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

AUG 07 2025

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 Environmental Services
2600 Bull Street
Columbia, South Carolina 29201

Mr. Jon Richards
Savannah River Site Remedial Project Manager
Superfund and Emergency Management Division
U. S. Environmental Protection Agency, Region 4
61 Forsyth Street, SW
Atlanta, Georgia 30303

Dear Ms. Fulmer and Mr. Richards:

SUBJECT: Contaminant Migration Modeling of Lead and Heavy Water within C-Reactor (105-C) (U) (SRNS-OS-2023-00213, Revision 1, August 2025) and Savannah River Site's Responses to the Regulatory Comments on the Revision 0 Document, SEMS Number: 79

The U. S. Department of Energy (DOE) is submitting the subject information for your review. The *Contaminant Migration Modeling of Lead and Heavy Water within C-Reactor (105-C) (U)* (SRNS-OS-2023-00213, Revision 0, August 2023) was submitted to the South Carolina Department of Environmental Services (SCDES) and U.S. Environmental Protection Agency (EPA) for review on April 9, 2025 (RDDD-25-131). The EPA's approval and SCDES' comments on the Revision 0 report were received on May 8, 2025. The draft responses to the regulatory comments were submitted for review via email on June 4, 2025. The SCDES stated that the draft responses were acceptable via their email dated June 18, 2025. The final responses were incorporated into the Revision 1 document.

Please review the enclosures and provide your response within thirty (30) days of receipt. The effort and time that the EPA and the SCDES have given on the subject operable unit are greatly appreciated.

AUG 07 2025



Questions from you or your staff may be directed to me at (803) 952-6211, or the DOE Program Manager, Khari Bell, at (803) 679-7086.

Sincerely,

MATTHEW BAKER Digitally signed by MATTHEW BAKER Date: 2025.08.06 13:47:05 -04'00'

Matthew R. Baker
Acting FFA Remedial Project Manager
DOE-Savannah River Operations Office
Remediation, Deactivation, and Decommissioning Division

RDDD-25-155

Enclosures:
1. SRS Responses to SCDES Comments on the Contaminant Fate and Transport Modeling for C-Reactor Lead and Heavy Water Sources, SEMS Number: 79 (SRNS-RP-2025-00161, March 2025) and Supporting Documents
2. Contaminant Migration Modeling of Lead and Heavy Water within C-Reactor (105-C) (U) (SRNS-OS-2023-00213, Revision 1, August 2025) SEMS Number: 79

cc w/o encl:
M. Reece, SCDES-Columbia
H. J. Porter, SCDES-Columbia
J. Blalock, SCDES-Columbia
S. French, SCDES-Columbia
R. G. Stewart, SCDES-Columbia
M. Mehta, SCDES-Columbia
G. O'Quinn, SCDES-Midlands Aiken Environmental Affairs Office
T. G. Corley, SCDES-Midlands Aiken Environmental Affairs Office
C. L. Robertson, SCDES-Midlands Aiken Environmental Affairs Office
E. G. Downing, SCDES-Midlands Aiken Environmental Affairs Office
H. L. Herlong, SCDES-Midlands Aiken Environmental Affairs Office

cc w/encl:
H. H. Cathcart, SCDES-Columbia
M. McRae, TechLaw, Inc.

**SRS Responses to SCDES Comments on the Contaminant Fate and Transport Modeling for C-Reactor Lead and Heavy Water Sources, SEMS Number: 79, (SRNS-RP-2025-00161) and Supporting Documents, March 2025**
**Savannah River Site, Aiken, South Carolina**



**Comments Received May 8, 2025**

---

**SPECIFIC COMMENTS**

1. Section 2.3.1, 20-ton Process Area Lead Source, page 17. It is stated in the first paragraph that an accurate account of the amount of lead in the process area was not available at the time of this modeling effort; however, the next paragraph states that the thickness for the lead shielding in the process area was estimated from using the mass of lead (20 tons). This implies that the mass of lead was already known, and therefore, contradicts the statement from the previous paragraph. It is unclear whether the thickness of the lead shielding was derived from a known mass of lead, or if the mass of lead was calculated based on an estimated lead thickness. Please clarify how the 20 tons of lead mass was calculated.

   **Response: Agree**

   **SRS agrees that the explanation for the 20 ton lead source in the Process Area needs clarification. The first paragraph stating that an accurate account of the lead was not available, refers specifically to the location and layout of the lead within the Process Area. However, it is also true that the lead inventory (e.g., bricks, sheets, and blankets) was estimated by inspection of pictures taken during vessel maintenance in March 2007 (example in Figure CR-1) and by visual observation from the doorway to the Process Area room by engineers with process knowledge of the lead shielding forms used. The shielding inventory was estimated using these methods and then a mass was calculated based on these estimates. In order to determine a more accurate lead source inventory, it would require entry into the Process Area, requiring proper training and planning, and risking exposure to site workers.**

   **The majority of lead within the Process Area was left surrounding the reactor vessel assembly (Figure CR-1). Therefore, the subcontractor used a conservative estimated lead source mass, the area surrounding the reactor vessel assembly, and the density of lead, to determine a lead thickness and ensure an inherent safety margin. The lead thickness is an input for the GoldSim® model structure.**

   **Although the lead inventory for the Process Area is estimated, it is based on the best available information at the time of the effort, and was conservative in approach.**

   **The second paragraph in Section 2.3.1 will be revised as follows:**

   **"The 20 tons of lead in the process area are comprised of miscellaneous lead shielding, such as bricks, sheets (coated and uncoated), and blankets (personal communication, Willey 2023). <u>Lead inventory (mass) in the process area was estimated by inspection of pictures taken during vessel maintenance in March 2007 (Figure 2.2) and by visual observation from the doorway to the process area by engineers with process knowledge of the lead shielding forms used. Conservative estimates for the various forms of lead shielding were used to calculate a lead mass in the process room. Although the lead</u>**

---

**inventory for the process area is estimated, it is based on the best available information at the time of this effort, and was conservative in approach.**

**An accurate account of all lead location and layout in the process area was not available at the time of this modeling effort; therefore, a conservative approach was used, assuming the lead sources form an annulus around the former reactor assembly. This is consistent with a majority of the lead inventory in the process area, which was left in place surrounding the reactor vessel assembly (Figure 2.2). Using dimensions ~~of lead shielding from~~ the process area drawings (Sheet W134619 and W134620), the area of annulus was estimated to be 27.9 m2 (300 ft2). Using this source area, the source width was estimated to be approximately 6 m (19.5 ft) in the GoldSim® model."**

**Figure CR-1 will be added to the Chapter 2 figures as Figure 2.2. Other Chapter 2 figures will be renumbered appropriately.**

**Responsible Party: Adam Willey, (803) 646-4944, adam.willey@srs.gov**

2. Section 2.3.2, 230-ton Crane Maintenance Area Lead Source, page 18. This section should clarify how the total lead mass of 230 tons was derived (i.e., from known inventory or from estimation/calculation).

   **Response: Agree**

   **SRS agrees that the report did not clearly define how the lead inventory was derived. All lead within the C-Reactor is tracked and accounted for periodically by the Spent Fuel Project Process Engineering group at SRS. The lead inventory for the Crane Maintenance Area included approximately 70 B-12 containers totaling 230,800 pounds (115 tons), 15 Defense Program casks totaling 68,500 pounds (34.3 tons), and approximately 17,000 pounds (8.5 tons) of miscellaneous reactor lead shielding (totaling 316,300 pounds [158 tons]). Each B-12 container was weighed and the known tare weight subtracted to determine the lead weight. The Defense Program cask lead weight was determined by reviewing the design specifications and engineering drawings. Miscellaneous lead shielding weight was estimated based on observations, records, and process knowledge. This lead inventory was assumed to be consolidated within the Crane Maintenance Area for the modeling effort.**

   **At the time modeling inputs were being determined, it was unclear what the path forward was for the Cask Car CD-5 located in the C-Reactor Transfer Bay. In a conservative effort, initial source estimates assumed lead shielding from CD-5 (140,400 pounds [70.2 tons]) would also be consolidated within C-Reactor's Crane Maintenance Area, although this would not be practical considering size and configuration of CD-5. The additional lead mass (total for all inventory of 230 tons) did not result in groundwater impacts within the compliance period based on the model results and therefore the conservative**

**assumption was retained.**

**The first paragraph in Section 2.3.2 will be revised as follows:**

**"Figure 2.~~2~~3 illustrates the three ISD alternatives being considered for the 230-ton lead source in the Crane Maintenance Area of the C-Reactor building. The 230 tons of lead that remain in the Crane Maintenance Area included approximately seventy B-12 containers totaling 230,800 pounds (115 tons), 15 defense program casks totaling 68,500 pounds (34.3 tons), and approximately 17,000 pounds (8.5 tons) of miscellaneous reactor lead shielding (totaling 316,300 pounds [158 tons]). Each B-12 container was weighed and the known tare weight subtracted to determine the lead weight. The defense program cask lead weight was determined by reviewing the design specifications and engineering drawings. Miscellaneous lead shielding weight was estimated based on observations, records, and process knowledge. This lead inventory was assumed to be consolidated within the Crane Maintenance Area for the modeling effort.**

**At the time modeling inputs were being determined, it was unclear what the path forward was for the Cask Car CD-5 located in the C-Reactor Transfer Bay. In a conservative effort, initial source estimates assumed lead shielding from CD-5 (140,400 pounds [70.2 tons]) would also be consolidated within C-Reactor's Crane Maintenance Area, although this would not be practical considering size and configuration of CD-5. The additional lead mass (total for all inventory of 230 tons) did not result in groundwater impacts within the compliance period based on the model results and therefore the conservative assumption was retained. ~~are contained within approximately seventy B-12 boxes, seven defense caskets, and eight T-pin caskets.~~"**

**Responsible Party: Adam Willey, (803) 646-4944, adam.willey@srs.gov**

3. Section 3.2, Vadose Zone, page 33. The first sentence on this page indicates that the vadose zone modeling was based on soil lithology from a boring CRG-5. Please provide the location of this soil boring on a figure.

   **Response: Agree**

   **Boring CRG-5 was completed in August 2010 in the immediate vicinity of C-Reactor to a total depth of 122 feet below ground surface. The water table in this area is estimated at 73 feet below ground surface and therefore the boring provides adequate lithologic information for the purposes of modeling the vadose zone. The location of CRG-5 is provided on Figure CR-2 of these responses.**

   **Figure CR-2 will be added to the Chapter 3 figures as Figure 3.1.**

   **Responsible Party: Adam Willey, (803) 646-4944, adam.willey@srs.gov**

4. Section 5.1.1, No Action (LS-PA-S1), page 64. The last paragraph of this page states that the maximum groundwater concentration of lead from the Process Area lead source occurs at the end of the 100,000 year simulation. The beginning of this section indicates that the 100,000 year time period is included for seeking peak concentrations in this analysis; however, it appears that a longer time period is needed for this determination, similar to the 1,000,000 year analysis performed for the Crane Maintenance Area lead source. Please clarify.

   **Response: Agree**

   **SRS agrees that the 100,000 year simulation for the Process Area lead source did not allow for determination of peak lead concentrations for this source. When working with the modeling subcontractor, the original scope included running simulations for 100,000 years for all sources and alternatives. The Crane Maintenance Area source time period was extended to 1,000,000 years due to the presence of long-lived radionuclides in the source inventory. During model setup, it wasn't considered that lead would have peaks past 100,000 years.**

   **Due to the 1,000 realizations used to simulate each alternative for the four sources, extending the time period from 100,000 years to 1,000,000 years resulted in a significantly longer run time and therefore impacted the schedule and scope for the modeling task. Since the Process Area lead source was significantly (about ten times) less than the Crane Maintenance Area lead source and contained no long-lived radionuclides, SRNS did not request the subcontractor to extend the time period.**

   **It is noted that the Process Area source considered only lead shielding left in the room during operations and maintenance. Further modeling will be required before the final ISD end-state is determined for the Process Area and longer time periods may be necessary at that time for the lead and potential radionuclide sources.**

   **The fourth paragraph in Section 7.0 will be revised as follows:**

   **"For the 20-ton Process Area lead source, the maximum concentration of lead occurs at the end of the simulation (approximately 4 µg/L at the 1m POA at 100,000 years), which is below the PO of 15 µg/L. The simulation time of 100,000 years did not allow for observation of lead peaks for the Process Area lead source. There were no long-lived radionuclides in the source, and the lead inventory was an order of magnitude lower than the nearby Crane Maintenance Area inventory, which was simulated to 1,000,000 years. It is expected the Process Area lead source would result in a lower peak than the Crane Maintenance Area lead source. Therefore, simulations were not rerun for the Process Area lead source with a longer time period. This effort considered only lead shielding within the Process Area, and future modeling will be required before the final ISD end-state is determined for the Process Area. Longer time periods may be necessary at that time for simulating lead peaks and for potential radionuclide sources identified in the**

**reactor vessel inventory. For the deionizer trailer lead and the heavy water tanks 204 and 205 sources, all of the simulated concentrations are significantly less than the regulatory limits or are zero."**

**Responsible Party: Adam Willey, (803) 646-4944, adam.willey@srs.gov**

**This page was intentionally left blank.**


**Figure CR-1.** **Process Area lead in photo taken during maintenance activities in March 2007 (Specific Comment #1)**

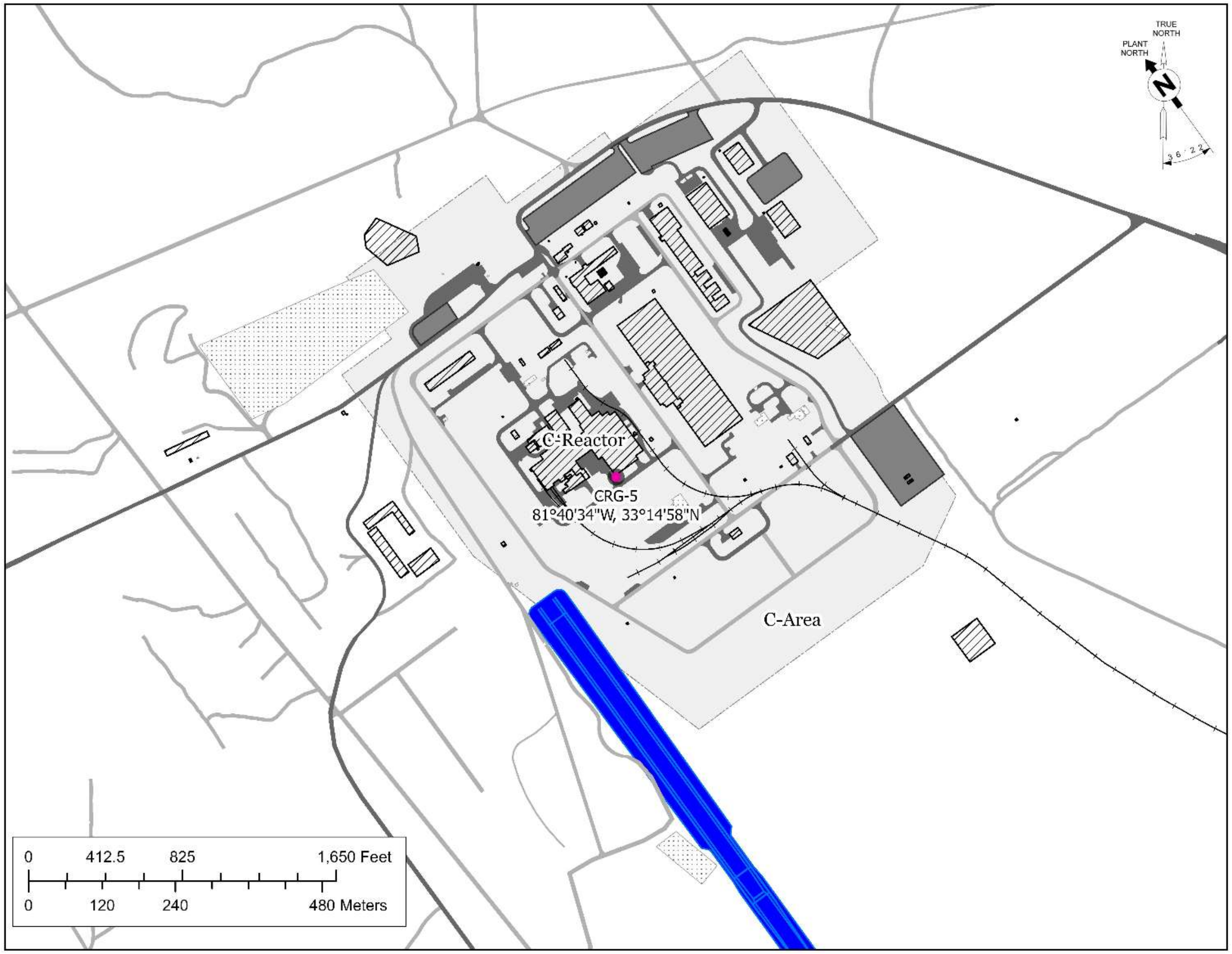


**Figure CR-2.** **Location map for boring CRG-5 (Specific Comment #3)**