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Subject: 2018 Groundwater Corrective Action Annual Review Report
Materials License No. SUA-1475
United Nuclear Corporation's Church Rock Tailings Site, Gallup, New Mexico

Dear Mr. Pham and Ms. Brooks,

On behalf of United Nuclear Corporation (UNC), Hatch Chester has prepared this annual performance review of the groundwater corrective action at UNC's Church Rock Mill and Tailings Site near Gallup, New Mexico, pursuant to License Condition 30C. This report is for the 2018 operating year and represents the period from January 2018 through October 2018.

This report focuses on both active remediation and the groundwater performance of the natural geochemical systems without active remediation. As indicated in the U.S. Environmental Protection Agency's (EPA's) First Five-Year Review Report (EPA, 1998) and by the approvals to decommission or temporarily shut off the former pumping systems, the agencies recognized that those corrective action pumping systems had reached the limit of their effectiveness. EPA (1988b) recommended that Technical Impracticability (TI) Waivers, Alternate Concentration Limits (ACLs), and Monitored Natural Attenuation (MNA) be used to complete the corrective action program. Those Record of Decision (ROD) recommendations continue to be timely.

Site groundwater standards used for data comparisons in this annual report were revised during 2015 in conjunction with the establishment of statistically-based background threshold values (BTVs). The U.S. Nuclear Regulatory Commission (NRC) issued a License amendment (NRC, 2015) to update the site groundwater protection standards (GWPSs). Additionally, EPA (2015) approved the use of the UNC-

proposed cleanup levels for remedy alternative evaluation in Part III of the Site-Wide Supplemental Feasibility Study (SWSFS). These revised EPA standards have been used for data comparisons in the previous three annual reports; their continued use in this report is intended to reflect the most recent thinking that is critical to distinguishing background water from seepage-impacted water with respect to the site remedial alternative evaluations. These agency actions lessen one of the technical impediments (GE, 2009) to eventual Site closure which stated that “long-term monitoring data and basic geochemical considerations reveal some cleanup objectives to be unattainable.” For most parameters, the establishment of background threshold values through statistical analysis will incorporate and account for the natural geochemical evolution of pre- or post-mining, pre-tailings (i.e., background) groundwater quality and distinguish it from the chemical characteristics of post-mining, post-tailings groundwater (i.e., water that is subject to the corrective action program).

In the Southwest Alluvium and Zone 1, the natural systems have functioned as effectively as when active remediation took place. Acidic seepage is being neutralized, resulting in attenuation of metals and radionuclides. During 2018, both onsite and offsite seepage-impacted water quality in the Southwest Alluvium met the NRC GWPSs (Appendix A) except for a slight exceedance of the NRC License standard for Pb-210 (5.9 pCi/L) in the sample from Well 801 in April 2018 (6.8 pCi/L). Exceedances of the current Pb-210 standard are historically infrequent and there is no basis to infer that this result reflects any impact of tailings seepage. With the exception of the uranium exceedances observed at Well GW 3 between 2012 and 2015, the groundwater quality at all POC wells has met the current License standards since January 2011. During 2018, there was only one exceedance of a revised EPA standard in seepage-impacted water outside Section 2; chloride, a non-hazardous constituent that is not regulated by NRC, slightly exceeded the standard in an April 2018 sample from Well GW 1.

The Well GW 3 uranium concentration data are not representative of general conditions in the Southwest Alluvium. Well GW 3 no longer produces enough water according to the low-flow sampling standard operating procedure (SOP) and the water level is projected to be below the 2-foot minimum specified in the SOP. Empirical data show that the elevated uranium concentrations in the mine discharge (i.e., the historical background concentrations) have been broadly and significantly attenuated in the alluvium in that most of the seepage-impacted wells have shown overall stable trends since the pumping system shutdown. The interaction of the uranium in the Southwest Alluvium sediments with varying geochemical factors (e.g., bicarbonate) or hydrologic factors (e.g., reductions in saturated thickness or isolation from the groundwater flow system) may result in variable concentration trends accompanied by localized exceedances of the Site uranium standard (e.g., at Well GW 3). The uranium standard in the Southwest Alluvium should be waived because the principal source of uranium for both background and seepage-impacted waters was the permitted mine discharge water rather than tailings seepage. It also is not possible to ensure that a standard will be achieved consistently throughout the seepage-impacted area as the geochemistry fluctuates and water levels decline over time. Moreover, the standard will only be attained upon extraction of all water in the alluvium, which is not practicable.

Consequently, UNC submitted a License amendment request (GE, 2015) in October 2015 and an amendment in December 2016 (GE, 2016; correction submitted in February 2017) that seek to terminate the Southwest Alluvium corrective action program. The proposed License amendment recommends continuing the monitoring and compliance requirements put forth in Conditions 30.A & 30.B for the POC wells and Well SBL 1 only. Taken together with the 2016 amendment, it is further proposed that Wells GW 2 and GW 3 be

omitted as POC wells because they can no longer be sampled due to safety concerns associated with their proximity to the unstable southern and northern edges of the Pipeline Arroyo canyon, respectively.

Outside the UNC property boundary in Zone 1, the post-pumping groundwater has improved overall. During 2018, there were four minor exceedances of the NRC License standard for nickel (but not the revised EPA standard) at POC Well EPA 7 and four minor exceedances of the EPA cobalt standard. The detected concentrations are within the range of historical concentrations and the nickel and cobalt concentration time-series elsewhere empirically demonstrate that natural attenuation occurs in two senses: over time at a given location, and spatially downgradient. There were also exceedances of NRC License standards at Wells 604 (POC), 614 (POC) and 515A within Section 2. The concentrations of non-hazardous constituents sulfate and TDS outside Section 2 reflect geochemical equilibrium of the groundwater with gypsum; there were no exceedances of the revised EPA cleanup levels for these constituents outside Section 2 during 2018. Chloride, a non-hazardous constituent that is not regulated by NRC, has exhibited a gradual increase at Well EPA 7 over the past few years; however, during 2018, there were no exceedances of the EPA standard.

For Zone 3, the following constituents exceeded NRC License standards at one or more POC wells during the 2018 quarterly monitoring: beryllium, nickel, uranium, vanadium, and thorium-230. NRC License standards for beryllium, nickel, uranium, and gross alpha were also exceeded in seepage-impacted water at non-POC Well 717. Additionally, the NRC license standards for arsenic and combined radium (i.e., the combined activities of radium-226 and radium-228) were exceeded in samples from northern Zone 3 Well NW 3, which is interpreted to monitor predominantly background water. The arsenic concentrations (range 0.98 to 6.2 mg/L) are considered to be related to background groundwater chemistry; similar notable exceedances (maximum 2.5 mg/L) were historically reported in nearby Well NBL 1 from 2002 to 2008, under both background and partially seepage-impacted conditions. The reported arsenic concentrations may be associated with declining saturated thickness and the increasing exposure of coal (and possibly pyrite) present in the lower part of Zone 3 to oxygen in the saturated zone.

Extraction well pumping continued in the northern part of Zone 3 during 2018. This extraction of seepage-impacted groundwater started with the hydrofracture program in 2005 and was supplemented, starting in 2009, with extraction from the NW-series wells located near the northernmost area of seepage impact. The purpose of the upgradient wells (e.g., the hydrofracture or RW-series wells) is primarily to dewater and recover contaminant mass, while the purpose of the downgradient wells (e.g., the NW-series) is to form a hydraulic barrier. The Zone 3 pumping system has been declining in performance and has approached the limit of its effectiveness due to declining saturated thicknesses, as predicted. Extraction wells having yields less than the 1 gpm decommissioning criterion may be recommended to NRC for decommissioning in a revision to the pending License amendment request or in a future License amendment request.

As recommended in previous Annual Reports, monitoring wells that do not meet performance criteria associated with low-flow groundwater sampling methods (which limits the ability to collect representative samples) should be removed from the monitoring program and decommissioned. These wells include, but may not be limited to Wells GW 3 and 632 (both are POCs in the Southwest Alluvium), Well 515 A (non-POC in Zone 1), and Well 517 (POC in Zone 3). Additionally, Wells 504 B and 446 should be removed from the Zone 3 monitoring program because water levels have declined below the screened or open interval. Well 504 B is dry and the Well 446 water level is below the bottom of the screened interval and is therefore unreliable. Finally, as of April 2017, the water level in Well 420 was below the base of Zone 3 and the screened interval

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of the well. The collection of water samples and water levels from Well 420 should be suspended because samples are no longer representative of Zone 3 (the water chemistry associated with Zone 2 [primarily shale and coal] would be expected to be dissimilar), until such time that the water level elevation at this well is above the base of Zone 3.

UNC proposed monitoring well locations north of the Section 36 boundary on the Navajo Reservation in 2014. The installation of these wells is recommended to support the adoptions of waivers, alternate standards or other administrative controls to close the corrective action program. Information obtained during 2018 suggests that Zone 3 may be deeper at the proposed monitoring locations than previously understood, which reduced (to three) the anticipated number of wells needed to meet the monitoring objectives. UNC anticipates that the wells will be installed during 2019.

Please contact Mr. Roy Blickwedel (General Electric Company) at (610) 529 6323 if you have any questions or need additional information.

Respectfully,



HATCH

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Enclosures:

Bo Pham, U.S. Nuclear Regulatory Commission (2 printed report copies, 2 CDs)
Janet Brooks, U.S. EPA Region 6 (1 electronic report copy on flash drive, 1 printed copy of tables and figures)

cc:

James Smith, U.S. Nuclear Regulatory Commission (2 printed report copies, 2 CDs)
U.S. Nuclear Regulatory Commission Document Control (1 printed report copy)
Jeff Lewellin, New Mexico Environment Department (3 CD)
Freida White, Navajo Nation Environmental Protection Agency (1 printed report copy, 1 CD)
Roy Blickwedel, General Electric Corporation (1 printed report copy, 1 CD)
United Nuclear Corporation, c/o Rick Spitz, Wood PLC, (1 printed report copy, 1 CD)

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