UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

January 26, 2018

MEMORANDUM TO: Cinthya I. Román, Chief
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FROM: Jessie Quintero, Environmental Project Manager **/RA/**
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SUBJECT: SUMMARY OF AUDIT ACTIVITIES RELATED TO THE U.S. NUCLEAR REGULATORY COMMISSION'S ENVIRONMENTAL REVIEW FOR THE WESTINGHOUSE COLUMBIA FUEL FABRICATION FACILITY LICENSE RENEWAL APPLICATION

BACKGROUND

In 2014, Westinghouse Electric Company, LLC (WEC) submitted a supplemented application to renew its special nuclear material (SNM) license SNM-1107 (Agencywide Documents Access and Management System [ADAMS] Accession Number ML14352A111) at the Columbia Fuel Fabrication Facility (CFFF). The U.S. Nuclear Regulatory Commission (NRC) staff submitted the following sets of Requests for Additional Information (RAIs) to which WEC responded:

- RAI (June 23, 2016): ADAMS ML16141A734 (RAIs No. 63-77)
- Response (August 31, 2016): ADAMS ML16246A300
- RAI (November 23, 2016): ADAMS ML16300A159 (RAIs No. 54-55)
- Response (September 28, 2017): ADAMS ML17271A163

The NRC staff assessed the responses and determined that additional information was needed to complete its environmental review. The purpose of the site audit activities, which included teleconferences and site visits, were for the NRC staff to address open items related to ground-water contamination and environmental monitoring at the site. The site visits were also an opportunity for the new environmental project manager to tour the site and its environment.

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On August 7, 2017, the NRC staff visited the CFFF site for a general site tour. The NRC staff then held two conference calls with WEC and its contractors on August 24, 2017 and August 29, 2017 focused on ground-water. On September 7, 2017, the NRC staff met again with WEC staff onsite at CFFF to discuss WEC's environmental monitoring program. On September 29, 2017, WEC staff met with the NRC staff while at the NRC headquarters. A summary of these interactions is provided below.

AUGUST 7, 2017 SITE VISIT

The purpose of this site visit for the new environmental project manager, Ms. Jessie Quintero, to view the CFFF site. Mr. Randy Crews, of WEC, toured the NRC staff (Ms. Quintero and Mr. Robert Johnson) around the CFFF property. The tour included a visit to the four ambient air/soil/vegetation sampling locations; the composite sampling at the wastewater treatment plant (WWTP); the discharge point at the Congaree River; and locations where surface water is collected.

The NRC staff noted a food composting program in the CFFF cafeteria. WEC stated that food waste is a large portion of the CFFF nonradiological waste and its goal is to cut waste volumes by 25 percent by implementing the food composting program. CFFF has placed composting bins alongside the trash and recycling bins in the cafeteria.

AUGUST 24, 2017 TELECONFERENCE

The purpose of this call was to discuss open items that were not adequately addressed in WEC's RAI responses. The topics were related to ground-water contamination and the lack of a conceptual site model.

On the call were Ms. Diana Joyner, Mr. David Wagoner, Ms. Amanda Spalding, and Ms. Nancy Parr of WEC and two contractors from AECOM, Mr. Jeremy Grant and Mr. Chuck Suddeth. The NRC attendees were Ms. Marilyn Diaz-Maldonaldo, Ms. Jessie Quintero, Mr. Thomas Nicholson, Mr. Jack Gwo and Mr. Paul Startz.

The NRC staff explained that the environmental review under the National Environmental Policy Act (NEPA) involves evaluating the environmental impacts of the continued operation of CFFF. The NRC staff is documenting those environmental impacts in an Environmental Assessment (EA). As part of the safety review, the NRC staff also evaluates WEC's environmental protection program to ensure WEC meets Title10 of the *Code of Federal Regulations* (10 CFR) Part 20 requirements including Subpart F, 10 CFR Section 20.1501 General, 10 CFR 20.1406, and 10 CFR 70.59. The NRC determined that in general, Chapter 10,- *Environmental Protection*, of WEC's license renewal application includes most of the relevant aspects of an adequate environmental protection program, however it lacks specific key information for the NRC staff to determine and obtain reasonable assurance that the regulatory requirements are met. After NRC's opening statements, participants started discussing the site conditions and ground-water contamination. During the call NRC asked the following questions and to which the WEC responded:

Q1. What is the hydraulic connection between the shallow aquifer and Black Mingo formation? What is the evidence and basis for that conclusion?

A1. AECOM staff stated that the shallow, water table aquifer is underlain by significant confining unit and another aquifer. Most of the site investigations, as documented in the Remedial Investigation (RI) Report (ADAMS ML16166A141) have been done in the water table aquifer. There is the Black Mingo confining unit and the deeper aquifer, the Black Mingo Aquifer. Previous site investigations have not gone below that. AECOM stated that the three sets of borehole log data is the evidence for their conclusion.

NRC asked how WEC was able to tell the boundary of the units. AECOM answered that from a hydro stratigraphy standpoint, the drilling has found the depth to top of confining unit. Three wells have gone through the confining unit and go into the deeper aquifer. AECOM stated that the confining unit is continuous through the site.

AECOM staff stated the depth to water table varies across the site, ranging from 10-25 feet (ft). The confining unit varies in thickness from 60-70 ft thick to 40 ft in thinner areas.

WEC staff and AECOM staff explained that water levels are measured quarterly when wells are sampled. Comprehensive sampling of all water table elevations was done June 6, 2013, including the three wells in the Black Mingo. Those results are included in AECOM's 2013 RI Report.

AECOM staff stated that the 1990 cross section, included in the RI Report, shows a net downward gradient from the water table to the Black Mingo aquifer.

Q2. What is the role of surface water (in ditches and ponds) and groundwater (including Black Mingo) interaction in radionuclide transport over the entire site, considering that both upward and downward gradients exist at the site?

A2. AECOM's response is that some of the ditches have water in them and intercept the water table just barely; they do not go all the way through the water table. Ditches are potentially in hydraulic connectivity with the water table but not near the confining unit. The connectivity is a function of the water table/rainfall and is seasonal.

WEC staff stated that all but one of the lagoons has been relined (east lagoon has a fabric lining that has not been replaced yet). AECOM stated there is no connectivity between the lagoons and groundwater because there is a liner although no testing has been done. There is no system to detect leaks, however ongoing ground-water monitoring results would indicate if there was a leak. Detection of leaks would be identified through ground-water samples which measure for alpha, beta, nitrate, ammonia, and fluoride.

WEC staff explained that in October 2015, West-II lagoon was overtopped by surface water flooding. There was no special/additional monitoring after the flood. The next sampling was done in October 2015 and then in January 2016. Ground-water wells 43 and 49 are closest wells to West-II lagoon.

WEC staff explained that one of the big byproducts of the WWTP process is calcium fluoride. It is the only solid removed from the WWTP lagoons and may contain residual radioactivity (uranium) at levels less than 30 pCi/g. It is stored onsite and shipped offsite for re-use in concrete. During the flooding event, part of the reason that West-II lagoon overtopped was because the solid calcium fluoride had not recently been removed from the lagoon, therefore the solids on the bottom were reducing the holding capacity of the lagoon for the rain.

Q3. Has the source of the contamination in all media – both gross alpha and gross beta – been sufficiently characterized? What efforts have been undertaken to stop/remediate/mitigate those sources?

A3. WEC staff stated there is no source of contamination from CFFF activities. WEC believes the results of the plume analysis demonstrate that the gross alpha and gross beta are generally background level. Further discussion on this topic was deferred until WEC presents the results of the plume analysis at a later date.

WEC staff said the source of gross alpha does not resemble the source term at CFFF and is characteristic of natural radioactivity. Concentrations could vary with rain. If results of ground-water sampling come back higher than the 15 pCi/L action level, then they do isotopic uranium analysis to ensure the result is not indicative CFFF's source term. WEC would look at the ratios of U-234, U-238, and U-235 to make this determination. Available data has shown there is no alpha contamination from WEC operations based on sampling of NRC wells and isotopic analysis. However, there are not a lot of data points because the action level prompting additional analysis is rarely exceeded and isotopic analysis was only done for the ten NRC wells. For wells monitored as part of its South Carolina Department of Health and Environmental Control (SCDHEC) permit, WEC tries to be consistent with the isotopic analysis but does not necessarily do the same analysis. The wells and constituents sampled are different for NRC and SCDHEC wells. The contamination (nonradiological and radiological) doesn't necessarily interact. Sampling of wells that are not SCDHEC or NRC are sampled based on data/trends.

There are 38 active wells. Three are completed in the Black Mingo and 35 are located in the water table/shallow aquifer. There are seven screened currently (only six now) in the lower portion, 28 in the upper.

WEC stated that the Technicium-99 (Tc-99) contamination was not from the uranium hexafluoride (UF_6) cylinder recertification area spill. As a result of that spill, WEC did remove soil in the spill area in 1998. WEC has never seen Tc-99 above the Environmental Protection Agency's (EPA) drinking water maximum contaminant level (MCL) (900 pCi/l). The closest wells to this area are north, W-10 and W-13. Gross beta has been noted in W-13. The water direction near W-13 is in the shallow aquifer moving southwest towards Sunset Lake. The lower aquifer is westerly with a southwest component. WEC has not specifically mapped the difference between the water table and shallow aquifer. Figure 3-6 of the 2013 RI Report was based on data from the 1990s. Figure 3-7 has the 2013 water table surface map.

EarthCon's plume analysis will only show a snapshot of where the contamination is currently located. WEC stated they have not exceeded the drinking water standards in any of the results. The plume is stable and they are meeting drinking water standards on site so there should be no concern of exceeding drinking water standards off-site. They have not seen Tc-99 above the 900 pCi/L MCL. WEC also pointed out that the drinking water standards are for public drinking water suppliers, thus WEC is not subject to those limits. They are not required to report any of the results to the NRC, although the inspector can review the reports onsite.

WEC staff have not done an analysis of nearby off-site wells. The hunting lodge is within the WEC property boundary, between the site and the Congaree River. It's at the western side of the canal. The building can be seen on Googlemaps. WEC does not believe there is a drinking water well there.

Q4. In the conceptual site model, what is the spatial extent of the contaminant plume(s), the associated aquifer(s), and the isotopic composition of the source term?

A4. WEC stated there is no regulatory requirement to have a conceptual site model. However, information provided in the 2013 RI Report could be used to infer a conceptual site model. AECOM walked NRC through some of the ground-water plume figures in the 2013 RI Report. Figure 4-16 shows gross alpha plume in December 2008. There are no contours because the action level is 15 pCi/L (also the MCL for alpha). Figure 4-17 shows gross alpha in October 2015 and indicates a small area that exceeded WEC's action level of 15 pCi/L (equivalent to the MCL). Figure 3-7 shows the general ground water flow from the NE to SW, with some flow to the west.

During the call, the NRC staff asked for confirmation about statements made in the response to RAI (# 72), specifically regarding private drinking water wells. WEC stated they have not done a survey of private wells. There is the one private well at the onsite hunting lodge.

The NRC staff asked about a statement made in the 2014 AECOM report "Preliminary Baseline Risk Assessment" (ADAMS ML17275A619) that surface water has not and will not be used for human consumption. However, the water from Sunset Lakes flows into Mill Creek which eventually flows into the Congaree River which is used for public drinking water supplies. AECOM staff stated that there is a large floodplain between the site and the Congaree River, which would dilute and slow the transport of material.

AUGUST 29, 2017 TELECONFERENCE

Participants on the call included – Ms. Nancy Parr, Ms. Diana Joyner, and Ms. David Wagoner from WEC; Mr. Chuck Suddeth from AECOM; Mr. Joe Ricker from EarthCon; and Ms. Jessie Quintero, Ms. Marilyn Diaz, Mr. Jack Gwo, and Mr. Tom Nicholson from the NRC.

WEC staff led off the discussion with basic information on drinking water standards. The EPA's drinking water standards for gross alpha is 15 pCi/L and 30 μg/L for Uranium. The latter, in CFFF's case around 4% U^{235} enrichment, can be converted to 84 pCi/L uranium in terms of toxicity to kidney. The MCL for gross beta is 4 mrem/yr and based on that, the derived MCL for Tc-99 is 900 pCi/L.

WEC staff suggested that isotopic analysis was applied only to NRC wells in the past. WEC staff is proposing a 'comprehensive' set of wells that both NRC and SCDHEC wells.

On the CFFF site, there are currently 38 wells, 3 of them are deep wells screened in the Black Mingo aquifer. WEC staff confirmed that only one well is likely to be down gradient from the area of contaminant source. WEC believe that there is no hydraulic connection between the shallow aquifer and the deep, Black Mingo aquifer based on (3 sets) borehole log data.

WEC's uranium isotopic analyses looked at the ratios of U^{234}, U^{235}, and U^{238} from well water samples. WEC compared the ratios with those of background and their products and determined that the signature (ratios) are similar to those of natural uranium. WEC was unable to provide a background value for uranium at the site.

WEC stressed that currently there is a separation of 3,200 feet between the site boundary and plume.

Mr. Ricker, of EarthCon, gave a presentation on the well sufficiency analysis prepared for WEC, based on historical data. Enclosure 1 is the presentation presented by EarthCon.

EarthCon staff stated that the fluoride charts appear to demonstrate peak fluoride values coinciding with the time right after the shutdown of the volatile organic compound (VOC) in situ remediation. From that point on, the concentration/mass/area of the fluoride plume trended down.

EarthCon staff assumed the shallow aquifer saturated thickness is uniform over the entire analytical area (average of water depth). The average concentration and mass are calculated on this basis. The NRC staff asked the EarthCon contractor if this would neglect the mass in the partially saturated zone, either in the pore fluid or on the solid phase, and so the mass calculation may not be accurate. EarthCon replied that what is of interest is the behavior of the plume, not necessarily the mass. EarthCon also suggested that fluctuation of the water table is small in the geographical area and the error is small.

EarthCon's analysis of gross alpha activity shows no trend after 2010 in the plume analysis. NRC staff asked EarthCon whether there is a correlation between the well water and surface water alpha/beta activities. EarthCon stated they did not conduct analysis of surface water samples.

For VOC plumes, only a limited number of wells were sampled, particularly west of the lagoons. WEC suggested that they will work with SCDHEC on the VOC plume.

WEC indicated that they may not drill new wells but will add additional screening of wells on the north and west side of the site.

WEC also indicated that they have no concern from contaminant contribution from the nearby superfund site at this time.

On the sufficiency of the ground water wells being monitored, EarthCon suggested reducing the number of sampling wells and the frequency of sampling to an annual basis.

SEPTEMBER 6, 2017 SITE AUDIT

Ms. Jessie Quintero, with the NRC, met onsite at CFFF with WEC staff, Ms. Nancy Parr, Ms. Diana Joyner, and Mr. David Wagoner.

WEC provided a portion of a 2015 Report (see Enclosure 2) that summarizes the results of WEC's monitoring and sampling program for its NRC license. Included with the 2015 report was lab results (see Enclosure 2) for recent isotopic analysis performed for uranium and beta/gamma analysis. Results provided were from well W-23 from October 2016 and January 2017 and well W-33 from January 2017. Beta/gamma analysis was provided for wells W-13 and W-32 from January 2017.

WEC also provided copies of three annual Ground Water Sampling Reports (2013, 2014, and 2015), submitted to SCDHEC as required by its National Pollutant Discharge Elimination System (NPDES) permit (see Enclosure 3).

Ms. Quintero asked about a natural gas pipeline that was expected to be installed potentially on the CFFF site. WEC responded that the segment of the Dominion pipeline that would cut through the property had not been built yet. It is expected to fairly closely follow the pathway of

an existing pipeline. There was an environmental evaluation prepared for that pipeline by Federal Energy Regulatory Commission that could be found online.

During the site visit, Ms. Quintero reviewed the "Regulatory Review of Configuration Administrative Procedure RA-104 Rev 29" and verified that it included considerations for archeological or historical sites when conducting new work onsite. Staff also reviewed the Checklist located in RAF-104-5, Rev 8.

Ms. Quintero asked WEC staff about statements in the 2007 EA that suggested WEC was considering a Memorandum of Understanding (MOU) with the Catawba Nation. WEC confirmed no MOU was pursued. However, during onsite presentations to local schools, information about the Tribe was provided, including a presentation by members of the Tribe. WEC staff gave Ms. Quintero a copy of the latest NPDES permit (ADAMS ML17283A098). The permit was revised in March 2017 and took effect in May 2017. The permit expires in March 2018 and WEC is currently preparing its renewal application to submit to SCDHEC. WEC expects to submit a timely renewal application to SCDHEC.

WEC staff confirmed that the East lagoon is the only lagoon that has not had its liner replaced, it still has a fabric liner. There are no plans at this time to replace the liner.

WEC has implemented a surface soil sampling program onsite to establish a radiological baseline. They have collected samples from the perimeter of the property. Results have been received but have not been evaluated by CFFF staff at this time. WEC stated that the next phase of the effort will be to collect surface soil samples from around the operating facility.

On June 23, 2016, the NRC issued an RAI (#70) asking about the location of river water and sediment samples. WEC stated it will provide a figure showing the locations of the surface water sampling locations, including the sample taken from the Congaree River in the next update to Chapter 10 of the license amendment application.

WEC noted that they have noticed surface water runoff from the Superfund site (located on the north side of Bluff Road) coming onto the CFFF site and traveling along the eastern ditch. The eastern ditch then turns west and goes under the employee parking lot and connects with the southern ditch before all surface water converges at the C-valve.

SEPTEMBER 29, 2017 MEETING

Ms. Jessie Quintero, Mr. Chris Ryder, and Ms. Marilyn Diaz-Maldonado of the NRC met with Ms. Nancy Parr of WEC at the NRC headquarters.

WEC submitted an updated version of its License Renewal Application on September 15, 2017 (ADAMS ML17261A085). The NRC staff discussed the changes in Chapter 10 and a summary of the discussion is provided below.

Sediment

The NRC requested an additional sediment sample be collected from Sunset Lake. This sample could be taken every two years from a location within Sunset Lake that allows a sample of the bottom sediment to be collected. WEC agreed to add this sediment sample. NRC also requested an additional sample be collected from Gator Pond at the same frequency as Sunset

Lake. Gator Pond was noted as a 'hot spot' in the 2013 AECOM report. Samples from Gator Pond will be relevant for decommissioning, to show if/what contamination may be present. WEC said that it will update Table 10.1 to reflect a total of three sediment samples and will collect them annually.

Ground Water

WEC indicated that Table 10.1 provided in the September 15, 2017 revision wrongly states that 10 wells will be sampled, so WEC stated it will update to reflect the new number. The NRC requested that the ground-water samples be collected semi-annually (dry and wet season) instead of annually. For the existing NPDES permit, WEC samples semiannually. However, because of varying requirements for seasonal sampling by the NRC and SCDHEC, WEC has elected to sample more frequently, on a quarterly basis, to ensure all sampling requirements are met. WEC stated that based on the recommendation of EarthCon, the same conclusions can be drawn with statistical confidence if sampling is reduced to once per year. WEC stated it would prefer an annual sampling campaign and the flexibility on which month the samples are collected. The NRC stated that statistically similar or not, from a hydrologic point of view, because WEC assumes the source of contamination is the residual contamination from past events, dry/wet season will result in different portion of the soil horizons being sampled. During the dry season, because the ground water table is lower, samples only represent the portion of the shallow aquifer near and above the confining Black Mingo. During the wet season, ground-water rises near the surface, and mass wise, more contaminants may get flushed out of soil pores and soil grain surface. However, due to higher recharge to the shallow aquifer during the wet season, the mass gets diluted. So the activity/concentration may appear the same but the mass that was flushed out of the soil grain surface or pore space is larger. The NRC stated it wants to ensure during wet seasons that the samples represent contaminants that are adsorbed or remain in the upper portion of the soil horizons, which is not the case for samples in dry season.

WEC explained there was no distinction between the Table 10.1 footnotes 1 and 2 as it relates to the additional analysis for gross beta exceeding the investigation limit. WEC committed to make the two footnotes the same in terms of additional beta/gamma analysis if gross beta measurements exceed the 50 pCi/L investigation limit.

NRC requested that ground-water well W-3 continue to be monitored for both alpha and beta. This is a deep aquifer well that will help show whether or not contamination has reached the deep aquifer. WEC responded that well W-3 is not statistically relevant to the alpha and beta contamination since the contamination is delineated by other wells in the network. However, WEC agreed to keep well W-3 in the ground-water sampling program.

NRC requested that ground-water well W-16 should also be monitored for gross alpha, in addition to gross beta. WEC stated that based on the recommendation of EarthCon's well sufficiency analysis, the same conclusions can be drawn with statistical confidence if sampling of gross alpha is not conducted in this well. NRC agreed no change was necessary related to the sampling of well W-16.

NRC requested that ground-water well W-39 should also be monitored for gross beta, in addition to gross alpha. This well location is important to potentially identify future leaks/spills from the lagoon area. WEC responded that based on well sufficiency analysis by EarthCon, the same conclusion could be drawn with statistical confidence if sampling of gross beta is not

conducted in this well. WEC stated it agreed to monitor W-39 for both gross alpha and gross beta.

Surface Water

NRC wanted confirmation that at least one surface water sampling location was downstream of Sunset Lake but upstream of Mill Creek. WEC explained that the "entrance" sampling location is upstream of Sunset Lake and where water flows through the south portion of the facility. The "entrance" and Sunset Lake are both located in line with the Mill Creek water body that winds around the back of the facility. WEC explained that the "exit" sampling location is downstream of Sunset Lake.

Fluoride and Nitrate

WEC stated it does analyze ground water for fluoride and nitrates but that those constituents are not listed in Chapter 10 as a parameter in the ground water sampling program. NRC asked for confirmation if there is any other media sampled for these two constituents (besides fluoride in vegetation). WEC responded that fluoride and nitrate are also sampled for in stormwater at C-valve. WEC also stated that it voluntarily samples treated effluent discharged to the Congaree River for nitrates. WEC is required by SCDHEC to sample treated effluent discharged to the Congaree River for fluorides but it is monitor and report only (i.e. there are no limits for fluoride specified in the permit, only the requirement to monitor and report). WEC will continue to analyze certain ground water wells for fluorides and nitrates, based on the outcome of the well sufficiency analysis. WEC has committed to providing NRC copies of the annual groundwater reports submitted to SCDHEC, as indicated in the September 15, 2017 version of Chapter 10 of the license renewal application (LRA).

In order to meet the environmental review schedule, WEC committed to submitting another revision of Chapter 10 of the license amendment application. On October 9, 2017, WEC submitted an updated Chapter 10 (ADAMS ML17282A012). The October 9, 2017 version of Chapter 10 incorporated the changes discussed during the September 29, 2017 teleconference.

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DATE: January 26, 2018

ADAMS ACCESSION NO.: ML17356A096

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