Enclosure 1

Response to Request for Additional Information

Environmental Review for the Proposed Renewal of the Westinghouse Columbia Fuel Fabrication Facility License

Enclosure 1 to
LTR-RAC-20-94
Date: December 18, 2020

RAI 1 – NEW INFORMATION

Provide a summary of facility and operational changes that have occurred at CFFF since the publication of the 2019 draft EA.

Additionally, provide any corresponding updates to the March 2019 ER (ADAMS Accession No. ML19088A100) and any changes, if applicable, to the updated License Renewal Application (LRA) Chapter 10 – Environmental Protection and Chapter 11 – Decommissioning (ADAMS Accession No. ML19234A077) in response to the RAI.

WESTINGHOUSE RESPONSE

Westinghouse is executing a comprehensive strategy to transform its operations and align them with the company's goals and values. These include operating in a safe, transparent, environmentally sound, and socially responsible manner.

As noted in the March 2019 Environmental Report (March 2019 ER) the Columbia Fuel Fabrication Facility (CFFF) entered into a Consent Agreement (CA) with South Carolina Department of Health and Environmental Control (SC DHEC) on February 26, 2019. The CA addresses all constituents of potential concern (COPC) from historical operations including fluoride (F), nitrate, gross alpha, gross beta, uranium (U), technetium-99 (Tc-99) and volatile organic compounds (VOCs) following all key steps of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process. Under the CA, a comprehensive Remedial Investigation (RI) is underway to gather data and samples needed to determine the presence and extent of contamination from historic operations at the site. The first phase of the RI fieldwork Final RI Work Plan (Phase I RIWP) was in completed 2019, with a Phase I RI Data Summary Report approved by SC DHEC in July 2020. The investigation found no evidence of any off-site COPCs, and a second phase of fieldwork is underway to close remaining data gaps to fully characterize the source, nature and extent of COPCs from historic operations.

Utilizing the CA framework CFFF has self-identified challenges and proactively initiated engagement with regulatory bodies and the surrounding communities to resolve issues. Westinghouse meets regularly with members of the community and have established a public website that contains environmental data and the work completed to support the CA. This website also provide links to key the Nuclear Regulatory Commission (NRC) and SC DHEC websites.

In addition to the work done under the CA, CFFF has completed several environmental improvement projects since the submittal the March 2019 ER. These include:

- installation of a redesigned spiking station to prevent leaks;
- sentinel well installation around the chemical area manufacturing building to monitor groundwater;
- removal of the intermodal containers that stored radioactive materials and remediation of impacted soil;
- removal of obsolete air handling equipment on the facility roof;
- completion of air emissions testing to validate minor source status for CFFF air permit;
- elimination of nickel-plating room operations to eliminate the only chemical source in the mechanical manufacturing area;

- certification of CFFF trained emergency brigade as a fire department;
- updat of the CFFF decommissioning funding plan;
- Finally, CFFF has eliminated other legacy hazards, including the use of tetrachloroethylene (perchloroethylene or PCE). Elimination of PCE eliminates the site of the only remaining significant source of VOCs.

More improvements are in progress:

- construction activities are underway to close and clean the East Lagoon, a former part of the wastewater treatment system located on site;
- disposal of other contaminated materials, calcium fluoride and obsolete cylinders is in progress per the NRC approved Alternate Disposal Request (ADR);
- Westinghouse is also planning to characterize the sludge in the sanitary lagoon in early 2021 to support closure planning for that lagoon.

Westinghouse has made numerous voluntary improvements to CFFF and that work continues. In addition, the CA provides SC DHEC with a legally binding commitment that ensures Westinghouse's work to address soil and groundwater impacts from historic operations are addressed in a comprehensive manner following the systematic steps of the CERCLA process.

Corresponding updates to the March 2019 Environmental Report (March 2019 ER) (ML19088A100) are provided in Enclosure 2.

The License Renewal Application (LRA) Chapter 10 – Environmental Protection and Chapter 11 – Decommissioning do not require updates to address the enclosed RAI responses.

RAI 2. STATUS OF PERMITS, LICENSES, APPROVALS

Provide an update of the status of proposed, pending, and approved permits, licenses, authorizations, that Westinghouse must obtain to continue to operate the CFFF for the next proposed 40 years. The information provided should identify (1) the issuing agency; (2) the type of license, permit, or authorization needed; and (3) the current status of securing the license, permit, or authorization.

WESTINGHOUSE RESPONSE

Table RAI 2-1 lists CFFF's current licenses and permits required for operation, including the issuing agency; the type of license, permit, or authorization needed; and the current status of securing the license, permit, or authorization.

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Table RAI 2-1 - CFFF Licenses and Permits

License/Permit Number	Issuing Agency	Type	Status
094	South Carolina Department of Health and Environmental Control (SC DHEC)	Radioactive Materials License	Current
40-0846	SC DHEC	X-Ray Facility Registration	Permanent – no expiration
0046-39-20-X	SC DHEC	Radioactive Waste Transport	Timely renewal submitted
1900-0050-R1	SC DHEC	Air Quality Permit	Timely renewal submitted
SC0001848	SC DHEC	National Pollutant Discharge Elimination System (NPDES) Permit	Timely renewal submitted
SCR000000	SC DHEC	Stormwater Permit	Current
40561001	SC DHEC	Environmental Laboratory Qualification	Current
SC40-0332G	SC DHEC	Infectious Waste Generator Permit	Current
10353	Richland County Emergency Services Department	Hazardous Material Transport Permit	Timely renewal submitted
T-SC004-L20	Tennessee Department of Environment and Conservation	Radioactive Waste Transport	Timely renewal submitted
207001421	Utah Department of Environmental Quality	Generator Site Access Permit	Timely renewal submitted
40-0006	SC Department of Labor, Licensing, and Regulation (LLR)	Office Building Passenger Elevator Permit	Current
40-0008	SC LLR	Cafeteria Dock Passenger Elevator Permit	Current
40-1125	SC LLR	Wheelchair Lift Permit	Current
40-1368	SC LLR	ERBIA Passenger Elevator Permit	Current
40-1369	SC LLR	IFBA Dumbwaiter/Freight Elevator Permit	Current
21040-20192	SC LLR	Columbia Plant Business and Professional License	Current
SNM-1107	NRC	Special Nuclear Materials License	Timely renewal submitted

RAI 3 – SOUTH CAROLINA STATE HISTORIC PRESERVATION OFFICER COMMENTS ON THE 2019 DRAFT EA

On November 19, 2019, the South Carolina State Historic Preservation Officer (SHPO), South Carolina Department of Archives and History, submitted comments (ADAMS Accession No. ML19331A601) to the NRC on the draft EA. As discussed in the July 31, 2020, notice to begin the EIS scoping process, comments submitted on the draft EA will be considered in the development of the EIS (See 85 FR 46193).

A. Denley Cemetery

1. Provide a figure indicating the location of the Denley Cemetery in relation to the ground-disturbing activities related to the installation of monitoring wells.

2. Explain whether the proposed license renewal and the installation of monitoring wells can impact the Denley Cemetery and, if so, what actions (e.g., access to the Denley Cemetery) Westinghouse has taken or will take to avoid or mitigate potential impacts. If avoidance or mitigation actions are described in procedures, please provide a copy.

B. Potentially Eligible Site (Canal)
The NRC staff searched in South Carolina ArchSite, as suggested by the SHPO in its November 19, 2019 letter to the NRC. The search yielded an unknown canal (Site Number 173-3577) that is listed as being potentially eligible for listing in the National Register of Historic Places. The site is located approximately one mile west of Sunset Lake and appears to be located either onsite or at the CFFF boundary. The site appears to be on Mill Creek between where Mill Creek enters the CFFF site boundary and enters Upper Sunset Lake.

    1. Indicate the location of the canal on the same figure with Denley Cemetery.

    2. Explain any potential effects on the Site #173-3577 and other previously identified historic and cultural resources from the proposed license renewal and describe what actions Westinghouse has taken or will take to avoid or minimize any potential impacts.

C. Results of Past Cultural Investigations
Provide documentation of past historic and cultural resource investigations completed for the CFFF site and if any known historic and cultural resources or cultural resource sensitivity zones have been identified.

    1. Indicate the location of these areas in the same figure as the Denley Cemetery.

    2. Provide documentation of any engagement with SHPO or other parties regarding the results of those investigations.

The information is necessary to evaluate potential impacts on historic and cultural resources as part of the NRC staff's National Historic Preservation Act (NHPA) Section 106 and NEPA reviews. All maps or reports describing the cemetery or other cultural resources can be submitted as non-public documents in accordance with NHPA Section 304 and 36 CFR 800.11(c)(1).

WESTINGHOUSE RESPONSE

RAI 3 Item A

1. The location of the Denley Cemetery was added to the Property Map and the Site Map (Figures 2 and 3) in Enclosure 4, Phase II RI Work Plan (Phase II RIWP). In addition, these features of interest are labeled on other figures if the cemetery is included in the area shown in the figure.

2. Westinghouse fenced in the Denley Cemetery and there are no current actions planned in the CA or license renewal that will impact the Denley Cemetery. Unanticipated discovery during the RI is addressed in Section 3 and Appendix C of the Phase II RIWP.

   When modifications are made to the CFFF site, a question in the RAF-104-5, Environmental Protection Guidelines and Checklist (Enclosure 5) asks “Does the change potentially impact any archeological or historical sites on the Westinghouse property, or have provisions been made for protection or mitigation in the event of an archeological or historical discovery on-site?” and TAF-500-11, 10 CFR 70.72 Engineering Pre-screening Checklist (Enclosure 6) asks if “Activity involves land/soil disturbance or removal?”. Controls would be established if the answer were yes on either form. There have been no such instances since the 2007 license renewal.

RAI 3 Item B

1. The location of the Canal was added to the Property Map and the Site Map (Figures 2 and 3) in the Phase II RIWP. In addition, these features of interest are labeled on other figures if the Canal is included in the area shown in the figure.

2. There are no planned CA or license renewal activities that will affect the Canal. The same procedures apply as listed in A1 to evaluate impacts to archeological or historical sites on the Westinghouse property.

RAI 3 Item C

Beyond the information in the March 2019 ER and provided above, Westinghouse is aware of no other evidence of historic or cultural resources or cultural resource sensitivity zones on the CFFF site. The CFFF property was included in the Lower Richland Historical Architectural Survey Report in September 1993 (http://nationalregister.sc.gov/SurveyReports/HC40003.pdf [nationalregister.sc.gov]).

RAI 4 – CULTURAL RESOURCE PROTECTION PLANS AND PROCEDURES

During the NRC staff's May 2019 site visit (see the site visit summary at ADAMS Accession No. ML19283A811), Westinghouse provided a description of the process used prior to installing groundwater monitoring wells and a copy of the procedure, "Procedures Guiding the Discovery of Unanticipated Cultural Resources and Human Remains." The information requested below will support the NRC staff's evaluation of potential impacts to historic and cultural resources from the proposed operation of the CFFF (e.g., from potential ground-disturbing activities) during the next 40 years.

A. Provide a description of any updates to this process and the procedure, if any have been made since the 2019 site visit.

B. Provide a description of any additional historic and cultural resource protection procedures in place that outline cultural resource identification and protection steps, such that impacts on any known or previously unidentified historic and cultural resources are avoided, minimized, or mitigated.

C. Provide a list of cultural resource studies and literature reviews used to develop these cultural resource protection plans and/or procedures and describe any engagement with SHPO or other parties regarding the development of cultural resource protection and management plans and procedures.

This information is necessary to evaluate potential impacts on historic and cultural resources as part of the NRC staff's NHPA Section 106 and NEPA reviews.

WESTINGHOUSE RESPONSE

A. The Procedures Guiding the Discovery of Unanticipated Cultural Resources and Human Remains, provided in Appendix C of the Phase II RIWP, were developed by AECOM. There have been no updates to the procedures since the NRC staff's May 2019 site visit.

B. As stated in RAI 3, additional checks have been integrated into the site change management procedures to avoid, minimize or mitigate impact to unidentified cultural or historic resources.

C. AECOM used registered professional geologists and the S.C. Code of Laws, Section 16-17-600 to develop the Procedures Guiding the Discovery of Unanticipated Cultural Resources and Human Remains.

RAI 5 – WASTE MANAGEMENT – INCINERATOR PROCESS

As discussed in the NRC's draft EA published in October 2019, Westinghouse stores drums of combustible waste containing uranium, waiting for uranium recovery via onsite incineration, in intermodal containers (sea-land containers) in an outdoor storage area. In addition, Westinghouse applied for renewal of its air permit in May 2019, which SC DHEC is considering. The air permit renewal application included facility-wide emissions inventory and modeling. Facility-wide emissions inventory includes emissions from the industrial incinerator. The NRC also received a comment on the draft EA from the public (ADAMS Accession No. ML19331A154) regarding by-product waste from the incinerator.

A. Provide updated information about the use of the incinerator for the proposed 40 years of operations including information about emissions and byproducts from the incinerator.

B. Provide a copy of "Table 2 – Emission Calculations for Industrial Incinerator," from Westinghouse's May 2019 renewal air permit application submitted to SC DHEC.

WESTINGHOUSE RESPONSE

Legacy intermodal (sealand) containers with materials awaiting incineration for uranium recovery have been emptied of their contents, for additional detail see RAI 6.

A. The CFFF incinerator is one of the many uranium recovery processes at the CFFF, and there are no changes planned for its use. The ash from this process is dissolved and the uranium is recovered in the form of uranyl nitrate which is the CFFF recycle feedstock. In July 2019, Westinghouse stopped the practice of incinerating Solvent Extraction (SOLX) materials containing residual quantities of PCE. Westinghouse eliminated its use of PCE in the SOLX process, in April 2020, and replaced it with dodecane (see RAI 9 for a detailed discussion of this change). Currently SOLX materials containing uranium are not mixed with Wet Combustible Material (WCM) originating from other areas of the facility that is incinerated for uranium recovery. In 2021, Westinghouse anticipates resuming the incineration of SOLX materials containing dodecane and will submit a revised air permit application to reflect this change, including new emissions calculations. The new permit application will also reflect a 2020 change that eliminated plating activities at the CFFF. Detailed modeling was performed (Enclosure 7,"Facility Wide Criteria and TAP Model") for all non-radiological air emissions as well as a comparison to the applicable limits. Radiological air emissions are sampled, and facility offsite exposure is calculated and submitted to the NRC on a semiannual basis as required by the facility license.

B. Enclosure 8 contains Table 2 "Emission Calculations for Industrial Incinerator" submitted to SC DHEC in May 2019 for the revised air permit renewal application. Also, Enclosure 9 contains tables of hazardous air pollutants submitted to SC DHEC in September 2019 for the revised air permit renewal application.

RAI 6. STORAGE CONTAINERS

In November 2019, Westinghouse submitted a work plan to SC DHEC to complete the risk-based investigation of intermodal storage within the Southern Storage Area Operable Unit in follow-up to a May 2019 inspection that discovered a hole in the roof of the storage container holding drums of combustible materials containing uranium. Rainwater penetrated the roof of the containers and compromised the flooring and the drum lids. Westinghouse sampled the water found within the storage containers and the soil underneath those containers. In its comments on the draft EA, Westinghouse clarified that the affected soil was remediated, and reports describing the progress on the removal of the intermodal containers have been submitted to SC DHEC. Please provide the following information:

A. Provide an update of the intermodal container removal activities, soil sampling results, and removal and disposal of contaminated soil.

B. Discuss the facilities and methods that will be used to manage uranium-containing material currently stored in intermodal storage (i.e., storage, treatment and disposal) during the proposed 40 years of operation.

WESTINGHOUSE RESPONSE

A. In May 2019, several intermodal containers which contained uranium-bearing materials were determined to be in poor condition. In response to this condition, Westinghouse developed an accelerated, risk-based approach for clearing the Southern Storage Area (SSA) In total, sixty-two intermodal containers in the SSA Operable Unit OU designated as containing uranium-bearing materials were identified for removal and accelerated processing (including the initial intermodal container, C-40). Westinghouse achieved this goal in November 2020, several months ahead of schedule.

   Due to the large size of the laboratory reports for the 62 intermodal containers, Westinghouse has provided Figure RAI 6-1 and Enclosure 10 the Sum of Fractions (SoF) of Isotopic Uranium in Soil Beneath Sea-Land Containers Figures, depicting the areas where uranium contaminated soil was removed at depths ranging from six inches to a few feet. This remediation removed shallow impacted soil to prevent future groundwater impact. Only the uranium values are listed on the figures as results for Tc-99, F, and PCE (with the exception of one area underneath intermodal container C-21) were below the residential screening values described in procedure RA-433, “Environmental Remediation” (Enclosure 11). Any impacted soil underneath the intermodal containers has been remediated as necessary per RA-433 to below the residential screening levels (RSL) for uranium. Impacted soil was or is being transported to an approved low level radioactive waste (LLRW) disposal site.

   The footprint under intermodal container C-21 exceeded the RSL for PCE (0.0056 mg/kg versus the RSL of 0.0023 mg/kg). Remediation and subsequent confirmatory soil sampling in this area, which has underground utilities, will begin in January 2021.

   In 2021, Westinghouse intends to complete removal of the remaining intermodal containers that do not contain radioactive materials and have been used for storage of

items such as maintenance equipment and spare parts. To date, 10 intermodal containers have been removed and two other intermodal containers have been emptied and repurposed to support the site's Emergency Response Organization.

Figure RAI 6-1: Map of CFFF Intermodal Containers & Soil Remediation Locations

B. Plant procedures have been revised to prohibit future storage of uranium containing materials in intermodal containers.

RAI 7 – SOIL DISPOSAL RELATED TO SPIKING STATION LEAK

Section 4.4.1.3 of Westinghouse's March 2019 ER states that soil was removed as part of the remedial action for the Hydrofluoric Spiking Station #2 Leak. The NRC's draft EA acknowledged Westinghouse's start of the remediation process to remove affected soil from below the spiking station. Provide information about the soil removal (waste disposal) for the remedial action that occurred following issuance of the draft EA, including the volume of material removed, process for treatment/disposal, associated permits for the remedial action, and/or references to the remedial action including requested information.

WESTINGHOUSE RESPONSE

Westinghouse investigated and remediated the area underneath Hydrofluoric Spiking Station #2 (HFSS#2) in accordance with an approved SC DHEC work plan (Enclosure 12). The volume of material and the associated manifests for HFSS#2 soil removal are provided in LTR-RAC-19-64, "Manifests for HF Spiking Station #2 Soil Remediation" (Enclosure 13). All soil removed during remediation of HFSS#2 was transported to a LLRW disposal facility.

RAI 8. SOIL DISPOSAL RELATED TO CONTAMINATED WASTEWATER (CWW) LINE BREACH

Section 4.4.1.4 of Westinghouse's March 2019 ER states that soil was removed as part of the remedial action for the 2008 CWW line breach. Provide updated information about the soil and concrete removal (waste disposal), including:

A. Volume of material removed.

B. Process for treatment/disposal.

C. Associated permits for the remedial action.

D. References to the remedial action including requested information.

WESTINGHOUSE RESPONSE

A. Westinghouse replaced the CWW line using a trench less repair method known as pipe burst method. Under this method, most of the soil around the line was left undisturbed. As a result, there was not a large volume of soil removed in this project. Discussions with personnel involved indicate that soil removed to install the equipment to make this repair was reused. A review of CFFF site records did not uncover an estimate of the volume removed. There was some soil excavated and removed to; repair a manhole and install an additional manhole. A rough estimate of the soil removed assuming the addition of a manhole is conservatively estimated at no more than 400 cubic feet.

B. All radioactively contaminated waste generated at the CFFF, including soil, is packaged and shipped to a licensed LLRW disposal facility. This would include any soil and debris associated with this repair. As previously discussed, most of the soil removed to repair this line was reused during the repair. Due to the limited remediation performed at the time of the breach and subsequent repair Westinghouse installed a series of wells to better characterize impact from this 2008 event. Approval and rationale for the installation of wells W-51 through W-59 performed in 2018 was requested and obtained from SC DHEC (Enclosure 3).

C. No permits were obtained for the work performed in 2008. See response B above for SC DHEC approval for CWW line well installation.

D. See answer to question A and B above.

RAI 9 – WASTE MANAGEMENT

Describe changes in the waste management processes (generation, treatment, handling, and disposal) of the dry and wet uranium-containing material and the solvents used at the CFFF. Describe wastes generated by onsite analyses as a result of the Consent Agreement with SC DHEC and confirm the disposition of materials (liquid and solid) sent offsite for analyses are not returned to CFFF (e.g., materials are disposed by the contracted offsite laboratories).

WESTINGHOUSE RESPONSE

Changes to waste management processes since the March 2019 ER involve the management and storage of the spent mixture from the SOLX Process as well as the management and incineration of wet combustible material (WCM) containing the SOLX mixture. Historically, WCM containing the SOLX mixture was incinerated to recover uranium by CFFF's on-site Uranium Recovery and Recycling Services (URRS).

Over the past year and half, CFFF has had several discussions with federal and state officials regarding these recovery practices due to the presence of PCE in the mixture. While these discussions are ongoing, CFFF has voluntarily modified its management practices of the SOLX mixture as follows:

- CFFF ceased adding SOLX mixture to WCM and revised its processes to segregate WCM containing the SOLX mixture into a dedicated Satellite Accumulation Area.
- CFFF ceased charging WCM containing the SOLX mixture into the incinerator.
- Any WCM containing the SOLX mixture is being stored in 90-day hazardous waste storage areas until a final disposition strategy can be agreed upon with state and federal officials.
- Any bulk SOLX mixture that existed as of July 1, 2019 was processed to recover uranium and then sent off-site, to a licensed facility, as a mixed hazardous waste for treatment and disposal.
- CFFF modified the SOLX process to eliminate the use of PCE.

In May 2020, CFFF began operating the revised SOLX process utilizing a design that no longer required the use of PCE. CFFF anticipates that in the coming months any residual PCE will be eliminated from the SOLX system such that it will be able to resume incineration of the SOLX mixture to recover the uranium.

Waste generated by laboratory analyses, including samples received by the on-site chemical laboratory, are returned to the on-site process or waste stream from which they came for final dispositioning. Samples requiring off-site analysis are transported via courier with a chain of custody to the external laboratory. The external lab performs the analysis, reports the results, and retains the sample for a contractually agreed upon time period. Once the retention period ends, the lab disposes of the sample in accordance with applicable regulatory requirements for the sample material.

RAI 10 – CFFF SITE PROPERTY AND LAYOUT FIGURES

In Westinghouse's March 2019 ER, Westinghouse describes the CFFF site property boundary in Figure 2.1-5 and the site layout in Figure 2.1-6. Please provide these figures in a higher resolution, so that all notations are readable.

WESTINGHOUSE RESPONSE

Enclosures 21 and 22, include Figures 2.1-5 CFFF Boundary and 2.1-6 CFFF Site Plan in a higher resolution, and all notations are readable.

RAI 11 – SANITARY LAGOON

In the July 2020 Final Interim Remedial Investigation Data Summary Report, Westinghouse indicates that there are elevated levels of uranium in the Sanitary Lagoon. Please provide the following information:

A. Describe Westinghouse's plans to minimize and monitor for leaks and/or leaching from the Sanitary Lagoon.

B. Discuss any planned remediation and remediation procedures (e.g., Environmental Remediation procedures) that are applicable to the Sanitary Lagoon.

C. Describe Westinghouse's plan to establish improved lagoon leak detection and preventative maintenance practices for the Sanitary Lagoon.

D. Confirm if effluent to the lagoons are monitored, or if the lagoons themselves are monitored, and if so, provide the monitoring data, if available.

WESTINGHOUSE RESPONSE

A. Groundwater monitoring well W-17 is downgradient of the sanitary lagoon and the data does not indicate that uranium is leaking/leaching from the sludge in the lagoon. The most recent data and historical trends are summarized in the 2019/2020 Groundwater Monitoring Report submitted annually to SC DHEC as required by the site's National Pollutant Discharge Elimination System (NPDES) permit. The report also shows that data from groundwater monitoring wells W-46, W-10, W-26, W-48 and W-42 support this conclusion.

   Additionally, Westinghouse entered into a legally binding CA with the South Carolina Department of Health and Environmental Control (SC DHEC) to comprehensively assess and address the impact of past site operations by following the Comprehensive, Environmental Response, Compensation and Liability Act (CERCLA) process. Westinghouse is currently performing a RI to assess the source, nature and extent of historic impacts. This RI includes assessment of the Sanitary Lagoon Area OU. Following completion of the RI and SC DHEC approval of the final RI Report, the CA requires a Feasibility Study, Record of Decision (RoD) and Remedial Design/Remedial Action. As part of the ongoing Phase II RIWP, Westinghouse is installing a well pair consisting of an upper surficial aquifer well (W-99) and a lower surficial zone well (W-100) west of the sanitary lagoon to obtain additional groundwater quality data downgradient of the lagoon. The Phase II RIWP also includes further assessment of sediment quality downgradient of the lagoon near sediment sample SED-16 and surveying of the deeply incised middle and eastern ditches to evaluate surface water and groundwater interactions.

   While there is no indication of leaking/leaching based on the monitoring data, Westinghouse has decided to permanently close the sanitary lagoon as part of its commitment to creating a new legacy of environmental excellence. Characterization of the sanitary lagoon sludge in preparation for closure is a commitment in the Phase II RIWP,

Section 3.6. Implementation of the Phase II RIWP began on November 9, 2020 and is expected to be completed in 2021.

B. As discussed in item A above, Westinghouse plans to close the sanitary lagoon. The sanitary lagoon closure process will include wastewater treatment plant modifications to be performed under construction permit(s) and the site's NPDES permit; submittal, approval and execution of a state approved lagoon closure plan; county approval for the land disturbance activities; proper waste disposal in accordance with state and federal regulations; and completion of any remedial activities, if needed, under the CA. The site will also use its risk-based programmatic procedure, RA-433 "Environmental Remediation" (a commitment in the Westinghouse NRC license renewal application) to assure a predictable outcome that is protective of human health and the environment.

C. Westinghouse plans to close the sanitary lagoon under its NPDES permit and the CA requirements. Characterization of the sanitary lagoon sludge in preparation for closure is a commitment in the Phase II RIWP, Section 3.6.

D. Inputs to the site lagoons are monitored through a variety of process controls and routine operator rounds performed by licensed (SC Labor, Licensing and Regulations Board) wastewater treatment operators. These activities are described in plant procedures. Effluent from the permitted wastewater treatment system including the site lagoons is monitored according to the parameters and limits described in the site NPDES permit. These data are submitted to SC DHEC through required monthly Discharge Monitoring Reports (Enclosure 14).

   Additionally, NRC regulations require monitoring and reporting of radiological effluents. These results, including liquid discharges to the Congaree River in accordance with the NPDES permit, are reported to the NRC on a semi-annual basis.

RAI 12. NEW LINER IN LAGOONS

In Section 2.1.4 of the March 2019 ER, Westinghouse stated that the North, South, West-I and West-II wastewater treatment lagoons were relined in 2012 in response to ground monitoring data that indicated increasing trends of fluoride and nitrate in the groundwater around the lagoons. In addition, the East Lagoon was last relined in 1980 when the site's Waterglass system was installed; it is monitored for pH and liquid level and is sampled for fluoride, ammonia, and total suspended solids. Given the remedial investigation activities that have been carried out and associated results related to the source and extent of contamination, additional information is needed regarding operation of the lagoons.

A. Discuss the methods used to verify the integrity of the liner to maintain its design basis.

B. Discuss the methods used to monitor the release of uranium and Tc-99 from these lagoons.

C. Describe the new wells that are used to monitor leakage from these lagoons and the basis for the locations selected for the new wells.

WESTINGHOUSE RESPONSE

A. All lagoon operations are regulated under Westinghouse's NPDES permit for the Columbia site. Under the CA, there are three OU containing these lagoons. The North, South and East Lagoons are in the Wastewater Treatment Area OU. The West I and West II Lagoons are in the West Lagoons Area OU, and the sanitary lagoon is in the Sanitary Lagoon OU. Each of these areas is being assessed under the CA to address historic or current impacts.

   Based on potential historic impact, and the age of the East Lagoon liner, Westinghouse has chosen to decommission the East Lagoon. Closure of the East Lagoon is in progress in accordance with CA requirements and a SC DHEC approved closure plan. For more information, see the Safety Evaluation Report Related to A Request For 10 CFR 20.2002 Alternate Disposal Approval And Exemptions From 10 CFR Part 30 And 10 CFR Part 70 For Disposal Of Columbia Fuel Fabrication Facility Waste At The Us Ecology Idaho Facility (ML20302A085).

   Following closure of the East Lagoon, Westinghouse is planning to close the Sanitary Lagoon. A commitment to characterize the sludge in the Sanitary Lagoon in preparation for closure is in Phase II RIWP Section 3.6.

   In addition to routine operational checks, new maintenance requirements were implemented for the North, South, West-I and West-II Lagoons in 2020. In addition, monthly inspections by site URRS engineers include visually inspecting the exposed portions of all the process lagoons liners for degradation such as holes, tears, etc. The lagoons are inspected on an annual basis by a South Carolina registered professional engineer (PE) with knowledge relevant to impoundment stability. The inspection includes the following:

- Observations of dams, dikes and toe areas for erosion, cracks or bulges, seepage, or wet or soft soil;
- Changes in geometry, the depth and elevation of the impounded water, sediment or slurry, or freeboard;
- Changes in vegetation such as overly lush, dead or unnaturally tilted vegetation or other vegetation growing in or on the basin or basin dikes;
- Evidence of animal burrows.

Every two years the lagoon liners are inspected by a PE. The inspections are to be planned during a period of the lowest water and sludge level achievable after a dredging campaign and, at a minimum, include the following:

- Observation of the impoundment liners for damages such as rips, tears or punctures;
- Spillway integrity;
- Changes to the discharge of all outlets of hydraulic structures which pass underneath the base, or through the dike, of the surface impoundment including abnormal discoloration, flow or discharge sediment;
- Any other changes which may indicate a potential compromise to impoundment integrity.

In addition to the visual inspection of the lagoon stability and liner integrity, wells are monitored as described in B below.

B. In order to detect potential groundwater impacts that may be emanating from beneath the lagoons, a monitoring well network was established. The groundwater monitoring network at Westinghouse CFFF is comprised of four types of wells: perimeter wells to detect potential releases before impacts could migrate off-site; sentinel wells to detect a leak in an OU; NPDES permit required wells to gather baseline data and detect leaks in the site wastewater treatment system; and wells to monitor known areas impacted by uranium and Tc-99.

Two lined settling ponds (North and South Lagoons), one process wastewater pond/lagoon (East Lagoon), a sodium silicate (Waterglass) wastewater treatment process to treat U-contaminated, ammoniated wastewater from the conversion process, and several storage tanks exist in the Wastewater Treatment Area OU (WWTAOU). The WWTAOU contains NPDES permit required monitoring wells W-18R, W-22, W-29, and W-30. Additionally, the site samples W-6 and W-28 to comply with SC DHEC CA requirements. Analytical results for all COPC, including U and Tc-99 are used for comparison against previous results and serve as one method for detecting potential leaks.

Two lined settling ponds exist within the West Lagoons area. West II Lagoon receives treated wastewater from the Waterglass and SOLX, U removal processes as well as still bottoms from ammonia distillation. The effluent from West II Lagoon typically flows to West I Lagoon. In both lagoons, calcium fluoride (CaF_2) solids settle out from the treated wastewater. The West Lagoon Area Operable Unit (WLAOU) contains NPDES permit required monitoring wells W-39 and W-43. Additionally, the site samples W-65 and W-66 to comply with SC DHEC CA requirements. Analytical results for all COPCs, including U

and Tc-99 are used for comparison against previous results and serve as one method for detecting potential leaks.

The entire monitoring well network is currently sampled at least semiannually. These analytical results are used for comparison against previous results and serve to detect potential leaks per the site's Environmental Data Management Procedure.

It also should be noted that the site is actively working to decommission the East Lagoon in 2021 as described in A above. Following East Lagoon closure, the site is planning to close the sanitary lagoon.

C. No new wells have been installed to monitor leak detection from the existing lagoons. However, the Phase II RIWP has been developed to collect additional focused data necessary to fill limited data gaps identified by evaluation of the Phase I RIWP data. The additional data will further define the source, location and extent of specific COPCs such as U and Tc-99. There are plans to conduct groundwater screening in and around the WWTAOU as part of Phase II RIWP Section 3.3.4. The areas of interest are:

- Surficial aquifer - lower zone side gradient of monitoring wells W-11 and W-6
- Surficial aquifer - lower zone near monitoring well W-30

After receipt of the groundwater screening data, CFFF will meet with SC DHEC to propose additional permanent well locations. Permanent monitoring wells will be installed and developed as described in the Phase I RIWP.

Additionally, an upper and lower surficial well pair discussed in Phase II RIWP Section 3.3 is planned for installation west of the sanitary lagoon, and characterization of the sanitary lagoon sludge will be completed per Phase II RIWP Section 3.6. Implementation of the Phase II RIWP began on November 9, 2020 and is expected to be completed in 2021.

RAI 13 – UPGRADES TO HYDROFLUORIC ACID SPIKING STATION AND DIKED AREAS

In Westinghouse's site assessment report for the Hydrofluoric Acid Spiking Station (HFSS) #1 (LTR-RAC-20-65) to SC DHEC dated July 30, 2020, Westinghouse indicated that it had installed a new containment dike (HFSS#1) (ADAMS Accession No. ML20294A056), upgraded the design of HFSSs and diked areas, protected concrete with a floor coating that is impervious to acidic materials, and guards against undetected deterioration of the concrete floor. Please provide the following information:

A. Describe the upgrades made to the HFSS design and diked areas.

B. Describe the methods implemented to evaluate the extent of condition of the uranium that leaked through the hole in the floor, such as verification that there were no other holes or cracks in the floors through which uranium could have leaked.

C. Discuss the preventative measures implemented to protect against future damage to the HFSS floor and dike, including any surveillance procedures.

D. Discuss the methods used to determine the extent of the condition of the uranium concentration beneath the concrete floor and the corrective measures taken, in addition to upgrading the design of HFSS and addition of dikes.

WESTINGHOUSE RESPONSE

A. The spiking station systems were redesigned to reduce the likelihood of leaks, improve the ability to identify leaks, increase the impermeability of the diked area including the floor, and eliminate the need for a dike liner. This modification has been completed on HFSS#2 and is in progress on HFSS#1 with an expected completion of spring of 2021. HFSS#1 will remain out of service until the upgrades are completed.

   The equipment changes include:

   - Tank replacement that eliminated all side nozzles (reduced 3 flanged connections)
   - Raised frame height to improve the ability to inspect under the tank and its connections for leaks
   - Installation of 2 removeable polypropylene catch pans to aid in early identification of small leaks
   - Replacement of the convolution couplings with pulse dampeners eliminating the primary source of historical leaks
   - Replaced carbon steel lined piping with stainless steel polyvinylidene fluoride (PVDF) lined piping including bottom outlet pipe fittings for improved reliability
   - Installed automatic shut off valves to remove Hydrofluoric (HF) system pressure when in recirculation
   - Raised berm height to 6"
   - New berm made of corrosion resistant concrete and a chemical resistant protective coating eliminating the need for a liner
   - Berm floor is sloped to the front of the station to aid in leak detection

B. Each HFSS was completely disassembled. The liner in each berm was removed and the floor was inspected for leaks. The concrete floor beneath each spiking station was removed. Extensive soil sampling was performed beneath each spiking station. The soil sampling and final disposition is described in LTR-RAC-18-81, “HF Spiking Station #2 Summary Westinghouse Nuclear Fuels Facility Hopkins, SC,” (Enclosure 15) and LTR-RAC-20-65/ML20294A056, “HF Spiking Station #1 Soil Sampling Assessment Report”.

C. Multiple changes were implemented to improve the chemical resistance of the floor and dike as described in response A. Multiple design changes were implemented to prevent leaks and to aid in early leak detection as described in response A.

In addition, new maintenance requirements have been implemented for;

- Checking for air in the pulsation dampeners
- Inspection/testing of the drip pans
- Revised CF-81-015, “Conversion Field Data Checklist for Conversion Line”, to require hourly spiking station inspections

D. In terms of the HFSS area, please see responses A and B. Regarding the chemical operations building in general, Westinghouse will utilize the information obtained through the ongoing RI being completed per the CA, specifically the array of sentinel wells discussed in RAI 24, to monitor for uranium contamination that may be beneath chemical operations building. Westinghouse updated the CFFF decommissioning funding plan to assume that 5’ of soil beneath the entire footprint of the chemical building will require remediation at decommissioning.

RAI 14. NEW WELLS

At the time of the publication of the EA and FONSI in June 2018 (ADAMS Accession No. ML18120A318), Westinghouse had a groundwater monitoring network of 38 wells, 35 in the water table aquifer and 3 in the deep aquifer. Since then, Westinghouse has installed new wells (up to well W-97). Current groundwater wells are located in the upper and lower surficial aquifer, Black Mingo Aquifer, and the Congaree River floodplain. Westinghouse updated its groundwater monitoring network to include sampling of the original 38 wells for uranium and Tc-99. Westinghouse also updated the well sampling to monitor for uranium and Tc-99, versus gross alpha and gross beta.

A. In its July 15, 2020 response to SC DHEC's May 4, 2020 comments on the February 2020 Final Interim Remedial Investigation Report, Westinghouse explains that wells W-4, W-85 and W-86 were not used for development of the potentiometric surface contour map because the water quality data were anomalous. The potentiometric data from those wells do not appear to be used in the July 2020 Report. In addition, the 1985 EA references a 1982 report by a Westinghouse consultant that identifies questionable completions for several wells and suggests that those wells should not be used for water quality determinations. The identified wells include wells W-6 through W-17, which reportedly did not contain bentonite seals or cemented casings, and wells W-1 through W-5, for which the completions are "not well known and appear to be open-hole completions below variable lengths of steel surface casings."

   If the water level data from a well (i.e., well W-4) are anomalous and its well completion questionable, explain why the water quality data from that well are suitable for delineating a plume.

B. In the NRC's May 2019 site visit summary, Westinghouse clarified that no groundwater contamination was found in W-25 because it had been damaged by a fallen tree and was recently repaired. The only data from well W-25 were taken in January 2019. Provide an update on the repairs on well W-25 and provide monitoring data if the well is currently part of the sampling program.

WESTINGHOUSE RESPONSE

A. This question discusses monitoring wells W-1 – W-17, including well W-4 which exhibited an anomalous groundwater level measurement in October 2019. Of wells W-1 through W-17, wells W-1, W-2, W-3, W-5, W-7, W-8, W-9, W-12, and W-13 are no longer part of the monitoring program and have been abandoned with some being replaced as denoted by an "R" suffix. Wells W-4, W-6, W-10, W-11, W-14, W-15, W-16, and W-17 remain in the monitoring program. Well W-4 was installed in 1977 with the remainder of the wells installed in 1980. Information pertaining to the construction of these wells and their use in the monitoring program is presented below.

   The NRC 1985 EA report references a 1982 report by a Westinghouse Consultant [(Davis and Floyd (D&F)] in the following way: "The quality of monitor well completions is variable." Well construction details are not available for well W-4 but are available for wells W-6 through W-17 installed by Law Engineering (D&F, 1980, Appendix I). The NRC

EA report states that wells W-6 through W-17 “were originally installed as temporary wells and contain neither bentonite seals nor cemented casings” and were “suitable for measuring water levels,… [but] are not satisfactory for determining water quality because of potential dilution from rain water infiltration through the well annulus” (NRC, 1985, p.4-25). D&F included well construction details for wells W-6 through W-17 in Appendix I (Law Engineering Phase I Report, 1980), and indicates that these wells have a grout seal (D&F, 1980, Appendix I). Therefore, wells W-6, W-10, W-11, W-14, W-15, W-16, and W-17 would be expected to be suitable to determine groundwater quality, and Westinghouse considers data collected from these wells as highly useful as part of the overall data collected from the numerous other wells on site.

Well W-4 was installed by Coleman Drilling in 1977 (RUST, 1995). Although the actual well construction details are unknown, depth measurements indicate that W-4 is approximately 12 feet deep and it is estimated to have a 2-foot screen, from 10 to 12 feet below ground surface. W-4 has been retained in the groundwater monitoring program since its installation.

The water level measurement collected at W-4 in October 2019 was not consistent with historical levels in W-4 or with elevations measured in surrounding wells. It is uncertain why the groundwater level was inconsistent. Because the measurement was anomalous, it was excluded for the purpose of creating the groundwater potentiometric surface map included in the Phase I RI Data Summary report because it could have created an inaccurate representation of the groundwater surface that could result in miscalculations of groundwater flow direction. Rejection of field measurements does not necessitate the rejection of all data associated with that sample point at that specific interval. Analytical results obtained from W-4 groundwater samples collected in October 2019 are still considered valid because the laboratory results are consistent with historic concentrations at W-4, and laboratory\quality control samples are within acceptable ranges

The water level measurement in W-4 during the April 2020 sampling event was within acceptable range as compared to historical water levels observed in W-4, and spatially proximal wells. AECOM evaluates all data from each well for usability. Any decisions from this evaluation are documented in associated reports. In the event that either field or laboratory data are too inconsistent at W-4, or any other well as defined by comparative spatial proximity, or singular trend/outlier analysis, that well would be considered, for repair, abandonment and/or replacement.

B. Well-25 was repaired and will be redeveloped in February 2021 along with the new wells that are being installed as part of the Phase II RIWP. The most recent analytical sample results are included in the 2019/2020 Annual Groundwater Monitoring Report (Table 4), (ML20284A203, ML20284A204).

RAI 15 – ENVIRONMENTAL SAMPLING VALUES

Provide clarification of the sample quantity and minimum detection level for environmental data presented in the July 2020 Final Interim Remedial Investigation Data Summary Report. Are the values presented in Westinghouse March 2019 ER in Table 6.1-2 for typical sample quantity and nominal minimum detection levels still applicable?

WESTINGHOUSE RESPONSE

The values presented in the Westinghouse March 2019 ER in Table 6.1-2 are still applicable with the exception of the minimum detection level/concentration for Tc-99 in sediment, soil, vegetation, and fish. The Nominal Minimum Detection Level was lowered from 50 pCi/g to 1 pCi/g. The level was lowered to provide data necessary to support environmental remediation evaluations against residential use criteria. The residential use screening level in the site's Environmental Remediation procedure (RA-433) for Tc-99 is 19 pCi/g. Updated March 2019 ER Table 6.1-2 is provided in Enclosure 2.

RAI 16 – CONTAMINATION MONITORING – WESTINGHOUSE'S COMMENTS ON THE DRAFT EA

To address the comments Westinghouse submitted (ADAMS Accession No. ML19331A105) on the NRC's draft EA, additional information is required. In particular, Westinghouse noted that "The 2013 AECOM Remedial Investigation incorrectly applied the 15 pCi/L maximum contaminant level (MCL) for gross alpha to the manufacturing operations at CFFF." Westinghouse also clarified that the MCL for gross alpha does not apply at CFFF because the alpha contamination would be from uranium, which is excluded from the MCL. Provide the value for adjusted gross alpha (i.e., gross alpha minus radon and uranium) in support of Westinghouse's assertion that the gross alpha exceedance was incorrectly applied. Identify past gross alpha exceedances in the groundwater and surface water data that could not be attributed to uranium.

WESTINGHOUSE RESPONSE

After reviewing RAI 16, Westinghouse's justification for comments made on the draft EA (LTR-RAC-19-94/ML19331A105) appear to have confused the reader. The following paragraphs attempt to clarify the comments provided on the EA and provide a revised justification.

The original justification is as follows:

> *"The 2013 AECOM Remedial Investigation Report incorrectly applied the 15 pCi/L MCL for gross alpha to the manufacturing operations at CFFF.*
>
> *The MCL for gross alpha does not apply, as the source of potential alpha contamination would be from uranium, which is excluded from the 15 pCi/L MCL per EPA guidance. https://www.epa.gov/dwreginfo/radionuclides- rule*
>
> *Prior to speciation of all samples, the site had an investigation level of 15 pCi/L for all gross alpha samples. If the investigation level was exceeded, the isotopic analysis was performed."*

This justification was provided for three comments made on the draft EA that are specific to surface and river water samples. While the language in the original justification is accurate, it did not clarify that MCLs and Environmental Protection Agency (EPA) regulations are only applicable to groundwater samples. Surface water and river water samples are not within the scope of EPA's drinking water standard and, as a result, no MCL's exist for these environmental sample types. In absence of a regulatory standard, Westinghouse has instituted internal investigation limits for gross alpha in surface water (50 pCi/l) and river water (15 pCi/l).

A revised justification for each of the three comments is listed in the table below:

		EA	Comments	Justification
3-13	1	"…concentrations are less than 10 pCi/L, which is lower than the 15 pCi/L MCL."	"…concentrations are less than 10 pCi/L, which is lower than the site's internal investigation level of 15 pCi/L ~~MCL~~, which initiates uranium speciation."	The investigation limit was incorrectly termed an MCL. This is a river water sample collected under Westinghouse's routine environmental surveillance program described in the license renewal application. MCL's do not exist for river water, however Westinghouse has an internal investigation limit of 15 pCi/l gross alpha for river water.
3-14	13-14	"Gross alpha was noted above its 15 pCi/L MCL in the drainage ("middle") ditch." AECOM 2013	"Gross alpha was noted above its ~~15~~50 pCi/L ~~MCL~~ investigation level in the drainage ("middle") ditch." AECOM 2013	The investigation limit stated in the EA is incorrect and was incorrectly termed an MCL. This is a surface water sample collected during a special sampling campaign in 2008. MCL's do not exist for surface water however Westinghouse has an internal investigation limit of 50 pCi/l gross alpha for surface water.
3-14	19	"…the MCL (15 pCi/L) for all sampling locations except…"	"…the ~~MCL (~~investigation level of ~~15~~50 pCi/L) for all sampling locations except…"	The investigation limit stated in the EA is incorrect and was incorrectly termed an MCL. This is a surface water sample collected under Westinghouse's routine environmental surveillance program described in the license renewal application. MCL's do not exist for surface water, however Westinghouse has an internal investigation limit of 50 pCi/l gross alpha for surface water. This investigation limit has never been exceeded at the roadway sample as stated in this sentence of the EA.

While the discussion above centers around river and surface water sampling, Westinghouse wishes to further explain why the gross alpha MCL for ground water does not apply to CFFF.

The radioactive COPCs present at CFFF are enriched uranium and Tc-99. The MCL for these COPCs per EPA's drinking water standard are 30 µg/l uranium (equivalent to 21 pCi/l at natural enrichment, 84 pCi/l at CFFF nominal enrichment) and 900 pCi/l Tc-99. It is important to note that the EPA drinking water standard specifically excludes uranium from the gross alpha MCL. Because uranium is the only alpha emitting COPC from CFFF operations, MCLs described above are the appropriate groundwater MCLs for CFFF.

Historically gross alpha analysis was used as a screening method for uranium, and if an investigation limit was exceeded, then isotopic uranium analysis was performed. Due to the presence of natural radioactivity in the environment and the fact that groundwater samples taken from monitoring wells at CFFF are not filtered/treated to remove sediments or natural radioactivity, it is possible for a sample to exceed the gross alpha investigation limit but not exceed the MCL for uranium. Isotopic uranium analysis was used to demonstrate whether the initial gross alpha exceedance was due to naturally occurring radioactivity or enriched uranium from Westinghouse's operations.

RAI 17 GEOLOGIC CHARACTERIZATION OF THE SITE

Westinghouse provided comments on the NRC's draft EA in November 2019 that stated, "Based upon greater geologic understanding of the developed portion of the site and Congaree River floodplain, better hydrogeologic understanding of the connections of permeable units above and below the bluff, and bathymetric data from Sunset Lakes, it appears that surface water and groundwater interaction are not as significant within the plant site as previously thought. Continued investigation to further the site's understanding is ongoing and refined with each assessment." The Final Interim Remedial Investigation Data Summary Report submitted to SC DHEC in February 2020 (and revised July 2020), states on page vi that Westinghouse has "[a]n improved understanding of site geology and hydrogeology has been developed, particularly with respect to the floodplain and how shallow groundwater interacts with surface water and sediment." The 2020 Final Interim Remedial Investigation Data Summary Report provides a summary of the data, including revised drawings. Provide a discussion of the process used to control revisions (e.g., change process) to the conceptual site model (CSM) based on the new data collected and how this process is anticipated to change over the period of the proposed license renewal term.

Based on the discussions and revised drawings in the 2020 Final Interim Remedial Investigation Data Summary Report, provide the following information related to the characterization of the site subsurface.

A. Changes in the CSM Cross Sections

In the July 2020 Final Interim Remedial Investigation Data Summary Report, Westinghouse provided enhanced cross sections (more vertical exaggeration and projected wells) compared to those provided in the February 2020 Final Interim Remedial Investigation Data Summary Report. While a CSM should evolve during the investigation as additional data are collected, it appears that the enhanced cross sections incorporated changes in the subsurface strata from the earlier version (February 2020).

1. On Section B-B', the thickness of several clay lenses appears to substantially decrease in the revised cross section. Explain how the new data support this change.

2. On Section F-F', a depression in the water table is depicted between the Lower Sunset Lake and well W-20 without any supporting data. Provide data to support the existence of silt and clay lenses beneath Lower Sunset Lake, Gator Pond, and particularly East Lagoon because no wells or borehole directly penetrated the bed sediment of these surface water bodies.

3. The data from only one lithographic boring (L-1) appear to be incorporated into the CSM but the information does not appear to be consistent with the data. Please, explain. On the Cross Section B-B', the elevation of the top of the Black Mingo is depicted at an elevation of approximately 47 ft-MSL whereas the boring log and the "Structure Contour Map - Top of the Black Mingo Confining Clay" in Appendix F of the July 2020 Report depicts the top of the Black Mingo at 31 ft-MSL.

4. On Sections F-F' and G-G', the top of the Black Mingo is shown at approximately 15 ft below the base of well W-11, whereas the February 2020 Report depicts the top of the

Black Mingo at the base of well W-11. The elevations on the expanded vertical exaggeration Cross Section F-F' do not appear to be consistent. Please, explain and revise, as appropriate. Also, in the response to Comment B5 from SC DHEC, Westinghouse states that the difference between the top of the Black Mingo and base of well W-11 is 9 ft, which differs from the CSM. Explain why well W-11 was installed in a 3 ft interval below the base of well W-32. Given that the highest Tc-99 concentrations are observed at well W-11 and have a potential for upward vertical flow, it follows that the plume existence and potential migration under well W-11 can be a data gap (also see Item #6 below and RAI-14A).

5. The CSM and the "Structure Contour Map - Top of the Black Mingo Confining Clay" in Appendix F of the July 2020 Report indicate other groups of borings (e.g., GP-x, TH-x, and SB-x), which do not appear to be reported. Confirm whether the lithologic data for those borings have been incorporated into the CSM. Provide logging information from these boreholes and from wells W-60 to W-68.

6. The eastern "spreading" of the various plumes north of Gator Pond may be attributed to impedance of southerly flow by a low permeable zone (i.e., clay) in the subsurface strata underlying Gator Pond. Such a clay body is evidence on the three boring logs in that area for which data are available (i.e., L-2 [94-107 ft-MSL], L-19 [94-103 ft-MSL], and W-92 [94-103 ft-MSL]). Explain how the CSM incorporates and discusses the impacts on flow by the subsurface clay consistent with the observed data.

7. Multiple plumes, including organic contaminants, when compared with the topological contour of the Black Mingo confining unit, appear to suggest that this lithological interface may control the spreading of all contaminants. Provide an evaluation in the CSM of the likelihood that the Tc-99 plume may potentially spread similarly, both southwards and eastwards, by (1) following the lithological interface and/or by (2) interacting with the tetrachloroethene (PCE)/trichloroethene (TCE)/VC organic plumes.

B. Black Mingo Aquifer

The July 2020 Final Interim Remedial Investigation Data Summary Report states that "[f]our of the monitoring wells (W-3A, W-49, W-50, and W-71) are screened within the Black Mingo Aquifer." Confirm whether Figure 5-4 of the report used the data from well W-71 for the construction of the Black Mingo Aquifer potentiometric surface. Given the limited number of wells screened in the Black Mingo Aquifer and located within the floodplains, provide the rationale to support determination that no contamination has reached the Black Mingo Aquifer.

C. Top of the Black Mingo Confining Unit

1. The "Structure Contour Map - Top of the Black Mingo Confining Clay" in Appendix F of the July 2020 Final Interim Remedial Investigation 2020 Data Summary Report depicts depressions in the western portions of the site including between borings/wells (L-14 and B-17) and at boring L-1. The radial contours surrounding boring L-1 are a result of limited data in that area and the elevation at L-1 being an "outlier" with the top of the confining unit being approximately 50 feet lower than at the surrounding boring

locations L-17 and L-18. The top of the Black Mingo confining unit is likely an erosional surface and may affect plume migration in the overlying surficial aquifer. The descriptions on the boring log for the basal sands at L-1 include a notation that "chemical odors" were detected. Describe any further investigations to explain the presence of these chemical odors and provide the rationale for not installing a well at the deepest portion of the aquifer at the location of L-1.

2. A 50 ft incision into the top of the Black Mingo confining unit at L-1 is significant, considering that the thickness of this unit reportedly was between 39 and 85 ft. The elevation of 31 ft-MSL is approximately 15 ft below the base of the confining unit at the closest well installed in the Black Mingo Aquifer (i.e., well W-49). Given the available lithologic borehole information, provide an estimate of the thickness of the Black Mingo confining unit at L-1 and the current estimate of the range of thickness for the Black Mingo confining unit on the CFFF property.

3. An alternative interpretation could be that the bottom of boring L-1 is within the Black Mingo Aquifer. This interpretation would suggest that the strata for the Black Mingo confining unit, if equivalent to elevations for the top of the Black Mingo confining unit at L-17 (87 ft-MSL) or at L-18 (81 ft-MSL), have changed to a coarser grained (silt/sand) unit that may enhance communication between the Black Mingo Aquifer and the shallow aquifer. Furthermore, wood is reported at a depth of 49 ft-MSL at L-1, which is similar to the depth (35 ft-MSL) at which petrified wood was noted in the cuttings on the boring log for well W-49. This horizon is screened by well W-49 (Black Mingo Aquifer). Given this alternative interpretation, explain whether Westinghouse detected wood fragments or petrified wood in the surficial aquifer and explain whether Westinghouse considered this alternative interpretation.

D. Western Groundwater Area of Concern, Source and Monitored Natural Attenuation

The previous NRC EAs determined that a mitigated FONSI could be reached in part, for the PCE and/or TCE impacts, based on Westinghouse's prior active remediation, the current monitoring well network being sufficient for the monitored natural attenuation (MNA) groundwater strategy, and the proposed remedial investigations and CSM approach being sufficient to address data gaps and to mitigate or define any new impacts. A summary of the available data is as follows:

In the December 2013 Remedial Investigation Report, the source of the PCE plume was attributed to the Former Oil House. In that source area, Westinghouse had performed active remediation including air sparging and soil vapor extraction between 1997 and 2011. The current groundwater remediation strategy is MNA. A source for the observed PCE plume in what is referred to as the Western Groundwater Area of Concern appears to not have been addressed in the report nor was any active remediation reportedly conducted in that area.

The CSM breaks the PCE impacts into three distinct plumes: Plume 1 is the PCE plume in the uppermost surficial aquifer downgradient of the Former Oil House; Plume 2 is the PCE plume in the lowermost surficial aquifer extending from the Former Oil House; and

Plume 3 is the PCE plume in the lowermost surficial aquifer extending from the area of well W-19B (Western Groundwater Area of Concern).

On pdf page 135 of the July 2020 Final Interim Remedial Investigation Data Summary Report, the descriptions of the two deeper plumes are as follows:

Plume 2 – "Preferential basal flow occurs within the lower surficial aquifer but is confined by the dense silt and clay of the Black Mingo."

Plume 3 – "Western Groundwater Area of Concern source flows toward the floodplain above the Black Mingo Confining Unit."

And finally, Figure A "Structural Contour Map – Top of the Black Mingo Confining Clay" in Appendix F of the July 2020 Final Interim Remedial Investigation Data Summary Report provides more detail of the top of the Black Mingo, including the existence of depressions in the area of well W-19B and L-1 and a structural high in the area of the Former Oil House.

According to the December 2013 Remedial Investigation Report, the reduction in levels (currently a maximum PCE concentration of 300 ppb versus total volatile organic compounds [tVOCs] concentration of 2360 ppb) in the shallow aquifer in 1993 suggests that the source area was sufficiently remediated (note: it is assumed that PCE comprises a significant proportion of the tVOCs). However, the source for the PCE plume in the area of well W-19B remains and continues to migrate southwards.

Based on the current monitoring well network, it appears that the in situ biodegradation of PCE/TCE may be effective in controlling the offsite migration.

The interpretation of the results in the July 2020 Final Interim Remedial Investigation Data Summary Report and responses to SC DHEC comments on that report, as noted above, suggest that the CSM method, as well as other prior assumptions, may not have characterized the source for the Western Groundwater Area of Concern. One possible source is a potential separate phase liquid migrating on the top of the Black Mingo Confining Unit to the location of well W-19B. If sufficient volumes were released, then a separate phase could have formed and sunk to the impervious Black Mingo Confining Unit. The topology of the upper surface of that unit would control its migration. The structure contour map for the upper surface of the Black Mingo Confining Unit indicates a separate phase liquid could have migrated to the location of well W-19B. Furthermore, the upper surface contains a depression in that area in which any migrated separate phase liquid would pool. If one was formed, such a pool would be a continuing source of dissolved PCE constituents in groundwater.

Therefore, please provide the following:

1. Explain whether Westinghouse considered the continuing presence of a separate phase liquid source of volatile organic compounds (VOCs). If not, provide a discussion of alternative sources for the observed PCE concentrations in the Western Groundwater Area of Concern.

2. Provide an estimate on the life expectancy of a PCE plume within the property.

3. Because a trace of PCE has been detected south of Upper Sunset Lake, provide an evaluation of the likelihood that the PCE plume may move south of well W-20 or W-25 within the next renewal period.

WESTINGHOUSE RESPONSE

The conceptual site model (CSM) was created and is maintained according to the Westinghouse CSM procedure, developed in 2018 by AECOM. CSMs are intended to be dynamic collaborative tools for the entire stakeholder team. The CSM is managed by a single designated representative who approves all changes to the CSM. To date, revisions have been frequent as the model was created and populated with data. As part of refining the model, Westinghouse reviewed its files to identify all potentially relevant data, including items such as geotechnical borings. Newly identified data were reviewed for inclusion in the CSM by two licensed South Carolina professional geologists with extensive site knowledge, by Westinghouse personnel, and by the technical review team, comprised of independent third party contractors. Since 2018, the CSM also has been reviewed and revised for various items, such as typographical errors, data entry errors, and best means of display (i.e. – vertical vs. horizontal scales). All changes have been approved by and incorporated into the model by the designated representative.

Westinghouse anticipates that refinements to the CSM will continue to be made by the designated representative with input from individuals with expertise in geologic interpretations, including but not limited to, members of Westinghouse staff, various Westinghouse contractors and SC DHEC. As new data are received, such as the data presently being acquired as part of the Phase II RIWP, the CSM will be updated only by the designated representative. Westinghouse will maintain the CSM over the period of the proposed license renewal term, recognizing that technology upgrades will necessitate changes in the model and procedure from time to time.

RAI 17 Item A Response

1. Cross sections generated from the CSM are dynamically connected to pull elevation profiles from the ground surface and the top of the Black Mingo Clay. The area between these two surfaces is interpolated based on nearby geotechnical borings. Borings that do not directly fall on the transect line are projected onto the cross section at the depth and thicknesses that occur at the precise location of the boring, even though the boring itself may be up to 100’ away. Therefore, manual adjustments are made by the professional geologists to provide a best estimate of the depth and thickness of lenses that occur within the surficial aquifer at the location of the transect.

   The estimated depth and thickness associated with suspected thinning of some clay lenses were not included in previous versions of the cross sections. Cross Section B-B’ was then revised to reflect a better estimate of the sedimentary units within the interpolated zone. This updated information was submitted to SC DHEC in the October 29, 2020 letter LTR-RAC-20-83 “Response to SC DHEC Letter dated October 14, 2020 Phase II RIWP Addendum,” (ML20322A261). SC DHEC approved this Addendum on November 5, 2020. Additionally, as new data are collected, such as the data presently being acquired as part of the Phase II RIWP, all cross sections will be reviewed and revised as deemed appropriate and according to the CSM procedure.

2. The “depression” in the water table surface was an interpolation artifact exaggerated by the 15X vertical exaggeration (VE) and has been revised. Although no lithological borings have been collected within the Gator Pond, Upper Sunset Lake or Lower Sunset Lake, sediment samples up to 18” deep have been collected in each of these areas, and lithological borings have been collected near the Gator Pond and on the dike between Upper Sunset Lake and Lower Sunset Lake. This information was not within the 100’ projection range of the transect for Cross Section F-F’, but the knowledge from those nearby borings was used in the interpretation and presentation of silt and clay lenses in these areas. To more clearly show the data that are driving this interpretation, the southern end of transect F-F’ is being re-oriented to be within the 100’ projection range of the borings referenced above. In summary, cross Section F-F’ is being revised to correct the errant water table depression on the 15X scaled cross section, show the adjusted alignment, and provide new data collected as part of the Phase II RI Report. The updated cross section will be included as part of the Phase II RI Report.

3. Many borings in addition to L-1 were included in the development of the top of the Black Mingo Clay structure contour map. An updated map, displaying all locations that have been used in the development of this surface, was provided as part of the Phase II RIWP Addendum submitted to SC DHEC on October 29, 2020. This updated structure contour map is the source of the Black Mingo Clay surface that is displayed in the CSM and pulled into Cross Section B-B’. Westinghouse acknowledges that the previous version of Cross Section B-B’ was errantly included in the Phase II RIWP Addendum, which still displayed the error of showing the top of the Black Mingo Clay at 47 ft-MSL at L-1. This error has been revised, and the revised version of Cross Section B-B’ is in Enclosure 24.

4. Although the 15X VE cross sections such as F-F’ and G-G’ were directly linked to the CSM model when they were initially created and dynamically display continuous surfaces (i.e. ground surface, potentiometric surface, and top of Black Mingo Clay surface), they were not linked to, and did not reflect the manual adjustments made on the 2.5X VE by the professional geologists who installed the projected borings. This resulted in inconsistencies in the scale adjustment from the 2.5X VE to the 15X VE. Workflow changes have been implemented that allow for a consistent scaling approach. The basis for selecting the screen depths for wells W-11 and W-32 at the time of their installation is unknown. Westinghouse agrees that more information needs to be gathered from a deeper interval in the area of these wells. This data will be collected as part of the Phase II RIWP and will be included in the Phase II RI Report.

5. Data from the borings noted in the question have been incorporated into the CSM. Westinghouse provided an excel table to SC DHEC in October 2020 containing all of the locations used to generate the Structure Contour Map of the Black Mingo Clay. Some of the historical locations did not have complete boring logs, but enough information was available to interpret a depth associated with the top of the Black Mingo Clay. This table included a top of Black Mingo Clay depth for GP-1 through GP-9, GP-11 through GP-15, GP-17 through GP-20, TH-34, SB-1 through SB-6, and W-60 through W-68. Boring logs for these locations are in Enclosure 25.

6. The borings used for lithologic interpretation in the area of the Gator Pond are W-11, W-32, W-92, and W-27. Data from these borings have been used in the development of the CSM and associated Cross Section G-G'. W-27 and W-92, which are both south of the Gator Pond, indicate silt and clay present from ground surface to approximately 16 ft below ground surface (bgs). The current interpretation suggests to the extension of silt to the north toward the Gator Pond. However, the thickness and extent of the silt beneath the Gator Pond have not yet been documented.

   Low permeability zones may prevent the southern migration of COPCs and may also cause spreading in the east-west direction. However, there are no data to definitively support such a mechanism either in the unconsolidated material or in the Black Mingo Clay. Therefore, additional data are being collected as described in the Phase II RIWP (Section 3.3.4, one groundwater screening point; Section 3.5, six sediment samples; and Section 3.7, pressure transducers) to further evaluate this apparent flow path. The findings will be incorporated into the CSM and presented in the Phase II RI Report.

7. The structural geometry of the Black Mingo Clay suggests moderate radial flow from the site high point at well W-33. However, flow lines generated in the CSM from contour to contour along the southern site terrace edge, and south toward the Gator Pond, then Upper/Lower Sunset Lakes indicate a stronger southerly flow direction at a very low angle, and do not appear to support the preference of east-west spreading that is apparent in COPC plume orientation. This observation suggests that unconsolidated, heterogeneous, high/low permeability zones within the upper zone of the surficial aquifer have a stronger effect on the likelihood of plume migration rather than the structural geometry of the deeper Black Mingo Clay surface.

   There is little academic research available that would indicate if an interaction in groundwater between Tc-99 and PCE/TCE, or other chemical or organic compounds, is likely. Generally, Tc-99 is highly soluble and mobile in groundwater, is considered stable over a wide pH range, and migrates with groundwater. Some sorption of Tc-99 may occur in soils that contain high organic matter content; however, in the absence of organic material, or strong reducing agents, little sorption is expected. Therefore, there is little evidence to suggest that any chemical or organic interaction is likely to affect the potential migration of the Tc-99 plume. The data collected as part of Phase II RI (Phase II RIWP Section 3.3.4) will be useful in refining the orientation of the Tc-99 plume. Additionally, the fate and transport of Tc-99, including further evaluation of the effects on lithology as well as potential for co-contaminant transport from co-mingling of plumes will be included in the Feasibility Study (FS) following completion of the RI.

RAI 17 Item B Response

The groundwater elevation value for Well W-71 (114.74) was used in the development of the Black Mingo Aquifer Potentiometric Map. No additional contours were needed between W-50 and W-71 since the contour interval was set to 1 ft.

The distribution of wells that penetrate the Black Mingo Aquifer are sufficient to demonstrate that no COPCs have reached the Black Mingo Aquifer. The wells are positioned such that COPCs

flowing from upgradient would be detected by Well W-71. Well W-50 is positioned horizontally within the central portion of the upper and lower zones of the surficial aquifer CVOC plumes. Well W-49 is positioned horizontally within the distal end of the COPC plumes. COPCs have not been detected in samples collected from W-49, W-50, or W-71 during October 2019 or April 2020 events. Well W-3A is located to the south, within the southern flow vector of the COPC plumes, and has been sampled intermittently since its installation in 1985 to monitor for COPCs. In its sampling history since 2004, no COPCs have been detected above the MCL except for nitrate in well W-3A in March 2010. Based on evaluation of the historical dataset of 25 events spanning from 2004 to 2019, the single exceedance of nitrate above its MCL is above the upper bounds of the interquartile range based on first and third quartile calculations of the dataset. This evaluation qualifies the single nitrate occurrence as an outlier, and therefore the single detection of nitrate does not constitute a statistically significant indication of the presence of nitrate within the Black Mingo Aquifer. Therefore, the current spatial distribution of sample locations, frequency, and modes of analysis are adequate for detecting the presence of COPCs in the Black Mingo Aquifer, and no additional wells within this unit are necessary.

RAI 17 Item C Response

1. Westinghouse agrees that further investigation of the area near L-1 is appropriate in order to develop a complete picture of site geologic characteristics. This area of L-1 will be assessed further as described in the Phase II RIWP, Section 3.3.

2. This question concerning the range of thicknesses of the Black Mingo confining unit will be addressed based on the additional data being gathered as described in the Phase II RIWP, Section 3.3.

3. Other than W-49, no boring identified the presence of petrified wood. Since then, the on-site field geologists have only observed minor wood fragments (not petrified) in borings L-1 and L-6. Both borings are located south of Upper and Lower Sunset Lakes.

   The visual appearance of the Black Mingo Clay is readily observable in soil samples logged in the field by the geologists with extensive on-site experience. The field geologist that logged L-1 recognized and noted that the Black Mingo Clay was observed at a deeper depth than elsewhere on the site. Rather than disregarding the interpretation of geologists that have consistent experience visually identifying the Black Mingo Clay for an alternative hypothesis, Westinghouse is gathering additional data in this area as described in the Phase II RIWP, Section 3.3.

RAI 17 Item D Response

1. Westinghouse did consider the potential presence of PCE in the form of a dense non-aqueous phase liquid (DNAPL) as an ongoing source of chlorinated volatile organic compounds. However, the detected PCE concentrations are below 1% of PCE's maximum solubility in water and do not indicate the potential presence of DNAPL. The source of the PCE has not been identified, and this area is being investigated further, as described in Sections 3.1 and 3.3.1 of the Phase II RIWP, to further define the plume and identify any potential source areas.

2. Predicting the life expectancy of the PCE plume requires further definition of the plume's source and extent within the property. Westinghouse has eliminated its use of PCE in current operations so there is no potential for additional impacts from operations today and for the next 40 years. Additional data on both the historic source and extent of PCE are being gathered as part of the Phase II RIWP, as described in Sections 3.1 and 3.3.1. As required by the CA, a FS will be performed. Fate and transport of COPC impacts will be evaluated as part of the FS to determine appropriate remedial actions for each plume. The extensive data obtained to date pertaining to PCE indicates that the PCE concentrations exceeding maximum COPC levels will attenuate on site based on degradation processes that occur in the floodplain as demonstrated by the extremely low residual concentrations of PCE degradation products detected in groundwater there.

3. The area around and downgradient of wells W-20 and W-25 is being investigated further as described in the Phase II RIWP, Section 3.3.1 to further define the downgradient edge of the PCE plume. However, it is unlikely that the PCE plume would move appreciably south of wells W-20 or W-25 within the next renewal period based on Westinghouse's elimination of the use of PCE in its operations and the data gathered to date which suggests the PCE plume is at equilibrium with natural attenuation limiting its further growth.

RAI 18 – GENERAL WATER RESOURCES

A number of water resources are present in the vicinity of the CFFF site. The following descriptions are needed to better understand the affected environment with regard to the overall watershed and subsequent potential for environmental impacts from the proposed action. Please revise the ER to accomplish the following:

A. Identify water uses for the private wells, located in the Congaree River floodplain (west, southwest, and south) of the CFFF property, that were determined to be present in the survey that became available after the NRC's October 2019 draft EA was published.

B. Provide currently available information (e.g., from state databases or the private well survey) about the depth at which the private wells are screened and from which aquifer they withdraw water.

C. Provide the Groundwater Plume Analytics study (or studies) and Ricker Method Well Sufficiency Analysis (or analyses) performed by Earthcon Consultants, Inc. in 2018, referenced in the March 2019 ER. If the results from these studies/analyses are no longer used to evaluate constituents of potential concern (COPC) plume area, mass, or average concentration, confirm this and revise the ER to be consistent. Describe any tools or analysis methods Westinghouse is currently using to evaluate COPC plume area, mass, or average concentrations, including evaluating changes over time.

D. Based on new information available since the NRC's October 2019 draft EA related to a connection between ditches and groundwater, provide ditch bottom elevations for all site drainage ditches along with a comparison to groundwater elevations. Identify the locations at which the bottom of each ditch tends to intersect the groundwater table.

E. Provide the Soil and Materials Engineer (1982) reference cited in the March 2019 ER. Is this report the "previous hydraulic characterization" referred to in the March 2019 ER (pages 3-23)? If not, identify and provide the previous hydraulic characterization.

F. Provide the SC DHEC (2019) study of water quality on the Congaree River, cited in the March 2019 ER, or provide the correct reference if it is an error.

G. The March 2019 ER states that Westinghouse submits an annual groundwater monitoring report to SC DHEC. The ER describes an annual monitoring report that gives a detailed discussion of groundwater results for the past 5 years (2013-2018) (pages 4–9). Provide this report.

WESTINGHOUSE RESPONSE

As discussed in the introduction and executive summary of the Phase II RIWP (See Section 1), groundwater, surface water, sediment and soil collected to date show no offsite impact from CFFF operations. As discussed previously, a comprehensive sitewide environmental assessment is underway to determine the source, nature and extent of existing onsite impacts in accordance with a legally binding CA between Westinghouse and SC DHEC. Completion of the CA provides

assurance that existing impacts will be addressed, thereby reducing the risk of environmental impacts to water resources for the next 40 years of operation.

The following responses have been incorporated in Enclosure 2.

A. Results from the private well survey are discussed in the July 2020 Final Interim RI Data Summary Report (See sections 3.7 and 9.0). Well WSW-01 runs for long periods of time and is used by a private hunt club to fill a pond. Wells IWSW-01 and IWSW-02 are small diameter wells that are no longer in service and are located on the same private hunt club as well WSW-01. Potable water is supplied to this hunt club by the City of Columbia. Well WSW-03 provides potable water to another private hunt club. Wells WSW-02 and WSW-04 provide potable water to two private cabins that are not full-time residences.

B. Westinghouse was unable to locate design information for these private wells.

C. The Earthcon references in the March 2019 ER are no longer being used, and the ER pages have been revised to reflect this. Westinghouse plans to perform new plume analytics and stability evaluations for all COPC plumes following collection of data from the Phase II RIWP. The current evaluation of COPC plumes, including methodology, is described in the 2019/2020 Annual Groundwater Monitoring Report (ML20284A203 & ML20284A204).

D. The requested information is not currently available. Surveying of the middle and eastern ditches is being performed in the Phase II RI (See RIWP Phase II Section 3.9) to better understand groundwater to surface water interaction within the deeply incised portions of the ditches. Assessment of the survey data will be included in the Phase II RI Report.

E. Enclosure 16 contains the requested 1982 reference, Soil & Material Engineers, Inc., 1982, Ground-Water Hydrology of the Westinghouse Electric Corporation Plant, Richland County, South Carolina: Report No. H-8119, March 1, 1982. This report is the “previous hydraulic characterization” reference document.

F. SC DHEC redesigned its webpage to be more user-friendly and as a result some files were relocated. The new/corrected link is:
https://scdhec.gov/sites/default/files/docs/HomeAndEnvironment/Docs/Watershed/wwqa/Saluda_WWQA_2011.pdf
The information pertaining to the Congaree River Watershed is located on pages 146-155 of the linked document.

G. Enclosure 17 contains the 2018/2019 Annual Groundwater report. Note that due to the size of the files, the actual field worksheets and laboratory reports are not included. Instead, the field parameter data and laboratory analytical data are summarized in Tables 3 and 4 respectively, of the report. The 2019/2020 Annual Groundwater report has since been completed and provided to NRC through (ML20284A203 & ML20284A204).

RAI 19 – FATE AND TRANSPORT ASSESSMENT

In its comments on the NRC's 2019 draft EA, Westinghouse proposed revisions that stated, "Recent COPC [constituents of potential concern] fate and transport assessment indicate that this natural, low permeability cap limits or eliminates groundwater discharge or recharge from Mill Creek and Sunset Lakes." Provide the referenced fate and transport assessment, and any supporting information to support the conclusion reached in that assessment.

A. Westinghouse also commented that "approximately 8 feet of silt or clay" is observed in the shallow strata in most areas of "the developed portion of the site" but that thick clay (16 to 26 ft) was observed at wells W-83 and W-86. A substantial thickness of clay was observed in numerous borings and may affect the migration of constituents in groundwater (see RAI-17A). Provide discussion of the impact the clay bodies may have on the flow paths and their potential to adsorb the various constituents. Include in this discussion the role of silt/clay bodies beneath Gator Pond in affecting groundwater/surface water flows to/from the pond.

B. The March 2019 ER states that groundwater flow in the lower surficial aquifer diverges from upper flow in areas near and west of West-II lagoon where it flows in a western and slightly northwestern direction. Is this observation consistent with the current CSM? Revise the ER as appropriate.

WESTINGHOUSE RESPONSE

In its comment letter to NRC on the October 2019 Draft EA and FONSI (LTR-RAC-19-94/ML19331A105), Westinghouse suggested an edit on page 3-12, lines 4-7 to the surface water resources section. This comment regarding surface water and groundwater interaction was made based on the data collected during the Phase I RI. Westinghouse commented that it appears that surface water and groundwater interaction are not as significant within the plant site as previously thought and that continued investigation to further the site's understanding is on-going and refined with each assessment. Planned additional assessment is included in the Phase II RIWP Sections 3.7 and 3.9.

In this suggested edit, Westinghouse also added that "recent geologic assessment at the CFFF site indicates that a silty clay overbank deposit caps much of the developed area of the site, the bluff and the floodplain. Surface water and groundwater interactions at the CFFF site appear to be primarily within the stormwater ditches and the Gator Pond. Recent COPC fate and transport assessment indicate that this natural, low permeability cap limits or eliminates groundwater discharge or recharge from Mill Creek and Sunset Lakes." The statement regarding fate and transport is based on the field observations and professional judgement of professional geologists working on the RI. Historical groundwater quality in monitoring wells W-20 and W-25 indicate that Upper Sunset Lake and Lower Sunset Lake act as a hydraulic barrier to COPC migration. However, additional investigation has demonstrated that PCE daughter products have been observed in groundwater on the southern side of Upper and Lower Sunset Lakes. This finding indicates that COPCs may be migrating beneath Upper and Lower Sunset Lakes. Additional investigation will be completed as part of the Phase II RI as described in Phase II RIWP Section 3.3.1.

A. The clay strata occur in various geometries that may reduce overall transmissivity and cause small-scale directional impacts on flow paths. Clays are evaluated for lateral continuity that are considered when interpreting flow paths of COPC migration within groundwater.

   Even though Non-Aqueous-Phase Liquid (NAPL) is not present on the site, bench scale studies as shown by Colorado State University have documented that dissolved CVOCs can adsorb into and back-diffuse from clay lenses. These low permeability zones have been observed in the field at many sites and appear to serve as "indirect, low-level sources of contamination to transmissive zones due to matrix diffusion" (Sale, Tom and Newell, Charles. 2011. A Guide for Selecting Remedies for Subsurface Releases of Chlorinated Solvents. ESTCP Project ER-200530. March 2011). Matrix diffusion is a well-established concept that explains the long term, sustained dissolved CVOC concentrations in groundwater for many years after the source is removed. Westinghouse will evaluate CVOC advection, dispersion, and diffusion in the low permeability and transmissive zones as part of the FS.

   As described in Phase II RIWP Section 3.7, Westinghouse will further assess groundwater flow in and around the Gator Pond using pressure transducers in monitoring wells surrounding the Gator Pond. Additional sediment sampling in the Gator Pond as described in Phase II RIWP Section 3.5 will also allow Westinghouse to better understand the permeability of the bottom of the Gator Pond.

B. The March 2019 ER incorrectly states that groundwater flow "in the lower surficial aquifer varies in direction from northwest to west to southwest" and further mentions a "slightly northwestern direction" (Westinghouse, 2019 p. 3-23). There is no northwesterly flow component. The CSM considers this, as shown on Cross Sections H and B where groundwater is flowing west and southwest. See Enclosure 2 for ER update.

RAI 20 – SURFACE WATER DITCH SEDIMENTS

Uranium is a mildly to strongly sorbing element depending on the chemistry of the substrate. Its appearance in stream sediment could indicate previous or ongoing migration of the radionuclide through either surface water flow or seepage of contaminated groundwater. Sediment sample SED-16, taken from a surface water ditch, showed uranium above residential screening levels. In the July 2020 Final Interim Remedial Investigation Data Summary Report, Westinghouse states that the result appears to be "isolated since the downstream samples were below the screening level."

A. Provide the technical basis for the statement in the July 2020 Final Interim Remedial Investigation Data Summary Report that the SED-16 sample is "isolated."

B. The sample location (SED-16) is due west of the Sanitary Lagoon, which is unlined. Did Westinghouse evaluate whether uranium contamination from the unlined Sanitary Lagoon is leaching into the subsurface and, if so, explain how likely it is migrating into the surface water ditch? If Westinghouse plans to install additional wells west of the Sanitary Lagoon and around the location of SED-16 to determine the source of uranium, provide the installation plans.

WESTINGHOUSE RESPONSE

A. The technical basis for its description of the sample as "isolated" is that, while sediment sample location SED-16 was elevated above the Residential Use Screening Level (RUSL), sediment sample location SED-17 which is approximately 350' downstream was below the RUSL. Additionally, all other sediment samples collected from the storm water ditch (e.g. SED-13, SED-14, SED-15 upstream, and SED-18 further downstream from SED-17) were below the RUSL as shown in the Table RAI 20-1:

Table RAI 20-1 – Storm Water Ditch Sediment Sample Results

Sample ID	Analyte (pCi/g)				SOF[3]	SOF
	U-234	U-235	U-238	Tc-99	Resid.	Ind.
SED-13	1.67	0.16[1]	1.33	0.00[2]	0.24	0.01
SED-14	1.42	0.03[1]	0.39	0.02	0.14	0.00
SED-15	2.58	0.18	2.05	5.62	0.66	0.02
SED-16	14.90	0.68	2.77	4.94	**1.69**	0.04
SED-17	0.66	0.02	0.30	7.50	0.47	0.00
SED-18	0.22	0.02[1]	0.30	0.00[2]	0.04	0.00

[1] Value is estimated, result below detection limit
[2] Negative values below lab background are reported as zero
[3] Some of Fractions (SOF)

The above notwithstanding, further investigation is being conducted as stated in the Phase II RIWP Section 3.5.

B. As described in Section 3.3 of the Phase II RIWP, Westinghouse plans to install new monitoring wells in the vicinity of SED-16, in part to investigate the potential for subsurface

leaching from the Sanitary Lagoon. This well data will be used to help determine if the presence of U in the storm water ditch could be attributed to subsurface leaching.

Surface water is routinely collected and analyzed for U, Tc-99 and fluoride at six locations along the primary surface water flow path exiting the site. The results of this sampling (March 2019 ER, section 4.4.1.5 page 4-19 and figure 6.1-2) do not indicate U contamination in surface water.

RAI 21 – SUNSET LAKE SEDIMENTS

In the July 2020 Final Interim Remedial Investigation Data Summary Report, results from sampling within Sunset Lake indicate there is uranium in the sediments. Describe any future plans Westinghouse has to determine if the radiological contamination in the Sunset Lake sediments are from the 1971 lagoon rupture event and/or if it is a result of groundwater discharge into the lake.

In the CSM, the bottom of Upper Sunset Lake is lined with silt and clay lenses (Cross Section B-B'), suggesting a bathtub conceptual model. The Lower Sunset Lake was conceptualized as being underlain by a thin silt and sand lenses in a portion of the lakebed (Cross Section G-G'). There are no boreholes or wells penetrating the lake beds or direct information to verify the conceptualization. It appears, thus, that the magnitude and spatial extent of surface water and groundwater interaction between the lakes and the surficial aquifer are not clear. Provide any evidence or analyses to establish the hydrologic connection between the surface water bodies and groundwater and the potential for transport of radiological contaminants.

Provide estimates of the amount of uranium isotopes sorbed on the lakebed sediment and Mill Creek riverbed sediment, in both totals and spatial distributions within the surface water bodies inside the site boundary.

WESTINGHOUSE RESPONSE

Westinghouse continues to collect data to refine and complete the CSM to assess the source, nature and extent of impacts from historical operations at the site including any hydrologic connections between surface water bodies and groundwater as well as potential pathways for COPC migration.

No evidence currently exists to support a conclusion that a hydrologic connection between the Upper and Lower Sunset Lakes and groundwater exists such that there is a potential to transport radiological elements from one to the other. In the Phase I RI, soil borings were collected along the dike separating Upper and Lower Sunset Lakes at depths that are useful in interpreting a representation of sediments beneath the lakes. However, those borings were outside of the projection range for the CSM cross section transects of interest. The lack of evidence to the contrary, as well as review of historic operations, supports the conclusion that U in the Sunset Lake sediments is likely from the 1971 lagoon rupture event and not a result of ongoing groundwater infiltration.

The Phase II RIWP describes how Westinghouse will perform groundwater screening borings (Section 3.3), new monitoring well installations (Section 3.4) and additional sediment sampling in Upper and Lower Sunset Lakes (Section 3.5). This new data will be incorporated into an updated version of the CSM and associated cross sections in the Phase II RI Report. Further the Phase II RIWP specifies installation of additional staff gauges and pressure transducers (Section 3.7) and surveying (Section 3.9) to further the understanding of surface water and groundwater interaction.

Given the limited existing data set, it is not possible to draw any reliable or meaningful conclusions regarding the total activity of U sorbed to sediments in Sunset Lake. To date 26 surface environmental samples, and 11 subsurface samples have been collected from this 56 acre area.

Using the results of one environmental sample to estimate the total activity over an area of approximately 2 acres would require speculative assumptions.

An estimate of the amount of U will be determined after the data gaps are addressed in the RI. This information is needed for completion of the FS and update of the site's decommissioning documents.

RAI 22. MILL CREEK SEDIMENTS AND PATHWAY ASSESSMENT

Sunset Lake empties into Mill Creek, which then leaves the site and eventually enters Congaree River. Mill Creek, between the site boundary and Congaree River, is accessible to the public (private property owners).

Based on the data in the July 2020 Final Interim Remedial Investigation Data Summary Report, there is uranium contamination in the Sunset Lake sediments. The report notes that contaminated sediments were found above the Lower Sunset Lake dike and that the dikes were effective "impounding barriers." However, the area is prone to flooding, such as the October 2015 rain event. Flooding and rain events could potentially suspend those sediments by saltation, and flood water could mobilize them outside of the dikes.

A. With the discovery of radiological contamination in Sunset Lake, explain why surface water and sediment sampling data from Mill Creek should or should not be included in the effluent monitoring reports submitted to the NRC. Explain the rationale for why it is not necessary to sample surface water, sediment, fish, or other biota within Sunset Lake and Mill Creek and incorporate those data into the dose calculations to demonstrate that there is no contribution to public dose from these pathways as part of the effluent reports submitted to the NRC per 10 CFR 70.59.

B. The July 2020 Final Interim Remedial Investigation Data Summary Report also notes that "Should elevated sample results be identified in the future, or isolated incidents such as environmental releases raise the potential for the migration of contamination, additional monitoring and potentially remedial action may be necessary." In the report, traces of uranium and Tc-99 were also shown to be detected in multiple sediment samples in Mill Creek. Discuss any preventative, defense-in-depth measures, besides monitoring, taken or to be taken by Westinghouse to preclude future release of the contaminants into onsite waterways.

C. Discuss what Westinghouse programs or procedures require sediment sampling in the future and what the protocol is for determining what should be done in the case of an environmental release.

D. Explain Westinghouse's plans to estimate the risk, dose or environmental, if elevated samples are discovered in the future, in particular in Sunset Lakes and Mill Creek.

E. Explain why the surface water at the mouth of Mill Creek where it meets the Congaree River is not being monitored downstream of the CFFF site for potential releases of effluent into the Congaree River.

F. The sediment sample data presented in Table A3 of the July 2020 Final Interim Remedial Investigation Data Summary Report show that uranium activity/concentration for the "background samples" (SED-54, SED-55, and SED-56) was 2 to 10 times higher than in most of the ditch samples. Given this, provide the technical basis for describing the SED-54, -55, and -56 samples as "background samples." What sediment uranium activity/concentration (or range of activity/concentration) does Westinghouse consider to be representative of background (i.e., unaffected by site activities)? What has

Westinghouse concluded from the sediment data regarding the movement of uranium off-site?

G. Describe the remediation plans if the actions taken to control leaks are not successful.

WESTINGHOUSE RESPONSE

A. Pursuant to NRC Regulations (10 CFR 70.59) effluents released from plant operations are monitored to determine the quantities of radionuclides discharged into the environment. The cumulative radioactivity released is summarized both semi-annually, and annually, and input into models developed by the NRC and EPA to estimate the potential dose to the public. The normal liquid discharge path for the CFFF is via a discharge line to Congaree River. Any discharge to Sunset Lake and/or Mill Creek would be reported as an abnormal release.

   At this time Westinghouse has no evidence of any recent/ongoing abnormal releases i.e., any release other than the normal liquid and gaseous effluent paths addressed in the semi-annual effluent report (LTR-EHS-20-60/ML20238C062). Westinghouse believes the sediment contamination in Sunset Lake is from historical operations, not an ongoing effluent release, and is most likely the result of the lagoon failure in October of 1971 that was previously reported and evaluated (Westinghouse Nuclear Fuel Columbia Site Evaluation Report February 1975 Section 5.1.1.4 (Enclosures 26, 27, and 28). In addition to any required immediate notifications, any abnormal release discovered during the RI or from any operational occurrence would be discussed in the subsequent semi-annual report.

   All impacts from historical operations are being assessed as part of the CA. In addition, the Westinghouse Columbia NRC License, SNM-1107, Chapter 10.1.4 Environmental Sampling and Monitoring specifies the type, frequency, and location of routine environmental samples. This license provision specifies that, in addition to monitoring gaseous and liquid effluent streams, environmental surveillance shall be conducted to monitor impacts of licensed activities to the surrounding environment and to detect any abnormal releases.

B. By Westinghouse letter (G. Couture) to the NRC Document Control Desk, Westinghouse Revised SNM-1107 License Renewal Application, LTR-RAC-19-68 (ML19234A078), Westinghouse provided the license renewal application that describes the planned environmental protection program structure. Specifically, section 10.1.2 describes the liquid effluent control scheme. In it, Westinghouse describes the facility and how the process liquid waste stream radioactivity level is controlled. Specifically, liquid waste treatment facilities, with sufficient capacity and capability to enable retention, treatment, sampling, analysis, and discharge of liquid wastes in accordance with applicable regulations, are provided and maintained in proper operating condition to limit the liquid effluent discharge to as low as reasonably achievable (ALARA) levels.

   Further, Section 10.1.4 describes the Environmental Sampling and Monitoring program. Air, soil, surface water, and groundwater are sampled at various locations throughout the site to track and monitor for radioactive materials.

The effluent control schemes and the environmental sampling and monitoring program described in the license renewal application are the planned tracking and preventative measures established by Westinghouse to limit the release of COPCs into onsite waterways.

C. Section 10.1.5 of the LRA contains four commitments that in total describe how Westinghouse will address any future environmental release should it occur. In Section 10.1.5 Westinghouse commits to maintaining a CSM, entering identified environmental issues in the corrective action program, an environmental monitoring program to provide early detection of adverse trends, and a risk-based decision-making process to address environmental releases to soil and groundwater.

D. Elevated COPC concentrations identified in samples collected during the execution of the CA will be addressed in accordance with the CA. The purpose of the RI phase of the CA is to determine the source, nature and extent of environmental impacts from historical operations at the CFFF, including those within the Sunset Lakes. Upon completion and acceptance of the RI by SC DHEC, Westinghouse is required by the CA to complete a FS. Paragraph 7 of the CA requires Westinghouse to evaluate remedial alternatives for the site based upon:

a. Overall protection of human health and the environment
b. Compliance with applicable or relevant and appropriate standards
c. Long-term effectiveness and permanence
d. Reduction of toxicity, mobility or volume
e. Short-term effectiveness
f. Ability to implement
g. Cost

All COPCs must be evaluated against these criteria, and necessary remedial actions to preclude any future offsite impact will be determined in the FS and agreed to by SC DHEC via the RoD.

In addition to the requirements of the CA, all future environmental samples containing elevated COPC concentrations, including those identified within the Sunset Lakes and Mill Creek, must be addressed in accordance with the LRA commitments discussed in C above.

E. Surface water at the mouth of Mill Creek where it converges with the Congaree River is being evaluated as part of the Westinghouse environmental monitoring program. The site conducts surface water monitoring on-site and at several off-site locations along the Congaree River. Specifically, there are four surface water sampling locations along the Congaree River, referred in the current license and the LRA as “River Water” samples. Section 10.1.4 of the current license application lists the River Water sampling locations as follows:

1. Blossom Street Bridge;
2. 500 yards above the discharge;

3. 500 yards below the discharge; and
4. Mill Creek (where it converges with the Congaree River).

To clarify the surface water sample location within Mill Creek, the August 2019 license application added the words "where it converges with the Congaree River."

F. Comparison of the sediment sample transects collected from Mill Creek (e.g. SED-51, SED-52, SED-53, SED-54, SED-55, and SED-56) to those of the sediment samples collected from site storm water ditches (SED-11 and SED-12) is not appropriate. Mill Creek is covered by water continuously throughout the year, while the storm water ditches of the site are intermittently dry throughout the year. Studies have shown that natural U concentration in soil and sediment are influenced by moisture content and the nature or the sediment/stream. Westinghouse performed a background soil study that demonstrated the effect of percent moisture on U concentrations in background soil. This study is documented in the CN-MC-19-005, CFFF Soil Baseline Activity Statistical Analysis, and it concludes: "*The background activities for the summation of all U isotopes analyzed by alpha spectroscopy range from 1.16 to 4.41 pCi/g total U. The average totalized Uranium activity of background soil sample results obtained just offsite is dependent on the moisture content of the sample*."

Appendix B in the Phase I RI Data Summary Report provides the technical basis for the radiological sediment assessment completed to date. This report states:

> **Upstream Areas**
> "Sediment samples were collected at eight locations to assess background sediment quality. These sediment samples were collected at locations that are upstream of the surface water flow from the site, where only naturally occurring radioactivity is expected to be present in the sediment. Locations SED-11 and SED-12 were each collected from a storm water ditch and are representative of the naturally occurring sediment within the storm water ditches as it enters the WCFFF site boundary.
>
> Locations SED-51, SED-52, and SED-53 were collected approximately 250 ft upstream of the site Entrance Dike, and locations SED-54, SED-55, and SED-56 were collected approximately 2,400 ft upstream within the flow path of Mill Creek. These six sediment sampling locations are representative of the naturally occurring background sediment within Mill Creek, which Upper and Lower Sunset Lakes are part of."

To confirm that an appropriate background level has been established, Westinghouse will collect as part of the Phase II RI an additional sediment transect approximately 500ft upstream of the entrance to the bypass canal as described in Section 3.5 of the Phase II RIWP. These results will be reviewed and compared to the sediment sample analytical results from the previously collected background sediment transects, and the analytical results will be incorporated into the RI Phase II Report.

Based on the sediment data collected to date and described in the July 2020 Final Interim RI Data Summary Report, there is no indication of U migration offsite. This conclusion is based on analytical data from analysis of sediment samples collected along the two transects downstream from the Lower Sunset Lake Dike and from the two sediment samples collected upstream of the site stormwater ditches.

G. Remediation of any future leaks that occur during the license period (and not addressed by the CA) must be addressed in accordance with the LRA license commitments discussed in C above.

RAI 23. SOURCE AND EXTENT OF TC-99 IN GROUNDWATER

The June 2019 Final Remedial Investigation Work Plan indicated that the source of the Tc-99 contamination in the groundwater was not known. In the July 2020 Final Interim Remedial Investigation Data Summary Report, Westinghouse states that there are two data gaps remaining, one of which is the source of the Tc-99 contamination. In February 2020, SC DHEC approved a Technetium Source Investigation Work Plan, which outlined Westinghouse's plans for determining the source and extent of Tc-99 contamination onsite. In July 2020, Westinghouse summarized its investigation of potential sources of Tc-99 in the Columbia Fuel Fabrication Facility Tc-99 Source Investigation Report (ADAMS Accession No ML20259A221). Westinghouse concluded that "Tc-99 groundwater impact is historical and not the result of current operations at the facility."

Westinghouse stated that "[a]dditional assessment of the soils beneath the East Lagoon liner will be completed once the lagoon is emptied and the liner is removed as part of closure activities." The apparent purpose of this assessment is to detect potential leaks from the East Lagoon that may result in leaching of uranium and Tc-99 into the vadose zone beneath the lagoon. Furthermore, the July 2020 Final Interim Remedial Investigation Data Summary Report indicated that wells W-92 and W-93 did not contain Tc-99 above the minimum detectible concentration. However, in the same report, Tc-99 in W-77 was at 101 pCi/L, above the 50 pCi/L detection limit, as is visible in the Tc-99 concentration contour map (Figure 12 in the July 2020 Final Interim Remedial Investigation Data Summary Report).

A. Explain whether Westinghouse plans to sample the vadose zone and groundwater beneath the East Lagoon to determine if there is a connection between the Tc-99 detected in W-77 and the Tc-99 plume south of East Lagoon.

B. Explain what could be the onsite hydrogeological and geochemical conditions such that Tc-99 is still present at concentrations above residential screening levels in Gator Pond sediment, given that Tc-99 behaves like a tracer in oxic surface water (e.g., Gator Pond) and near surface groundwater.

C. Explain how the mechanism of Tc-99 retention in lagoon sediment or sludge and the relatively high concentration in Gator Pond sediment and trace of Tc-99 in Sunset Lakes sediment may relate to (1) the surface water and groundwater connection near the Gator Pond and Sunset Lakes transition area from the Terrace to the Flood Plain of the Congaree River, (2) the extent of Tc-99 plume during the 40 years relicensing period, and (3) the likelihood of off-site movement through surface and subsurface waters.

D. Explain the source of the Tc-99 discovered in Gator Pond sediment and its implication for Westinghouse's assertion that "a silty clay overbank deposit caps much of the developed area of the site, the bluff and the floodplain" and can minimize surface and groundwater interaction.

E. Finally, explain the observations at wells W-11/W-32 and their relevance to determining the vertical extent of the Tc-99 plume and its direction of spreading. The shallow well W-32 is screened at elevations between 116 and 121 ft-MSL, with a potentiometric head of 121.02 ft-MSL (on October 14, 2019) and a Tc-99 concentration of 321 pCi/L. The slightly

deeper well W-11 is screened at elevations between 110 and 113 ft-MSL, a potentiometric head of 121.74 ft-MSL and a Tc-99 concentration of 3420 pCi/L. The potentiometric head gradient suggests upward groundwater flow near the well pair. However, the surficial aquifer underlying well W-11 and before reaching the top of the Black Mingo confining unit is estimated to be between 9 and 15 ft and the strata may be sand (current CSM Version 1A) or clay as suggested by the downgradient borings. Describe any plans to further characterize the Tc-99 plume, particularly near the W-11/W-32 well pair.

WESTINGHOUSE RESPONSE

A. East Lagoon closure activities are currently underway as per the SC DHEC approved Closure Plan. Once the East Lagoon is dewatered, the sludge will be stabilized and removed. To the extent practical, an assessment of the liner will be made prior to removal to inform sampling locations. Following liner removal, soil samples will be collected and analyzed for COPCs including Tc-99. Based on the soil sample results and discussions with SC DHEC, additional actions may include sampling the vadose zone and groundwater beneath the East Lagoon.

B. While Tc-99 is generally considered highly soluble and mobile in groundwater, some sorption of Tc-99 may occur in soils that contain high organic matter content. Given the relatively stagnant nature of Gator Pond, and the amount of plant matter settled at its bottom, conditions may exist where the dissolved oxygen is low enough, and the organic content is high enough, that the Tc-99 has become immobilized in the sediment. Furthermore, the hydrostatic pressure created by the pond may be retarding the flow of groundwater in this area, further reducing the mobility of Tc-99 in sediments. Sediment samples are being collected along transects in the Gator Pond as described in in the Phase II RIWP Section 3.5, to obtain additional data in this area.

C. The mechanism controlling the surface water/groundwater connection has not been explained through evaluation of currently available data. As described in RAI 23.B, organic matter within sludge and sediment in the bottom of the ponds, and/or the hydrostatic pressure created by the pond itself likely contribute to the control of this connection from surface water to groundwater. Groundwater, sediment, and hydrostatic pressure will be investigated further as described in Phase II RIWP Section 3.3.4, 3.5, and 3.7.

   Determining the extent of the Tc-99 plume is a CA requirement of the RI currently underway. Westinghouse's assessment has already concluded that current operations are not the source of the existing Tc-99 impact. Additional assessment to fully define the plume is described in the Phase II RIWP Section 3.3.4. Under the CA a FS will be performed upon completion of the RI to include a fate and transport evaluation of COPCs to determine if any remedial actions are warranted to preclude offsite movement. Based on current data, the approximate distance to the property boundary in the direction of groundwater flow for Tc-99 above its MCL is 0.64 miles in the upper zone of the surficial aquifer.

D. Additional investigation of the Gator Pond is occurring in the Phase II RIWP Sections 3.5 and 3.7. With the understanding as described above that Westinghouse's current

operations are not the source of the existing Tc-99, Westinghouse will continue to follow the defined CERCLA process in the CA, and the complete ongoing RI. A silty clay overbank deposit covers much of the site. However, the Gator Pond is a man-made feature that was excavated into the silty clay overbank deposits. It is possible that permeable sands lie beneath the thin layer of silty clay material that has settled at the bottom of the Gator Pond. Those sands may have contributed to the migration and occurrence of Tc-99 in the Gator Pond. Groundwater, sediment, and hydrostatic pressure will be investigated further as described in Phase II RIWP Section 3.3.4, 3.5, and 3.7, and may provide further insight related to the occurrence and distribution of Tc-99 within the Gator Pond area.

E. Westinghouse agrees that observations at wells W-11 and W-32 are relevant to understand the vertical migration of impacted groundwater, and that the October 2019 data suggests a slight upward groundwater flow. Therefore, Westinghouse will install a new well in the lower zone of the surficial aquifer on top of the Black Mingo clay to be paired with wells W-11 and W-32 to further define the vertical gradient as part of the Phase II RIWP, Section 3.3.4. Groundwater field and laboratory data from this new well will be evaluated and reported in the Phase II RI Report.

RAI 24 – NEW URANIUM GROUNDWATER PLUME

Data submitted to SC DHEC in the July 2020 Final Interim Remedial Investigation Data Summary Report include groundwater sampling results collected in late 2019 from newly installed groundwater monitoring wells (e.g., W-77). Uranium concentrations found in W-77 indicate there is potentially another uranium groundwater plume. Provide an assessment of what historical or unidentified accidental release(s) the high uranium concentration may have been derived from. Include any information about potential future investigations or remediation plans. Based on the latest LRA, discuss the three wells Westinghouse proposes to monitor for this uranium plume.

A. The July 2020 Final Interim Remedial Investigation Data Summary Report indicated high concentrations of fluoride in groundwater monitoring wells W-77 and W-78, which are downgradient along the groundwater flow direction from the hydrofluoric acid (HF) spiking stations. Explain whether Westinghouse plans to further investigate the connection between the coincidental high uranium and fluoride concentrations at well W-77 and the previously discovered leaks at the HFSS and discuss the rationale. In addition, if Westinghouse will not further investigate, explain the potential extent of subsurface spreading of uranium during the proposed 40-year license renewal period.

B. Currently no existing sampling wells are located between W-77 and the chemical section of the plant buildings to determine the source and the extent of this uranium plume north of W-77. Regulations at 10 CFR 20.1501 require that the licensee survey the area, including subsurface, upon discovery of elevated uranium concentrations or quantities. What surveys (sampling, etc.) does Westinghouse plan to undertake to determine the source and delineate the extent of the contamination with respect to the high uranium concentration at well W-77?

WESTINGHOUSE RESPONSE

Based on the work completed in the Phase I RI and the updated CSM Westinghouse is routinely monitoring wells W-77, W-28, W-78, and W-93. This data will allow tracking in both the vertical (W-93) and horizontal directions (W-78 and W-28).

A. The CA between Westinghouse and SC DHEC requires Westinghouse to fully characterize the current state of the environment at the CFFF site by following the well-defined CERCLA process to identify and address past known and unknown releases. As part of this agreement Westinghouse proposed eight OU and one area of concern based on process knowledge, previous investigation results, and geological characteristics including ground water flow. The site's chemical manufacturing area footprint is one of those OUs. Based on the difficulty in assessing soil and groundwater beneath the chemical operations building as well as the difficulty in determining the impact to groundwater from a specific past event in the building, Westinghouse proposed and gained approval for a series of sentinel wells that were installed around the south and west end (in the downgradient direction of ground water flow) of the chemical building. Well W-77 is one of those sentinel wells. Given the location of this well (very close to the building and approximately 0.75 miles from the site boundary) and the absence of any U in the wells immediately downgradient (wells W-28 and W-78), that there is no current potential for offsite impact.

After completion and acceptance of the RI, Westinghouse is required by the CA to complete a FS. Paragraph 7 of the CA requires Westinghouse to evaluate remedial alternatives for the site based upon:

a. Overall protection of human health and the environment
b. Compliance with applicable or relevant and appropriate standards
c. Long-term effectiveness and permanence
d. Reduction of toxicity, mobility or volume
e. Short-term effectiveness
f. Ability to Implement
g. Cost

All COPCs including the U identified in well W-77 will be evaluated against the above criteria, and remedial actions to preclude any potential for off-site impact (if necessary) will be determined in the FS and agreed to by SC DHEC via a RoD.

B. The areas north of well W-77 up to the manufacturing building contain underground utilities and process equipment interferences, and therefore, well W-77 was the closest location that was safe for a monitoring well installation. Ongoing groundwater monitoring will continue to be performed at wells W-77, W-28, W-78, and W-93. Additional actions will be taken as required under the CA, RA-433, Environmental Remediation and in accordance with the CFFF environmental monitoring program. Any subsurface work within the OU in the Controlled Access Area (CAA) requires radiological monitoring including soil sampling per plant procedures. See the discussions above regarding the source and extent of the uranium impact.

RAI 25 – CO-CONTAMINANT TRANSPORT OF PCE AND URANIUM

In the July 2020 Final Interim Remedial Investigation Data Summary Report, Westinghouse's CSM suggests the co-location of elevated (i.e., above background) uranium levels with elevated PCE, nitrate, and fluoride plumes underneath the chemical plant areas. The comingling of plumes may result in the formation of complexes or aquifer speciation that changes the fate and transport of uranium. Uranium can also be sorbed into the non-liquid aqueous phase of VOC plumes and later become mobile after the non-aqueous phase degrades into water soluble daughter products. Near the area where the on-site ditch exits the fenced area and the stream deeply incised the soil horizons, the July 2020 Final Interim Remedial Investigation Data Summary Report also indicates PCE and TCE were detected in surface water samples and that uranium was present in sediment samples. Furthermore, the PCE plume has spread beyond the Sunset Lakes. Explain whether Westinghouse considered the effect of co-contaminant transport in its modeling, pathway analysis, and risk assessment. Additionally, did Westinghouse consider the potential for the uranium plume in the shallow aquifer at W-56 and moving toward wells W-74 and W-75 to co-evolve with the PCE plume with an enhanced spreading via the organic partitioning and aqueous phase complexation mechanisms? If Westinghouse has considered the effect of co-contaminant transport what is the likelihood the effect may accelerate the movement of uranium and to what extent? If co-contaminant transport has not been considered, does Westinghouse plan to integrate the co-contaminant transport phenomenon into its environmental monitoring and CSM development efforts, and how?

WESTINGHOUSE RESPONSE

Westinghouse is currently performing a RI to fully characterize historic site impacts. Upon completion, the RI report will provide a comprehensive evaluation of the quality of groundwater, surface water, sediment and soils. The report will also include an up to date CSM and human health/ecological risk assessment (including pathway analysis). The report shall be approved by SC DHEC, and following that approval, Westinghouse will complete a FS to evaluate remedial alternatives. An understanding of the fate and transport of COPCs, including co-contaminant transport, is a key element in the evaluation of remedial alternatives that will be performed as required in Item 7 of the CA., Westinghouse agrees that under certain conditions, co-mingled plumes may have a relationship with fate and transport of uranium. Fate and transport of uranium in groundwater, as well as other COPCs will be addressed in the FS.

Based on the current monitoring data, there is no concern regarding the potential for the co-evolution of U and PCE plumes in the area of wells W-55 and W-56 moving toward wells W-74 and W-75 because there is currently no evidence of elevated PCE/TCE, nitrate, or fluoride in wells W-55 or W-56. While trace levels of nitrate were identified above the detection level in these wells, it is not reasonably expected to observe an interaction with U until higher levels of nitrate are observed (e.g. > 10 ug/L). Elevated U was identified in wells W-55 and W-56, and based on the flow path of groundwater across the site, would be expected to be seen next in wells W-57, W-73, W-74, and W-75 if further migration of the U plume occurs. The only well where U and nitrate have been identified above their respective MCLs is in monitoring well W-77, which appears isolated at this time. Further, well W-28 is 55' downgradient, and has not displayed any results above MCL for these two COPCs. These wells, along with all of the other site monitoring wells listed in the Phase I RI Report and the new wells being installed in the Phase II RIWP are monitored on a semi-annual basis for all COPCs. In addition to the routine environmental

monitoring and CA requirements, assessment of the data is also performed on an annual basis per the Annual Groundwater Monitoring Report required by the site's NPDES permit. These assessment and monitoring requirements would identify any potential future changes in COPCs that occur.

There is no evidence at this time that co-location of U and other COPCs may accelerate the transport of U in groundwater, however should significant co-location of COPCs be identified in future routine environmental efforts, the potential for co-contaminant transport will be evaluated and the CSM will be updated accordingly.

RAI 26. PAHS, ACETONE, 2-BUTANONE

Low levels of various polycyclic aromatic hydrocarbons (PAHs) were detected at several sediment locations (e.g., SED-13, SED-14 and SED-28), but the July 2020 Final Interim Remedial Investigation Data Summary Report did not discuss these compounds. Acetone and 2-butanone were detected in a majority of sediment samples. The report stated that the "CFFF personnel are not aware of historic or current manufacturing activities using acetone or 2-butanone that could have impacted sediment at the site facility."

A. Provide additional discussion of the potential source of these compounds to include the possibilities of effluent from the incinerator and/or byproducts of bioremediation related to the previous CVOC remediation efforts. A common source for PAHs is the incomplete combustion of fuel (i.e., vehicle exhaust or fires). If Westinghouse determined the compounds occur naturally (as stated in the July 2020 Report), provide the basis for this statement.

B. In addition, comment on the suitability of the data considering laboratory QA/QC for acetone and 2-butanone in which the spike recovery was out of criteria and the concentrations for several samples exceeded the calibration range.

WESTINGHOUSE RESPONSE

A. The Phase I RI Data Summary reports the presence of some polycyclic aromatic hydrocarbons (PAHs), acetone, and 2-butanone in some sediment samples collected from Mill Creek, including Upper and Lower Sunset Lakes. None of these compounds are believed to be related to plant activities as these compounds are not a known part of any plant production process and were also detected in sediment samples collected on the plant property but upstream of plant facilities. As potential sources, the comment questions the operation of the on-site incinerator as well as byproducts of bioremediation related to previous CVOC remediation efforts. Both of these are unlikely potential sources for the reasons stated below.

   - The incinerator is small, operates at 1,600F, and discharges from a stack that is 58-feet above ground level. If present, these volatile compounds would be destroyed in the incinerator based on their low boiling points. Surviving that, the incinerator scrubber system would capture them.

   - Acetone and 2-butanone can be formed as a result of certain types of remediation techniques that generally include injection of a material into the subsurface to increase bioremediation rates. The generation of these compounds is discussed in detail in the Enclosure 18 article *Acetone and 2-Butanone Creation Associated with Biological and Chemical Remediation of Environmental Contamination*. The conditions discussed in this article do not appear to be applicable to the Westinghouse site as these types of remediation technologies have not been implemented at the site[1]. Furthermore, when generated the acetone and 2-

[1] Air sparging coupled with soil vapor extraction was implemented in the 1990s to remediate the CVOC plume. This treatment was discontinued in 2011.

butanone are typically short-lived, with half-lives ranging from 13-187 days as noted in Enclosure 18. These compounds have not been detected in groundwater at elevated concentrations. Therefore, it is unlikely that these compounds were generated by bioremediation related to previous CVOC remediation efforts.

PAHs were detected at low concentrations in five of 66 sediment samples collected and analyzed for PAHs in the Phase I RI Data Summary Report. Three of the samples containing PAHs (Sed-13, -14, and -41) were collected from Mill Creek. The remaining two samples containing PAHs were collected from wastewater pond sludge in the Sanitary Lagoon and East Lagoon, respectively. (A second sample collected from each wastewater lagoon contained no PAHs). Although PAHs can occur naturally, they are also commonly derived from anthropogenic sources such as incomplete combustion of petroleum fuels including diesel and heavier fuels. PAHs are also present in creosote (telephone poles, railroad ties, etc.) and coal tar. The result of the presence of PAHs in common materials is that PAHs are routinely detected at low concentrations in environmental samples, particularly in long developed areas, such as urban and industrial settings where there is no corresponding specific source.

The PAHs present in the pond sludge samples are likely the result of plant influents from non-specific sources. Mill Creek receives stormwater runoff from SC Highway 48 (Bluff Road) and the plant site. It also is periodically flooded by the Congaree River, and coal tar is known to have been deposited directly into the Congaree River from the historic operation (1900-1950s) of a manufactured gas plant upstream of the site near Gervais Street Bridge in Columbia[2]. Coal tar is still present in the form of pure product in Congaree River sediments near the former coal gasification plant site which serves as a potential past and ongoing source of PAHs that could be mobilized, particularly during flood events. Given the length of time the plant has been developed, the presence of state highway drainage, and the presence of an upstream PAH source, the presence of low concentrations of PAHs in some sediment and sludge samples is to be expected and is not believed to be related to a single, specific source.

B. Acetone and 2-butanone were detected in 49 and 18 of 63 Mill Creek sediment samples analyzed for VOCs, respectively. As noted above, the source of these compounds is unknown. Acetone and 2-butanone are common field and laboratory interferences. One laboratory batch including one sediment sample with reported acetone had a spike recovery slightly above the laboratory acceptance criteria. Additionally, eight samples reported acetone at estimated concentrations above the instrument calibration range. The reported concentrations in these nine samples are in the same order of magnitude as the sample results which had neither of these qualifiers. Furthermore, one of the samples with an estimated concentration (SED-37-DUP) had a duplicate sample (SED-37) with a similar concentration (360 parts per billion [ppb] vs. 350 ppb, respectively). Collectively, these data indicate that acetone is present in these samples, although the concentrations must be evaluated with the laboratory's qualification that the concentrations may be biased

[2] Details about the former MGP site can be found at https://scdhec.gov/sites/default/files/media/document/Congaree%20River%20Cleanup%20Public%20Meeting%20-%2011-17-2020.pdf

high for the eight samples flagged with an “E” qualifier. The “E” qualifier indicates that a reported concentration is an estimated value above the instrument’s calibration range.

Additional sediment sampling is underway as described in Section 3.5 of the Phase II RIWP. The data gathered from this additional assessment will be combined with the Phase I RI data to further evaluate the occurrence of acetone and 2-butanone in sediments.

RAI 27 – GROUNDWATER OFF-SITE IMPACTS

The July 2020 Final Interim Remedial Investigation Data Summary Report concludes that the groundwater contamination remains onsite. Sampling from the floodplain wells indicates that, while at low levels, chemical contaminants have migrated south of Sunset Lake. Previously, Sunset Lake was considered to act as a "sink" for groundwater contamination. Data provided in the Summary Report also indicate a migration pathway to the Western Groundwater Area of Concern and the detection of contaminants in Sunset Lake sediments.

A. Based on the newest data, has Westinghouse revised their analysis to determine if groundwater contamination could reach offsite in the next 40 years? If yes, discuss the evaluation, including explicit discussion of health and environmental impacts that could affect minority or low-income populations residing in the vicinity. If not, explain why it is not necessary.

B. With the new information in the July 2020 Final Interim Remedial Investigation Data Summary Report, discuss the monitoring well network and surface water sampling's ability to detect offsite migration of contaminants. Describe the margins, including between the contaminant plumes and the site boundary and the associated uncertainties, and the rationale thereby, that would trigger Westinghouse's remediation actions to ensure the contaminants remain onsite if such margin is reached.

C. Based on the CSM in the July 2020 Final Interim Remedial Investigation Data Summary Report, provide a high-level, narrative description of the current understanding of past and current COPC releases to the environment, predicted transport pathways for all COPC, and predicted fate and transport of existing contamination. References to the CSM figures and data should be made, as appropriate, to support the narrative description.

WESTINGHOUSE RESPONSE

Data gathered during Phase I RI indicates that CVOCs are naturally reductively dechlorinating during their migration within the surficial aquifer in the floodplain south of Sunset Lake. Further assessment is planned in the Phase II RIWP to better understand the migration of COPCs from the developed portion of the site into the floodplain. The activities described in Section 3.3.1 of the Phase II RIWP will generate this data. Also included in this section of the Phase II RIWP is additional assessment to determine if there is a preferential groundwater flow path from the plant area to the Western Groundwater area of concern.

A. As presented in the Phase I RI Data Summary Report, all data gathered and reviewed to date continues to support the conclusion that all COPCs in groundwater, above an MCL, remains onsite at least 0.56 miles from the property boundary, in the direction of groundwater flow. The CA between Westinghouse and SC DHEC follows the CERLCA process and is, in part, designed to ensure that there has been no offsite impact to groundwater from historical operations and there will be none during the proposed 40-year license renewal period. This process accounts for known impacts and any that may be discovered during the RI. Per the CA (Paragraph 6) Westinghouse is required to submit a risk assessment and an updated CSM as part of the final RI report to SC DHEC. To meet

the requirement for a risk assessment, Westinghouse will submit a human health and ecological risk evaluation (see RAI 30) as part of the final RI report.

After completion and acceptance of the RI, Westinghouse is required by the CA to complete a FS. Paragraph 7 of the CA requires Westinghouse to evaluate remedial alternatives for the site based upon:

a. Overall protection of human health and the environment
b. Compliance with applicable or relevant and appropriate standards
c. Long-term effectiveness and permanence
d. Reduction of toxicity, mobility or volume
e. Short-term effectiveness
f. Ability to implement
g. Cost

All COPCs must be evaluated against the above criteria, and necessary remedial actions to preclude any offsite impact will be determined in the FS and agreed to by SC DHCEC via the RoD.

At any time during the execution of the RI should Westinghouse determine, with SC DHEC approval, that a remediation action should be implemented prior to the RoD, the CA process allows for this flexibility. The elimination of intermodal container storage in the SSA OU and the decommissioning of the East Lagoon are two examples of actions being performed prior to the RoD. While these examples posed no current potential for offsite impact, it was determined that performing these remediation actions early was in the best interest of human health and the environment and would not impact the RI process.

The CA by design will address all impacts from historical operations in accordance with the well-established CERCLA process. Any future issues outside the CA that should arise will be identified and addressed in accordance with license commitments, described in Chapter 10 of the LRA. The CA and the new license commitments strengthen the existing environmental program and provide high assurance that there will be no offsite impact to groundwater, during the renewed license period.

B. Assessment activities outlined in the Phase I RIWP represented the first step in an iterative process to fulfill the requirements of the CA to assess the source, nature and extent of impacts from historical operations (i.e., goal of the RI). The Phase I RI closed many data gaps. The Phase II RIWP is designed to close the remaining gaps with a goal of completing the site RI. See Phase II RIWP, and Phase II RIWP Addendum (ML20322A261) for a detailed description of the work being performed. Following completion of the Phase II RI, Westinghouse will have over 100 groundwater monitoring wells in a network design based on the data gathered and informed using the CSM. Once completed, the final RI report will include an investigative CSM. The investigative CSM will be used during the FS to aid in selecting the final remedial actions and required monitoring network. Margins, uncertainties, and rationale will be provided in the FS. In addition to the requirements outlined in the CA, Westinghouse has implemented an environmental data management procedure, that requires assessment to detect potential trends within the CFFF environmental monitoring program and a risk-based remediation process (RA-433)

that describes both trigger points and actions required for environmental issues involving soil and groundwater. These programmatic procedures coupled with the CSM and extensive environmental monitoring data are designed to prevent off-site impacts.

The well network and its relation to COPC plumes are show in Figures 1-12 of Phase II RIWP.

C. As stated in B. above, Westinghouse is working to complete a RI to assess the source, nature, and extent of impacts from historical operations. There are no known ongoing active releases from current operations. RI data gathered and reviewed to date indicates no offsite impacts nor a need to conduct detailed fate and transport evaluations until required as a key input to the FS. Specifically, PCE (and its daughter products), uranium, Tc-99, fluoride, and nitrate have been identified above MCLs on site in groundwater within the upper and lower zones of the surficial aquifer. Soil, groundwater, sediment, and surface water sampling and analysis have been used to help define the migration pathways of COPCs from historical operations. Westinghouse is completing the RI to fully delineate the groundwater plumes and evaluate the potential for any remaining COPS sources. The current pictorial description for all plumes can be found in Figures 1-12 of Phase II RIWP, and additional information is provided in RAI 17. Summaries of the current understanding of all COPCs can be found in Phase I RI Data Summary Report sections 3-5. A description of the work being performed to close the existing data gaps can be found in Phase II RIWP and LTR-RAC-20-83, Phase II RIWP Addendum (ML20322A261).

RAI 28 – COST BENEFIT ANALYSIS

The NRC is preparing an EIS and per 10 CFR 51.71(d), the EIS "will include a consideration of the economic, technical, and other benefits and costs of the proposed action and alternatives." Provide the following economic values for the proposed license renewal period:

A. Any construction, refurbishment, or other expected capital costs by year.

B. Annual operations and maintenance costs including fuel feedstock costs.

C. Any expected mitigation costs or other compliance fees.

D. Annual payments in lieu of taxes, property tax payments, or other tax-like payments to local jurisdictions or the state.

E. Expected aggregate annual value of the fabricated fuel.

F. Other known economic costs or benefits not listed.

G. This information is requested for each alternative considered.

H. Provide the distribution of the current CFFF workforce summarized by county of residence

WESTINGHOUSE RESPONSE

A. Westinghouse sets an annual budget for capital expenditures for the CFFF and forecasts the budget for approximately 5 years in the future. Table RAI 28-1 documents the estimated capital expenditures (expressed in constant 2020 dollars) for the CFFF for 2020 (based on actual costs for the first 3 quarters and an estimate for the 4th quarter) through 2025.

Table RAI 28-1- Expected Capital Costs	
Calendar Year (CY)	**Cost ($M)**
2020	[ ]d
2021	
2022	
2023	
2024	
2025	

Based on this data and assuming current conditions continue, it can be projected that expected capital costs for CFFF would be approximately ([ ]d) over the lifetime of the 40-year renewed license.

B. Table RAI 28-2 documents the estimated expected manufacturing costs (expressed in constant 2020 dollars) for the CFFF for 2020 (based on actual costs for the first 3 quarters and an estimate for 4th quarter) through 2025. These totals include all manufacturing costs

incurred by the CFFF. Fuel feedstock costs are typically incurred by the CFFF's customers.

Table RAI 28-2 - Expected Manufacturing Costs	
CY	Cost ($M)
2020	[ ]d
2021	
2022	
2023	
2024	
2025	

Similar manufacturing costs are expected over the lifetime of the 40-year renewed license.

C. Compliance fees, comprised of regulatory and business fees, for the CFFF total approximately $3.084M annually. The details of these estimates are described below. Additionally, the CFFF has performed, and continues to perform, activities on site to mitigate environmental impacts of operations. Cost estimates of several recent and ongoing activities are included in this response. Note, that these mitigation costs are provided on a project basis, which often spans over several years.

Based on past NRC invoices (both Part 170 direct-billed fees and Part 171 annual fees), and planning for future licensing actions, Westinghouse estimates costs totaling approximately $3M annually for all NRC fees for the CFFF. Assuming there are no significant changes in NRC fees (i.e., large increases in the annual fee and/or hourly professional rate), it is expected that the CFFF will continue to spend roughly $3M annually in NRC fees over the course of the proposed 40 year renewed license.

The CFFF holds other licenses and permits, which have annual fees associated with them. For CY2019, the CFFF paid compliance fees to the following agencies: SC DHEC, SC Labor Licensing Regulation (LLR), Tennessee Department of Environment and Conservation, and Utah Department of Environmental Quality. These fees totaled $11k for the year. It is expected that the CFFF will continue to have similar non-NRC compliance fees over the course of the proposed 40-year renewed license.

Additionally, the CFFF pays an annual Richland County Business License fee. For CY2020, this fee was $73k.

There are additional mitigation costs associated with the activities performed at the CFFF. The following are estimates of some environmental remediation-related mitigation costs, including both already incurrent costs and estimates for future costs to complete each activity (the total cost, whether already incurred or expected in the future, is listed for each activity): CA compliance ([ ]d), shipping and disposal of sealand containers ([ ]d), and the elimination and disposal of PCE ([ ]d). It is expected that the CFFF will continue to have some level of spending on additional mitigation activities in the future. The CSM will be used to analyze and evaluate the site and determine what remediation and mitigation activities will need to be performed on an ongoing basis.

Finally, as required by NRC regulation, the CFFF is required to maintain a decommissioning trust fund. The fund is required to be sufficient to decommission the site, based on a cost estimate updated and submitted to NRC on a triennial basis. The current CFFF Decommissioning Cost Estimate (DCE) was submitted to NRC in July 2019. The CFFF currently pays approximately $880k annually for the financial instruments that ensure adequate decommissioning funding. This number is likely to change on a triennial basis due to changes in the DCE.

D. For CY2019, the CFFF paid $3.4M in property taxes and fees in lieu of taxes. It is assumed that this is an appropriate estimate for continued annual payments over the course of the 40-year renewed license.

E. Annually, the CFFF has the capacity to produce approximately 1,600 MTU of fuel, which corresponds to 1,125 x 10^9 KW-hr/yr of energy produced in the U.S. Table RAI 28-3 documents the expected aggregate value of fabricated fuel (expressed in constant 2020 dollars) for the CFFF for 2020 (based on actual costs for the first 3 quarters and an estimate for the 4th quarter) through 2025.

Table RAI 28-3 - Expected Aggregate Value of Fabricated Fuel

CY	Cost ($M)
2020	[ ]d
2021	
2022	
2023	
2024	
2025	

Based on these data, it is estimated that the expected aggregate annual value of the fabricated fuel will be approximately ([ ]d) over the lifetime of the 40-year renewed license.

F. The primary benefit of the CFFF is the fabrication of uranium fuel for commercial nuclear power plants in the U.S. Approximately 10% of electricity produced in the U.S. comes from fuel produced at the CFFF. This is a vital benefit not only for the U.S., but also globally, as the fuel produced at the CFFF supports clean, carbon-free energy production with minimal environmental impacts from the operation of existing commercial nuclear power plants. When looking at carbon-free energy goals, nuclear is a valuable part of the future energy mix, as stated in a 2018 study performed by the Massachusetts Institute of Technology (MIT)[3]:

> In the 21st century the world faces the new challenge of drastically reducing emissions of greenhouse gases while simultaneously expanding energy access and economic opportunity to billions of people. We examined this challenge in the electricity sector, which has been widely identified as an early candidate for deep

[3] "The Future of Nuclear Energy in a Carbon-Constrained World," http://energy.mit.edu/wp-content/uploads/2018/09/The-Future-of-Nuclear-Energy-in-a-Carbon-Constrained-World.pdf

decarbonization. In most regions, serving projected load in 2050 while simultaneously reducing emissions will require a mix of electrical generation assets that is different from the current system. While a variety of low- or zero-carbon technologies can be employed in various combinations, the analysis shows the potential contribution nuclear can make as a dispatchable low-carbon technology. Without that contribution, the cost of achieving deep decarbonization targets increases significantly. The least-cost portfolios include an important share for nuclear, the magnitude of which significantly grows as the cost of nuclear drops.

From the World Nuclear Association, Figure RAI 28-1 compares the average life-cycle carbon dioxide-equivalent emissions for many different energy sources. Based on this figure, in comparison to the alternatives, most of which emit substantial greenhouse gases and other pollutants, continuing production of carbon-free energy is environmentally beneficial for many reasons, including from a human health and climate change perspective. Especially when looking at nuclear as a vital baseload energy source, many of the other high capacity sources produce the most carbon dioxide emissions. The proposed action of renewing the CFFF license for an additional 40-year term will therefore aid in achieving clean energy goals.

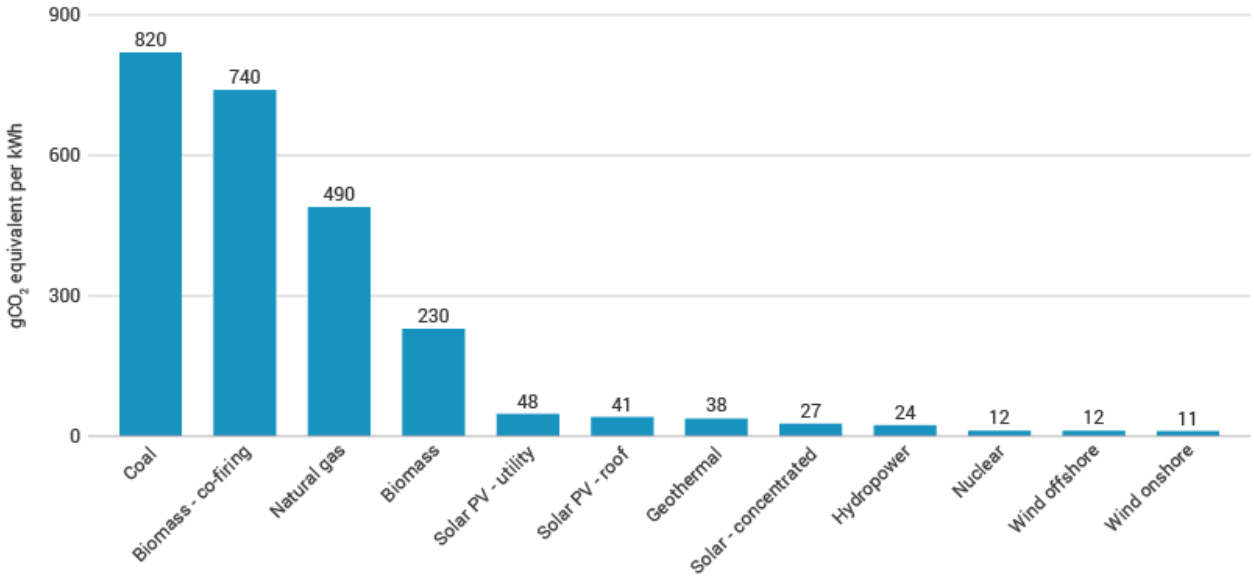

Figure RAI 28-1[4]- Average life-cycle carbon dioxide-equivalent emissions for different electricity generators

Moreover, the existence and preservation of the U.S. commercial nuclear fleet, fuel cycle, and the overall stability of the commercial nuclear industry provide important strategic benefits to the U.S. economy and national security. As stated by the U.S. Department of

[4] World Nuclear Association, "How can nuclear combat climate change?" https://www.world-nuclear.org/nuclear-essentials/how-can-nuclear-combat-climate-change.aspx

Energy (DOE)[5], stability in the U.S. energy infrastructure leads to stability in the U.S. economy, as well as supports the health and welfare of the American people. In addition, the U.S. Department of Defense (DoD) relies on a reliable and resilient power grid to allow the nation to defend itself. The Nuclear Energy Institute (NEI)[6] also states that nuclear power plants are among the most robust elements of U.S. critical infrastructure, and the plants' ability to withstand extreme weather and generate electricity 24/7 helps provide a resilient grid, which supports national security. Additionally, because nuclear plants typically have up to two year of fuel stored securely on-site, they are less likely to be impacted by fuel supply disruptions compared to other electricity generators. Therefore, both U.S. national security interests and the health and welfare of the American people benefit from the continued operation of the commercial nuclear power industry. The value of these significant benefits is difficult to precisely quantify.

The CFFF provides a large benefit to the local economy. The CFFF has roughly 1100 employees (see Table RAI 28-4 in subpart H for a breakdown by county). Through continued operation of the facility and continued employment of these individuals, the local economy will benefit from both those employees' tax dollars and disposable income supporting the community. These benefits will provide support of local schools, parks, public services, restaurants, shops, other businesses, etc.

The CFFF also routinely provides economic benefits through a broad range of community service initiatives. These have included donation drives, sponsorship of local events, and support of local schools. A few recent examples are below. CFFF intends to continue to emphasize these types of activities during the period of the renewed license.

- During the current COVID-19 public health emergency (PHE), CFFF has donated various supplies to local schools, to support remote learning capabilities.
- Also during the PHE, the CFFF Emergency Fire Brigade has supported local healthcare workers, through supplying lunches and sending thank you cards for their work.
- CFFF is a participant in the South Caroline Wildlife and Industry Together (W.A.I.T.) program. Through this program, the CFFF has supported and personnel have participated in community beautification projects such as Congaree River and Adopt-A-Highway clean-up events.
- CFFF was a corporate sponsor for a local walk for education, which focused on increasing awareness of opportunities available in college among the community.
- Employees have participated in Science, Technology, Engineering, and Mathematics (STEM) and Fire Safety events at local schools.
- Westinghouse has an annual summer internship program, which hires interns for the CFFF from local colleges.

G. If the alternative option (i.e., not renewing the CFFF's special nuclear materials license) is selected, the costs and benefits documented in this response will be applicable only

[5] U.S. DOE report, "Restoring America's Competitive Nuclear Energy Advantage," https://www.energy.gov/sites/prod/files/2020/04/f74/Restoring%20America%27s%20Competitive%20Nuclear%20Advantage-Blue%20version%5B1%5D.pdf.
[6] https://www.nei.org/advantages/national-security

through the end of the current license (September 30, 2027). The costs after the current license expires would be for decommissioning the facility, as documented in the CFFF's most recent decommissioning cost estimate (submitted to NRC in July 2019). The benefits related to support of commercial nuclear power generation and providing clean energy would no longer be realized, as the facility would no longer be producing fuel. There would still be some benefits related to local employment and community service initiatives through the decommissioning phase, but these would be greatly diminished as the workforce would be significantly decreased once the facility stops manufacturing fuel.

H. Table RAI 28-4 documents the number of CFFF employees by county and the percentage of the CFFF work force that resides in each local county, as of November 2, 2020.

Table RAI 28- 4- CFFF Employees by County

County	Count	%
Aiken	15	1.3%
Anderson	2	0.2%
Bamberg	4	0.4%
Beaufort	1	0.1%
Berkeley	1	0.1%
Calhoun	12	1.1%
Charleston	1	0.1%
Chester	3	0.3%
Chesterfield	1	0.1%
Clarendon	3	0.3%
Dorchester	3	0.3%
Fairfield	16	1.4%
Greenville	4	0.4%
Greenwood	1	0.1%
Kershaw	92	8.1%
Lancaster	4	0.4%
Laurens	1	0.1%
Lexington	369	32.4%
Newberry	9	0.8%
Orangeburg	39	3.4%
Richland	489	43.0%
Spartanburg	1	0.1%
Sumter	23	2.0%
York	2	0.2%
Non-SC	42	3.7%
TOTAL	1,138	100%

RAI 29 – ENVIRONMENTAL JUSTICE

Provide a discussion of any CFFF-specific environmental justice community outreach activities undertaken to engage the local minority and low-income populations in the vicinity and to communicate about current environmental sampling, remediation activities, or this licensing action.

WESTINGHOUSE RESPONSE

CFFF engages in environmental justice community outreach activities on several fronts including the Lower Richland Citizen Advisory Council (LRCAC), the Community Engagement Board (CEB), the National Association for the Advancement of Colored People (NAACP), the CFFF Community Website, and the CFFF Community Monthly Newsletter.

Lower Richland Citizen Advisory Council (LRCAC)

Since late 2018 CFFF routinely meets with the LRCAC Chairs. The LRCAC is a diverse cross-section of Lower Richland County residents. *The mission of the Lower Richland Citizen Advisory Committee is to promote a safe environment in the Lower Richland community. Its goal is to establish a reasonable relationship with Westinghouse and other entities in an effort to pave the way for better transparency and communication between the companies and the surrounding communities regarding possible contamination of soil, air and/or water when concerning issues arise.*

Initially, CFFF met with LRCAC leaders to share updates, remediation, and safety actions occurring at the site. Now, the Chairs sit on CFFF's Community Engagement Board with several other community leaders across the county and state and receive frequent communication via phone, email, and newsletter updates.

Community Engagement Board (CEB)

The CEB was established in Summer 2020 by CFFF to provide a setting for key community leaders to understand the operations, environmental and regulatory procedures associated with the site. Through the CEB, members share their concerns and goals to resolve gaps in outreach and engagement thereby driving alignment that will facilitate, long-standing partnerships and collective advancement. CFFF is committed to being actively involved and supporting community-based efforts that maximize the shared impact of local services, stakeholders, and state/municipal agencies that increase opportunities and improve local communities' quality of life. The CEB meets at least quarterly and more often as needed. Members are given the opportunity to suggest topics and review reports/materials before meetings. Matters discussed during recent meetings include:

The CFFF Manufacturing Strategy and Environmental Performance and the site’s continuous Improvement Culture.

- CA
- Risk Reduction Activities
- Intent to comprehensively address all legacy issues

- Progress reports/routine meetings with regulatory bodies (SC DHEC, NRC, EPA)

National Association for the Advancement of Colored People (NAACP)

CFFF has met with representatives from local and state chapters of the NAACP to discuss the association's concerns with CFFF operations, environment, transparency, and community engagement. CFFF has provided an overview of the plant's current state and transformation progress and is working with the association to determine ways and opportunities to be better community partners. Currently, both the State Chapter and Lower Richland NAACP Presidents sit on the CEB.

CFFF Community Website

The CFFF Community Website was created and maintained by CFFF to provide up-to-date information about CFFF operations and engagement. The website significantly reduces the burden on the public by establishing a central repository of public information that would normally require interfacing with a number of public agencies. For example, it houses a library of public meeting announcements, media statements, philanthropic initiatives, newsletters and reports from SC DHEC and NRC regarding current environmental sampling, remediation activities, licensing action.
https://www.westinghousenuclear.com/about/independent-pages/columbia-community

CFFF Community Monthly Newsletter

CFFF Community Monthly Newsletter: CFFF releases a monthly community newsletter with updates on site activities and initiatives, providing additional transparency for local community members and stakeholders. The e-newsletter is distributed via email to CEB members and local stakeholders. The newsletter is available for download in PDF on the CFFF Community Website.
https://www.westinghousenuclear.com/about/independent-pages/columbia-community/community-newsletters

RAI 30 – EXPOSURE PATHWAYS

Westinghouse commented on the NRC's draft EA that "Migration pathways have been assessed in an updated risk assessment." Provide the updated risk assessment, including the exposure pathways. Provide any supporting information from the CSM and updated risk assessment. Describe the plan to complete a human health and ecological risk assessment upon completion of the remedial investigation activities.

WESTINGHOUSE RESPONSE

Westinghouse completed a Preliminary Human Health Risk Assessment in support of the March 2019 ER. This preliminary risk assessment, including exposure pathways is included in Enclosure 19. As required by the CA paragraph 6, a final report will be submitted to SC DHEC upon completion of the RI and that will include a human health and ecological risk evaluation supported by the CSM.

RAI 31 – AIR PERMIT

Westinghouse's air permit renewal application, submitted to SC DHEC in May 2019, contains emissions and dispersion modeling results. On September 26, 2019, SC DHEC conducted a public meeting to discuss the proposed renewal of the air quality was discussed and gathered public comments through October 2019. Provide updated information relevant to this renewal permit application:

A. The emission calculations were provided in the permit attachment "Air Quality Construction Permit Application" performed by AECOM. The NOX emissions are much higher in this permit (45 tons/year) compared to the reported value of 28.47 tons/year in the March 2019 ER. Please provide the updated emissions data and calculations including the emission factors used.

B. Table 4 with emission calculations for scrubbers is missing in this permit application. Please provide these emissions calculations including those related to the S-958 Scrubber.

C. It is unclear from the tables in Sheets 1 through 4 of the AECOM attachment to the Westinghouse air permit renewal application how the activity data (8,760 hr/yr) were distributed between natural gas and fuel oil combustion in the two boilers (4.5 MMBTU/hr capacity). Please provide the activity data or frequency of use for natural gas and fuel oil for these two boilers that were used to estimate the composite emissions.

WESTINGHOUSE RESPONSE

A. In June 2018, Westinghouse submitted an Air Quality Construction Permit Application (prepared by AECOM) for two new boilers, each rated at 24.5 MMBTU/hr. The new boilers are fired with natural gas as primary fuel and fuel oil as the backup fuel. The two new boilers replace three older boilers also fired with natural gas/fuel oil that now have been decommissioned and removed from service.

   In the June 2018 Air Quality Construction Permit Application prepared by AECOM, on page 1 of 7 of SC DHEC Form 2569, annual fuel combustion NOx emissions after the new boiler project are shown as 27.99 tons per year (tpy). This value is very close to the annual fuel combustion NOx emission value reported in the March 2019 ER (28.47 tpy). Slight differences in the fuel combustion NOx emission values can be attributed to rounding of emissions factors and calculations.

   For the June 2018 construction permit application, AECOM calculated fuel combustion NOx emissions at 27.99 tpy as follows:

   11.75 tpy New Boiler #1 + 11.75 tpy New Boiler #2 + (0.24 tpy x 5) 5 Calciners + 3.29 tpy Incinerator = 27.99 tpy

   Based on discussions with SC DHEC, Westinghouse's May 2019 revised air permit renewal application includes documentation on process NOx emissions from the inherent

S-1030 and S-958 scrubbers. For the May 2019 permit renewal application, the calculation for total NOx emissions at 45 tpy is as follows:

11.75 tpy New Boiler #1 + 11.75 tpy New Boiler #2 + (0.24 tpy x 5) 5 Calciners + 3.29 tpy Incinerator + 1.58 tpy S-1030 + 15.42 tpy S-958 = 44.99 tpy (rounded to 45 tpy)

B. Table 4 from the May 2019 air permit renewal application is included in Enclosure 20. It includes emission calculations for the scrubbers including the S-958 scrubber. Please note that Table 4 includes a listing for S-4025, which was the scrubber associated with plating operations. Plating operations and the use of S-4025 ceased in 2020. As a result, there are no longer any emissions from S-4025. SC DHEC has been notified of the change. In addition, a revised permit application will be prepared and formally submitted in 2021 to reflect the elimination of PCE and decommissioning of the plating room.

C. As noted in Response A. above, in June 2018 AECOM prepared an Air Quality Construction Permit Application for two new boilers rated at 24.5 MMBTU/hr each. The new boilers combust natural gas as primary fuel and fuel oil as backup fuel.

To identify worst-case composite annual emissions for permitting purposes, AECOM identified tpy emissions for each pollutant assuming the new boilers operate 8,760 hours per year on natural gas. AECOM then identified tpy emissions for each pollutant assuming the new boilers operate 8,760 hours per year on fuel oil. The worst-case tpy emissions (either natural gas or fuel oil) for each pollutant were selected for the purposes of identifying “composite emissions” for the air construction permitting application.

RAI 32. METEOROLOGY

Please provide the hourly meteorological data that were used to create the joint frequency distribution meteorological data set referenced in Westinghouse's March 2019 ER, which will support NRC staff's analyses in the EIS related to air emissions and dispersion modeling results and public and occupational health (see RAI 31).

WESTINGHOUSE RESPONSE

The meteorological data described in the March 2019 ER is taken from NUREG-1118. NUREG-1118 χ/Q data was developed using the data and methods described in Westinghouse Nuclear Fuel Site Evaluation Report March 1, 1975 Appendix 2.E (Enclosure 21).

The χ/Q data listed in the March 2019 ER is used for accident consequence analysis in the Integrated Safety Analysis. These dispersion coefficients are not used by Westinghouse for non-radiological air modeling. The meteorological data used for discussed revised air permit renewal application in RAI 31 is prescribed by SC DHEC and can be found at https://scdhec.gov/environment/air-quality/air-dispersion-modeling-data#nwsmet [scdhec.gov]

Westinghouse uses the EPA COMPLY Code to calculate airborne dose in the semiannual effluent report. Westinghouse uses the code's default meteorological data to calculate dose and does not use site specific data. See LTR-EHS-20-60 (ML20238C062) for additional details on methods and results for the most recent semi-annual effluent report.