August 20, 2012

Mr. Lance Hauer
Remedial Project Manager
Corporate Environmental Programs
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640 Freedom Business Center
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SUBJECT: PRELIMINARY REVIEW OF THE CONSOLIDATION AND WATER STORAGE CAPACITY RELATED TO PLACEMENT OF MINE MATERIAL ON THE EXISTING UNC MILL SITE TAILINGS IMPOUNDMENTS REPORT, PREPARED FOR THE NORTHEAST CHURCH ROCK MINE SITE, GALLUP, NEW MEXICO

Dear Mr. Hauer:

As part of the ongoing preliminary design effort in support of the Northeast Church Rock Non Time Critical Removal Action, United Nuclear Corporation (UNC), a subsidiary of General Electric, submitted the document entitled, "Consolidation and Water Storage Capacity Related to Placement of Mine Material on the Existing UNC Mill Site Tailings Impoundments Report," prepared by Dr. Stephen Dwyer in May 2011. A hard copy of this document was received by the U.S. Nuclear Regulatory Commission on May 22, 2012 [ML1222A159].

The staff has completed its preliminary review of this report and has identified several areas of concern requiring further information [see enclosure]. Some of these concerns have been discussed with both the Environmental Protection Agency and UNC during a Technical Meeting held in Albuquerque, New Mexico on May 15-16, 2012.

Sincerely,

/RA/

Yolande Norman, Project Manager
Special Projects Branch
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental management Programs

Docket No.: 40-8907
License No.: SUA-1475

Enclosure: Areas of Concern

cc: UNC Church Rock Distribution List

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Areas of Concern Requiring Details on the Consolidation and Water Storage Capacity Related to Placement of Mine Material on the Existing United Nuclear Corporation Mill Site Tailings Impoundments Report – Dated May 2011

The following information is needed in order for the staff to complete its independent evaluation and analyses and to complete its safety review to determine compliance with the U.S. Nuclear Regulatory Commission (NRC) regulations.

Overall:

The findings and conclusions described in the subject report are based on assumptions or data from the 1990. These assumptions and data should be validated and more updated data should be used. The licensee should state in the report which properties data will be confirmed with field work and compared with the assumptions to determine if they are valid prior to placement of the additional mine spoils. Some of the properties that should be confirmed with field data include but are not limited to: hydraulic conductivity and moisture/water content. In addition, discussion on uncertainties involved in the model is needed to provide confidence.

Technical Information:

1) In page 3 of the report, third paragraph, the licensee provides a summary of the findings from a similar report submitted in February 2010 and states the following: "There is no longer excess free water within the existing tailings, due to evapotranspiration, vertical drainage and lack of recharge." Reference the specific report with page citation to support such a statement. This statement is a significant factor for the report, but it is not clear which of the three processes listed above is responsible for having removed the excess free water within the existing tailings.

2) Section 3.1: The licensee mentioned that Terzaghi's theory of consolidation was used to calculate settlement at the site. Please explain why this theory is applicable to the site given its current and future conditions.

   In order to apply Terzaghi's principle, certain assumptions need to be fulfilled. The report should state how these assumptions are being fulfilled, or why it is not significant if one or more of these assumptions are not being fulfilled. Assumptions include:

   - The soil is homogenous (uniform in composition throughout); e.g., the effect of wood and metal from the "boneyard" within the mine spoils.

   - The soil is fully saturated (zero air voids due to water content being so high).

   - The solid particles and water are incompressible.

   - Compression and flow are one-dimensional (vertical axis being the one of interest).

   - Strains in the soil are relatively small.

- Darcy's Law is valid for all hydraulic gradients.

- The coefficient of permeability and the coefficient of volume compressibility remain constant throughout the process.

- There is a unique relationship, independent of time, between the void ratio and effective stress.

3) Figure 4 - Typical Soil Moisture Characteristic Curve: Please explain if this curve is applicable to all types of soils and why it is applicable to the Church Rock site?

4) Section 4.0, Step 5, states that the secondary consolidation coefficient (Ca) was calculated as a function of the primary consolidation coefficient (Cc), using the following relationship: Ca=0.03 x Cc. Please explain why this relationship is applicable to the type of soils at the site.

5) Section 4.0, Step 8, states that the Van Genuchten equation was used to estimate the current moisture content. Please explain why this method is applicable. Also, explain what each parameter means.

6) Section 4.0, Step 9, states that the mine spoils and waste rock is deposited directly on the final cover of the existing tailings impoundment. Is this additional weight going to be placed instantaneously or in phases? Do you expect any differential settlement?

7) Section 4.0 Step 11, states that: "It was assumed that the revised porosity is equal to the new saturated moisture content of the fine tailings layer." Is this the condition expected at the site? Or is this condition assumed to be conservative and why?

8) Section 4.0: Discussion on general assumptions used is needed in Section 4.0 explanatory paragraph on validity of use, specifically in Appendix C, is needed to provide confidence in the results of the study. The validity of the assumptions made will be questionable unless the requirements necessary to use an assumption are met.

9) Section 4.0: Please explain the calibration of the model used to provide the results in the report. The calibration of the model is an important part of the modeling process.

10) Section 4.0 and Appendix C: Discussion on uncertainties involved is needed to provide confidence in the results of the study. The report is attempting to predict "primary" consolidation after loading additional weight on top of the existing tailings. Uncertainty is unavoidable and will be part of the analysis and modeling effort. A section discussing input and output uncertainty is necessary and inevitable for a study such as this.

11) Section 4.0: To help reduce the uncertainty and provide greater understanding, a water budget for the proposed mine spoils cover and original cover below should be provided. The components of the conceptual water balance model would be the average annual precipitation, surface runoff, lateral drainage, evaporation, transpiration, deeper infiltration, and water storage change. Potential infiltration through the mine spoils cover may end up accumulating on top of the old radon barrier layer and exit the disposal system by means of lateral drainage. A water budget of the cover components will

provide for greater understanding of how the cover will function and where water will move.

12) Section 4.0: Potential scenarios with greater overall uncertainty should be discussed. For example, if water is sprayed on the parts of the cover during construction, discuss how this will affect the results of the consolidation report. In addition, if heavy machinery be going back and forth over the cover area during construction, discuss how this will affect the consolidation results of the report. A section discussing future uncertainty during the construction phase and beyond is a necessary part of the report and will help provide confidence in the model results.

13) Section 5.0, second paragraph, states that: "During the first analysis, it was found that the most sensitive parameter was the saturated hydraulic conductivity of the underlying material below the fine grained tailings (alluvium or Zone 3 material)." Is this finding explained in the U.S. Filter (2004) report?

14) Section 5.0, third paragraph, the licensee explained that for the second set of sensitivity analysis, the saturated hydraulic conductivity of the course and fine grained tailings were changed based on values from Rawls et al. (1982). Please explain why these values are applicable and should be used.

15) Appendix A: The parameters values listed in the tables should clearly state the source of the value given, e.g., result of modeling, lab results, field studies, or literature based. Stating the source of the data value, i.e., result of modeling, lab results, field studies, or literature based, provides transparency and can build confidence in the results. The staff was not able to find in the references the values used in the calculation.

16) Section B.2, first paragraph, last sentence: the licensee mentioned the Samani method and Penman Method. Please explain why these methods are applicable to the site.

17) Section B.2, second paragraph, states that: "For infiltration events, the upper boundary was set to a maximum hourly flux (representative of local conditions). For these runs it was conservatively set to 0.4 inches (1 cm) per hour that produced minimal runoff while maximizing infiltration." This means that infiltration coefficient is 1? Is it accurate?

18) Please provide the water table location for each profile if it exists within the layers presented.

19) Appendix C, page C-2: Please specify where in the reference the weight of tailings is described as to be 110.1 pcf. Also, please explain why the coarse tailings have the same weight as the fine tailings.

20) Appendix C, page C-3: For each profile, please provide the detailed calculation of Primary Consolidation coefficient (Cc), including the numbers in the equations as provided at the top of the page when calculating the stresses. Also provide the reference for assuming a void ration of 1.12766 for the fine tailings.

21) Appendix C, page C-3: Provide references for weight of cover layer (mislabeled as "weight of coarse tailings") given as 129.6 pcf.

22) Please clearly label the detailed calculations for steps 10 thru 13 described in Section 4.0. These steps are significant to understanding the report, but difficult to review and evaluate in Appendix C.

23) Please make sure the calculations are accurate. The staff made some confirmatory calculations and obtained different results:

    Examples:
    Page C-3 of the report:

$$\Delta\sigma = (5)(110.1) + (2)(129.6) = 809.7\ psf\ (not\ 810.7\ psf)$$

    Page C-6:

    Pressure due to placement of spoils and waste rock on top of the tailings
    $= (105.9\ (15.5) + (3)(105.9) = 1959.15\ psf\ (not\ 1958.7\ psf)$

24) Appendix C, page C-6: Please provide a reference for the density of 105.9 pcf for the mine spoils and waste rock. Please also explain why the cover has the same density of 105.9 pcf.

25) Appendix C, page C-6, Figure 2: It is not clear that figure C2 is showing 'initial versus final head' before mine spoils emplacement. Note should be revised to state that "the results show the final average soil suction….**before** placement of additional soil…"

26) The staff noticed that sensitivity analysis #2 was only included for Profile #2 and sensitivity analysis #1 was not included. Is there a reason why this analysis results were not included and discussed?

27) Did any of the analyses showed that drainage could occur or that the water content was close to saturation?

28) Request: In recent meetings with General Electric (GE), U.S. Environmental Protection Agency, NRC, and other organizations, GE agreed to include in their schedule the time needed to study changes to the old radon barrier once the rip-rap and top soil has been removed from the old cover. Studying the old radon barrier and the processes that have potentially changed the barrier over the last decades will give valuable insight into long-term cover performance (changes to the soil properties, heterogeneity, etc.). Please confirm that this is still the intention of the licensee.

Editorial Changes:

Pages 5 and 6 present Figures 3 and 4 and should be renumbered to Figures 1 and 2, respectively.

Please include page numbers in all pages.

Appendix A: In table of parameters used for analysis, current residual moisture content for the coarse tailings is listed as 0079, please correct it to 0.079. For the saturated hydraulic conductivity listed for alluvium for Profile#1, please remove one of the units since are repeated.

Section B.2, second paragraph, please change “(Equation1)” to (Equation B.1).”