Engineering and the Environmental, Environmental Science Division Technology Transfer Outreach Office, U.S. Air Force"**

No changes are proposed to the current report.

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

SPECIFIC COMMENTS

1. **Section 2, Operable Unit Description and History, Page 2, and Section 4.6.1, Trichloroethylene, Page 13:** There is contradictory information presented regarding the detection of TCE contamination in the Gordon Aquifer. The text in Section 2 states, "Contamination is vertically confined to the Upper Three Runs Aquifer (UTRA) and outcrops into the wetlands and surface water of Twin Lakes and Fourmile Branch;" however, as Section 4.6.1 indicates, TCE was detected in the Gordon Aquifer (GA) well CRP 22A at a concentration of 0.419 µg/L in 2022. Until further analysis confirms TCE contamination or non-detection in the GA, the text should include the potential for this unit to be contaminated. Please revise the statement to clarify that concentrations of TCE have been observed in the GA.

   Response: Agree.

   The J-qualified result (J 0.419 ug/L) at GAU well CRP022A is unlikely to be verified in the next sample event, as all 11 previous results at CRP022A were below detection. SRS will continue to monitor well CRP022A to determine if there is TCE in the GA at concentrations above detection at this well. SRS will clarify in future reports if TCE is detected at any GAOU wells or if the results are a J-qualified or null-qualified result.

No changes to the current report are proposed.

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

2. **Section 4.5, SVE Results, Page 8:** The EMR should provide supporting documentation for obtaining soil vapor extraction (SVE) rates. The text provides the 2021 and 2022 time weighted averages of the four MicroBlower™ SVE used to estimate the removal rate; however, the text should expand on the individual rates to show where significant removal is occurring and vice versa. Please revise the EMR to include the SVE rates for individual wells for 2021 and 2022.

   Response: Agree.

   SRS proposes including similar tables to the attached tables Xa, Xb, Ya and Yb to future reports. Table Xa shows the calculation for the VOCs removed from the four SVE wells in the month of December 2021, while Table Xb shows the 2021 annual totals for VOCs removed from each SVE well. Likewise, Table Ya shows the calculation for the VOCs removed from the four SVE wells in the month of December 2022, while Table Yb shows the 2022 annual totals for VOC mass removed from each SVE well. In addition, text similar to the following will be added to Section 4.5 SVE Results in future reports:

   "Table Xb and Table Yb indicate well SVE-22B removed the most amount of VOC mass for the two-year period, while well SVE-19B removed the least amount of VOC mass for the two-year period."

   No changes are proposed to the current report.

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

3. **Section 4.6, Groundwater and Surface Water Results, Page 9:** The text in Section 4.6 contradicts the CSM regarding degradation contaminants. The CSM indicates that degradation products (e.g., VC) are expected to increase in the upper aquifer, as opposed to TCE, which is expected to have higher concentrations in the lower aquifer; however, the text indicates only TCE is provided in Appendix D (TCE Plume Maps) because other contaminants behave similarly. Without plume maps for degradation products, it is unclear whether plumes are behaving as indicated in the CSM or more similar to TCE plumes. Please revise the text to provide additional information to support the assertions in the text.

   Response: Agree/Clarification.

   The CSM is meant to indicate as groundwater flows upward through organic-rich

sediment layers along Twin Lakes and Fourmile Branch that biodegradation of TCE occurs. The VOC data from paired MNA wells (CRP 45A&B through CRP 52A&B) are used to monitor biodegradation compounds of TCE. The VOC pie chart figure (attached) discussed in General Comment #3 can be used to show changes occurring in the VOC components from the deeper "B" well to the "A" well as groundwater flows upward to Twin Lakes and FMB (e.g., CRP 50A and CRP 50B). SRS proposes generating a figure similar to the attached pie chart figure in future reports. No changes are proposed to the current report.

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

4. **Section 5, Summary, Page 18:** It is unclear whether the figures in Appendix C support the statement that concentrations of TCE continue to decrease overtime. Many of the time series plots depict relatively stable TCE concentrations trends for wells exhibiting detections (including CRW010, CRP 50, CRP 46, CRP 45B, CRP 20CU, CRP 18C, and CRP 48B and CRP 22 since 2010), and the majority of remaining wells are consistently non-detects, but very few wells actually show significant decreases in concentrations. Please revise the statement in support of the trend graphs provided.

   Response: Clarification.

   The long-term (2000-2022) average TCE concentration for all monitoring stations indicates a large decrease in the groundwater TCE concentration for the CBRP OU. The trend has been relatively stable from 2009 to 2022 (see attached CBRP OU Average TCE Trend figure). The maximum concentration of the plume, currently centered on CRP 20CU, has the biggest impact to the average TCE plume concentration, but the percent of monitoring stations exceeding the MCL (5 ug/L) has decreased from about 42% (13 of 31 stations) to about 27% (9 of 34 stations) from 2010 to 2022. The decreasing number of stations where groundwater exceeds the MCL is another indication of a contracting plume. SRS proposes adding these two metrics to Section 4.6.1 in future CBRP OU EMRs. No changes are proposed to the current report.

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

5. **Section 5, Summary, Page 19:** The text states the Statement of Basis/Proposed Plan for the C-Area Burning Rubble Pit Operable Unit indicated natural attenuation would require 70 years for all areas of the volatile organic compound (VOC) plume to be below MCLs; however, it is unclear if the 2008 Record of Decision (ROD) provided remedial timeframes for groundwater restoration. Please revise the text to discuss remedial timeframes for groundwater restoration that are presented in the ROD.

Response: Agree.

The ROD for the CBRP OU (131-C) (WSRC-RP-2007-4082, Rev. 1, May 2008) stated that 70 years is the timeframe required for the TCE plume to be depleted below cleanup levels (i.e., MCLs) based on groundwater monitoring. The reference to the Statement of Basis/Proposed Plan in this sentence will be replaced with the reference to the ROD in future CBRP OU EMRs.

No changes are proposed to the current report.

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

6. **Section 5, Summary, Page 19:** The text should include the time to reach cleanup estimations as a separate section instead of as a discussion in the Summary. The Summary should provide only conclusions based on the main report and include recommendations, if any. Please revise the EMR to include a separate section that evaluates the estimated time to reach cleanup goals and whether the timeframe for restoration of groundwater is reasonable based on observed trends.

Response: Agree.

SRS proposes moving the discussion on time to reach cleanup goals to section 4.6.1 Trichloroethylene. No changes are proposed to the current report.

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

7. **Appendix D, TCE Plume Maps, Pages D-1 to D-8:** It is unclear why a figure depicting the 2021 TCE Results for the GA and the 2021 potentiometric contours for the GA were not presented. Appendix D contains figures for Upper Aquifer Zone (UAZ) and Middle/Lower Aquifer Zone for 2021 and 2022 but only provides a 2022 figure for the GA. Please revise the EMR to include a figure depicting TCE concentrations in 2021 in the GA.

Response: Agree.

The 2021 TCE figure for the GA was not included in the report because all values were below the detection limit for the GA wells in 2021. Future CBRP OU EMRs will include figures for the GA aquifer wells with the TCE values for the two-year reporting window. No changes are proposed to the current report.

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

Comments Received 10/12/2023

8. **Appendix E, Figure E-5, 2022 TCE Results for the Gordon Aquifer (GA), Page E-7:** It appears Figure E-5 is mis-named. The figure title for E-5 is "2022 TCE Results for the Gordon Aquifer (GA);" however, the figure presents potentiometric contours for the GA. Please revise the figure title to address the discrepancy.

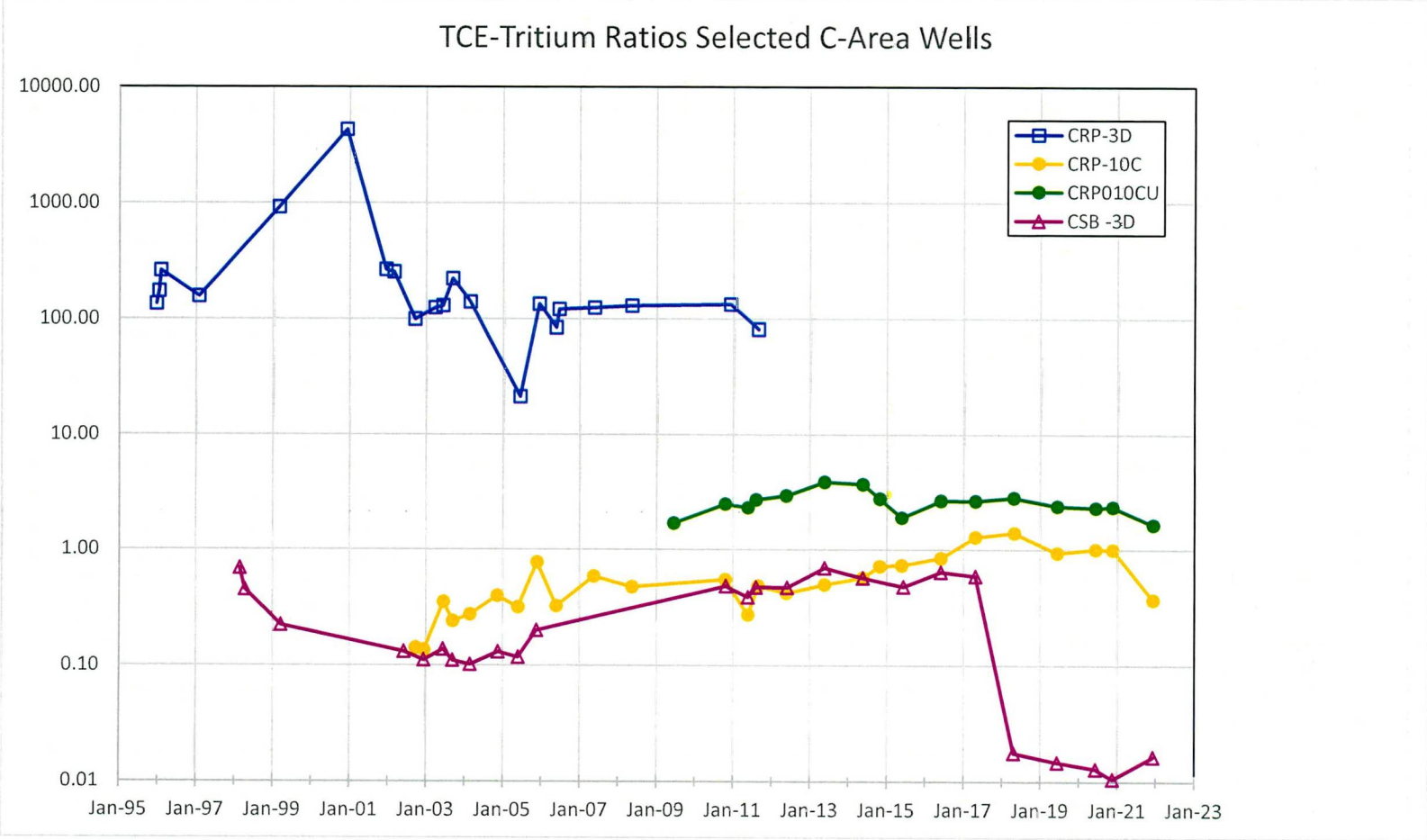
   Response: Agree.

   SRS will ensure all figure titles correctly correspond to the figures in future CBRP OU EMRs. No changes are proposed to the current report.

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

SRS Responses to USEPA 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 2021 through December 2022, SEMS Number: 31, SRNS-RP-2023-00678, Revision 0, June 2023

Comments Received 10/12/2023

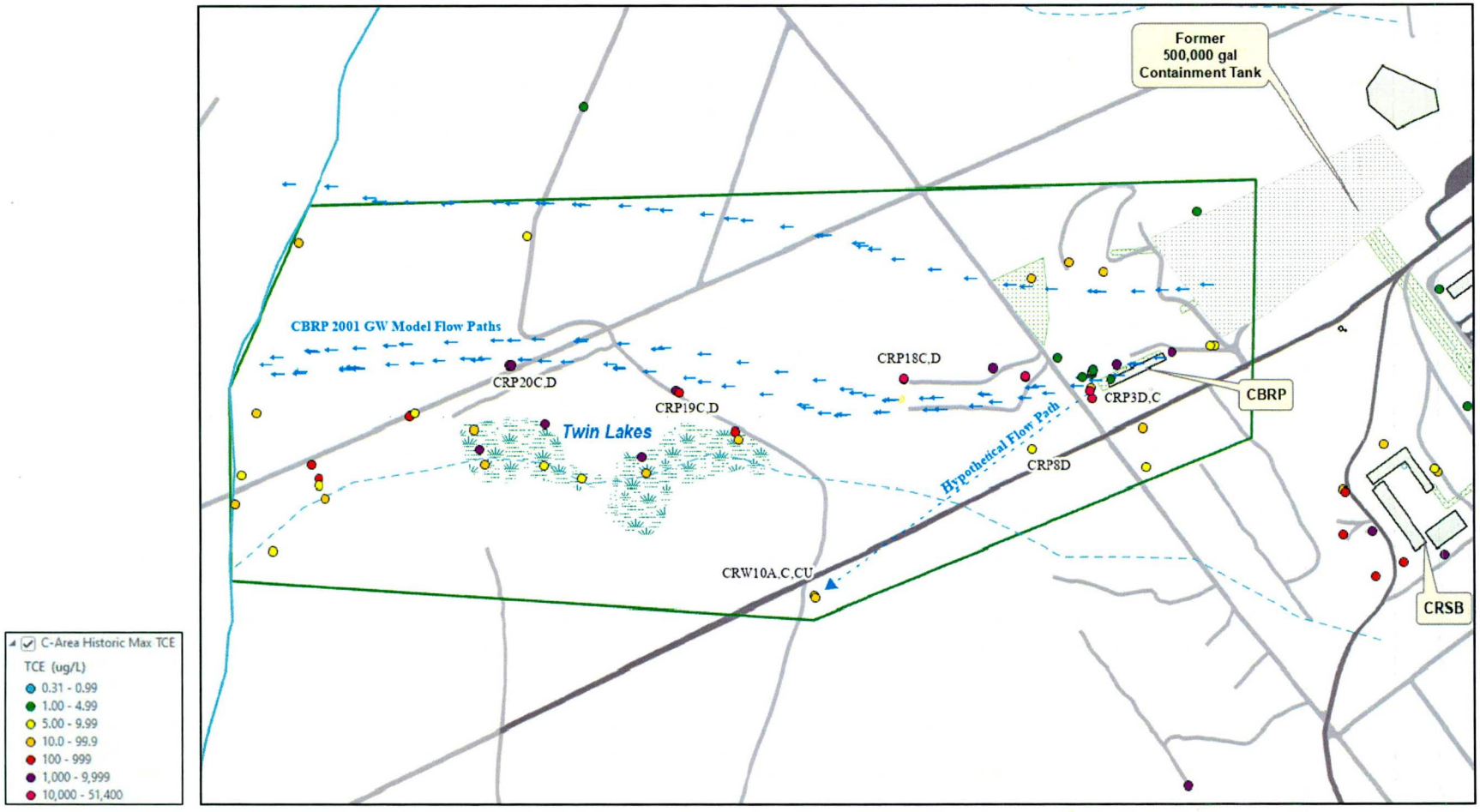


TCE – Tritium Ratios for Selected C Area Wells

SRS Responses to USEPA 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 2021 through December 2022, SEMS Number: 31, SRNS-RP-2023-00678, Revision 0, June 2023

Page 11 of 16

Comments Received 10/12/2023



Hypothetical Flow Path from CRP 3D to CRW010CU with Historic Maximum TCE Values

SRS Responses to USEPA 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 2021 through December 2022, SEMS Number: 31, SRNS-RP-2023-00678, Revision 0, June 2023

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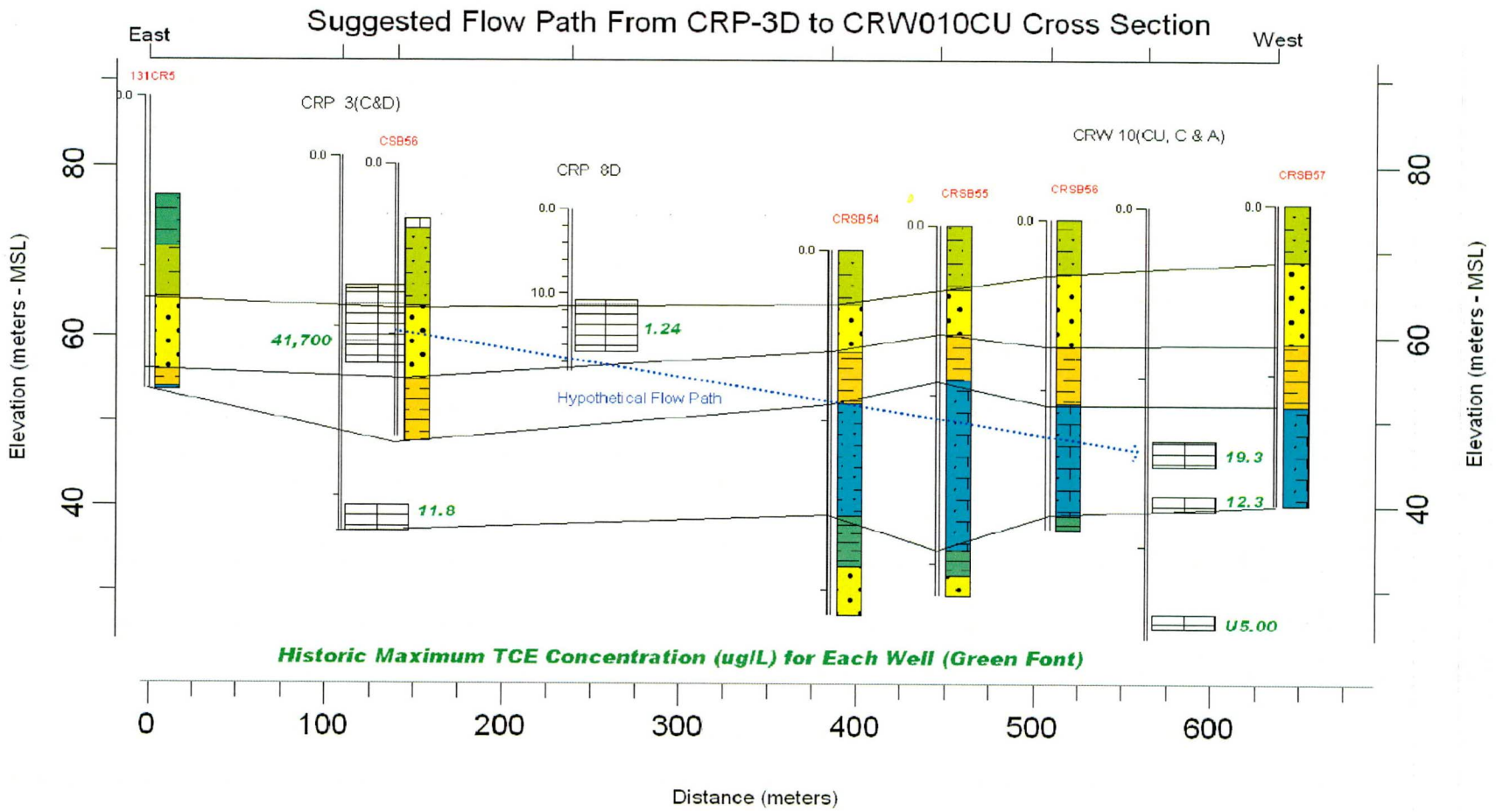

Hypothetical Flow Path from CRP 3D to CRW010CU Cross Section

SRS Responses to USEPA 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 2021 through December 2022, SEMS Number: 31, SRNS-RP-2023-00678, Revision 0, June 2023

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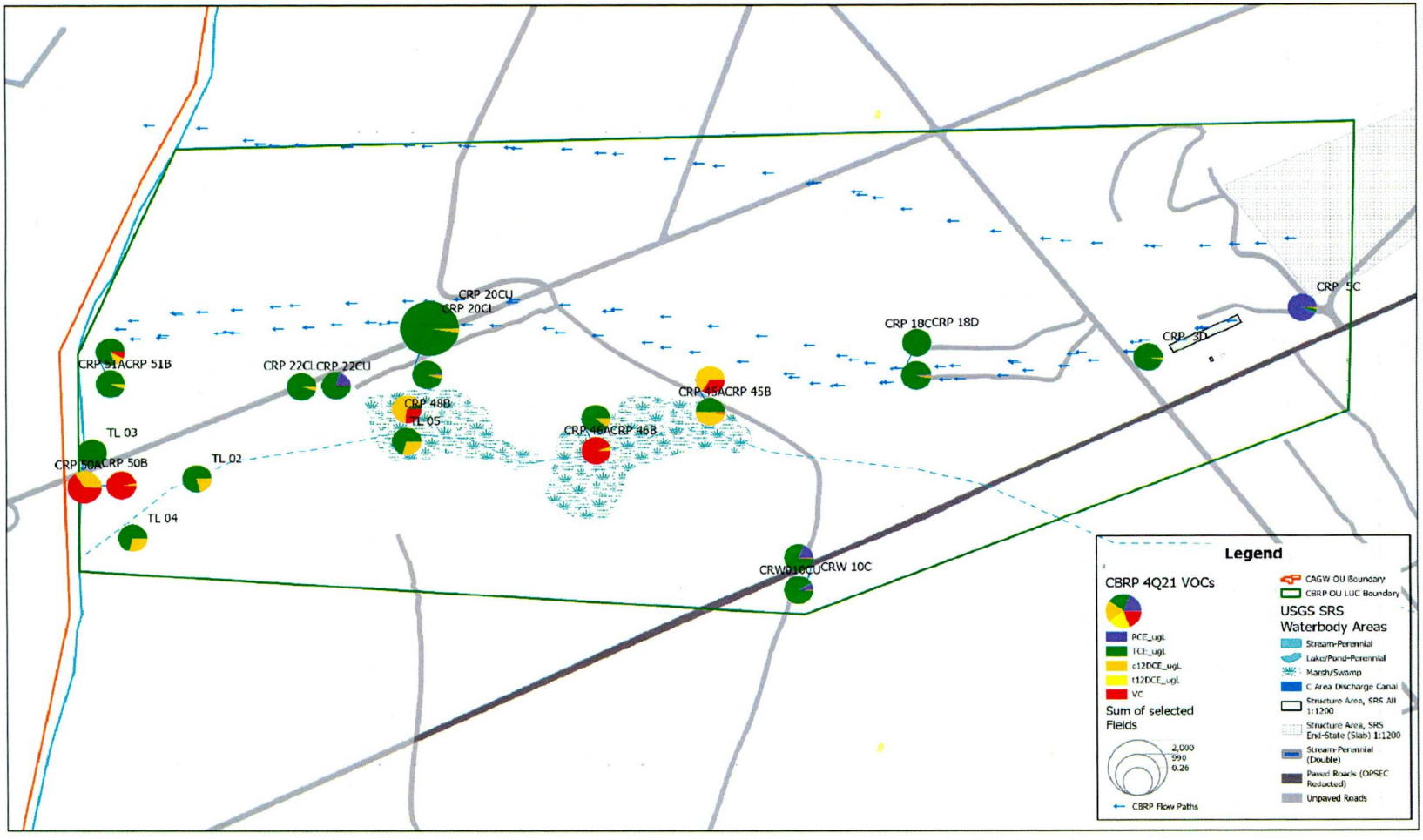


VOC Pie Chart with VOCs Above Detection 4Q21

Comments Received 10/12/2023

Table Xa. MICROBLOWER POUNDS OF SOLVENT REMOVED - DECEMBER 2021 ESTIMATE

	TCE (ppmv)	PCE (ppmv)	Flow Rate (cfm)	Sample Date	Operating Hours	LBs TCE	LBs PCE	Total LBs
SVE-19B	1.34	0	3.49	Dec-21	744	0.07	0.000	0.070
SVE-22B	5.89	0.0183	7.3	Dec-21	744	0.64	0.003	0.645
SVE-23B	1.38	0	1.52	Dec-21	744	0.03	0.000	0.031
SVE-27	0	0	1.44	Dec-21	744	0.00	0.000	0.000
CBRP (4)				103%		0.74	0.00	0.747

Table Xb. MICROBLOWER POUNDS OF SOLVENT REMOVED - 2021 Annual ESTIMATE

	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	12 Month
	Total LBs	Total LBs	Total LBs	Total LBs	Total LBs	Total LBs	Total LBs	Total LBs	Total LBs	Total LBs	Total LBs	Total LBs	Total LBs
SVE-19B	0.225	0.203	0.225	0.019	0.225	0.057	0.059	0.059	0.057	0.059	0.057	0.070	1.315
SVE-22B	1.366	1.275	1.411	0.437	1.411	1.388	1.434	1.434	1.388	1.434	1.388	0.645	15.011
SVE-23B	0.365	0.330	0.365	0.131	0.365	0.174	0.180	0.180	0.174	0.180	0.174	0.031	2.649
SVE-27	0.006	0.055	0.006	2.838	0.061	0.825	0.882	0.882	0.853	0.882	0.853	0.000	8.143
CBRP (4)	2.017	1.863	2.063	3.424	2.063	2.444	2.555	2.555	2.472	2.555	2.472	0.747	27.230

SRS Responses to USEPA 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 2021 through December 2022, SEMS Number: 31, SRNS-RP-2023-00678, Revision 0, June 2023

Comments Received 10/12/2023

Table Ya. MICROBLOWER POUNDS OF SOLVENT REMOVED - DECEMBER 2022 ESTIMATE

	TCE (ppmv)	PCE (ppmv)	Flow Rate (cfm)	Sample Date	Operating Hours	LBs TCE	LBs PCE	Total LBs
SVE-19B	0.333	0	2.42	Dec-22	744	0.01	0.000	0.012
SVE-22B	9.16	0	4.8	Dec-22	744	0.66	0.000	0.657
SVE-23B	6.8	0	1.29	Dec-22	744	0.13	0.000	0.131
SVE-27	27.1	0.0222	5.63	Dec-22	744	2.28	0.002	2.283
CBRP (4)				100%		3.08	0.00	3.083

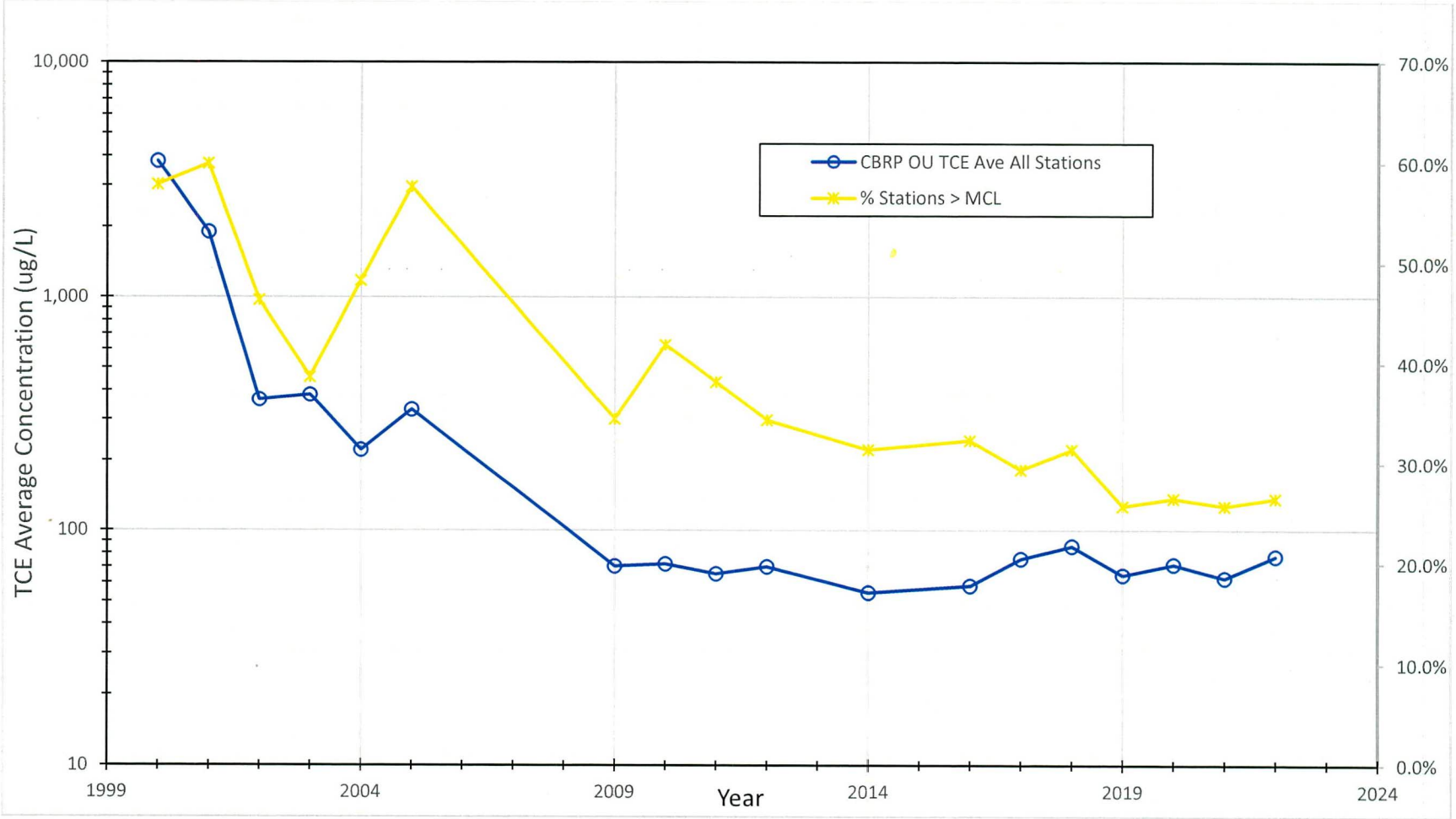
Table Yb. MICROBLOWER POUNDS OF SOLVENT REMOVED - 2022 Annual ESTIMATE

	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22	12 Month
	Total LBs	Total LBs	Total LBs	Total LBs	Total LBs	Total LBs	Total LBs	Total LBs	Total LBs	Total LBs	Total LBs	Total LBs	Total LBs
SVE-19B	0.070	0.063	0.070	0.068	0.070	0.177	0.182	0.182	0.177	0.182	0.177	0.012	1.430
SVE-22B	0.645	0.583	0.645	0.624	0.645	0.281	0.291	0.291	0.281	0.291	0.281	0.657	5.515
SVE-23B	0.031	0.028	0.031	0.030	0.031	0.172	0.177	0.177	0.172	0.177	0.172	0.131	1.329
SVE-27	0.000	0.000	0.000	0.000	0.000	0.228	0.236	0.236	0.228	0.236	0.228	2.283	3.675
CBRP (4)	0.747	0.674	0.747	0.722	0.747	0.857	0.886	0.886	0.857	0.886	0.857	3.083	11.949

SRS Responses to USEPA 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 2021 through December 2022, SEMS Number: 31, SRNS-RP-2023-00678, Revision 0, June 2023

Page 16 of 16

Comments Received 10/12/2023



CBRP OU Average TCE Trend (Based on all monitoring stations 2000-2022)

SRS Responses to 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 2021 through December 2022, SEMS Number: 31, SRNS-RP-2023-00648, Revision 0, June 2023

Comments Received 10/12/2023

General Comments

1. The Department does not agree with the recommendation to replace wells CRW010CU, CRW 10A, and CRW 10C with wells CRP 6DR and CRP 8D as LUC boundary wells. Due to the exceedance of a trigger level at well CRW010CU, the Department prefers that the Core Team be convened to discuss a path forward as per protocols mentioned in Section 4.4.

   Response: Agree with Clarification.

   A viable flow path from the CBRP OU pit and to wells CRW010CU, CRW 10A, and CRW 10C has not been identified. EMR Figure 8 demonstrates that TCE contamination in the CRW 010 well cluster is from the C-Area reactor area. The 2001 CBRP OU Groundwater Model (WSRC-TR-2001-00298) particle tracks indicate TCE from the CBRP OU pit will travel toward Twin Lakes and Fourmile Branch, rather than to well cluster CRW 10 (EMR Figure 9). Prior to installation of the soil cover in January 1999, large rain events in 1997 (59.67 in.) and 1998 (54.5 in.) resulted in a large increase in TCE groundwater concentrations at the CBRP OU pit. This spike in TCE groundwater concentrations (51,400 ug/L at AS 1 in 1999 and 43,200 ug/L at CRP 3D in 2000) has followed the particle tracks predicted by the 2001 groundwater model from 1999 (first detection) to the present (2023). In contrast, the 2001 C-Area Groundwater OU Model (WSRC-TR-2001-00206) particle tracks indicate TCE from the C-Area reactor area will travel to well cluster CRW 10 (EMR Figure 10).

   Well CDB 3D, which is the nearest downgradient well to the CBRP OU pit has high TCE concentrations and low tritium concentrations, which yield high TCE to tritium ratios in the groundwater. In contrast, wells CRW 10C and CRW010CU have higher tritium concentrations relative to TCE, which yield low TCE to tritium ratios (Attached Figure of TCE-Tritium Ratios Select C-Area Wells). The low TCE to tritium ratios in the CRW 10 well cluster are indicative of a CAGW OU source because tritium contamination in the groundwater is sourced from the C-Area Reactor and the C-Reactor Seepage Basins.

   Based on the particle tracks and TCE groundwater data, the Twin Lakes wetlands and the associated intermittent stream are the southern-most boundary of the CBRP OU TCE plume, and the Twin Lakes wetlands are the northern-most boundary of the CAGW OU TCE plume.

SRS Responses to 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 2021 through December 2022, SEMS Number: 31, SRNS-RP-2023-00648, Revision 0, June 2023

Comments Received 10/12/2023

Well CRP 8D lies directly between wells CRP 3D and CRW 10CU, -C, and -A (Attached Hypothetical Flow Path figure from CRP 3D to CRW010CU). Well CRP 8D is screened in the same aquifer zone as CRP 3D, which is the Transmissive Zone of the Upper Aquifer Zone of the Upper Three Runs Aquifer. In contrast, wells CRW 10C and CRW010CU are screened in the lower portion and upper portion of the Lower Aquifer Zone (LAZ), respectively, while CRW010A is screened in the Gordon Aquifer (Attached Hypothetical Flow Path from CRP 3D to CRW010CU Cross Section). CRP 8D is much closer to CRP 3D than CRP 18D, and both CRP 8D and CRP18D are screened at the same depth and aquifer zone as CRP 3D (EMR Figures 5-7). If a flow path existed between wells CRP 3D and CRW010CU, then well CRP 8D would be expected to have a similar historical TCE concentration trend to well CRP 18D, which lies in the CBRP OU flow path to FMB. High levels (> MCL) of contamination have never been observed at well CRP 8D. No changes are proposed to the current report.

SRS agrees to further Core Team discussion to determine the path forward.

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

Specific Comments

1. Section 4.6.1, Trichloroethylene, page 9. The last complete sentence of this page should be corrected to state that the trigger level for LUC boundary well CRW010CU was exceeded in 2021. The reasons for this exceedance may be unclear, but the fact that this trigger level was exceeded should be noted. Reference to the discussion of this exceedance later in this section may be provided.

   Response: Agree.

   The last sentence should have stated that LUC boundary well (CRW010CU) exceeded a trigger level for TCE in 2021 but not in 2022 (EMR Table 3). Exceedances of trigger levels in LUC boundary wells will be correctly reported in future reports. No change to the current report is proposed.

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

2. Section 4.6.1, Trichloroethylene, pages 9-13. This section discusses TCE results for monitoring wells screened in each aquifer zone except for those designated as

TCCZ monitoring wells. Please include a discussion of TCE results in these wells or provide a reason for the omittance. Furthermore, the second paragraph of the MAZ discussion indicates that there are two monitoring wells in the MAZ; however, Tables A-1 and 4 list a total of six MAZ monitoring wells. The two wells referred to (CRP 20CU and CRW 12C) are part of the compliance monitoring well network listed in Table 3 and this should be clarified as it is misleading.

Response: Agree.

There is one LUC boundary monitoring well (CRW 12D) and four MNA monitoring wells (CRP 48A, CRP 48B, CRP 50A, and CRP 50B) screened in the TCCZ (EMR Table 4). MNA monitoring wells are discussed in section 4.6.7 MNA Summary. Well CRW 12D was not discussed in section 4.6.1 as indicated in the first paragraph of section 4.6.1 because no boundary wells exceeded a trigger level for TCE in 2021 or 2022 (Table 3).

There are two LUC boundary monitoring wells (CRP 20CU and CRW 12C) and four MNA monitoring wells (CRP 51A, CRP 51B, CRP 52A, and CRP 52B) screened in the MAZ (EMR Table 4). MNA monitoring wells are discussed in Section 4.6.7 MNA Summary. For clarity, future reports will provide a better description of LUC boundary compliance monitoring wells and MNA monitoring wells in the text. No change to the current report is proposed.

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

3. Section 4.6.1, Trichloroethylene, page 12. The first paragraph of the LAZ discussion states that the well with the highest TCE concentration was CRP 20CL with 57.4 µg/L in 2022; however, according to Table A-1, the LAZ well with the highest TCE concentration was CRP 18C (83.8 µg/L) in 2021. Please correct.

Response: Agree.

In future reports, all the sample results for each aquifer will be reviewed to identify the maximum VOC results correctly. No change to the current report is proposed.

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

SRS Responses to 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 2021 through December 2022, SEMS Number: 31, SRNS-RP-2023-00648, Revision 0, June 2023

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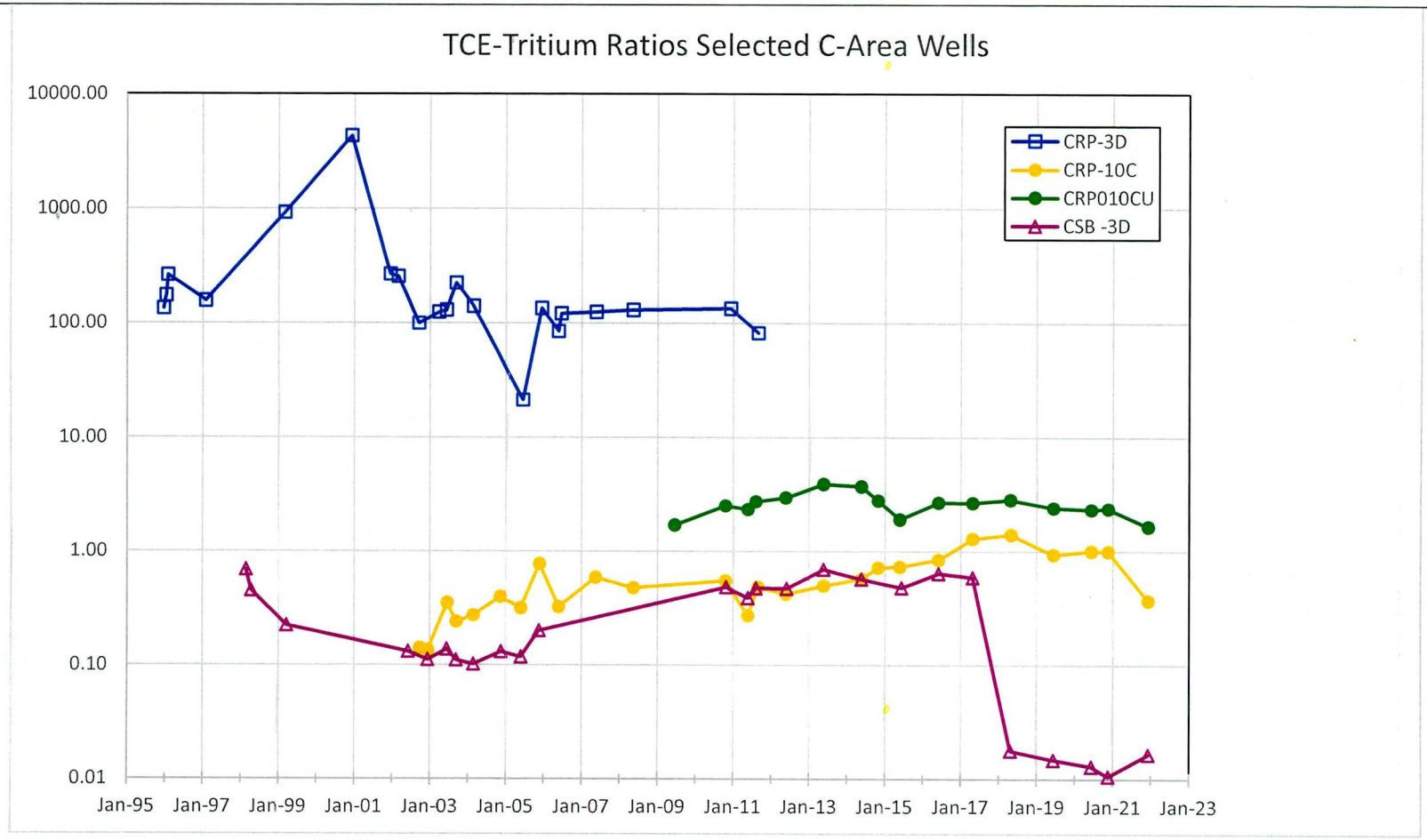

TCE – Tritium Ratios figure for Selected C Area Wells

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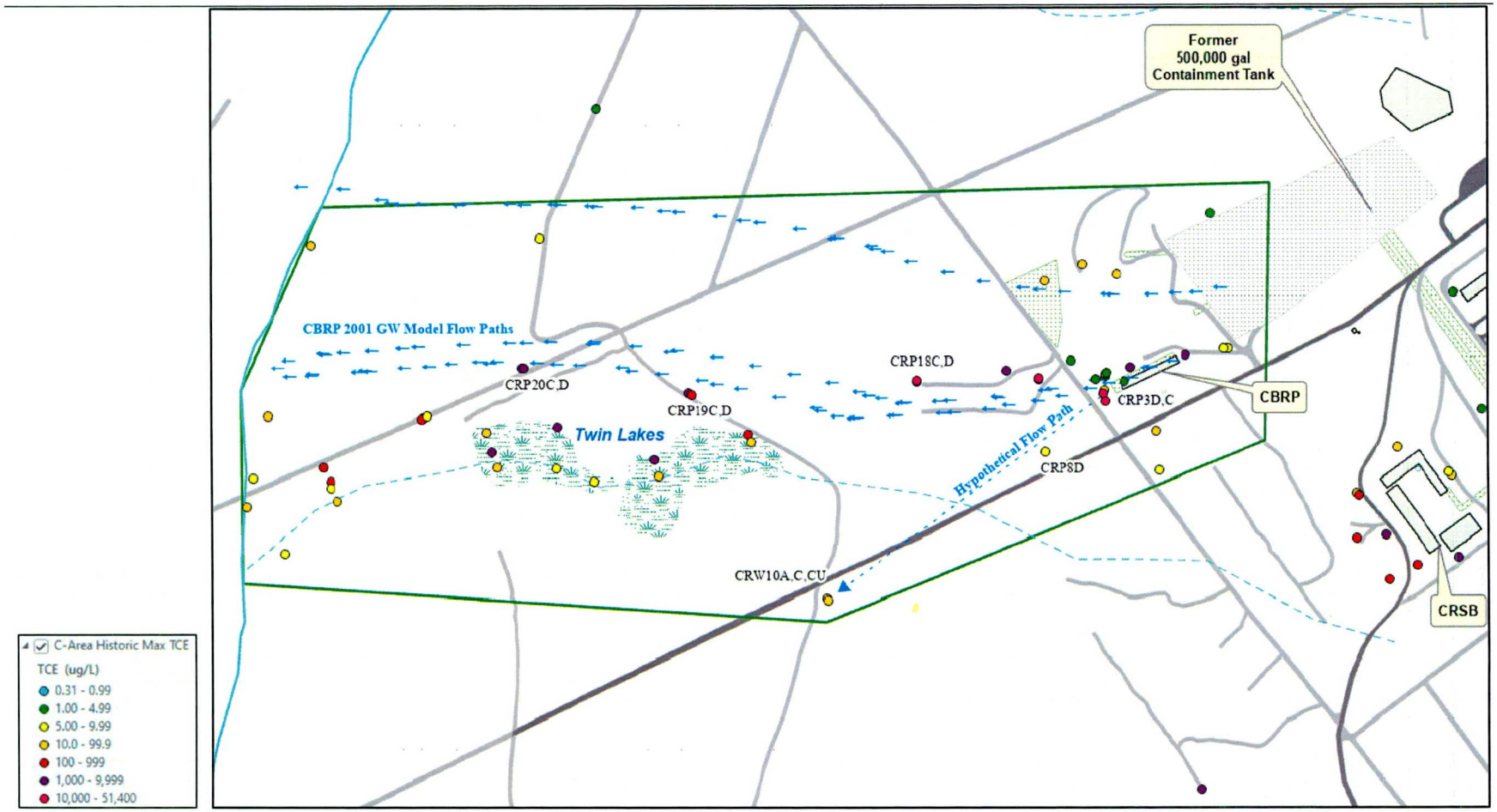

Hypothetical Flow Path from CRP 3D to CRW010CU with Historic Maximum TCE Values

SRS Responses to 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 2021 through December 2022, SEMS Number: 31, SRNS-RP-2023-00648, Revision 0, June 2023

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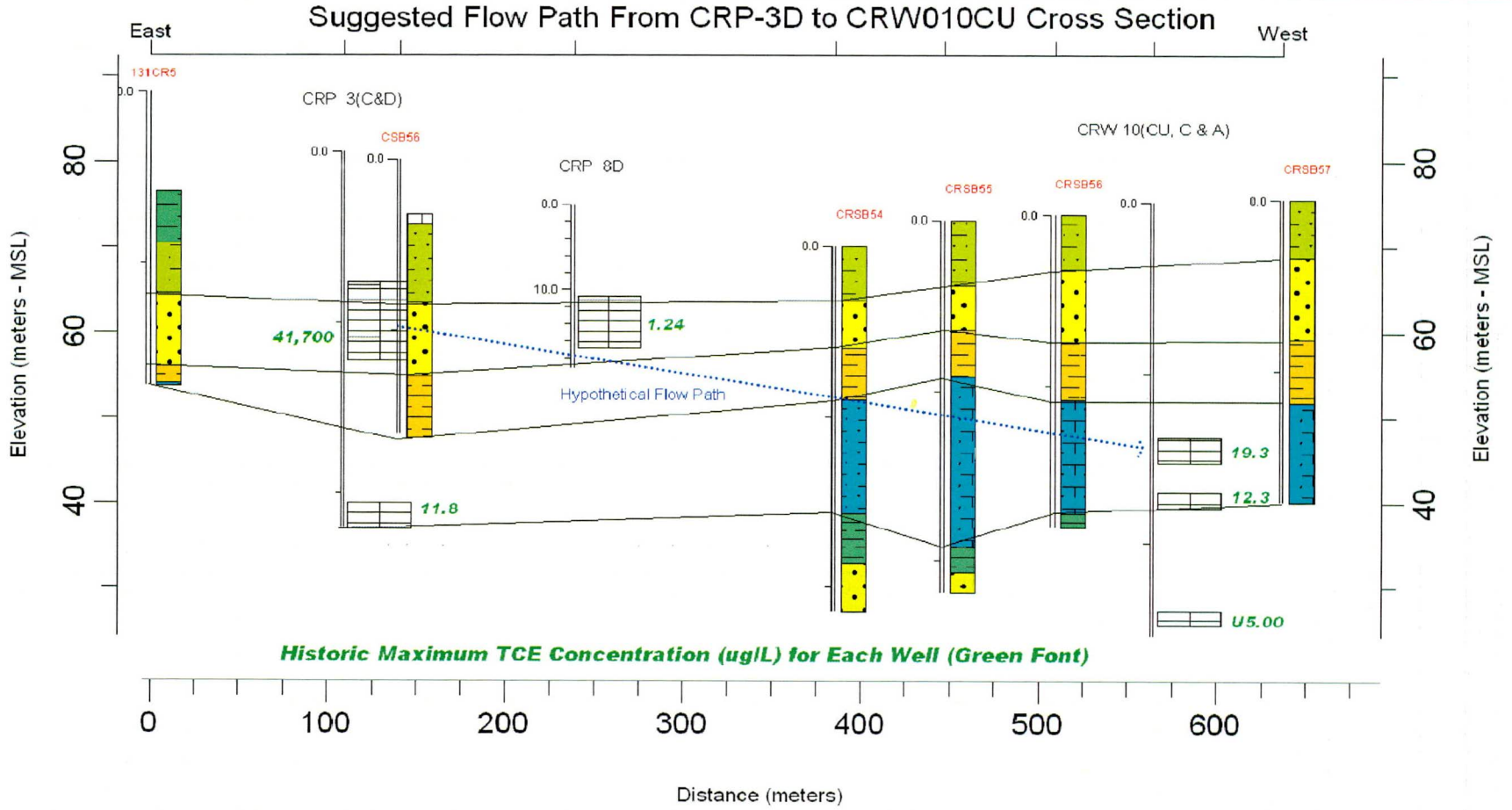

Hypothetical Flow Path from CRP 3D to CRW010CU Cross Section