



**BUILDING A BETTER WORLD**

31 October 2014

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Washington D.C. 20555-0001

**RE: Final Pre-Design Studies Report**  
Northeast Church Rock Mine Removal Action  
McKinley County, New Mexico

Dear Ms. Jacobs and Mr. McLaughlin

On behalf of United Nuclear Corporation and the General Electric Company (UNC/GE), this letter transmits the final Pre-Design Studies Reports (PDSRs) for the Northeast Church Rock Mine Removal Action. The PDSRs have been revised to address comments on the draft PDSRs submitted by USEPA Region 6 and DOE on September 8, 2014. Responses to the USEPA and DOE comment letters are attached to this letter. The final PDSRs and responses to EPA and DOE comment letters have been uploaded to the Northeast Church Rock Remedy Design Team Site, at the following location:

*Project Documents > Working Documents > Reports > Pre-Design Studies Report*

Please provide your approval of the final reports. Once approval has been received, the documents will be moved on the Team Site to the *Mill Site Documents* and *Mine Site Documents* folders.

If you have any questions regarding this letter or the information attached, please feel free to contact me at (970) 871-4361.

Sincerely,  
MWH Americas, Inc.

Toby Leeson, P.G.  
Removal Action Project Manager

Encl.: Responses to Comments

CC: Janet Brooks, US EPA Region 6  
Debbie Barr, US DOE  
Chandra Manandhar, Navajo Nation EPA  
Earl Dixon, NMED  
Larry Bush, United Nuclear

Cynthia Wetmore, US EPA Region 9  
Stephen Dwyer, Dwyer Engineering, LLC  
Lance Hauer, General Electric  
Randall McAlister, General Electric  
Roy Blickwedel, General Electric

## **ATTACHMENTS**



**Responses to EPA Region 6's Comments on Pre-Design Studies Report, Church Rock Mill Site, dated July 17, 2014**

1. **Section 1.0, 1<sup>st</sup> Paragraph:** *The NECR is northwest of the Mill Site, not northeast as stated.*

**Response:** This sentence has been corrected in the revised report.

2. **Section 1.0, 2<sup>nd</sup> Paragraph:** *I believe the context should be the Church Rock Mill Site and not the Northeast Church Rock Mine Site in the first sentence.*

**Response:** Agreed. The context of this paragraph has been clarified in the revised report.

3. **Section 1.0, 2<sup>nd</sup> Paragraph and Section 4.0, 1<sup>st</sup> Paragraph:** *Please change "Region 6 Proposed Plan ... and the Record of Decision..." to "Region 6's Proposed Plan ... and the Record of Decision...for the United Nuclear Corporation ("Church Rock Mill Site" in this report") Surface Soil Operable Unit NPL Site.*

**Response:** This change has been made throughout the revised report.

4. **Section 1.0, Throughout:** *Please be consistent in your labeling of the Mill Site, in some cases it is Church Rock Mill Site and in others it is only Mill Site.*

**Response:** This change has been made throughout the revised report.

5. **Figure 1-2:** *Please also label Sections 1 and 2.*

**Response:** The section numbers have been labeled on Figures 1-2 and 1-3 in the revised report.

6. **Section 2.1.2, Last Paragraph:** *What does this sentence mean to this report "... to aid in evaluation of the radon modeling (UNC, 1993)."*

**Response:** The reference to radon modeling was included in the 1993 report because that was the purpose of the work at that time. However, this statement is not relevant to the PDS report, and has been removed from the revised report.

7. **Section 3.2.2.4, 2<sup>nd</sup> Paragraph:** *Make this a clearer statement "there is no consistent correlation between measured static pore pressures at two different depths within these holes that indicates a static water level is present within the tailings."*

**Response:** This concept has been clarified in the report. The resulting quasi-steady-state pore pressures from the two tests conducted within the tailings at CPT-10 showed pressure heads of about 21 and 31 feet at test depths 15 feet apart vertically. These results indicate increasing quasi-steady-state pore pressure results with depth in the tailings at that location. Other pore pressure dissipation tests conducted in Borrow Pit No. 1 at CPT-8, CPT-9, CPT-18, and CPT-19 show a range of quasi-steady-state pore pressures, without a trend of increasing quasi-steady-state pore pressures as test depths increased. The results indicate the presence of a series of depositional layers



with different textures, degrees of saturation, and varying quasi-steady-state pore pressures, rather than a static water level.

8. **Section 3.2.2.4, 3<sup>rd</sup> Paragraph:** *Add additional information here: what does CPT sounding mean? How was free water not observed? Laboratory test result from what specific sample and what Table is this data in?*

**Response:** The term “sounding” has been removed, as it is redundant to the term cone penetrometer test (CPT). CPT is a method used to obtain in-situ soil data (e.g., soil type, moisture content and stratigraphy) without collecting soil samples. The raw data generated during CPT includes tip resistance, sleeve resistance, friction ratio, dynamic pore pressures, and bulk resistivity.

The text in the report has been revised to explain that free water was not observed in T1-B11 during drilling at the location where elevated pore pressures were measured during CPT-11. Furthermore, no free water was observed on the Shelby tube used to collect a sample near that depth (51.5 to 52.5 feet bgs). Laboratory test results for the Shelby tube sample tested from 51.5 to 52.5 feet bgs from T1-B11 are shown in Table 3-4.

9. **Section 3.2.2.6, 3<sup>rd</sup> Paragraph:** *What figure is the referenced previously-developed bedrock surface displayed in? Are the paleochannels identified in the updated map?*

**Response:** Bedrock surface information was used to create the maps shown in both the Work Plan and in the PDS Report, but the bedrock surface itself is not shown in any figures other than the cross sections (Figures 3-4 and 3-5). Additional information to support the identification of the paleochannels is included in Section 3.2.2.6 of the revised report.

10. **Section 3.2.2.9:** *Last 2 paragraphs. Is a variation of 0.5 to 3.0 percent significant? Is there a correlation of the gypsum and the higher measured % of larger (silt-size) particles? Will this cause and design changes? Does it need to be further investigated?*

**Response:** A difference of 0.5 to 3.0 percent is generally insignificant, considering the variability in the materials selected for laboratory testing. The significance of the variation in water content has been described in the revised report. Based on the results of the investigation, as the percentage of silt-size material in the tailings increases, the difference between the water contents measured with the two oven temperatures also increases. The results of the laboratory testing program described in the report provide adequate data for design. No further investigations into the water content of the tailings are necessary for design. Additionally, no design changes are expected based on the information obtained and presented in the PDS Report.

11. **Section 3.3.3, 1<sup>st</sup> Paragraph:** *Please define “extent reasonably achievable”*

**Response:** This phrase has been deleted from the revised report. However, it was referring to site constraints such as required material volumes, locations of cultural resource sites, efforts to limit unnecessary disturbance to vegetation, and depths of



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suitable and available materials that will influence the final borrow area grading configurations.

12. **Section 3.4.4, 1<sup>st</sup> Paragraph:** Please define “in general accordance”. Where was it not in accordance?

**Response:** The sentences containing this term have been revised to state the following:

*“Samples were tested for durability based on guidance for long-term performance outlined by the NRC. The guidance is for rock to be used for erosion protection on exposed surfaces and utilization of a rock scoring value (Johnson, 2002).”*

13. **Figure 3-8:** Do you mean to have the Borrow Pit No. 2 label pointing to cross section at A-3?

**Response:** The label for Borrow Pit No. 2 has been removed from Figure 3-8.

14. **Boring Log TI-B10, Figure 3-4:** Add to the text a discussion of water that was encountered in B-10 and as shown on Cross Sections 1 and 2. Figure 3.4 states that all of the water in B-10 and CPT-11 were found in the alluvium. Boring log TI-B10 indicates that weathered sandstone was located from 82-85.5', clayey sand from 85.5-105' with water from 90.2'-108.2'. Weathered sandstone was located from 105-108'. Explain how the clayey sand was found beneath two weathered sandstones and which geologic formation this is.

**Response:** A summary of free water encountered beneath the tailings impoundments during the subsurface investigation is presented in Section 3.2.2.5 of the revised report. Free water was encountered below the tailings in three boreholes: TI-B3 (in the dam), TI-B10 (Borrow Pit No. 1), and TI-B11 (Borrow Pit No. 2). The water was present in the alluvium underlying the dam at TI-B3 and in the alluvium underlying the tailings at TI-B10 and TI-B11. No free water was identified in the tailings during the drilling program.

Borehole TI-B10 encountered several obstructions within the alluvium. These obstructions (at elevations of 6,910 and 6,868) are interpreted to be boulders in the alluvium, as opposed to in-place bedrock. This information is described further in Section 3.2.2.6 of the revised report and has been clarified on the boring log.

15. **Boring Log TI-B2:** Please explain 0.4' of water due to precipitation in TI-B2. Was the hole left open to the snow? Were augers left in the hole overnight?

**Response:** Boring TI-B2 was drilled on November 20, 2013 and grouted the following day. The augers were left in the borehole overnight on November 20, 2013 to prevent caving prior to grouting. Rainfall occurred overnight and the small amount of water measured in the bottom of TI-B2 on the morning of November 21 was likely the result of rainwater seeping into the hole from the ground surface. The note at the bottom of the log for TI-B2 has been revised to indicate that the borehole was left open overnight during a precipitation event.



16. **Boring Log TI-B3:** Please explain water in this boring in relation to the two prior borings. Include discussion of all measured water in the text. Also please explain why the boring log does not indicate any fill material as Figure 3-2 shows there should be 10-15' of fill? Also explain the log stating that from 40-55' it becomes very moist to wet and wet at 55-57' but notes state water measured at 65.8'

**Response:** A summary of free water encountered during the subsurface investigation beneath the impoundment is presented in Section 3.2.2.5 of the revised report. This discussion includes a summary of free water measured in TI-B3, TI-B10, and TI-B11. The description of "very moist to wet" describes a soil moisture condition (based on standard field observation guidelines) between "very moist" and "wet". Wet material, where encountered, is described as "wet" on the logs.

Embankment fill was encountered in TI-B3 to a depth of at least 16.8 feet. This has been modified on the boring log.

17. **Boring Log TI-B1:** Please add this boring into the discussion on water as it mentions wet material as well as the above borings.

**Response:** A summary of free water encountered during the subsurface investigation beneath the impoundment is presented in Section 3.2.2.5 of the revised report. This discussion includes the fact that very moist to wet alluvium was encountered in TI-B1, although a free water surface did not develop in the borehole during or immediately following drilling of TI-B1.

18. **All Boring Logs:** Please indicate Alluvium, Zone 1, Zone 2, and Zone 3 on all of the boring logs (including Borrow area) where these units were encountered.

**Response:** During the field drilling program, the field engineer was tasked with logging the materials encountered in the borings in accordance with the Field Sampling Plan and the applicable Standard Operating Procedures. Identifying the specific formation or unit name (alluvium, Gallup Sandstone, etc.) on the boring log was not performed. The boring logs provide a physical description of the materials encountered during drilling, and do not provide an interpretation of individual lithologic units, except in the case of "tailings" or "fill" materials.

The configuration of the subsurface stratigraphy and the various geological units in the area of the tailings impoundment are interpreted based on information obtained during drilling and our understanding of regional geology at the site. This information is presented on the cross sections on Figures 3-4 and 3-5 of the report.

19. **ConeTec Report (pg. 75-76 in Appendix B1.3 – B2.5):** Please include in the main text a discussion of the CPT Testing Summary table where it presents the Apparent Water Table and your interpretation of these presented results.

**Response:** The ConeTec report includes a table summarizing the data collected during the CPT investigation. The table contains a column showing depths for "Apparent Water Table". These depths were calculated based upon quasi-steady-state pore pressure measurements obtained during pore pressure dissipation (PPD)



testing. The quasi-steady-state pore pressure is typically taken to be the pore pressure measurement recorded at the end of the PPD test. In cases where a hydrostatic groundwater condition exists (i.e. no vertical flow component) and where the pore pressures at the end of PPD testing have truly dissipated to static levels, the depth of the water table at the CPT sounding location can be calculated by subtracting the static pressure from the depth at which the PPD test was performed. ConTec used these assumptions and procedures to estimate the Apparent Water Table depths.

In cases of multiple saturated or nearly-saturated fine-grained zones (as is often the case in tailings after cessation of operations), or where there is a component of flow in the vertical direction, the procedure ConeTec used to define the depth for the "Apparent Water Table" is not appropriate. In addition, when positive dynamic pore pressures are generated during CPTs in finer-grained materials, quasi-steady-state pore pressures measured at the time of PPD test termination are often higher than true "static" pore pressures. This overestimation of static pore pressures results in underestimation of the depth to the water table and overestimation of saturated thicknesses.

At Church Rock, and specifically in the borrow pits, the CPT results and the borings indicate the presence of coarse-grained materials above, and in some cases interlayered with, fine-grained materials. The laboratory data indicate the upper coarse-grained materials have low water contents and are partially saturated, even though many of the test specimens were obtained from zones that are below the "Apparent Water Table" identified by ConeTec. Likewise, laboratory testing of finer grained samples indicated that, although they were at a higher moisture content and degree of saturation, many of these materials were also partially saturated even though they lie below the "Apparent Water Table" defined by ConeTec. Therefore, the elevated dynamic and quasi-steady-state pore pressures are interpreted to indicate compressible fine-grained materials that are near saturation, rather than a static water level. This is consistent with the properties of tailings placed hydraulically during milling.

The term "Apparent Water Table", which is standard language used by ConeTec in their reports, does not accurately describe the saturation state of groundwater conditions of the tailings in this situation as verified by testing the physical samples collected during drilling. This information has been added to Section 3.2.2.4 of the revised report.

- 20. Appendix A and B1.1, pg. 24:** *The Subject is Potential Borrow Areas and Borrow Characterization Plan, Northeast Church Rock Mill Site Please correct title to be consistent with the text.*

**Response:** The title of the memorandum is inconsistent with current project nomenclature. The title of Appendix A2 has been changed to *Potential Borrow Areas and Borrow Characterization Plan, Church Rock Mill Site*. The laboratory reports may also contain references to the incorrect site name, but these have not been



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updated in the revised report. Actual sample locations (borrow area, tailings impoundment, stockpiles, etc.) are described on the tables in the report.

21. **Appendix B1.3:** *Please remove NE Church Rock Mine site data unless it is pertinent to the Church Rock Mill Site report.*

**Response:** This has been updated in the revised report.



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**Responses to DOE Comments on Pre-Design Studies, Northeast Church Rock Mine Site Removal Action, Church Rock Mill Site, dated September 8, 2014**

1. *"... we agree with NRC's statement that the proposed modeling approach "should not be used to determine or quantify drainage/seepage rates resulting from the consolidation of mine waste collocated on the tailings impoundment at the mine site."*

**Response:** Comment noted.

2. *"... it is not clear if there is a commitment to develop a contingency factor for the capacity of the repository to account for any additional waste which could be encountered during the excavation process."*

**Response:** The design will include a contingency factor for a final excavated volume both above and below the design capacity of the repository. This is a standard design item for repository capacity for a soil cleanup action, and will be explained in the Design Work Plan.

3. *"... we suggest that a field expert characterize and classify the genesis and morphology of the analogs soil profiles, and document relationships between in situ hydraulic properties and morphological features such as soil structure."*

**Response:** A natural analog study utilizing a tension infiltrometer was performed on three potential borrow soil sources near the impoundment. Two of the sources included soils that were previously undisturbed, and the third included soils that were disturbed during tailings reclamation. During the study, the soil structure was examined for physical properties that can affect water infiltration, such as the presence of voids or macropores, salt-accumulation zones, and other discontinuities. No obvious soil structure was observed. The soils were visually classified as predominantly sandy silt with some clay. The soils were likely deposited as alluvial and eolian deposits. No calcium carbonate horizon or any layered salt accumulation was observed throughout the profiles. Roots were typically the most dense near the surface and did not appear to create significant preferential flow paths. Roots were visible to the full depth of the profiles examined, but at a low density at depths of 4 to 5 feet. No other significant macropores were visible in the soils.

The soil structure was observed to be uniform from the ground surface to the depth of the profile examined. This is further supported by the consistent hydraulic properties measured with the tension infiltrometer throughout the profiles. Furthermore, the in-situ hydraulic properties measured at the soil analog locations are consistent with those measured in the laboratory on smaller, remolded samples of the same soil. Therefore, the effects of pedogenesis and long-term morphology on the hydraulic properties of the soils proposed for use in cover construction are not expected to vary significantly or impact performance over the design life of the cover. For these reasons, an additional study of the genesis and morphology of the analog soil profiles is not proposed.



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4. *"Please note that although DOE does not have authority for approving the final design, we would like to remind EPA and other stakeholders that we have agreed to perform long-term surveillance and maintenance (LTS&M) at the Church Rock site under the following conditions:..."*

**Response:** Comment noted.

5. *"... waste from the NECR mine site placed on the existing byproduct cells is, and will be, regulated under UMTRCA."*

**Response:** Comment noted.

6. *"... the collocation of waste from the NECR Mine Site will not affect the integrity of the existing byproduct cells"*

**Response:** The repository will be designed such that it will not negatively affect the integrity of the existing byproduct cells.

7. *"DOE concerns expressed in 2002 regarding differential settlement and erosion at the Church Rock site are addressed."*

**Response:** The repository design will include repair of the existing differential settlement areas and erosional issues.



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## **Responses to DOE's Verbal Comments on Pre-Design Studies Report, Northeast Church Rock Mine Site During the September 9, 2014 Advisory Group Teleconference**

- 1. Paraphrased Comment:** Provide additional detail describing the basis for each RAL Cut depth shown on Figure 3-3.

**Response:** Table 3-3, *Subsurface Soil Field Screening Results* has been expanded to include both the field screening results and laboratory soil analytical results from all soil borings and test pits advanced at the Mine Site during the RSEs and the PDS. Additionally, two columns have been added, one that indicates the interpreted RAL cut depths (as shown on Figure 3-3), and a second that provides an explanation and basis for those depths. Clarifying notes have also been added to Figures 3-3, 3-4 and 3-5.