UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

November 13, 2020

CERTIFIED MAIL
RETURN RECEIPT REQUESTED
Mr. Brian Hennessey, 730-B
SRS Remedial Project Manager
Area Completion Projects
Savannah River Operations Office
P.O. Box A
Aiken, South Carolina 29802

Dear Mr. Hennessey:

The U.S. Environmental Protection Agency (EPA) has reviewed the Effectiveness Monitoring Report for the Monitored Natural Attenuation at the Chemicals, Metals, and Pesticides Pits Operable Unit, April 2019 through March 2020, Revision 0 dated June 2020.

EPA can not provide approval for the above mentioned report until the comments below have been addressed. If you have any questions, please contact me at (404) 229 -9500.

Sincerely,

Diedre Lloyd

Diedre Lloyd
Remedial Project Manager
Restoration and Sustainability Branch
Region 4, Superfund & Emergency Mangement Division
61 Forsyth Street, S.W.
Atlanta, Georgia 30303

cc: Angelia Holmes, DOE-SRS, C. L. Bergren, SRNS-ACP (Signed Original), Phil Prater, DOE-SRS, C.L. Bergren SRNS-ACP (Signed Original), Susan Fulmer, SCDHEC

EPA COMMENTS ON THE
EFFECTIVENESS MONITORING REPORT
FOR THE MONITORED NATURAL ATTENUATION (MNA)
AT THE CHEMICALS, METALS, AND PESTICIDES (CMP) PITS OPERABLE UNIT
APRIL 2019 THROUGH MARCH 2020
REVISION 0

DATED JUNE 2020

SAVANNAH RIVER SITE
AIKEN, SOUTH CAROLINA

EPA GENERAL COMMENTS

1. Based on the information presented in the EMR, contingency measures are needed to address unacceptable performance of the selected remedy. Consistent with the EPA MNA guidance document, "*Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action and Underground Storage Tank Sites*, Office of Solid Waste and Emergency Response (OSWER) Directive 9200.4-17P, April 1999 (EPA MNA Guidance), contingency measures should be implemented if unacceptable performance of the selected remedy should occur. Consistent with the EPA MNA Guidance, the CMP Pits OU groundwater remedy includes 4 of the 5 "trigger" criteria signaling unacceptable performance of the remedy and generally include, but are not limited to, the following:

   - ***Contaminant concentrations in soil or groundwater at specified locations exhibit an increasing trend not originally predicted during remedy selection.*** Lindane concentrations have been increasing since 2016 in well CMP064BU and were slightly above the maximum contaminant level (MCL) in 2019. Tetrachloroethylene (PCE) has been increasing since 2013 in distal plume well CMP8B.
   - ***Near-source wells exhibit large concentration increases indicative of a new or renewed release.*** Recent data in the source area has shown the following:
     - PCE, trichloroethylene (TCE), and /or lindane in well CMP 35D directly north of the CMP Pits have been increasing. Lindane has been increasing since 2013 in CMP35D, and PCE/TCE has been increasing since 2010.
     - PCE concentrations have been increasing in CMP10C since 2013, and TCE has been increasing since 2008.
     - PCE/TCE concentrations have been increasing in well CMP13B since 2001.
     - PCE concentrations have been increasing in well CMP13D since 2009.
     - Increasing trend in PCE/TCE concentrations are noted for well CMP32C since 2001.
     - Increasing trends in PCE/TCE concentrations are noted in well CMP34D since 2008.
     - An increasing trend in PCE concentration is noted for well CMP52C since 2002, and an increasing PCE/TCE concentration trends were observed in CMP52BU since 2005.
     - Finally, an increasing trend in PCE concentration is noted for well CMP058B since 2006.
   - ***Contaminants are identified in monitoring wells located outside of the original plume boundary.*** The EMR indicates modeling did not predict contamination to reach the Gordon Aquifer (GA) above MCLs. Two new monitoring wells were installed in the GA in September 2019, CMP010A and CMP055A. Results from CMP010A indicate that the GA is contaminated

above MCLs with PCE, TCE, and also has concentrations of 1,4-dioxane above the USEPA tap water regional screening level (RSL). One well located north of Pen Branch, CMP067B, had detections of PCE and TCE below MCLs during 4Q2019.

- ***Contaminant concentrations are not decreasing at a sufficiently rapid rate to meet the remediation objectives.*** Remedial timeframe estimates indicate groundwater contamination would remain above MCLs up to another 100 years.

Discussion of contingency measures are needed to address unacceptable performance of the selected remedy is retained as a project need and for future discussions among core team members.

2. The source(s) of contamination is uncertain for the volatile organic compound (VOC) and lindane in the northeast distal groundwater plume. For example, the text in Section 1.2 (Nature and Extent of Contamination), Page 3 of 100, states "Groundwater modeling indicated that the CMP Pits were the source for the main plume. Particle tracking toward and from the northeast plume suggested that its source was different from that of the main plume." The text presents three hypothesis and/or a combination thereof to explain the current plume(s) geometry and locations relative to potential source areas:

   - A drainage ditch located approximately 361 feet north of the CMP Pits is a possible source area. It is possible that this ditch was used as a dumping location prior to the use of the actual CMP Pits. Additional characterization for the source of the distal plume using soil gas surveys indicated that if a source was previously present in the vadose zone, it has been depleted.
   - It is also plausible, due to the dry zone areas within the transmissive zone (TZ) and to some degree the middle aquifer zone (MAZ), that one plume separated into two distinct plumes over time.
   - Additionally, upwelling of the MAZ as it discharges to the stream most likely brings some contamination up into the TZ.

   It is noted that Figure 3, CMP Pits Groundwater OU Conceptual Site Model (CSM), Page 33 of 100, shows a single distinct VOC plume with the CMP Pits as the apparent source of contamination. Additionally, it is noted lindane was detected at a concentration of 0.223 micrograms per Liter (µg/L) which exceeds the MCL of 0.2 µg/L in the distal lower aquifer zone (LAZ) plume well MW064BU. However, lindane was not sampled in wells screened in the TZ or MAZ and located in the northeast distal plume area. There is no evidence lindane was disposed of in the drainage ditch. As such, detections of lindane in northeast distal plume wells screened in the TZ and/or MAZ would indicate the CMP Pits is the source of not only lindane contamination but also VOC contamination. **The uncertainty of the source of VOC and lindane contamination, and a current supporting CSM for the northeast distal VOC plume, are retained as data gaps for future core team discussions.**

3. **Section 1.2, Nature and Extent of Contamination, Pages 2-4 of 100:** The extent of groundwater contamination is not defined and/or poorly defined for many of the COCs within the upper three runs aquifer (UTRA). For example, a review of the figures indicate the following:

   - **Figure 10, 2019 PCE Plume and Groundwater and Surface Water Results for the TZ and MAZ, Page 47 of 102 and Figure 17, 2019 TCE Plume and Groundwater and Surface Water Results in the TZ and MAZ, Page 61 of 100.** 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.

The lack of VOC data to delineate the horizontal and vertical extent of contamination in the TZ and MAZ and a supporting CSM will be retained as data gaps for future core team discussion.

- **Figure 11, 2019 PCE Plume and Groundwater Results for the LAZ and GA, Page 49 of 100 and Figure 18, 2019 TCE Plume and Groundwater Results for the LAZ and GA, Page 63 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. Additionally, the horizontal and vertical extent of VOC contamination is not defined in the GA, as identified at new GA well CMP10A.
  The lack of VOC data to delineate the horizontal and vertical extent of contamination in the LAZ and GA and a supporting CSM will be retained as data gaps for future core team discussion.

- **Figure 12, Cross Section A - A' at the CMP Pits OU Area with 2019 PCE Plume and Results, Page 51 0f 100; Figure 25. 2019 Lindane Plume and Groundwater Results for the TZ and MAZ, Page 77 of 100; Figure 26. 2019 Lindane Plume and Groundwater Results for the LAZ and GA, Page 79 of 100' Figure 27. Cross Section A - A' at the CMP Pits OU Area with 2019 Lindane Plume and Results, Page 79 of 100; Figure 28. Cross Section B - B' at the CMP Pits OU Area with 2019 Lindane Plume and Results, Page 83 of 100; and, Figure 29. Cross Section C - C' at the CMP Pits OU Area with 2019 Lindane Plume and Results, Page 85 of 100.** The figures demonstrate lindane is not defined and/or poorly defined horizontally and/or vertically in the TZ, MAZ and LAZ. Additionally, due to the exceedances of VOCs in GA well CMP10A, it is uncertain whether lindane has migrated to the GA.
  The lack of lindane data to adequately delineate the horizontal and vertical extent of contamination in TZ, MAZ and LAZ and a supporting CSM will be retained as data gaps for future core team discussion.

It is noted in order for the scope of the problem to be adequately understood and addressed, complete horizontal and vertical delineation of all groundwater COC plume(s) is necessary to ensure attainment of and compliance with the Government Performance and Results Act of 1993 (GPRA) Corrective Action (CA) Milestones CA725 (Human Exposure Controlled) and CA750 (Groundwater Migration Controlled).

EPA SPECIFIC COMMENTS

1. **Section 1.3, Observed Hydrostratigraphy at the CMP Pits OU, Page 4 of 100:** The text describing the confining zones for the tan clay confining zone (TCCZ), tan clay lower confining zone (TCLC), and the green clay confining zone (GCCZ) is not consistent with the confining zones shown on Figure 3, CMP Pits Groundwater OU Conceptual Site Model (CSM). For example, the first paragraph states "The confining zones are hummocky, vary in thickness, and can be almost non-existent or leaky in areas." However, the confining zones depicted in Figure 3 are of equal thickness and contiguous throughout the site.
   The uncertainty in the thickness and continuity of the confining units across the site and the need for a supporting CSM are retained as a project need for future discussion among core team members.

2. **Section 1.4, Observed Hydrology at the CMP Pits OU, Page 5 of 100:** The text states "Regional groundwater flow for the UTRA, as depicted in Figure 6, is to the northwest towards Pen Branch from CMP Pits." However, a review of Figure 6, Regional Water Table Potentiometric Surface, Page 39 of 100, does not depict water table elevation control points for the well locations depicted in the figure. As such, the potentiometric water table contours presented in the figure are not supported by site specific water level data.
The uncertainty in the regional groundwater flow and the necessity of a supporting CSM are retained as data gaps and future discussion by core team members.

3. **Section 1.4, Observed Hydrology at the CMP Pits OU, Page 5 of 100:** Based on the data, it is uncertain whether contaminants on the southern side of Pen Branch are not flowing underneath the stream to the north, as indicated in the text. For example, the text states "Measurements show that groundwater in the vicinity of Pen Branch flows toward Pen Branch on both the southern and northern side of the stream, further supporting that contaminants originating south of Pen Branch from CMP Pits are not flowing underneath Pen Branch towards the north. Water elevations in the LAZ on the north side of Pen Branch are higher than elevations on the south side of Pen Branch." However, according to Figure 8, 2019 Potentiometric Surface for the LAZ and GA, Page 43 of 100, the water level for LAZ well CMP067B located north of Pen Branch was 195.8 feet (ft) mean sea level (msl) and lower than the 196.26 ft msl water level measured for LAZ well CMP055B located southeast of CMP067B and south of Pen Branch indicating potential flow to the northeast.
The uncertainty of whether contaminants on the southern side of Pen Branch are flowing underneath the stream to the north and a necessity of a current supporting CSM are retained as project needs and for future core team discussion.

4. **Section 2.2.2.1, Groundwater Aquifers, Page 12 of 100:** Total dissolved mass estimates were not presented for each COC over time (e.g. 2008 through present) for each aquifer zone. As such, an evaluation could not be performed on whether the total estimated dissolved masses over time are declining for each COC (i.e., horizontally and vertically), and if the total mass is being reduced for each aquifer zone as a supporting line of evidence for natural attenuation, consistent with the EPA MNA Guidance.
Documented reduction in total contaminant mass over time in each aquifer zone is retained as a project need and for future core team discussion and inclusion future reporting efforts.

5. **Section 2.2.2.1, Groundwater Aquifers (Transmissive Zone:), Page 12 of 100:** The text incorrectly states a low permeability cap was installed at the CMP Pits that may retard infiltration. A similar statement is made on Page 20 of 100. According to the Sixth Five-Year Remedy Review Report for Savannah River Site Operable Units with Groundwater Remedies (U) SEMS Number: 00 SRNS-RP-2019-00511 Revision 1 Aiken, South Carolina, July 2020, only a vegetative cover is installed at the CMP Pits.
The uncertainty of whether an engineered cap versus a vegetative cap is installed over the CMP Pits and a need for a supporting CSM are retained as data gaps for future core team discussion.

6. **Section 2.2.2.1, Groundwater Aquifers (Transmissive Zone:), Page 12 of 100:** The significance of the non-detect result (< 50 µg/L) for TCE in well CMP34D with respect to the elevated detection limits for TCE analysis was not discussed in this section. For example, the text states "The 2Q2019 results were 1,940 µg/L for PCE and non-detect (<50 µg/L) for TCE. The 4Q2019 sample results decreased to 1,440 µg/L for PCE and non-detect (<50 µg/L) for TCE." As such, it is uncertain whether TCE concentrations would be detected in CMP34D if appropriate detection limits were

achieved. It is unclear why the detection limits for TCE were elevated for these samples as no explanation was provided in the text.

a. Please provide information within the document text to address this concern.

The lack of a representative TCE data from CMP34D is retained as a data gap for future core team discussion.

7. **Section 2.2.2.1, Groundwater Aquifers (Transmissive Zone:), Page 12 of 100:** Based on the data, it is not clear whether TCE is a parent chlorinated compound and/or a daughter product of tetrachloroethylene (PCE). This issue potentially impacts the cleanup timeframe estimated for restoration of VOC groundwater contamination. For example, the text discusses a complex source composition/history is indicated by the significantly different PCE/TCE ratio between the wells CMP34D and CMP35D.

   a. Please provide information within the document text to address this concern.

   The uncertainty of whether TCE is a parent and/or daughter product of PCE and how this impacts estimated cleanup timeframes for groundwater restoration is retained as a data gaps and a future discussion among core team members.

8. **Section 2.2.2.1, Groundwater Aquifers Monitored Natural Attenuation Remedy (Lower Aquifer Zone:), Page 15 of 100:** The detection of PCE and TCE in well CMP67B located north of Pen Branch indicates potential groundwater flow from the south under Pen Branch to the north. For example, the text indicates during fourth quarter 2019 (4Q19) well CMP067B measured PCE and TCE below MCLs at concentrations of 1.5 µg/L and 2.47 µg/L, respectively. To confirm the 4Q19 results, CMP067B was resampled in first quarter 2020 (1Q20) and VOC concentrations were all non-detect. However, it is noted the LAZ water level in CMP067B was 0.76 ft higher during 1Q20 than during 4Q19 potentially impacting fate and transport of contaminants and groundwater concentrations.

   The uncertainty of whether contaminants on the southern side of Pen Branch are flowing underneath the stream to the north and the necessity for a current supporting CSM are retained as project needs and for future core team discussion.

9. **Section 2.2.2.1, Groundwater Aquifers (Lower Aquifer Zone:), Page 16 of 100:** There is no supporting data or lines of evidence to show that the LAZ discharges to Pen Branch at the CMP Pits OU. For example, the text states "Some upward vertical water elevation heads are present in the LAZ closer to Pen Branch (i.e., CMP064BU and CMP064B) which supports that the LAZ is discharging into Pen Branch." However, the text in Section 1.3, Observed Hydrostratigraphy at the CMP Pits OU, states the LAZ is incised by Pen Branch on the western portion of the stream. It is noted the upward vertical water elevation heads measured at distal plume wells CMP064BU and CMP064B are based on the potentiometric surface (i.e., the level water will rise in a well) of the LAZ. As such, due to the presence of the TCLC, it is not certain whether LAZ discharges to Pen Branch in this area. For example, the TCLC unit depicted in Figures 11 and 12 is not incised and appears uniform in thickness beneath Pen Branch and to the north.

   The uncertainty of whether contaminants on the southern side of Pen Branch are flowing underneath the stream to the north and the necessity for a current supporting CSM are retained as project needs for future core team discussion.

10. **Section 2.2.2.12, Lindane, Page 20 of 100:** Based on the data, it is not known whether there is a co-solvency effect between VOC contamination and lindane pesticide contamination. For example, the text states "The VOC solvent plumes have likely mobilized lindane to some degree and/or the contaminant may have originated from a previous alternate dumping spot such as the drainage ditch,

if it was used." There currently is no evidence presented that lindane was disposed of in the drainage ditch. As such, it appears the detection and presence of lindane concentrations indicate facilitated transport due to co-solvency effects with the VOCs directly impacting the fate and transport of lindane. The number of wells sampled for lindane contamination is limited and therefore, the magnitude and extent of lindane contamination may be underestimated, particularly at wells exhibiting relatively high concentrations of PCE and/or TCE and not analyzed for lindane. **The uncertainty associated with the co-solvency effects for PCE/TCE wrt to lindane impact the fate and transport and known magnitude and extent of the dissolved lindane contamination and the necessity for a current supporting CSM are retained as project needs for future core team discussion.**

11. **Section 2.2.3, Surface Water Sampling Results, Page 22 of 100:** The buffering and attenuation capacity of the aquifer(s) is insufficient to reduce the COCs in groundwater to below MCLs prior to discharge into Pen Branch. For example, the 2018 Additional Data from Independent Analysis performed by South Carolina State College (SCSC), indicated the maximum concentrations of PCE, TCE, cis-1,2-dichloroethylene and vinyl chloride in groundwater samples measured 81 µg/L, 42 µg/L, 99 µg/L and 98 µg/L, respectively. The SCSC groundwater samples collected were a combination of samples taken from beneath the Pen Branch stream bed and locations immediately adjacent to the stream bed using passive diffusion bags (PDBs) and shallow wells. It is noted surface water samples collected for the EMR did not exceed MCLs. However, the SCSC screening level data results offer the best indication of the flux of groundwater contamination just prior to discharge to Pen Branch. The EMR indicates advection and dispersion are the main MNA processes occurring at CMP Pits, with some biodegradation (near Pen Branch). The EMR also states the modeling results show an expected VOC discharge to Pen Branch above MCLs. It is evident from the data that in order to improve the efficacy of the MNA, additional actions will be necessary to ensure the subsurface geochemistry, biochemistry and microbial evidence in the aquifers(s) are sufficient to support complete reductive dechlorination(e.g., bioaugmentation, nutrient amendments, etc.).
    The lack of subsurface aquifer geochemistry, biochemistry and microbial data as an additional line of evidence to support complete reductive dechlorination per the EPA MNA guidance along with the need for a supporting CSM and geochemical, biochemical and biological data will be retained as a project need for future core team discussion.

12. **Figure 8, 2019 Potentiometric Surface for the LAZ and GA, Page 43 of 100:** It is not certain whether an easterly flow exists in the GA as indicated in the figure. For example, Figure 8 shows the 180-foot potentiometric contour line turning to the north from CMP 12A to CMP055A and CMP 8A and indicating groundwater flow to the east. However, there are no GA groundwater wells installed between CMP 12A, CMP055A and CMP 8A to provide control of the 180-foot contour. **The uncertainty in the flow direction(s) in the GA along with GA water levels and supporting CSM are retained as a project need and data gaps for future core team discussion.**

EPA has summarized the list of data gaps and project needs for future team discussions and looks forward to a core team member meeting in early 2021:

1. Discussion of contingency measures are needed to address unacceptable performance of the selected remedy is retained as a project need;
2. The uncertainty of the source of contamination and a current supporting CSM for the northeast distal VOC plume are retained as data gaps;

3. The lack of VOC data to delineate the horizontal and vertical extent of contamination in the TZ and MAZ and a supporting CSM will be retained as data gaps;
4. The lack of VOC data to delineate the horizontal and vertical extent of contamination in the LAZ and GA and a supporting CSM will be retained as data gaps;
5. The lack of lindane data to adequately delineate the horizontal and vertical extent of contamination in TZ, MAZ and LAZ and a supporting CSM will be retained as data gaps;
6. The uncertainty in the thickness and continuity of the confining units across the site and a supporting CSM are retained as a project need;
7. The uncertainty in the regional groundwater flow and supporting CSM is retained as data gaps;
8. Documented reduction in total contaminant mass over time in each aquifer zone is retained as a project need;
9. The uncertainty of whether an engineered cap is installed over the CMP Pits and a supporting CSM are retained as data gaps;
10. The lack of a representative TCE data from CMP34D is retained as a data gap;
11. The uncertainty of whether TCE is a parent and/or daughter product of PCE and how this impacts estimated cleanup timeframes for groundwater restoration are retained as project needs;
12. The uncertainty of whether contaminants on the southern side of Pen Branch are flowing underneath the stream to the north and a current supporting CSM has been retained as a project need;
13. The uncertainty of whether co-solvency effects impact the fate and transport and known magnitude and extent dissolved lindane contamination and a current supporting CSM are retained as project needs;
14. The lack of subsurface aquifer geochemistry, biochemistry and microbial data as an additional line of evidence to support complete reductive dechlorination per the EPA MNA guidance will be retained as project need, and the need for geochemical, biochemical and biological data and a current CSM are retained as a data gaps; and,
15. The uncertainty in the flow direction(s) in the GA is retained as a project need and GA groundwater levels and supporting CSM are retained as a data gap.