UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 4

ATLANTA, GA 30303

ARF-025124

ENVIRONMENTAL COMPLIANCE &

SEP - 8 2025

AREA COMPLETION PROJECTS

September 8, 2025

SRNS-OS-2025-00255

Mr. Matthew Baker
SRS Remedial Project Manager
Remediation and Deactivation & Decommissioning Division
U.S. Department of Energy
Savannah River Operations Office
P.O. Box A
Aiken, South Carolina 29802

EPA Comments: EFFECTIVENESS MONITORING REPORT FOR THE CHEMICALS, METALS, AND PESTICIDES (CMP) PITS OPERABLE UNIT (OU) (U), SEMS NUMBER: 24, SRNS-RP-2025-00708, REVISION 0, JUNE 2025 and the GROUNDWATER MODEL UPDATE FOR THE CHEMICALS, METALS, AND PESTICIDES (CMP) PITS OPERABLE UNIT (OU) (U), SEMS NUMBER: 24, SRNS-RP-2024-01410, REVISION 0, JUNE 2025, SAVANNAH RIVER SITE, AIKEN, SOUTH CAROLINA

Dear Mr. Baker:

EPA has reviewed the CMP EMR and the GW Model Update, dated June 17, ~~2925~~ 2025 Alm 9/8/2025. Our comments for both are attached below.

If you have any questions or require additional information, please contact Jon Richards at (404) 431-1340.

Sincerely,

JON RICHARDS

Digitally signed by JON RICHARDS
Date: 2025.09.08 16:19:12 -04'00'

Jon Richards, FFA RPM
Federal Facilities Branch
Superfund and Emergency Management Division

cc: C.L. Bergren, SRNS-ACP
Susan Fulmer, SCDHEC

<u>EFFECTIVENESS MONITORING REPORT</u>
GENERAL COMMENTS

1. The EMR Section 2.2.2.2, PCE and TCE, Gordon Aquifer, states that the modeling did not predict contamination would reach the Gordon Aquifer (GA) above maximum contaminant levels (MCLs); however, it is unclear how reliable this prediction is when the Green Clay Confining Zone (GCCZ) and GA were not included as modeled layers in the Groundwater Model Update for the Chemicals, Metals, and Pesticides (CMP) Pits Operable Unit (OU) (U), SEMS Number: 24, SRNS-RP-2024-01410, Revision 0, dated June 17, 2025 (the Model Update Report). Recently, detections of volatile organic compounds (VOCs) were observed in one GA well, CMP 12A in the second quarter 2024 (2Q2024) with tetrachloroethylene (PCE) at 2.6 micrograms per liter (µg/L) and trichloroethylene (TCE) at 1.1 µg/L. The maximum 1,4-dioxane concentration, exceeding the regional screening level (RSL) of 0.46 µg/L, was detected in well CMP 12A at 0.53 µg/L in 2Q2024. It is noted that PCE, TCE and 1,4-dioxane have historically exceeded respective maximum contaminant levels (MCLs) and regional screening levels (RSLs) in the GA on several occasions during the past twenty years. *Please revise the EMR to discuss the uncertainty and reliability in the modeled contaminant mass and estimated cleanup time predictions since the GCCU and GA were not included as layers in the Model Update Report.*

2. The EMR states that the effectiveness monitoring data collected through March 2025 indicates that the monitored natural attenuation (MNA) remedy is working as predicted, i.e., the cleanup timeframe for PCE was calculated at 104 years (CY 2126); however, the modeling prediction of a 104 year cleanup timeframe for PCE may not be reasonable and the MNA remedy may not be effective in restoring contaminated groundwater to beneficial use within a *reasonable timeframe*. The EMR states that based on the evaluation of monitoring data, advection and dispersion are the main MNA processes occurring along transport pathways from the source to the wetlands at the CMP Pits; however, according to the EPA MNA Guidance, biologically mediated reductive dechlorination is the primary mechanism for effective chlorinated solvent attenuation. Since biodegradation is not the primary mechanism for attenuation, MNA may not be occurring based on the chlorinated solvent concentrations being attenuated via advection and dispersion, which is not a groundwater remedy per the EPA MNA Guidance. The EMR should discuss that the next Five-Year Review prepared for the CMP Pits OU may need to identify the issue concerning potential ineffectiveness of the MNA remedy by not appearing to restoring contaminated groundwater to beneficial use within a *reasonable timeframe* per the EPA MNA Guidance, with recommendations and follow up actions to address residual contaminant mass and reduce cleanup times. *Please revise the EMR to discuss that the potential ineffectiveness of MNA may be identified as an issue in next Five-Year Review and will be addressed accordingly.*

3. The EMR should discuss the how the modeled contaminant mass and estimated cleanup time predictions could be underestimated due the uncertainty of how much contaminant mass remains at the CMP Pits OU. The EMR states that SRS used the 2021 soil sampling data, as well as recent groundwater data, to update the source term (and plumes) in the 2017 model used to update simulated cleanup timeframes; however, the mass of residual contamination trapped within clay horizons and/or pore space in the vadose zone, in or out of the electrical resistance heating/soil vapor extraction (ERH/SVE) zone, which is a secondary source for groundwater contamination, is unknown. The EMR states that contaminants are partitioning onto clay particles and/or diffusing into less permeable layers, not only near the original source area at the CMP Pits, but also throughout the aquifer system, acting as secondary sources of contamination to groundwater. Increasing VOC concentrations in all aquifer zones, i.e., the transmissive zone (TZ), middle aquifer zone (MAZ), lower aquifer zone (LAZ) and GA) suggest potential back diffusion/desorption from

the less permeable confining units, i.e., tan clay confining zone (TCCZ), tan clay lower clay (TCLC) and GCCZ. According to the EMR the confining zones are not considered thick competent confining clays, but are hummocky, vary in thickness, and can be almost non-existent or leaky in areas allowing some degree of flow between aquifers. *Please revise the EMR to discuss how the modeled contaminant mass and estimated cleanup time predictions could be underestimated due the uncertainty of how much contaminant mass remains at the CMP Pits OU and matrix diffusion.*

4. The EMR should discuss whether any preliminary investigation into the use of per- and polyfluoroalkyl substances (PFAS) has been conducted at the CMP Pits OU. Per the Historical and current usage of per- and polyfluoroalkyl substances (PFAS): A literature review, Linda G. T. Gaines, May 2022 (https://onlinelibrary.wiley.com/doi/10.1002/ajim.23362), PFAS have been used as an active and inert (or inactive) pesticide ingredient, and may also have been a component of other chemicals that were disposed in the CMP Pits OU. Also, at Department of Energy (DOE) sites uranium enrichment and plutonium production process areas including equipment/lubricants serve as PFAS sources since PFAS was used on an industrial scale in uranium separation activities during Manhattan Project and Cold War era operations. It is noted that restoration of contaminated groundwater to beneficial use will not be considered complete until all potential sources of groundwater contamination are sufficiently investigated. *Please revise the EMR to discuss whether any preliminary investigation into PFAS presence at the site has been conducted and if not, recommend sampling for PFAS be conducted prior to the next Five Year Review to ensure protectiveness.*

SPECIFIC COMMENTS

1. **Section 1.4, Observed Hydrology at the CMP Pits OU, Page 6 of 124:** The text should explain why only a select number of wells screened in the LAZ were used to draw the potentiometric surface. For example, it is unclear why the text box on Figure 8 (2024 Potentiometric Surface for the LAZ and GA) indicates that only well screens between 130 and 150 feet above mean sea level (ft amsl) were used to generate the LAZ potentiometric surface when the cross-sections in Figures 12-14 indicate that the LAZ is present from about 95 to 190 ft amsl. *Please revise the text to explain why the LAZ potentiometric surface was drawn using only wells screens within the range of 130 to 150 ft amsl.*

2. **Section 1.4, Observed Hydrology at the CMP Pits OU, Page 6 of 124:** Measurements show that groundwater in the vicinity of Pen Branch flows south towards Pen Branch on the northern side of the stream, further supporting that contaminants originating from CMP Pits are not flowing underneath Pen Branch towards the north. However, historically constituents of concern (COCs) have been detected in wells located north of Pen Branch including PCE and TCE. More recently at CMP066B, dichloromethane (DCM) was detected at a low estimated value of 1.1 µg/L in second quarter 2024 (2Q2024) and 1,4-dioxane was detected at low estimated concentration of 0.0542 µg/L in fourth quarter 2024 (4Q2024). The contaminant detections in wells located north of Pen Branch suggest that under certain conditions contaminated groundwater flows to the north underneath Pen Branch. *Please revise the text to acknowledge this flow path.*

3. **Table 1, CMP Pits OU MNA Monitoring Network, Page 113 of 124, and Figure 13, Cross Section B – B' at the CMP Pits OU Area with 2024 PCE Plume and Results, Page 63 of 124:** The figure shows that well CMP 15B is screened in the LAZ; however, Table 1 (CMP Pits OU MNA Monitoring Network) lists CMP 15B as a MAZ well. Also, CMP 15B is shown on Figure 7 (Potentiometric Surface for the TZ and MAZ) and in Table 3 (CMP Pits OU Annual MNA Results,

April 2024 through March 2025) as a MAZ well. It is noted the CMP 15B groundwater elevation of 203.3 ft amsl is within the MAZ elevations of approximately 187 to 212 ft amsl; however, based on the CMP 15B screen elevation of 145.1 – 155.1 ft amsl, the well is screened within the middle LAZ. Also, CMP 15B is identified as a MAZ well on Figure C-2 (2024 Cation/Anion Stiff Diagrams); however, based on the cation/anion signature, CMP 15B more closely resembles the LAZ cation/anion stiff diagrams. *Please revise the EMR to address this discrepancy.*

4. **Section 2.2.2.2, PCE and TCE, Lower Aquifer Zone, Page 19 of 124:** The text states, "Concentrations on the western edge of the plume (well CMP 33D) have also been decreasing since 2007 indicating the LAZ plume is contracting to the west within the LAZ," but based on a comparison of the plume configurations in the LAZ on Figure 16 (PCE Plume Comparison from 2008 and 2024 in the LAZ and GA), it appears that contamination was migrating in a westerly direction in 2008, but is now migrating to the north-northeast. It appears that (but is unclear) if the groundwater flow direction has changed. *Please revise the text to discuss changes in flow direction in the LAZ since 2008 based on the 2024 PCE plume configuration.*

MINOR COMMENTS

1. **Table of Contents, Page iii of viii:** The subsections in Section 2.2.2 (Groundwater Sampling Results) are mis-numbered within the text. According to the table of contents (TOC), Section 2.2.2 contains subsections 2.2.2.1 through 2.2.2.12; however, within the body of the text, Section 2.2.2 begins with subsection 2.2.2.2 and ends with subsection 2.2.2.13. *Please revise the EMR to address this discrepancy.*

2. **Section 2.2.2.2, PCE and TCE, Lower Aquifer Zone, Page 18 of 124:** The text should discuss the 2024 concentrations, not the 2023 concentrations (i.e., it appears the values are correct, but the year is wrong). *Please revise the text to state that 2024 concentrations are discussed.*

GROUNDWATER MODEL UPDATE

GENERAL COMMENTS

1. The Model Update Report indicates that modeling did not predict contamination to reach the Gordon Aquifer (GA) above maximum contaminant levels (MCLs); however, it is unclear how reliable this prediction is when the Gordon Confining Unit (GCU) and GA were not included as modeled layers in the groundwater model update. It is noted that there were detections of volatile organic compounds (VOCs) tetrachloroethylene (PCE), trichloroethylene (TCE) and 1,4-dioxane in the GA wells CMP 12A, occasionally in CMP 8A and in the recently abandoned CMP 010A. The maximum detections of VOCs were observed in one well, CMP 12A in the second quarter 2024 (2Q2024) with PCE at 2.6 micrograms per liter (µg/L) and TCE at 1.1 µg/L. The maximum 1,4-dioxane concentration exceeding the RSL of 0.257 µg/L was detected in well CMP 12A at 0.53 µg/L in 2Q2024. It is noted that PCE, TCE and 1,4-dioxane have historically exceeded respective MCLs and RSLs on several occasions during the past twenty years. According to Figure 3 (Hydrogeologic Conceptual Model for the CMP Pits Site (after GeoTrans 2002a)) the GCU and GA are included in the hydrogeologic conceptual model (HCM) developed for the CMP Pits OU; however, the GCU and GA were not discussed in Section 2.0 (Hydrogeological Conceptual Site Model). The current model predictions do not match with the current detections of contaminants in the GA, suggesting the modeled contaminant mass and estimated cleanup times are underestimated. *Please revise the Model Update Report to discuss the uncertainty and reliability in the modeled contaminant mass and* *estimated cleanup time predictions since the GCU and GA were not included as layers in the model update.*

2. The confining units shown on Figure 3 (Hydrogeologic Conceptual Model for the CMP Pits Site (after GeoTrans 2002a)) are not depicted as being discontinuous and/or leaking in areas (Section 2.0, Hydrogeological Conceptual Model) and it is unclear whether this hydrogeological conceptual model figure is outdated based on the dated reference citation "GeoTrans 2002a." The Model Update Report states that the aquifer properties such as storage and transmissivity are employed differently for confined and unconfined layers in the model update. As such, assuming that the confining units are aquicludes that do not transmit water, are continuous and not leaky is not a realistic assumption in the model, particularly since the GCU and GA were not included as layers. The discontinuous and/or leaky confining units appear to be realistic assumptions based on detection of constituents of concern (COCs) in all the aquifers, the Transmissive Zone (TZ), Middle Aquifer Zone (MAZ), Lower Aquifer Zone (LAZ) and GA. *Please revise the Model Update Report to discuss the uncertainty and reliability of the model predictions regarding the estimated contaminant mass and cleanup time if the confining units were assumed to be aquicludes that do not transmit water.*

3. The Model Update Report states that Table 2 (Model Parameters (Post-Calibration)) lists the initial parameter values used in the current groundwater flow model; however, the table lists the post-calibration values and not the initial input values. Also, any input values that are neither site-specific values *nor* reference values must be verified to be conservative. Please revise the Model Update *Report to include a table of all initial parameter values and their source/justification as well as final parameter values, including parameter ranges and ensure a complete explanation of the input values used is included.*

4. Section 3 states, "In addition, the head residuals are randomly distributed geospatially, indicating minimal spatial bias," but Figure 9 (Potentiometric Surface and Head Residuals in the MAZ) and Figure 10 (Potentiometric Surface and Head Residuals in the LAZ) indicate that the head residuals are skewed in the MAZ and LAZ since the greatest negative head residual is in the south (-5.4), while the north only includes positive head residuals. The area in the middle appears to have both, but the magnitude of the negative head residual is more than twice the highest positive head residual in the south, so the model is not spatially calibrated. The gradient appears to be skewed with lower than expected heads in the south, and higher than expected heads in the north. This means that the gradient in the model is likely higher than it actually is and predicted impacts to surface water in Pen Branch over the MCL and predicted plume cleanup times are underestimated. *Please revise the text to acknowledge the uncertainty with the calibration of head residuals and how the model predictions are impacted by the higher gradient.*

5. Figure 9 (Potentiometric Surface and Head Residuals in the MAZ) and Figure 10 (Potentiometric Surface and Head Residuals in the LAZ) appear to be identical. It appears that both figures are the MAZ head residuals based on Figure 11 (Comparison of Modeled vs Observed Heads and Head Residuals vs Observed Heads). For example, in Figure 11 the location with the highest difference in residual head is red, indicating MAZ. This is confirmed in Table 4 (Head Residual post-Calibration Simulation) where the residual is -5.4 in CMP-063-C. Also, the LAZ figure is missing; according to Table 4 there should be a positive head residual of 5.44 in CMP-015-B, but that does not appear on either figure. *Please revise the figures as appropriate to address these issues.*

6. Only one piezometric surface is plotted on Figures 8-10 and it is not clear if this is the observed or simulated piezometric surface (ideally, both would be plotted in different colors). Further, the figures

lack legends. *Please revise Figures 8-10 as appropriate to clarify if the piezometric surface is simulated or observed, consider including both the simulated and observed piezometric surface, and include figure legends.*

7. The Model Update Report discusses that the quantification of the process of sorption is uncertain and affects the longevity of the plume and a reason the 2017 modeling effort factored in continuing sources from residual contamination/desorption from low permeable zones located beneath the CMP Pits knoll. It is noted that a new, powerful MODFLOW-USG/MDT model (Panday et al. 2017, Falta et al., 2023) is available to analyze the existing chemical data before and after remediation, which will delineate the mass diffusion (MD) parameter distributions and their uncertainties and further improve the estimated K-distribution and reduce uncertainty. *Please revise the Model Update Report to recommend the use of the MODFLOW-USG/MDT model for future CMP OU Pits groundwater fate and transport modeling.*

SPECIFIC COMMENTS

1. **Section 2.0, Hydrogeological Conceptual Model, Pages 2 and 3 of 50:** The text does not discuss the vertical gradients between the TZ, MAZ, LAZ and GA zones. Vertical gradients can influence how water moves between aquifers and how contaminants might spread. *Please revise the text to discuss the vertical gradients and impacts on contaminant transport between the aquifer zones.*

2. **Section 2.0, Hydrogeological Conceptual Model, Page 2 of 50:** The text discusses that the tan clay confining zone (TCCZ) and the tan clay lower clay (TCLC) are incompetent clay units that may be hummocky, discontinuous, and/or leaky in some areas; however, the text should also discuss that the Gordon confining unit (GCU) overlying the GA (see Figure 3, Hydrogeological Conceptual Model for the CMP Pits Site (after GeoTrans 2002)) is also characterized as being discontinuous and/or leaking in areas (*Effectiveness Monitoring Report for the Monitored Natural o MNA) at the Chemicals, Metals, and Pesticides (CMP) Pits, April 2024 through March 2025*, Revision 0, June 2025). *Please revise the text to discuss the GCU as a discontinuous and leaky unit.*

3. **Figure 3, Hydrogeologic Conceptual Model for the CMP Pits Site (after GeoTrans 2002a), Page 21 of 50:** The confining units TCCZ, TCLC and the GCU are not depicted in the figure as being hummocky, discontinuous, and/or leaky in some areas as discussed in Section 2.0 (Hydrogeological Conceptual Model). *Please revise the figure to depict the confining units as described in the text.*

MINOR COMMENT

1. **Section 4.5, 1.4-Dioxane Transport, Page 14 of 20:** The text cites Figure 20 (Initial Lindane Plume for All Aquifers (end of 2022)) for 1,4-dioxane, but should cite Figure 21 (Initial 1,4-Dioxane Plume for All Aquifers (end of 2022)). *Please revise the text to cite Figure 21 for 1,4-Dioxane.*