Fort Calhoun License Termination Plan Review

Request for Additional Information for the Technical Evaluation

Chapter 2 - Site Characterization

TE2-1: Background for characterization data

Comment: Provide the background data for the samples/measurements performed in the site characterization or justify why background was not needed for this assessment.

Basis: Per NUREG-1700, Revision 2, Section 2.2.1, the site characterization should include "the background levels used during scoping or characterization surveys." This does not appear to be addressed other than in tables of data for direct measurement or scanning. Utilizing no background or ambient background for structural measurements appears adequately justified in section 5.2.4 of the LTP but nothing appears to discuss background for open land areas, subsurface soil, or why it was not needed. The licensee should describe the background/reference materials used to evaluate the characterization data and provide data, as appropriate. This information is needed for staff to determine if the licensee is in adequate compliance with 10 CFR 50.82(a)(9)(ii) that the LTP includes a site characterization.

Request: Provide the background data utilized to support the characterization surveys or discuss why such was not needed.

TE2-2: Sr-90 as a soil ROC in the Deconstruction Area

Comment: Please provide justification why Sr-90 was not considered as a Radionuclide of Concern (ROC) in Deconstruction Area (DA) soil since it had been identified in monitoring wells.

Basis: Section 2.4.2 of the LTP discusses Sr-90 and H-3 in groundwater. In the 1st paragraph of this section, it states that "the episodic but low Sr-90 concentrations reported in the shallow monitoring wells within the DA suggest that a small Sr-90 release has occurred at the site." Given this statement, why isn't Sr-90 a ROC in soil in the DA? In addition, Sr-90 is a ROC in the structures and piping being removed so there is a significant likelihood of cross contamination. This information is needed for staff to determine if the licensee is in adequate compliance with 10 CFR 50.82(a)(9)(ii) that the LTP includes a site characterization.

Request: Evaluate Sr-90 as a ROC for soil in the DA portion of the site based on previous release/leak involving this radionuclide and risk of cross contamination or justify why it merits only being considered an insignificant contributor.

TE2-3: Estimation of Sr-90 for Existing Groundwater Dose

Comment: Data for existing Sr-90 groundwater contamination does not support use of existing monitoring well data locations as the sole basis for estimating the maximum groundwater Sr-90 at the site to be used for the Final Status Survey (FSS) dose calculation.

Basis: LTP Section 2.4.2 summarized Sr-90 results for the groundwater during the period 2011 through 2018 as sporadic and low. However, staff review of Sr-90 data in FCS Annual Radiological Effluent Release Reports (ARERR) for 2007 through 2021 reveals a persistent, but sporadic, presence at different wells in and surrounding the DA. The continued presence of Sr-90 residual radioactivity in the groundwater indicates a persistent source that has not shown signs of abating. Staff identified 65 Sr-90 results above the lower limit of detection (LLD) for the period 2007 through 2021. Two elevated Sr-90 results were also found in deep wells. Staff also assessed the Sr-90 results for the period 2011 through 2018, which was the period used for the summary provided in LTP Section 2.4.2 and found 36 results above LLD. Assessment of these Sr-90 values do not support a decreasing trend in Sr-90 over time. In addition, staff also notes that uncertainty and LLD were not provided with the ARERR Table III.9 groundwater results. The uncertainty may reflect on estimates of maximum Sr-90 activity needed for the FSS dose calculation.

There are several factors that influence the estimate of maximum Sr-90 groundwater concentration at the site. The source area for the Sr-90 contamination within the protected area is not known. Modeling to narrow possible source areas will be complex due to historical groundwater gradients influenced by onsite well pumping, flux of groundwater into the Turbine Building sump, and significant river stage changes occurring during water level measurement. Staff assessment of the historical groundwater data indicated gradients approximately equally divided between plant-west (inland), mounded under the site, and plant-east (towards the river). There is a broad area in the footprint of the plant and towards the river that is not covered by monitoring wells, i.e., the important zone between wells MW-7 and MW-6. Also, the possibility of a source area affected by rising and falling river stage cannot be discounted based on available hydrologic data and sporadic Sr-90 results. Full evaluation of Sr-90 in groundwater is needed to complete the site characterization required by 10 CFR 50.82(a)(9)(ii).

Request: Provide an estimate of the maximum Sr-90 in the groundwater for the entire site that includes the area below the structures within the DA where the maximum contamination is expected to occur.

TE2-4: Groundwater Monitoring Network

Comment: Given the historical distribution of Sr-90 results from groundwater samples, do the remaining wells serve either function of detection or estimation of residual radioactivity for FSS? This information is needed for staff to determine if the licensee is in adequate compliance with 10 CFR 50.82(a)(9)(ii) that the LTP includes a site characterization.

Basis: Several documents provide maps of well locations. The LTP cites two supporting documents, Haley & Aldrich (2021) and the Historical Site Assessment (2020), that contain maps of the well locations. The following documents were used to tally the monitoring well locations:

- LTP Revision 0 (ADAMS accession number ML21271A144) Figure 2-6
- Haley & Aldrich (2021, Rev 5), earlier version cited in the LTP (ADAMS accession number ML22034A594), including citation as the source of LTP Figures 6-5 and 6-6

- Historical Site Assessment (2020) (ADAMS accession number ML21271A609), cited in LTP; includes current and historical wells
- 2021 Annual Radiological Effluent Release Report (ARERR) (ADAMS accession number ML22110A216)

Staff presumes that LTP Figure 2-6 includes the wells that will be used until license termination. However, during the NRC site visit of July 13, 2022, staff learned that several wells were recently or would soon to be abandoned due to proximity to dismantlement activities. Based on the site visit and comparisons of the site to the documents above, the remaining question is whether the MW-1A/B well pair will be or was abandoned. Wells abandoned in 2021 and 2022 include MW-2A/B, MW-4A, MW-7, MW-8, MW-9, MW-10, MW-11. Of the ten wells with historical Sr-90 results above lower limit of detection, three were abandoned in recent years: MW-2A, MW-2B, and MW-9.) In addition, according to the 2021 ARERR, monitoring wells MW-15 and MW-16 replaced abandoned wells MW-7 and MW-4A, respectively.

For the bank storage conceptual site model and its implementation in dose modeling, it is not clear how the monitoring network serves its purpose of detection and support for estimation of maximum existing groundwater contamination. An evaluation of the adequacy of a monitoring well network necessarily includes the conceptual site model and historical residual radioactivity. The assessment of the monitoring network should include that historical Sr-90 results for the groundwater have occurred on all sides of the site. This information is needed for staff to determine if the licensee is in adequate compliance with 10 CFR 50.82(a)(9)(ii) that the LTP includes a site characterization.

<u>Request:</u> Please identify which wells of the groundwater monitoring network will continue to be sampled and monitored during decommissioning and until license termination. Describe how that network serves its detection purpose and supports estimation of existing contamination for final status survey, and how they may reflect potential Sr-90 or other residual radioactivity migrating from the DA given the historical distribution. Please also submit the Terracon (2022) Hydrogeologic Assessment and Conceptual Site Model Report, as discussed during the NRC's site visit in July 2022, as information needed by NRC to support evaluation of the LTP.

TE2-5: Broken Drain Lines Below Turbine Building

<u>Comment</u>: Information is needed for the historical event below the Turbine Building where broken drain lines led to cavities caused by soil erosion and groundwater entry to the building basement.

<u>Basis</u>: This information is needed for staff to determine if the licensee is in adequate compliance with 10 CFR 50.82(a)(9)(ii) that the LTP includes a site characterization. Staff noted in the 2012 "Flood Recovery Action Plan 4.1" (ADAMS accession number ML21272A219) that broken drain lines and cavities in the sediments below the Turbine Building were first identified in the 1990s. There was concern in the Flood Report that the cavities in the sediments below the building floor may have been enlarged during the 2011 flood event leading to structural concerns for the building. Groundwater flow and sediment transport occurred into the Turbine building basement with the broken drain lines as the entry pathway. Whereas the Flood Report discussed structural and geotechnical aspects important for the flood recovery planning, it did not provide information on other potential consequences of broken drain lines. Staff is concerned that the broken lines have not been sealed or plugged, liquids draining along the lines to the sump may have contained residual radioactivity, and those liquids may have been released to the unconsolidated sediments below the Turbine Building leading subsurface contamination of sediments and groundwater.

Request: To support the NRC staff's understanding of the characterization of the Turbine Building subsurface, please provide a basis for why no subsurface soil contamination exists below the Turbine Building due to the broken drain lines. This basis should include (i) the function of the drain lines, (ii) when and how the drains were sealed or grouted, (iii) description of liquids carried in the broken drain lines and any summary sampling or characterization of those liquids in the lines or destination sump, (iv) continuing characterization surveys (including locations) of drain lines and sampling of sediments near the broken drain lines, and (v) where the characterization will be documented (e.g., continuing characterization report and FSS release report) with reference to the broken drain lines.

Chapter 5 – Final Status Survey Plan

TE2-6: RAs and RASSs in Excavations

Comment: Provide clarification as to what a Radiological Assessment (RA) or Remedial Action Support Survey (RASS) will consist of for excavations and how it will be applied and documented in FSS reports.

Basis: 10 CFR 50.82(a)(9)(ii)(D) states that a license termination plan will contain a detailed final status survey plan. In Section 5.1.4.1 of the LTP, the licensee states that "In areas where remediation is required, a remedial action support survey (RASS) will be performed to confirm that remediation was successful prior to initiating FSS activities. Radiological assessments (RA) or turnover surveys for areas not requiring remediation, may be performed to verify the area is suitable for FSS. The results of RASS and RA will be documented in the applicable FSS release records." Similarly, in Section 5.2.3.1 of the LTP, the licensee states that "[t]he determination of readiness for controls and the preparation for FSS will be based on the results of characterization, RAs, and/or RASS that indicate residual radioactivity is unlikely to exceed the applicable DCGLs in the respective survey unit." In Section 5.2.5 of the LTP, the licensee states that "RAs are a form of continuing characterization and…a limited number of soil samples are typically collected as a part of the RA. Ten percent of any soil samples collected during an RA in a survey unit, with a minimum of one sample taken, will be analyzed for the full initial suite of radionuclides from Table 5-2." In Section 2.5 of the LTP it states that "the results of continuing characterization surveys will be addressed with revisions to the Radiological Characterization Report." Section 5.4.1.4, "Excavations," states that "any surface or subsurface soil contamination identified by continuing characterization or operational radiological surveys that is in excess of the Base Case DCGLs for each of the potential ROCs as presented in Table 5-7 will be remediated." It goes on to discuss how a RASS would be performed consistent with the Data Quality Objectives (DQOs) of a FSS with scanning and sampling. Alternatively, a NaI detector or germanium detector may be used to scan the excavation to demonstrate that the area meets the Operational DCGLs and only if exceeding the Operational DCGLs would additional investigation/sampling occur (staff assume that level of survey to be a RA).

It appears that the intent of RAs/RASSs is to primarily demonstrate the area of the site being assessed is ready for FSS as opposed to being the final survey of record. Section 5.4.1.4 states that excavations will be assessed against Base Case DCGLs vs Operational DCGLs for a RASS while the RA will be assessed against Operational DCGLs. For example, if RAs/RASSs may be the surveys of record performed for small excavations (e.g., < 400 m^2 in planer area or less than 1/5th of the Class 1 survey unit area limit), then some random samples should be obtained to add consideration of the excavation in the FSS of the survey unit. The number of samples could be related to the sampling density for Class 1 open land areas (e.g., 15 samples/2,000 m^2 = 1 sample/133 m^2 area with a minimum of 1 sample) and added to the systematic sample data for the survey unit as an additional data point(s). NRC staff agree that scanning of accessible areas in excavations is warranted (e.g., bottom and sidewalls of excavations) with additional judgmental samples taken based on scanning results. The related information can be added to the FSS report for the survey unit(s) in which the excavation was performed, like how radiologically elevated areas are typically discussed in a FSS report. Larger excavations could be assessed as a standalone survey unit before being backfilled.

If scanning or a sample demonstrates that soil in a small excavation exceeds the Operational DCGL for subsurface soil, then it should be investigated as a possible elevated area in the survey unit consistent with the Final Status Survey Plan section of the LTP (Section 5.2.6 of the LTP states that Operational DCGLs are used for the FSS design of a survey unit including surrogate DCGLs, investigation levels, etc.). Any RASS of a small excavation that results in remediation due to the presence of radiological materials necessitates a class 1 FSS survey.

Clarification of this issue is needed for staff to determine if the licensee is in adequate compliance with the requirement in 10 CFR 50.82(a)(9)(ii) that the LTP includes a site characterization and detailed plans for the final radiation survey and the requirement in 10 CFR 20.1501 that licensees must make or cause to be made, surveys of areas, including the subsurface.

Request: Clarify the scope and intent of RAs and RASSs in the LTP with respect to how they will be conducted in excavations and documented in the survey unit FSS report. Specifically, clarify when each type of survey will be performed, what level of QA (if any) will be conducted with these surveys, what DQOs will be applicable, and what documentation will be provided to supplement the FSS Reports for the survey units in which these are conducted. Justify why Base Case DCGLs, Table 5-7, will be the primary criteria applied in excavations as opposed to Operational DCGLs, Table 5-8, which will be in effect for open land area surveys and describe how any residual radioactivity present in excavations will be considered in demonstrating compliance for the survey unit. Update Section 5.4.1.4 of the LTP, “Excavations,” as appropriate, based on the discussion presented.

TE2-7: Justification for media specific reference materials

Comment: Provide a description of media specific reference materials, if planning to use, and justification for their selection.

Basis: 10 CFR 50.82(a)(9)(ii)(D) states that a license termination plan will contain a detailed final status survey plan. NUREG-1757, Vol 2, Section 4.4.1.1.3, provides a list of information that should be submitted with the LTP with regards to Final Status Survey Planning. This includes bullet 3, “a description of the background reference areas and materials, if they will be used, and a justification for their selection.” In the LTP, Section 5.2.4, the licensee states that determination of media specific background will be evaluated in a technical support document and available for inspection. Submittal of this document as suggested in the guidance will support staff's review of the LTP.

Request: Provide the technical support document(s) identifying and justifying the reference areas/materials that will be used to support final status surveys or revise the LTP to discuss the reference areas/materials in detail so that that information can be used in NRC's evaluation of the FSSs.

TE2-8: Characterization of soil beneath paved areas

Comment: Clarify how soil beneath areas that will remain pavement covered will be characterized.

Basis: Section 5.4.1.6 of the LTP discusses that pavement covered areas will be incorporated into the FSS of the open land areas and if the pavement does not meet the DCGL for surface soil the pavement will be removed and disposed of, and the soil beneath would be investigated/surveyed as per the classification of open land areas. Section 2.5 of the LTP (Continuing Characterization) states - "Radiological Assessments (RAs) will be performed in currently inaccessible soil areas that are exposed after removal of asphalt or concrete roadways and parking lots, rail lines, buried piping, or building foundation pads (slab on grade). Survey results for RAs will be presented in the relevant survey unit release records." However, there is no discussion of how subsurface soil beneath paved areas will be characterized if pavement will remain at the time of license termination. This is a concern if an area may have been contaminated and then later paved over during operations. This information is needed for staff to determine if the licensee is in adequate compliance with the requirement in 10 CFR 50.82(a)(9)(ii) that the LTP includes a site characterization and detailed plans for the final radiation survey.

Request: Clarify in Section 5.4.1. the approach for characterizing the subsurface beneath paved areas that will remain at the time of license termination.

TE2-9: Measurement Sensitivity

Comment: Section 5.4.2.4, Measurement Sensitivity, discusses the *a priori* calculation of the static and scan minimum detectable concentration (MDC) for instruments and techniques used for the Final Status Survey (FSS). Included in this discussion are the equations used to calculate MDC_{static} (Equation 5-19) and the MDC_{scan} for beta-gamma (Equation 5-20). Table 5-21 lists the typical FSS survey instruments including the effective detector area. The d' value is given as 1.38 (page 5-57). The surveyor efficiency (p) is set at 0.5-0.75 (page 5-58). Table 5-22 includes the typical FSS instrument detector sensitivities for several instrument model, including values for MDC_{static} and MDC_{scan}. The numbers provided in Table 5-22 (i.e., 510 dpm/100 cm^2 and 1591) for the Ludlum Model 44-116 were not reproducible with the equations provided.

Basis: 10 CFR 20, Subpart F, "Surveys and Monitoring," §20.1501, specifies that the licensee shall conduct surveys of areas that evaluate the concentrations or quantities of residual radioactivity. NUREG-1700, *Standard Review Plan for Evaluating Nuclear Power Reactor License Termination Plans*, A.4, Final Status Survey Design, indicates that in situ measurements by field instruments demonstrate adequate sensitivity. NUREG-1757, Volume 2, *Consolidated Decommissioning Guidance: Characterization, Survey, and Determination of Radiological Criteria*, A.6, Instrument Selection and Calibration reiterates that to demonstrate that the radiological criteria for license termination in 10 CFR 20.1402 has been met, the measurement instruments should have adequate sensitivity, and be calibrated and undergo period proper response checks. Thus, demonstrating that MDCs have the appropriate sensitivity is critical to the decision-making process.

Request: Verify all the calculations for the MDC_{static} and MDC_{scan} values listed in Table 5-22 and provide changes made within the LTP If necessary, clarify any assumptions not already specified in the LTP.

TE2-10: Documenting Excavation Radiological Assessments and Backfill Characteristics

Comment: The LTP does not identify the process used for documenting both the results of gamma scans and analyses of soil samples of the backfill material collected following excavation and prior to backfilling as well as the specific characteristics of the compacted material identified in the "Fort Calhoun Station Backfill Requirements" (ADAMS accession number ML21271A200) document.

Basis: 10 CFR 50.82(a)(9)(ii)(D) states that a license termination plan will contain a detailed final status survey plan. Multiple sections of the LTP note that following excavation the licensee will perform a radiological assessment of excavated areas that consist of gamma scans and soil sampling prior to backfilling. The LTP also notes that backfilling of the excavated areas will be performed in accordance with the "Fort Calhoun Excavation and Backfill Requirements" document. The requirements include ensuring that the fill material will not include "rocks or stones larger than three (3) inches and shall be free of frozen lumps, organic matter, trash, snow, ice contamination or other deleterious material," the backfill material will be placed in twelve inch lifts and "compacted to at least 85% of the maximum Modified Proctor in accordance with ASTM D1557, or 90% of the maximum Standard Proctor density in accordance with ASTM D698," and that the compacted material will be "within plus or minus 3% of the optimum moisture content in accordance with the applicable ASTM D1557 or ASTM D698 standards."

Request: Clarify how the licensee intends to document the results of both the radiological assessments of the excavated areas performed prior to backfilling as well as the analyses performed to ensure that the compacted backfill material meets the requirements dictated in the "Fort Calhoun Station Backfill Requirements" document.

Chapter 6 - Compliance with Radiological Criteria for License Termination

TE2-11: Loam-Based Sorption Coefficients for the Contaminated Zone

Comment: Selection of sorption coefficient distributions for uncertainty analyses and deterministic values for soil DCGLs assume the soil is loam for the contaminated zone (CZ) and unsaturated zone (UZ), though confounding information in the LTP is provided for those assumptions.

Basis: The LTP does not provide sufficient information on the basis for selecting loam for the contaminated zone and whether the available information provides reasonable assurance that the final conditions of the site are consistent with the dose criteria in 10 CFR 20.1402 and that the site has been adequately characterized per 10 CFR 20.1501.

The basis provided for sorption coefficient (K_d) ranges for uncertainty analyses provided in Table A.1.1 were the sand, loam, and generic (default values) tables from the Data Collection Handbook (Argonne National Laboratory, ANL/EVS/TM-12/4, 2015). Similarly, for the soil scenario DCGLs, LTP Tables 6-5 and 6-6 provided deterministic K_d values based on the Data Collection Handbook tables. For both the uncertainty analyses and selection of deterministic K_d values for soil DCGLs, the licensee selected values from the loam table for the UZ and CZ in RESRAD simulations. Because the release model uses an equilibrium desorption-based model, the consequence of the loam assumption for the CZ leads to smaller releases from the contaminated zone, possibly affecting the sensitivity of dose to saturated zone parameters. Descriptions of the unconsolidated sediments provided in the geology sections of LTP Chapters 1 and 6, which staff presumed contained the basis for selecting loam for the CZ and UZ. The Defueled Safety Analysis Report or DSAR (ADAMS accession number ML18010A129) and the TSSD Services Fort Calhoun Nuclear Station Limited Site Non-Radiological Characterization Survey Report or TSSD Services Report (ADAMS Accession Number ML21271A181) were cited as supporting documents for geology in LTP Section 1.3.5. The upper 20 to 50 feet of unconsolidated sediments are variously described in the LTP and cited supporting documents for geology:

- LTP Section 1.3.5 as fine-grained sandy clay with silt
- LTP Section 6.2.1 as fine-grained sand and silt with some clay
- DSAR Section 2.6 as predominantly sandy silts and silty sands, though borehole logs in DSAR Appendix C suggest a prominence of SP soils below the uppermost 2 to 10 ft
- TSSD Services Report Section 2.2.2 as fine-grained sandy clay with silt

These brief descriptions of sediments in the upper 20 to 50 feet reflect a summary and interpretation of the data from borehole logs of test borings and monitoring wells. Secondary documents with borehole logs and summary tables variously use Unified Soil Classification System (USCS), the USDA Textural Classification System (TCS), abbreviated or qualitative sediment names. These secondary documents include the DSAR (ADAMS accession number ML18010A129) Appendix C, Fort Calhoun Nuclear Station Limited Non-Radiological Characterization Survey Report (2017, ADAMS accession number ML21271A181), Haley and Aldrich (2021, Hydrogeological Conceptual Site Model, Revision 5) (ADAMS accession number ML22034A594), and Flood Recovery Action Plan 4.1 (2012, ADAMS accession number ML21272A219). Information gaps include (i) the drilling approach of hydrojetting the top 10 feet of the borehole instead of collecting core (e.g., the 2007 monitoring wells), (ii) no description of the construction fill material during initial plant construction or later modifications, and (iii) no locations provided for borings (e.g., Haley & Aldrich, 2021) that would enable an assessment of representativeness. In addition to the difficulty in using different classification systems to apply sediment classification to the K_d estimation approach, the borehole logs and associated descriptions illustrate the lensing and interstratification of sediment layers consistent with the ascribed fluvial and glacial environment. If releases to the subsurface are limited to a subset of sediments at the site, a basis should be provided, or a conservative approach should be taken.

Neither the USCS nor USDA TCS classification system map cleanly to the soil categories used in sorption coefficient databases, such as that in the Data Collection Handbook (2015) cited in LTP Table A.1.1. The compilations of K_d values use the following criteria for categories of sand, loam, and clay:

- Sand category was defined as >70% sand-sized particles
- Loam category as even distribution of sand, silt, clay, and up to 80% silt
- Clay category as >=35% clay

The criteria are based on Sheppard and Thibault (1990), Default Soil Solid/Liquid Partition Coefficients, K_ds for Four Major Soil Types: A Compendium, Health Physics 59(4), which was the early version of the K_d compilation on which later compilations expanded.

Request: Provide justification for using sorption coefficients for the contaminated zone in RESRAD based on loam rather than the soil material used for the saturated zone calculation of DCGLs.

TE2-12: RESRAD Inputs Representing Groundwater Conditions

Comment: The RESRAD input presumed to be representative of long-term conditions for groundwater is supported by a single measurement cycle made on June 16 and 17, 2020, that did not include river stage.

Basis: Information is needed to demonstrate that the final conditions of the site are consistent with the dose criteria in 10 CFR 20.1402 and that the site has been adequately characterized per 10 CFR 20.1501. The licensee stated that the conceptual site model is bank storage where prior and current river stage strongly affect groundwater levels across the site. Staff reviewed groundwater contours reported in the Terracon (2022) and the Flood Recovery Plan Report (2012). Staff also analyzed historical groundwater and river stage levels provided by OPPD in a response to a request for supplemental information January 13, 2022 (ADAMS accession number ML22034A602). Staff found that gradients inland, towards the river, and mounding under the site all occur and are consistent with a bank storage conceptual site model (CSM). Use of the June 2020 groundwater gradient towards the river represents only one condition reflected in historical data.

Staff acknowledges difficulties in using historical data to represent future conditions at Fort Calhoun. Though theoretically there may be influx from the higher elevation bluffs to the west, staff notes that there are confounding conditions in monitoring well data that might affect groundwater levels under the Deconstruction Area. Interpretations of natural gradients from historical groundwater data is confounded by: (i) pumping from a well from 2007 through 2018, (ii) measurement cycles where river stage changed significantly during the cycle, (iii) later measurement cycles that did not include river stage, and (v) no measurement point between the bluffs and the Deconstruction Area; note that top of the collar or MW-12A/B has not been surveyed and thus provides no groundwater elevation data.

In addition, intermittent flow in Fish Creek may also influence site groundwater conditions but no hydrological information was found to assess that influence. A continuous pump rate of 200 gpm from the well at the northwestern corner of the old warehouse slab for supporting the reverse osmosis process from the period 2007 through 2018 was stated to induce a cone of depression extending 600 feet. For reference, the distance from the pumping well to the river is approximately 800 feet, thus covering a significant portion of the Deconstruction Area.

For river stage measurements, staff notes that there are indications early measurements have concurrent river stage levels, either actual site measurement or use of an adjustment factor of 2.11 to represent site conditions compared to the river stage measured at the U.S. Geological Survey station near Blair NE. The groundwater measurement cycle in June 2020 used for the LTP does not appear to use site-relevant river stage data. There is also indications that river stage levels representative of the site were discontinued once decommissioning started.

Request: Explain why the June 16-17, 2020, measurement cycle best represents the long-term average gradient across the site, or why the gradient magnitude is not important in the DCGL calculations.

TE2-13: Values used to calculate the buried pipe DCGLs

Comment: Clarify the total length and surface area values used to calculate the buried pipe DCGLs.

Basis: Section 6.14.1 of the LTP discusses the buried piping source term for the buried pipes that will remain onsite at license termination. Internal pipe diameter values provided in the text and the pipe length values provided in Table 6-22 were used to determine the interior surface area of the remaining pipes, which equates to the amount of material that will be released to the soil and serves as the “Area of Contaminated Zone (m^2)” value when calculating the buried pipe DCGL values. As noted in the LTP Section 6.14.1 text and Table 6-22, the remaining buried pipes include 955.9 m of storm drainpipes with internal diameters ranging from 8 inches to 84 inches (0.2 m to 2.13 m) and 54.9 m of service water pipes with an internal diameter of 2.9 inches (0.07 m). Using the formula, π X Length X Diameter = Surface Area, NRC staff independently calculated an internal surface area for the service water pipes equaling the value provided in Table 6-22 (12.7 m^2). However, NRC staff were unable to independently reproduce the total internal surface area value, 2167.8 m^2, provided for storm drainpipes. The NRC staff calculated a range of 610.2 m^2 to 6407.3 m^2 based on the assumption that all the storm drainpipes had diameters of either 8 inches (0.2 m) or 84 inches (2.13 m), respectively.
This information is needed to have reasonable assurance that the site will meet the unrestricted release criteria in 10 CFR 20.1402.

Request: Clarify the calculation inputs used to determine the internal surface area of the storm drainpipes provided in the LTP. If necessary, update the buried pipe DCGL values using the appropriate internal surface area value for the “Area of Contaminated Zone (m^2)” parameter value.

TE2-14: Calculation of soil area factors

Comment: Clarify issues related to the specific areas evaluated as part of the soil area factor evaluation process and the radionuclides considered. This information is needed to have reasonable assurance that the site will meet the unrestricted release criteria in 10 CFR 20.1402.

Basis: LTP Section 6.20 outlines the process used by the licensee to calculate soil area factors for the ROCs, which are reported in Tables 6-37 and 6-38. The analyses, performed using the RESRAD computer code, consider area factors for a range of "generic areas" (e.g., 1 m^2, 2 m^2, 5 m^2, 10 m^2, 100 m^2) as well as the specific area of 143 m^2. The LTP does not provide the basis for using that specific area for the evaluation.

Additionally, the RESRAD analyses associated with the area factors provided with the LTP consider Ni-63 and Sr-90 but Tables 6-37 and 6-38 do not include them.

Request: Provide the basis for considering an area factor for the specific area of 143 m^2. The licensee should also provide the basis for excluding the calculated area factor values for Ni-63 and Sr-90 from Tables 6-37 and 6-38.

TE2-15: RESRAD Uncertainty Analyses

Comment: Additional clarification is needed regarding the RESRAD uncertainty analyses. This information is needed to have reasonable assurance that the site will meet the unrestricted release criteria in 10 CFR 20.1402.

Basis: Although the LTP says that the NUREG/CR-6697 values were used in the uncertainty analyses, the specific values used in the uncertainty analyses were not identified in the LTP. Additionally, the methodology used to determine the 25% and 75% values from the distributions was not included. This information is needed for NRC to verify the uncertainty and sensitivity analysis results used to develop the DCGLs that Ft. Calhoun intends to use as the basis for ensuring compliance with the unrestricted release criteria in 10 CFR 20.1402

It also was not clear whether correlations were used in RESRAD for parameter values that are expected to be correlated (e.g., K_d values in multiple layers, groundwater flow parameters), and, if so, what values were assumed for the correlations. Neglecting to correlate parameters appropriately in a probabilistic analysis can lead to an underestimation of the true uncertainty in the dose estimates and can lead to a misidentification of whether a parameter is risk-significant or not (see Appendix I and Appendix Q in NUREG-1757 Vol 2, Rev 2).

Request: Provide the parameter distributions used for the RESRAD uncertainty analyses. Specifically, the details on the calculations used to determine the 25% and 75% deterministic values and why selecting the 25% vs the 75% (or vis versa) was the appropriate assumption for the conceptual model. Describe if related parameters (e.g., K_d) were correlated in the uncertainty analyses and provide the correlations used. Describe the basis for correlating the parameters, or not, as well as the specific values used for the correlations.

TE2-16: Source for RESRAD parameter values

Comment: Clarify the basis for the use of NUREG/CR-6697, "Development of Probabilistic RESRAD 6.0 and RESRAD-BUILD 3.0 Computer Codes," (2000) in Chapter 6 of the LTP, instead of NUREG/CR-7267, "Default Parameter Values and Distribution in RESRAD-ONSITE V7.2, RESRAD-BUILD V3.5, and RESRAD-OFFSITE V4.0 Computer Codes," (2020) as the reference for parameter values and parameter distributions used when assessing whether doses calculated in accordance with the LTP meet the radiological criteria for unrestricted use in 10 CFR 20.1402.

Basis: When assessing the doses relative to the radiological criteria for unrestricted use in 10 CFR 20.1402, the uncertainty/sensitivity analyses discussed in the LTP references the use of NUREG/CR-6697, "Development of Probabilistic RESRAD 6.0 and RESRAD-BUILD 3.0 Computer Codes," as the source for parameter values and parameter distributions. NUREG/CR-6697 was published in 2000 as part of a series of documents addressing the procedures used to enhance the deterministic RESRAD and RESRAD-BUILD codes for probabilistic analysis. NUREG/CR-7267, "Default Parameter Values and Distribution in RESRAD-ONSITE V7.2, RESRAD-BUILD V3.5, and RESRAD-OFFSITE V4.0 Computer Codes," provides updated information on the default parameter values and parameter distributions in combination with ANL/EVS/TM-14-4, "Data Collection Handbook to Support Modeling Impacts of Radioactive Material in Soil and Building Structures," which was published in 2015. NUREG/CR-7267 provided new and more up-to-date information on default parameter values and, depending on the information available, includes new and/or updated distributions for specific RESRAD parameters.

Request: Clarify the basis of continuing to use the parameter values and parameter distributions referenced from NUREG/CR-6697 instead of the updated values and distributions included in NUREG/CR-7267 when assessing the doses relative to the radiological criteria for unrestricted use in 10 CFR 20.1402.

FORT CALHOUN STATION, UNIT 1 – 2nd Set of Request for Additional Information on License Amendment Request for Approval of License Termination Plan DATE June 5, 2023

DISTRIBUTION:
RidsNmssDuwpRdb, NMSS
RidsRgn4MailCenterResource, RGN IV
GChapman, NMSS/DUWP/RDB
KPinkston, NMSS/DUWP/RTAB
ASchwartzman, NMSS/DUWP/RTAB
RFedors, NMSS/DUWP/RDB
CDennes, NMSS/
TimothyBarvitskie, NMSS/DUWP/RDB
ETabakov, NMSS/REFS/FAB
GWarnick, R-IV/DNMS/RIB
VDricks, OPA/OPA-RIV
RAlexander, R-IV/DRS/RCB
AMoreno, OCA

ADAMS Accession No.: Ltr ML23151A004

OFFICE	NMSS/DUWP/RDB	NMSS/DUWP/RDB		
NAME	JParrott *JP*	JParrott *JP*		
DATE	Jun 2, 2023	Jun 5, 2023		

OFFICIAL RECORD COPY