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BUILDING A BETTER WORLD

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November 23, 2015

James Smith
Project Manager
Division of Waste Management and Environmental Protection, USNRC
Mail Stop T-8 FS
Washington D.C. 20555-0001

RE: Final Design Work Plan
Northeast Church Rock Mine Removal Action, McKinley County, New Mexico

Dear Ms. Jacobs and Mr. Smith

On behalf of United Nuclear Corporation and the General Electric Company (UNC/GE), this letter transmits the *Final Design Work Plan* for the Northeast Church Rock Mine Removal Action, including Responses to Agencies Comments on the draft *Design Work Plan* (MWH, July 2015), which are attached to this letter. All of the comment documents were sent to GE via email by the U.S Environmental Protection Agency (USEPA) on Wednesday, September 16, 2015, except for the "preliminary" comments document, which was sent Friday, September 4, 2015.

Due to the nature of the Agency comments on the draft Work Plan and the similar themes among the comments, the comments have been grouped by topic subject where possible. Each comment is clearly marked with the Agency name and comment number for ease of reference. Additionally, where one individual comment contains several different questions or topics, those are designated with a red letter to differentiate responses to individual topics within the same comment.

If you have any questions, please feel free to contact me at (970) 871-4361 or Eileen Dornfest at (970) 212-2774.

Sincerely,
MWH Americas, Inc.

Toby Leeson, P.G.
Removal Action Project Manager

Encl.: Responses to Comments

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Final Design Work Plan
Repository Screening and Selection Report
Design Criteria Report

CC: Janet Brooks, US EPA Region 6
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Stephen Dwyer, Dwyer Engineering, LLC
Steve Jetter, NMED
Roger Florio, General Electric

ATTACHMENT

RESPONSES TO AGENCY COMMENTS ON THE DRAFT DESIGN WORK PLAN

NORTHEAST CHURCH ROCK MINE REMOVAL ACTION

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Responses to Grouped Comments on the NECR Design Work Plan

1. *Design analyses results, input parameters, and assumptions:*

   a. ***EPA Additional Comments (Comment #2)**: The results, input parameters, and assumptions used in each of the design analyses should be compared to ensure that there are no contradictions between the analyses. For example, the assumptions and material properties (e.g. riprap size, etc.) used in the erosion analyses should not contradict those used in the ET cover analyses.*

   b. ***NRC Comment (Comment #3)**: The results, input parameters, and assumptions used in each of the design analyses should be compared to ensure that there are no contradictions between the analyses. For example, the assumptions and material properties (e.g. riprap size, etc.) used in the erosion analyses should not contradict those used in the ET cover analyses.*

      Response: Comment noted. This evaluation will be started during the Preliminary (30%) Design and refined during the Pre-Final (95%) Design. These evaluations will be described in the Design Reports submitted as part of the 30% and 95% Design packages.

2. *Define terms*

   a. ***EPA Additional Comments (Comment #3)**: The terms consolidation, settlement, and differential settlement should be clearly defined when they are discussed. Consolidation will occur to some extent in the mill tailings below the repository (both over the short term and over the long term) in contrast to the tailings outside of the new repository boundary. Settlement may also occur in the mine waste over time. If the settlement in the mine waste is uneven due to the nature of the mine spoils, e.g., larger object (debris) vs. fine-grained sediments, differential settlement may occur. A settlement analysis for the mine waste and the mill tailings should be performed for profiles containing varying materials and at the boundary of the new repository.*

   b. ***NRC Comment (Comment #2)**: The terms consolidation, settlement, and differential settlement should be clearly defined when they are discussed. Consolidation will occur to some extent in the mill tailings below the repository (both over the short term and over the long term) in contrast to the tailings outside of the new repository boundary. Settlement may also occur in the mine waste over time. If the settlement in the mine waste is uneven due to the nature of the mine spoils, e.g., larger object (debris) vs. fine- grained sediments, differential settlement may occur. A settlement analysis for the mine waste and the mill tailings should be performed for profiles containing varying materials and at the boundary of the new repository.*

      Response: Definitions of the terms “consolidation,” settlement,” and “differential settlement” are included in Appendix B of the Work Plan. A description of the settlement analyses that will be performed as part of the design is also included in Appendix B of the Work Plan. Settlement analyses will be performed as part of the 30% design, and described in the Design Report submitted as part of the 30%

Design package. The settlement analyses will be performed for profiles containing varying amounts of soil, tailings, and mine debris. Additionally, construction specifications developed during design will provide specifications for debris demolition and placement in the repository.

3. *"Areas of Potential Concern" from May 16, 2013 NRC letter*

   a. ***EPA Additional Comments (Comment #5)**: An additional "Areas of Potential Concern" from the May 16, 2013 NRC letter [ADAMS No. ML13126A259] included perched conditions within the mine waste. a) An analysis demonstrating that such concerns are unfounded should be included in the Design Work Plan. b) Another potential concern related to breaks/cracks outside the repository perimeter. MWH's response in August 2013 was that, "This abrupt change in loading is not planned, since the repository will be constructed with a sloping surface. The perimeter of the repository will be thin…" In the Draft Design Work Plan, two of the three designs, including the preferred option, contradict this statement and do include "abrupt changes." Therefore, the concern is still relevant.*

   b. ***NRC Comments (Comment #9)**: An additional "Areas of Potential Concern" from the May 16, 2013 letter [ADAMS No. ML13126A259] included perched conditions within the mine waste. a) An analysis demonstrating that such concerns are unfounded should be included in Design Work Plan. Additionally, the NRC staff had previously commented on "Areas of Potential Concern" in the May 16, 2013 letter and MWH had responded to these potential concerns on August 16, 2013 [ADAMS No. ML13242A118]. b) One potential concern related to breaks/cracks outside the repository perimeter. MWH's response stated that, "This abrupt change in loading is not planned, since the repository will be constructed with a sloping surface. The perimeter of the repository will be thin…" Two of the three designs, including the preferred option, contradict this statement and do include "abrupt changes." Therefore, NRC staff's concern is still relevant.*

      Response: This response is separated into multiple sections, to address the individual topics.

      a) The original NRC comment relating to development of perched water conditions (May 16, 2013 letter) is as follows: ***NRC Comment 5:** The occurrence of drainage, if a liner or low permeability layer is placed beneath the mine waste, may potentially create a perched condition within the mine waste, above the existing tailings impoundment. Failure of the side-slopes or slope instability could result due to pore water pressure increase. The transport and placement of the mine waste prior to final cover completion may allow a significant amount of water to enter into the impoundment (Note this may also include the application of water for dust suppression)*.

      Regarding perched water conditions, design of the ET cover will include determination of the cover thickness that minimizes percolation into the underlying mine spoils. Infiltration modeling, including sensitivity analyses for the ET cover design, will be performed during the 30% Design. This modeling will also evaluate

water migration through the mine waste and the potential for collection on the repository base layer. That is, the modeling will evaluate the full depth of the profile from surface to the underlying alluvium including the unsaturated portions of the underlying alluvium. To emphasize the importance of minimizing the potential for introduction of new water into the existing profile, construction specifications developed during design will include an acceptable soil compaction zone for both the repository base layer and the mine spoils. Material will be compacted to meet a minimum density and will be placed and compacted as dry as possible, but not to exceed the optimal moisture content. If material is wetted during construction due to a precipitation event or accidental over-watering, no subsequent soil will be placed until the wet material is re-worked until it meets the construction specification.

b) The original NRC comment relating to breaks/cracks outside of the repository perimeter (May 16, 2013 letter) is as follows: ***NRC Comment 3:*** *Breaks/cracks outside repository perimeter Weight from the addition of mine waste within the tailings impoundment may cause future breaks and cracks in components (e.g., compacted clay liner) of the existing impoundment around the perimeter of the repository (i.e. tailings disposal area).*

Regarding the potential for development of cracks outside of the repository perimeter, this evaluation will be performed during the design. Analyses will include stress influence of the embankment fill beyond the perimeter of the repository, bearing capacity calculation, differential settlement, and cover cracking for the radon barrier. Descriptions of the analyses that will be performed as part of the design are included in Appendix B of the Work Plan. It is important to note that a compacted clay layer does not exist, rather the radon soil layer is composed of a loamy soil excavated from an on-site borrow source.

4. *Section 3.5, pg. 3-3, Design Management Strategy; Section 9.1.1, pg. 9-2, Preliminary (30%) Design; Table 9-1*

   a. ***EPA Additional Comments (Comment #8)****: Page 3-3, Section 3.5, Page 9-2, Section 9.1.1 and Table 9-1: It's not clear from the Work Plan permitting discussion whether GE is intending to apply for any of the listed permits or just meet the substantive requirements as allowed under an on-site remediation under CERCLA. Permitting applications may be required for certain aspects of the construction such as off-site transportation of the principal threat waste. Please clarify the language in the referenced sections of the work plan to clarify when or whether the discussion refers to the substantive versus the administrative permitting requirements.*

   b. ***DOE's Comments (Comment #1):*** *Section 3.5, pg. 3-3, Design Management Strategy; Section 9.1.1, pg. 9-2, Preliminary (30%) Design; Table 9-1: It's not clear from the discussion if GE is intending to apply for permits or just meet the substantive requirements as allowed under an on-site remediation under CERCLA. Also 9-2 states "activities will be managed to meet the substantive requirements of applicable environmental permitting regulations"; doesn't the law apply to all permits? We believe the intent is met by dropping the clause "environmental permitting". Table 9-1,*

Permitting Requirements and Compliance Plan, includes a "schedule for obtaining permits". We suggest that the Language in the Design Work Plan should be clarified.

Response: Text in Section 3.4 of the Work Plan has been revised to state that substantive requirements will be followed for permits applicable or relevant to any portion of the Removal Action that occurs entirely within the Site as defined by the SA. Permits applicable or relevant to portions of the Removal Action that occur off-site (e.g., off-site transport of mine spoils) will be applied for, if required.

5. *Section 6.1, pgs. 6-1 and 6-1, Siting and Conceptual Design Criteria*

   a. ***EPA Preliminary Comments (Supp. Misc. Comments #4):*** *Section 6.1, pgs. 6-1 and 6-2, Siting and Conceptual Design Criteria: We believe that if visual aesthetics is a required goal, the view from nearby residences should be considered. Which vantage point(s) that is the reference for the visual impact determination should be clearly described in the Work Plan (e.g., pg. 6-5, "this option [3] has the greatest visual impact of the three options")? Minimizing visual impact is a laudable goal but not as great a criterion as protection. The use and determination of visual impact should be discussed in the September design meeting.*

   b. ***DOE's Comments (Comment #3):*** *Section 6.1, pgs. 6-1 and 6-2, Siting and Conceptual Design Criteria: We believe that if visual aesthetics is required as a goal, the consideration should be as viewed from nearby residences, not from the highway. Which vantage point it is the reference for the determination should be described in the Work Plan (e.g., pg. 6-5, "this option [3] has the greatest visual impact of the three options"). Maybe minimizing visual impact is a laudable goal but not as great a criterion as protection. We do not understand how a rock slope in the desert is a visual impact to drivers travelling down the highway. This is especially true if left subject to the natural forces and vegetation. In time the new cell should become just like the analog sites. The use and determination of visual impact should be discussed in the September design meeting.*

      Response: Section 6 of the Work Plan has been moved to Appendix A. The qualitative comparison of repository options provided in the Work Plan has been revised to include additional quantitative comparison criteria.

6. *Section 8.2.4, pg. 8-8, Haul Roads*

   a. ***EPA Additional Comments (Comment #31):*** *Page 8-8, Section 8.2.4: Lists that "a traffic control plan will be prepared to define the possible haul routes…The traffic control plan will be used to identify the routes of travel, times of operation, and traffic rules". Section 9.1.1, pg. 9-2, lists a traffic safety plan as an element of the Preliminary Design. In addition, the material management plan will include "…a map with a description and coordinates of routes that will be used by heavy equipment…" Table 5-1, pg. 4 of 15, under paragraph 2.9.5, Transportation, states "a transportation plan will be used to identify routes"… Table 9-1. The table does not include a Traffic Control Plan nor a Traffic Safety Plan. The Site Management, Safety, & Security Plan under the Plan Description includes "-7) traffic control &safety, including upgrades to local*

roads, and"... We suggest that the Design Work Plan include a clarification of which documents have what information and rename if all of these plans are the same document.

b. ***DOE's Comment (Comment #4):*** *Section 8.2.4, pg. 8-8, Haul Roads: Lists that "a traffic control plan will be prepared to define the possible haul routes…The traffic control plan will be used to identify the routes of travel, times of operation, and traffic rules". Section 9.1.1, pg. 9-2, lists a traffic safety plan as an element of the Preliminary Design. In addition, the material management plan will include "…a map with a description and coordinates of routes that will be used by heavy equipment…". Table 5-1, pg. 4 of 15, under paragraph 2.9.5, Transportation, states "a transportation plan will be used to identify routes"… Table 9-1. The table does not include a Traffic Control Plan nor a Traffic Safety Plan. The Site Management, Safety, & Security Plan under the Plan Description includes "-7) traffic control &safety, including upgrades to local roads, and"... We suggest that the Design Work Plan include a clarification of which documents have what information and rename if all of these plans are the same document.*

Response: The appropriate sections of the revised Work Plan have been modified to reference the Traffic Safety Plan, which will be part of the Site Management, Traffic Safety & Security Plan (see Table 7-1 of the revised Work Plan).

7. *Section 6.1, pg. 6-1, third bullet*

a. ***EPA Preliminary Comments (Supp. Misc. Comment #3):*** *Section 6.1, pg. 6-1, third bullet: A repository cover design that minimizes long-term maintenance is considered inadequate. The final repository design will need to provide permanent isolation of byproduct and non-byproduct material, and minimize the potential for dispersion by natural forces, without the need for active maintenance, over the 1,000-year longevity requirement. Additionally, no credit may be taken for active maintenance in the design for long-term stability.*

b. ***NRC's Comment (Comment #14):*** *Repository cover design to minimize long-term maintenance: A repository cover design that minimizes long-term maintenance is considered inadequate. The final repository design will need to provide permanent isolation of byproduct and non-byproduct material, and minimize the potential for dispersion by natural forces, without the need for active maintenance, over the 1,000-year longevity requirement. Additionally, no credit may be taken for active maintenance in the design for long-term stability.*

Response: Comment noted. This has been clarified in Appendix B. The repository will be designed for no active maintenance requirements over the 1,000-year longevity requirement.

8. *Original UNSAT H modeling*

a. ***EPA Preliminary Comments (Comment #1):*** *Overall Comment – Outstanding comments: The staffs from various agencies had comments and concerns with the original UNSAT H modeling that was done in 2011, and would like an opportunity to*

resolve those issues before the model is run to determine the flow through the tailings impoundment. The more significant issues are listed below.

- *a) It is not clear how the Terzaghi assumptions are being fulfilled, or why it is not significant if one or more of these assumptions are not being fulfilled. However, a previous UNC response did state that: "...the assumptions have been shown to be valid in similar applications..." in reference to Terzaghi's theory of consolidation. NRC staff has long expressed interest in such documents and is interested in reviewing documentations pertaining to these similar applications which demonstrate that Terzaghi's theory (for saturated soils) has been successfully applied to partially saturated, heterogeneous/ anisotropic soils to predict consolidation. This information is necessary to demonstrate the conservatism of the simulations.*
- *b) Section 3.1 in the 2011 Consolidation report stated that the first stage of consolidation is the "Immediate" stage. No further discussion was presented in the report on this stage. Technical literature suggests that immediate settlement analyses are used for all fine-grained soils including silts and clays with a degree of saturation of 90% or less, and for all coarse-grained soils, while consolidation settlement analyses are used for all saturated, or nearly saturated, fine-grained soils. If the impact from immediate settlement is not significant in comparison to the Terzaghi's primary and secondary consolidation, a technical basis assumption should be provided.*

It is critical that this comment be addressed promptly.

b. ***NRC Comment (Comment #17d):*** *The staffs from various agencies had comments and concerns with the original UNSAT H modeling that was done in 2011, and NRC staff would like an opportunity to resolve those issues before the model is run to determine the flow through the tailings impoundment. The more significant issues are listed below. NRC staff can provide more detail and specifics about these issues upon request.*

   i. *a) It is not clear how the Terzaghi assumptions are being fulfilled, or why it is not significant if one or more of these assumptions are not being fulfilled. However, a previous UNC response did state that: "...the assumptions have been shown to be valid in similar applications..." in reference to Terzaghi's theory of consolidation. NRC staff has long expressed interest in such documents and is interested in reviewing documentations pertaining to these similar applications which demonstrate that Terzaghi's theory (for saturated soils) has been successfully applied to partially saturated, heterogeneous/ anisotropic soils to predict consolidation. This information is necessary to demonstrate the conservatism of the simulations.*

   ii. *b) Section 3.1 in the 2011 Consolidation report stated that the first stage of consolidation is the "Immediate" stage. No further discussion was presented in the report on this stage. Technical literature suggests that immediate settlement analyses are used for all fine-grained soils including silts and clays with a degree of saturation of 90% or less, and for all coarse-grained soils, while consolidation*

settlement analyses are used for all saturated, or nearly saturated, fine-grained soils. If the impact from immediate settlement is not significant in comparison to the Terzaghi's primary and secondary consolidation, a technical basis should assumption should be provided.

Response: A response to this comment will be provided as a separate document by the end of the year.

9. *Repository – New Cover/Existing Cover*

   a. ***EPA Preliminary Comments (Comment #2):*** *Overall Comment – Sitewide Design Objective: The UNC Design Advisory Team does not agree with the abrupt distinction between the new cover and the existing cover. Previous design alternatives integrated the slopes of the new cover with the existing cover slopes. The necessary aprons, toes, and drainage swales proposed for the design will be a major area of review due to the potential for damaging erosive forces at these interfaces. The design objective for the repository should first consider reasonable low risk alternatives with consideration of potential environmental impacts (e.g., ground water impacts) and long-term maintenance (e.g., self-sustaining vegetation, differential settlement, and erosional stability).*

   In addition, the UNC Design Advisory Team will evaluate the overall drainage of the entire site, including but not limited to, the existing drainage channels and area north of the North Cell that has been subject to frequent flooding. Also of sitewide interest, is the stability of the existing dam.

   b. ***NRC Comment (Comment #16 b):*** *Repository construction should minimize the disturbance area on the existing TDA cover: The NRC staff does not agree with the abrupt distinction between the new cover and the existing cover. Previous design alternatives integrated the slopes of the new cover with the existing cover slopes. The necessary aprons, toes, and drainage swales proposed for the three options will be a major area of NRC review due to the potential for damaging erosive forces at these interfaces. The design objective for the repository should first consider reasonable low risk alternatives with consideration of potential environmental impacts, e.g., ground water impacts, long-term maintenance, e.g., self-sustaining vegetation, differential settlement, and erosional stability.*

   Response: Comment noted. These items will be addressed during the design process.

10. *Existing Radon Barrier*

   a. ***EPA Preliminary Comments (Comment #8)***: *General Comment – Radon Barrier: The existing radon barrier will perform as the foundation for the proposed repository. a) An additional stability analysis should be performed on the foundation (previous radon barrier) to determine loading conditions and factors of safety at this interface. The foundation will be subjected to shear stresses imposed by the weight of the new repository. Many soils undergo relatively large plastic strains as the applied shear stresses approach the shear strength of the soil and should be analyzed as a potential*

point of failure. Regulatory Guide 3.11, Version 3 should be reviewed for additional guidance.

b) Section 8.2.1 (p. 8-3) discusses how "The upper 12 inches of the existing 18-inch thick tailings cover (radon barrier) will then be scarified, moisture conditioned, and compacted in place, to form the repository base layer." In case the radon barrier is thinner than expected, additional suitable material may be needed to supplement the existing radon barrier. In addition, with a thinner radon barrier, there is a concern that tailings may be brought to the surface.

c) If grading of the base layer of the mine waste cell follows the existing grades, it appears the possibility of a seep at the low end/toe of the cover would be increased. How is the design going to minimize this potential, and eliminate any possible long-term maintenance problems potentially associated with the seeps? Please provide greater detail on the choice of the design strategy in using the proposed grading plan.

b. ***NRC Comments (Comment #18)**: b) Section 8.2.1 (p. 8-3) discusses how "The upper 12 inches of the existing 18-inch thick tailings cover (radon barrier) will then be scarified, moisture conditioned, and compacted in place, to form the repository base layer." In case the radon barrier is thinner than expected, tailings may be brought to the surface.*

c. ***NRC Comments (Comment #7)**: The existing radon barrier will be utilized as a liner and will also perform as the foundation for the proposed repository. a) An additional stability analysis should be performed on the foundation (previous radon barrier) to determine loading conditions and factors of safety at this interface. The foundation will be subjected to shear stresses imposed by the weight of the new repository. Many soils undergo relatively large plastic strains as the applied shear stresses approach the shear strength of the soil and should be analyzed as a potential point of failure. Regulatory Guide 3.11, Version 3 should be reviewed for additional guidance.*

d. ***DOE Comment (Comment #18)**: Section 8.2.1, pg. 8-3, Repository Design-Minimizing Perched Water: "Grading of the base layer will generally follow existing grades on the cover." c) If grading of the base layer of the CERCLA cell follows the existing grades, it appears the possibility of a seep at the low end/toe of the cover would be increased? If there is a seep, will it be a part of design? If a seep occurs, how will EPA, NRC, or State of New Mexico view it? What would the view of the seep be, particularly if the water had elevated uranium (e.g., a release under environmental regulations?) and what might be requested of GE? Please provide greater detail on the choice of the design strategy in using the proposed grading plan.*

Response: a) Regarding failure of the radon barrier of the repository, a cracking analysis will be conducted to verify that the existing radon barrier will not experience cracking due to differential settlement. Additionally, factors of safety for bearing capacity failure and the stress influence of the proposed repository on the existing cover will be evaluated. Appendix B of the Work Plan (Section 3.3.1.12) describes the approaches for these analyses.

b) Comment noted. This comment supports one of the reasons for limiting the overall size of the repository. Thickness information for the existing cover will be used to develop the specifications. The specifications will include contingency requirements to address the possibility of encountering tailings and adding material to the radon barrier if it is too thin.

c) The potential for seep development will be evaluated during the 30% Design.

11. Repository selection criteria

a. ***EPA Preliminary Comments (Comment #3): Overall Comment – Selection Criteria****: The Design Work Plan states that Option 2, the North Dome option, (Figure 6-2) is the preferred repository option, based on the evaluation presented in Section 6.2 and siting and conceptual design criteria summarized in Table 6-1. However, Section 6.2 does not contain an evaluation, but instead a qualitative listing of comparative characterizations relative to two other repository options, and Section 6.3 justifies the selection of Option 2 by repeating the descriptions in Section 6.2. Critical information and data is missing from the report, e.g., no quantitative information is provided with regards to the implications for an ET cover, stability/seepage in the Borrow Pit Area, etc., so that a selection of conceptual design is not possible.*

   The criteria of "Long-Term Maintenance - Erosional Stability" listed in Table 6-1 is only addressed in a relative manner by classifying each of the designs as high, medium or low risk. No supporting calculations are presented. To determine a range of erosion protection designs that are compatible with an ET-type cover, screening calculations using the methods presented in NUREG-1623 should be conducted. These screening calculations could provide a range of stable slope-length configurations to inform the conceptual design.

   This table would be more useful if it was expanded to specific items such as estimated settlement, estimate runoff, and estimated flux.

   Finally, discussion seems to place higher emphasis on avoiding use of 4:1 slopes and riprap and the asserted visual impact. The impact is undoubtedly even less significant as the cell cover ages. It would appear that the functionality of the 4:1 slopes should be a greater consideration than visual impact in the discussion.

b. ***NRC Comments (Comment #10):*** *Section 1-1 (p. 1-2) states that, "This Design Work Plan describes the process and strategy that will be used to design the remedy; it does not contain design details such as best management practices (BMPs), design calculations, assumptions, or technical specifications. These details will be developed during the actual design process and will be included in the design submittals." Although this critical information is missing from this report, Section 6.3 states that Option 2, the North Dome option, (Figure 6-2) is the preferred repository option, based on the evaluation presented in Section 6.2 and siting and conceptual design criteria summarized in Table 6-1. However, Section 6.2 does not contain an evaluation, but instead a qualitative listing of comparative characterizations relative to two other repository options, and Section 6.3 justifies the selection of Option 2 by repeating the descriptions in Section 6.2. Characteristics that seemed to have been given higher consideration for choosing Option 2 included visual impact which appears to have*

been synonymous with the amount of riprap included in the design. In comparison, repository features and processes relied upon to protect public health and safety, which may or may not include riprap, could not be considered when selecting the design option since this information is currently unknown. Critical information and data is missing from the report, e.g., no information is provided with regards to the ET cover, so that a selection evaluation is not possible.

Response: Comment noted. Additional information is provided throughout Appendix A of the Revised Work Plan.

12. *Section 4.3.2, page 4-2*

a. ***EPA Preliminary Comments (Supplementary Comment #2):*** *Section 4.3.2 (p. 4-2) States that, "During the RA, PTW will be segregated from lower activity mine waste and transported to an off-site…" The references for how for this PTW will be segregated from the lower activity mine waste should be provided.*

b. ***NRC Comments (Comment #21):*** *Section 4.3.2 (p. 4-2) states that, "During the RA, PTW will be segregated from lower activity mine waste and transported to an off-site…" The references for how for this PTW will be segregated from the lower activity mine waste should be provided.*

Response: Agreed. Methods and procedures to identify and segregate PTW material from lower activity mine waste will be described in the Design Reports submitted in the 30% and 95% Design packages.

13. *Section 8.2.1.9, radon emanation*

a. ***EPA Preliminary Comments (Supplementary Comment #5):*** *a) Section 8.2.1.9 provides a brief description of the radon emanation analysis and states that "The cover thickness and material will prevent release of radon-220 and -222 exceeding an average release rate of 20 pCi/m2s…." To comply with 10 CFR 40, Appendix A, Criterion 6(5), near surface cover materials (i.e., within the top three meters) may not include waste or rock that contains elevated levels of radium; soils used for near surface cover must be essentially the same, as far as radioactivity is concerned, as that of surrounding surface soils. This is to ensure that surface radon exhalation is not significantly above background because of the cover material itself. b) Section 8.2.1.9 further states that "Soil properties for the cover materials in the RADON model will be based on the laboratory test results for the mine spoils and the borrow materials from the PDS." This statement is unclear and appears to include the mine spoils into the final cover thickness. The final cover that will be placed above the mill tailings and the mine waste must meet all the requirements in Criterion 6. Therefore, the final cover thickness must be calculated to account for radon emanation from both the mill tailings, the mine waste, and any additional material that exceeds background conditions for radioactivity. Please provide clarifying information about the final cover calculation and assumptions used.*

b. ***NRC Comments (Comment #11):*** *a) Section 8.2.1.9 provides a brief description of the radon emanation analysis and states that "The cover thickness and material will prevent release of radon-220 and -222 exceeding an average release rate of 20*

pCi/m2s…." To comply with 10 CFR 40, Appendix A, Criterion 6(5), near surface cover materials (i.e., within the top three meters) may not include waste or rock that contains elevated levels of radium; soils used for near surface cover must be essentially the same, as far as radioactivity is concerned, as that of surrounding surface soils. This is to ensure that surface radon exhalation is not significantly above background because of the cover material itself. b) Section 8.2.1.9 further states that "Soil properties for the cover materials in the RADON model will be based on the laboratory test results for the mine spoils and the borrow materials from the PDS." This statement is unclear and appears to include the mine spoils into the final cover thickness. The final cover that will be placed above the mill tailings and the mine waste must meet all the requirements in Criterion 6. Therefore, the final cover thickness must be calculated to account for radon emanation from both the mill tailings, the mine waste, and any additional material that exceeds background conditions for radioactivity. Please provide clarifying information about the final cover calculation and assumptions used.

Response: a) The RADON model will be used to calculate radon emanation through the ET cover from the underlying mine waste. The cover will be designed to meet the radon emanation criteria. b) Soil properties for the cover materials and mine waste materials were determined during the PDS and will be used in the RADON model. This has been clarified in Appendix B of the Revised Work Plan.

14. Institutional Controls

a. ***EPA Additional Comments (Comment #12):*** *Page 4-4, Section 4.3.8: Due to the permanent structures such as the caps for the mine shafts, institutional controls may be necessary on the Mine Site as well to protect these structures. An initial list of proposed institutional controls or access restrictions should be included in the 30% design.*

b. ***DOE Comments (Comment #9):*** *Section 4.3.8, pg. 4-4, Institutional Controls and Access Restrictions: Are IC's or access restrictions intended for the mine site? (See comment 8).*

Response: Comment noted. At the Mine Site, the revegetation monitoring period will last at least five years. Additional access controls or maintenance requirements may be required and will be proposed during the design process, if necessary.

15. Long term site management

a. ***EPA Additional Comments (Comment #13):*** *Page 4-4, Section 4.3.9: "…OMM activities that will be performed at the Mine and Mill Sites until property transfers occur." There is no plan for the **NECR mine** site property to transfer (to another entity). Please correct this sentence. Are long-term OMM activities anticipated at the mine site (i.e., when revegetation is considered successful)?*

b. ***DOE Comments (Comment #2):*** *Section 4.3.9, pg. 4-4, Long-term Site Management: "…OMM activities that will be performed at the Mine and Mill Sites until property transfers occur." We were not aware that the mine site property would transfer (to another entity). If the sentence is incorrectly stated, please correct. If the mine site*

will not transfer to another entity, when does the OMM activities end at the mine site (i.e., when revegetation is considered successful)? Please clarify in the Design Work Plan the end state, ownership and activities occurring as Operation, Monitoring and Maintenance (OMM).

Response: Text in Section 4.3.6 of the revised Work Plan has been clarified to address this comment.

16. Table 8-1

a. ***EPA Additional Comments (Comment #18):*** *Table 8-1: "Minimize Perched Water: Low-permeability layer" - Under Performance Criterion-"This [low permeability] layer will be compacted to meet a hydraulic conductivity of no more than 1 x 10-7 cm/s." It needs to be specified if this is saturated hydraulic conductivity or unsaturated conductivity and how will the value of conductivity be assessed, by laboratory testing or field permeability testing. Please address in the Preliminary (30%) Design Document.*

b. ***DOE Comments (Comment #13):*** *Table 8-1, "Minimize Perched Water: Low-permeability layer" - Under Performance Criterion: "This [low permeability] layer will be compacted to meet a hydraulic conductivity of no more than 1 x 10-7 cm/s." It needs to be specified if this is saturated hydraulic conductivity or unsaturated conductivity and how will the value of conductivity be assessed, by laboratory testing or field permeability testing. Please address in the Preliminary (30%) Design Document.*

Response: Comment noted. The remaining soil currently termed the radon barrier will be evaluated for 10^{-7} cm/sec unsaturated hydraulic conductivity as stated in the ROD. This evaluation will be performed during the 30% design to verify compliance with this ROD requirement. Results of preliminary evaluations will be included in the Design Report submitted as a part of the 30% Design package.

17. Compaction and placement requirements

a. ***EPA Additional Comments (Comment #20):*** *a) Page 8-2, Section 8.2.1: Compaction and placement requirements should include percent of debris in any given area and the lift and compaction/testing requirements for lifts with debris. (e.g., test pads may be required depending on percent of debris mixed with soil). These details can be addressed in the 30% design.*

b) The text includes several general references that will be used for the differential settlement and drainage analysis. Please provide the specific criteria from the referenced materials that will be used and the location of these references within the guidance documents.

c) Please provide additional details on why particular factors of safety are used for the Seismic Hazard Analysis/Liquefaction Analysis and Slope Stability Analysis sections,

especially the guidance that it pertains to. Additionally need to describe the selected critical profile and why that is the critical profile used.

Again – the references are general and you need to provide the specific paragraph/section that you are following.

b. ***DOE Comments (Comment #10):*** *a) Section 8.2.1, pg. 8-2, Placement of Waste: Compaction and placement requirements should include percent of debris in any given area and the lift and compaction/testing requirements for lifts with debris. (e.g., test pads may be required depending on percent of debris mixed with soil).*

Response: a) The comments about debris placement are noted. This information will be developed during the design and included in the construction specifications.

b) and c) Appendix B of the revised Work Plan provides additional information on design references and design criteria that will be used during the design.

18. Construction Sequencing

a. ***EPA Additional Comments (Comment #33):*** *Page 8-9, Section 8.3.1: Please include a discussion of the process of separating waste streams. This can be included in the Preliminary (30%) Design Document.*

Does GE/UNC intend to restrict haul trucks to generally daylight hours and weekdays, with weekends available upon approval, if needed to recover schedule? Is a winter shutdown envisioned? Since some of these scheduling issues, such as the winter shutdown, affects the design and site logistics, they should be addressed in the Preliminary (30%) Design Document.

b. ***DOE Comments (Comment #11):*** *Section 8.3.1, pg. 8-9, Construction Sequencing: Does GE/UNC intend to restrict haul trucks to generally daylight hours and weekdays, with weekends available upon approval, if needed to recover schedule? Is a winter shutdown envisioned? Since some of these scheduling issues, such as the winter shutdown, affects the design and site logistics, they should be addressed in the Preliminary (30%) Design Document.*

Response: Comment noted. This information will be developed during the 30% Design and provided in the Design Report submitted with the 30% design package.

19. Haul Roads

a. ***EPA Additional Comments (Comment #34):*** *Pg 8-10, Section 8.3.4: We recommend consulting with New Mexico DOT. In addition, Navajo BIA and Navajo DOT may need to be consulted for any improvements or signage needed on Red Water Pond Road or Pipeline Canyon Road.*

b. ***DOE Comments (Comment #5):*** *Section 8.3.4, pg. 8-10, Haul Roads: We recommend consulting with New Mexico DOT not the state police.*

Response: Comment noted. This information will be obtained during the 30% Design and provided in the Design Report submitted with the 30% Design package.

20. *Surface Water Hydrology and Hydraulics*

    a. ***EPA Additional Comments (Comment #35):*** *Pg 8-12, Section 8.3.8: GE/UNC might consider also evaluating the long-term condition using peak flows as outlined in the USGS Report 2008-5119, Analysis of Magnitude and Frequency of Peak Discharge and Maximum Observed Peak Discharges in New Mexico and Surrounding Areas. It presents data based on observed storm events and gaging stations located in northern New Mexico and should be compared to results from methods cited. Consider using the more conservative result.*

    b. ***DOE Comments (Comment #12):*** *Section 8.3.8, pg. 8-12, Surface Water Hydrology and Hydraulics: GE/UNC might consider also evaluating the long-term condition using peak flows as outlined in the USGS Report 2008-5119, Analysis of Magnitude and Frequency of Peak Discharge and Maximum Observed Peak Discharges in New Mexico and Surrounding Areas. It presents data based on observed storm events and gaging stations located in northern New Mexico and should be compared to results from methods cited. Consider using the more conservative result.*

       Response: Comment noted. This information will be considered and evaluated during the 30% Design. A summary of hydrologic analyses will be provided in the Design Report submitted with the 30% Design package.

21. *Table 9-1, Anticipated Design Plans and Submittals*

    a. ***EPA Additional Comments (Comment #38):*** *Table 9-1: DOE recommends that the Institutional Control Implementation & Assurance Plan and Operation, Monitoring & Maintenance Plan both have an annotated outline presented at the Preliminary (30%) Design submittal. We believe that it is critical to the design and long-term performance of the cell that ICs and OMM activities are identified early and integrated throughout the design process.*

    b. ***DOE Comments (Comment #21):*** *Table 9-1, Anticipated Design Plans and Submittals: DOE recommends that the Institutional Control Implementation & Assurance Plan and Operation, Monitoring & Maintenance Plan both have an annotated outline presented at the Preliminary (30%) Design submittal. We believe that it is critical to the design and long-term performance of the cell that ICs and OMM activities are identified early and integrated throughout the design process.*

       Response: Comment noted. Section 7.2.1 of the Work Plan has been revised to state that an annotated outline of the Institutional Control Implementation & Assurance Plan and Operation, Monitoring & Maintenance Plan will be submitted as a part of the 30% design package.

22. Page 9-3, Section 9.1.1

a. ***EPA Additional Comments (Comment #37):*** *Page 9-3, Section 9.1.1: Top two bullets appear to be repeated. Should they be combined? Please clarify the difference between the two bullets.*

b. ***DOE Comments (Comment #6):*** *Section 9.1.1, pg. 9-3: Top two bullets appear to be repeated. Should the second bullet be for the mill? Please clarify the difference between the two bullets.*

Response: The two bullets are separate items. The first bullet describes the Design Report that will be submitted as part of the 30% design package. The second bullet refers to the design drawings that will be submitted as part of the 30% design package. The second bullet has been clarified in the revised Work Plan.

23. Table 6-1, Repository Layout Comparison

a. ***EPA Preliminary Comments (Supplementary Comment #1):*** *General: Depth of fill thickness over the borrow pits presented should be verified. It would be more informative to show the range of depth of fill over each borrow pit rather than just the maximum. Identifying the borrow pits on the cross-sections would also help make comparison of alternatives easier.*

b. ***DOE Comments (Comment #7):*** *Table 6-1, Repository Layout Comparison: Depth of fill thickness over the borrow pits presented should be verified. It would be more informative to show the range of depth of fill over each borrow pit rather than just the maximum. Identifying the borrow pits on the cross-sections would also help make comparison of alternatives easier.*

Response: Comment noted. This information is provided in figures in Appendix A of the revised Work Plan.

24. Table 6-1, Repository Layout Comparison

a. ***EPA Preliminary Comments (Supplementary Comment #7):*** *General: In aiding the discussion of options at the September 29th meeting, additional criteria may be helpful. a) Perhaps calculate any settlement at each of the soil profile locations and draw a contour map of settlement. Assuming there is settlement differential, by laying it on top of an option map we can readily see the impact. b) Another example is would be calculate runoff to get an idea of any difference between the plans. The acreage would be a first approximation but the steepness proposed and type of cover, little rock, big rock or vegetation would affect erosion possibilities at the toe.*

b. ***DOE Comments (Comment #15):*** *Table 6-1 Repository Layout Comparison: This table would be more useful if it was expanded to specific items. The complete set of criteria and more analytical. For example, include more about settlement. a) Perhaps calculate any settlement at each of the soil profile locations and draw a contour map of settlement. Assuming there is settlement differential, by laying it on top of an option map we can readily see the impact. b) Another example is would be calculate runoff to*

get an idea of any difference between the plans. The acreage would be a first approximation but the steepness proposed and type of cover, little rock, big rock or vegetation would affect erosion possibilities at the toe.

Response: a) Contour maps showing results of preliminary settlement calculations are included in Appendix A of the revised Work Plan. b) Additionally, combinations of slope lengths and grades, and corresponding rock sizes calculated for the site-specific PMP for the cover are included in Appendix A of the revised Work Plan.

25. *Copper Rule*

a. ***EPA's Additional Comments (Comment #6)**: NMED, in the attached letter, has suggested that requirements of subsections 20.6.7.33. A, B, C, and F of their Copper Rule, can be useful in understanding NMED's expectations for mine repositories in the State of New Mexico.*

b. ***NMED Comment #1**: NMED's concerns primarily involve the proposed long outslope at a nine-percent grade on the repository, and the ability of the proposed design to meet standards for erosion, water holding capacity, and vegetative cover. Additionally, NMED typically requires a cover thickness of 36 inches for similar units at mine sites in New Mexico. A copy of the relevant subsections (20.6.7.33. A, B, C, and F) of the Supplemental Permitting Requirements for Copper Mine Facilities, December 1, 2013 (Copper Rule) is attached as guidance. While the Copper Rule does not directly apply to mines and mills at facilities not associated with copper mining activities, it represents the standards for closure and cover systems that NMED typically requires for similar repositories at other mine facilities.*

c. ***NMED Comment #3**: There are a number of technical requirements described in the Copper Rule for which it is unclear if the Option 2 design would be comparable. These comparable requirements for the cover system include erosion rates equal to or less than stable slopes in the surrounding environments, the ability to sustain plant growth without continuous augmentation, and the capacity to store within the fine fraction at least 95% of the long-term average winter precipitation or at least 35% of the long-term average summer precipitation, whichever is greater. Additionally, the long outslope at nine-percent grade while allowed for in the copper rule, may require interbenches to limit erosion and allow a cover material size distribution with an adequate water holding capacity capable of sustaining a vegetative cover. The Copper Rule also requires a 1.1 or greater slope stability factor of safety for pseudostatic analysis-it is not clear that the proposed 1.0 or greater factor of safety for seismic hazard analysis in the design work plan is as protective.*

d. ***NMED Comment #4**: Most of the above comments would also apply to the other two (unselected) options; in all three options, NMED recognizes that many of the comments would be resolved during the detailed design phase.*

Response: Comments noted. These comments will be considered during the 30% Design. As described in Appendix B to the revised Work Plan, the minimum

acceptable factor of safety for seismic conditions is 1.0, as specified in NRC Regulatory Guide 3.11, Section C (NRC, 2008) and Technical Approach Document, Revision II, Section 6.2 (DOE, 1989).

26. *Footprint of New Cell*

a. ***EPA Preliminary Comments (Comment #4)***: *Overall Comment – Footprint of new cell: a) The UNC Design Advisory Team would like further clarification why construction of the new repository should minimize disturbance on the existing TDA. This constraint appears to have limited the design of the repository, resulting in two options that are strikingly different than the alternatives previously considered.*

b) The Draft Design Work Plan does not contain any options where mine waste is placed over the western portion of the central cell. It is noted that placing mine waste in this area was presented as Alternative No. 3 of the 2014 Pre-Design Studies report (Figure 3-2). It is unclear why some version of this option, utilizing more of the central cell, was not carried forward to the 2015 Draft Design Work Plan.

c) The UNC Design Advisory Team agrees that the repository should limit the fill thickness over fine tailings with a higher water content to avoid potential impacts to ground water. The fill thickness limit should be guided by the estimated seepage flux predicted by modeling with UNSAT-H with an appropriate factor of safety. Proposed placement of mine waste over the fine tailings should be limited to loads that do not cause impact to groundwater. The decision to limit fill thickness or avoid placement of fill over the thick tailings profile in the western and center portion of the Central Cell is unclear since these locations consist mainly of coarse tailings with low water content. Historic boring logs, SHB79-13 and SHB79-18, were located in tailings with the thickest profiles at these locations and consist entirely of coarse sand tailings. Figure 3-3 of the 2014 Pre-Design Studies report indicates that the eastern portion of the central cell generally contains greater thicknesses of fine-grained tailings, while the western portion of the central cell generally has fine-grained tailings thicknesses that are less than 5 ft.

b. ***NRC Comments (Comment #15)****: Repository should limit fill thickness over tailings and minimize additional migration of residual pore water from the tailings into the underlying alluvium:*

c) The NRC staff agrees that the repository should limit the fill thickness over fine tailings with a water content that would result in sufficient seepage to impact ground water above the NRC approved Ground Water Protection Standards (GWPS). The fill thickness limit should be guided by the estimated seepage flux predicted by modeling with UNSAT-H. However, the decision to limit fill thickness or avoid placement of fill over the thick tailings profile in the western and center portion of the Central Cell is unclear since these locations consist mainly of coarse tailings with low water content. Historic boring logs, SHB79-13 and SHB79-18, were located in tailings with the thickest profiles at these locations and consist entirely of coarse sand tailings. Figure 3-3 of the 2014 Pre- Design Studies report indicates that the eastern portion of the central cell generally contains greater thicknesses of fine-grained tailings, while the western portion of the central cell generally has fine- grained tailings thicknesses that are less than 5 ft.

The differentiation between coarse and fine tailings is relevant to the design because the potential adverse impacts (e.g. settlement and pore water migration) from fill placement over tailings may vary depending on the grain size of the tailings. This point is highlighted in the 2011 Steve Dwyer seepage and consolidation report which states that its focus is on the fine tailings, which were placed wet.

b) The Draft Design Work Plan does not contain any options where mine waste is placed over the western portion of the central cell. It is noted that placing mine waste in this area was presented as Alternative No. 3 of the 2014 Pre-Design Studies report (Figure 3-2). It is unclear why this option was not carried forward to the 2015 Draft Design Work Plan. The merits of placing mine waste in the western portions of the central tailings should be evaluated. Screening-level settlement calculations which encompass the areas of thicker tailings (both coarse and fine-grained) should be conducted to inform the conceptual design.

c. ***NRC Comment (Comment #16a)**: Repository construction should minimize the disturbance area on the existing TDA cover:*

a) The NRC staff would like further clarification why construction of the new repository should minimize disturbance on the existing TDA. This constraint appears to have limited the design of the repository, resulting in two options that are strikingly different than the alternatives previously considered. (This comment contains two topics. The other portion of this comment is addressed below in Grouped Comment #27 – Slope of Repository).

Response: a) The new repository should minimize disturbance on the existing TDA for the reason that NRC presents in NRC Comment #18. The larger the area disturbed during construction, the greater the likelihood of disturbing the existing tailings. In addition, the available borrow volume limits the overall size of the repository footprint and cover. Lastly, foundation materials are also considered during placement of the repository since the subsurface conditions affect the flux and the differential settlement. This information is discussed in detail in Appendix A of the revised Work Plan. Additionally, a summary of the history of development and screening of various repository concepts is provided in Appendix A of the revised Work Plan.

b) Due to the existing topography, the eastern side of the central cell provides more capacity with less need for abrupt or steep side slopes. In addition, preliminary UNSAT/H analyses by Dwyer Engineering indicate similar changes in flux at the base of the tailings for the coarse-grained profiles as the profiles that contain fine-grained tailings.

Results of preliminary settlement calculations are provided in the figures provided in Appendix A of the revised Work Plan. The approach that will be used to calculate settlement and flux as a result of repository construction is described in Appendix B (Section 3.3.1.9) of the revised Work Plan.

c) Comment noted. Preliminary UNSAT/H analyses by Dwyer Engineering indicate similar flux rates for the base of the tailings for the coarse-grained profiles as the

profiles that contain fine-grained tailings. The calculations (not included in the Work Plan) indicate repository fill thicknesses up to 30 feet results in minimal changes in flux at the depth of saturated alluvium.

27. *Slope of repository*

a. ***EPA Preliminary Comments (Comment #5)**: Overall Comment - Slope: a) Section 6.1 (p. 6-2) states that, "Conceptual slopes and slope lengths of each repository option were optimized to shed water, mitigate ponding, and minimize erosion." The references for this optimization should be provided.*

b) Options 2 and 3 are questionable considering the proposed 9-percent evapotranspirative top slopes and the 4 horizontal units (4h) to one vertical unit (1v) side slopes. The UNC Design Advisory Team does not believe that (for ET covers), 9% slopes over a long period of time are erosional stable nor provide a suitable slope for an ET cover.

Under NUREG 1620, the use of slopes steeper than 5h:1v is considered an alternative to the requirements in 10 CFR Part 40, Appendix A, Criterion 4(c). When slopes steeper than 5h:1v are proposed, a technical justification should be offered as to why a 5h:1v or flatter slope would be impractical and compensating factors and conditions are incorporated in the slope design for assuring long-term stability. For slopes steeper than 5h:1v, an acceptable economic basis and an equivalent level of protection must be provided to justify an alternative to 10 CFR Part 40, Appendix A, Criterion 4(c) (NUREG 1620). Additionally, Criterion 4(d) requires the establishment of a full self-sustaining vegetative cover or a rock cover employed to reduce wind and water erosion to negligible levels and that a rock covering of slopes may be unnecessary where impoundment slopes are very gentle (on the order of 10h:1v or less). A slope of 0.5 – 1 percent is considered generally acceptable by the NRC for top slopes with lengths greater than 500 feet and 1 – 4 percent for top slopes with lengths less than 500 feet.

b) For the ET cover to perform as designed, DOE has found that average slope gradients should not exceed 5% and 1 to 3 % is more desirable. Stable slopes tend to form a concave shape due to upslope erosion and toe deposition over time (Birkeland, P.1991). Consideration should be given to natural and stable shapes of slopes. Soils along with vegetation should emulate types observed in the analog areas.

c) Vegetation also prefers rough soils, where water can accumulate. The grading plans need to take in consideration both drainage and establishment of an ET cover. This should also be discussed in Section 6 evaluating the three options.

b. ***NRC Comment (Comment #16a – continued from previous grouped comment)** b) Options 2 and 3 are questionable considering the proposed 9-percent evapotranspirative top slopes and the 4 horizontal units (4h) to one vertical unit (1v) side slopes. The use of slopes steeper than 5h:1v is considered an alternative to the requirements in 10 CFR Part 40, Appendix A, Criterion 4(c). When slopes steeper than 5h:1v are proposed, a technical justification should be offered as to why a 5h:1v or flatter slope would be impractical and compensating factors and conditions are incorporated in the slope design for assuring long-term stability. For slopes steeper*

than 5h:1v, an acceptable economic basis and an equivalent level of protection must be provided to justify an alternative to 10 CFR Part 40, Appendix A, Criterion 4(c) (NUREG 1620). Additionally, Criterion 4(d) requires the establishment of a full self-sustaining (emphasis added) vegetative cover or a rock cover employed to reduce wind and water erosion to negligible levels and that a rock covering of slopes may be unnecessary where impoundment slopes are very gentle (on the order of 10h:1v or less). A slope of 0.5 – 1 percent is considered generally acceptable by the NRC for top slopes with lengths greater than 500 feet and 1 – 4 percent for top slopes with lengths less than 500 feet.

c. ***NRC Comment (Comment #19):*** *a) Section 6.1 (p. 6-2) states that, "Conceptual slopes and slope lengths of each repository option were optimized to shed water, mitigate ponding, and minimize erosion." The references for this optimization should be provided.*

d. ***DOE Comment (Comment #14):*** *Section 4.3.5, pg. 4-3, Construction of an Evapotranspiration Cover on the Repository; Section 6.1, Siting and Conceptual Design Criteria, pg. 6-2; table 6-1; Section 8.2.1. (no 8.2.1.7), pg. 8-5, Evapotranspiration Cover Water Balance Analysis; and Table 8.1, pg. 3 of 6, Design Elements: b) for the ET cover to perform as designed, we find that average slope gradients should not exceed 5% and 1 to 3 % is more desirable. Stable slopes tend to form a concave shape due to upslope erosion and toe deposition over time (Birkeland, P.1991). Consideration should be given to natural and stable shapes of slopes. Soils along with vegetation should emulate types observed in the analog areas. c) Vegetation also prefers rough soils, where water can accumulate. The grading plans need to take in consideration both drainage and establishment of an ET cover. This should also be discussed in Section 6 evaluating the three options.*

Response: Comments noted. This information is incorporated in Appendix A of the revised Work Plan and will also be taken into account during the 30% Design.

a) The term "optimized" is used to describe the iterative process of changing the grading plan to meet a specified volume and changing the layout to meet slopes and grades for which the erosion protection rock can then be sized. The process also includes provisions for altering the repository cover thickness to provide adequate storage capacity in the cover.

b) Comment noted. The inclusion of cover slopes as great as 9% is in line with Dwyer et al. (2007) which states: *"The 5% maximum EPA (1991) recommended top slope is to mitigate soil loss due to erosion of the topsoil. However, the surface treatment required for each cover system (rock/soil admixture) as described earlier in this section can prevent excessive erosion to greater slopes, generally as high as 10%."* As the repository grading plan is refined further, it will be adjusted in the 30% design to limit the rock size, shorten slope lengths, and limit top slopes to 5% or less. This is discussed in detail in Section 4 of Appendix A of the revised Work Plan. It is understood that gentle slopes are better for long-term erosion control as well as shorter slope lengths. This will be a high priority in optimizing the design in the 30% Design phase.

Side slopes of "*4 horizontal units (4h) to one vertical unit (1v) side slopes*" were included based on NUREG-1757, Vol.2 Appendix P, which states: *"It is important to reiterate that the requirements of 10 CFR Part 40 are very prescriptive and may have precluded the use of many types of erosion protection designs. The staff considers that the design criteria suggested in NUREG-1623 may be used at decommissioning sites using approaches that were not necessarily used in uranium mill tailings applications. For example, nearly all tailings sites were designed with disposal cell side slopes of about 1 vertical (V) on 5 horizontal (H). Based on the stability of erosion protection placed on much steeper slopes of stream channels, levees, and/or dam slopes, there is no reason why slopes steeper than 1V on 5H could not be used for the side slopes of disposal cells. The criteria in NUREG-1623 were not developed for use on specific slopes and may be adapted for steeper side slopes, as necessary. Minor changes to construction specifications, emphasizing careful rock placement on steeper slopes, may be the only added design consideration."*

The 30% Design will include technical justification for side slopes steeper than 5:1 (if included) and demonstrate an equivalent level of protection. The range of slopes proposed as "generally acceptable" and "desirable" in the comments will be considered during the 30% Design. During the design, erosion, differential settlement, water balance, and the ability to sustain vegetation will all be considered to optimize the slopes, slope lengths, and cover design of the repository.

c) Comment noted. The construction specifications will include provisions for a rough soil surface. The surface layer of the ET Cover will include a designed rock/soil admixture referred to as a "desert pavement." This surface design described in Dwyer et al. 2007, will minimize soil loss due to wind and water erosion. Furthermore, it has been shown to be effective in allowing the establishment and long-term maintenance of native vegetation.

Responses to EPA's UNC Design Advisory Team Preliminary Comments on the NECR Design Work Plan, dated September 4, 2015

6. ***Overall Comment – UNSAT Model**: The ten-year period to allow evaluation of the impacts of settlement, as well as anticipated reduction in surface infiltration due to the repository configuration and ET cover system is not expected to be sufficient to capture the peak rate of drainage resulting from consolidation of the existing tailings. The long term drainage model, UNSAT-H should model drainage for 1,000 years (the design life of the disposal cell) as opposed to the proposed 10 year time frame to demonstrate that seepage from the disposal cell coupled with contaminant transport will not adversely affect groundwater in the long-term.*

   The UNC Design Advisory Team would also like to see a short-term impact for the times where primary consolidation and secondary consolidation is estimated to be completed. Then, an evaluation should be done subsequent from when consolidation is completed. The level of complexity required to determine groundwater impacts should be dependent on the resulting level of increased flux. If the increased rate of flux appears to be minimal, a simplistic and highly conservative analysis may be appropriate to evaluate groundwater impacts.

   The models and equations proposed in the design analyses have not been determined to be acceptable at this time due to the limited information provided in the work plan. The UNC Design Advisory Team will require an evaluation of the models and equations to ensure that they are appropriate for conditions and consistent with guidance. Additionally, the final repository design must be supported by design analyses that use specifications and conditions that are consistent with the final design unless the design analysis is more conservative than elements used in the final design, e.g., the seepage estimates would be considered conservative if the overall thickness of the overlying material was reduced in the final design.

   Finally, The NRC staff disagrees that the average climate data over a ten-year period will provide conservatism in the model and recommends that the model should be based on daily historical climate conditions. This can be a discussion item during the September 29th meeting.

   Response: Comments noted. These comments will be taken into account during the 30% Design. The modeling time period will be determined based on results of preliminary modeling and sensitivity analyses performed during the 30% Design. The Design Report submitted as part of the 30% Design package will include a description of analyses conducted as well as the associated spreadsheets and model results. Input parameters and boundary conditions will be described in detail along with their derivation and inclusion in sensitivity analyses as appropriate. Section

7. ***General Comment – Volume Estimate**: The Design Work Plan should include the over/under percentage of mine waste volume the design will accommodate. The statement about increasing the top area and/or extending the southwest edge is insufficient. The UNC Design Advisory Team expects a detailed approach to*

accommodate over/underrun during excavation that maintains the erosion stability, and functionality of the cap. This analysis can be included in the 30%.

Response: Comment noted. The design will accommodate 1,000,000 cy of mine waste material, which is approximately 22% more than the volume of mine waste estimated as a part of the PDS (2014a), as described in Appendix A of the revised Work Plan. Appendix A further describes changes to the repository grading plan that will be included to accommodate a smaller volume. Analyses and supporting calculations will be included in the Design Report submitted as part of the 30% Design package.

9. ***General Comment – Restoration of Mine Site**: The Mine Site regrading and surface water controls must be designed to prevent flooding immediately downstream of the Mine where residents live. Hydraulic and hydrologic analysis must be performed to verify that grading and water control systems will be protective.*

Response: Comment noted. Long-term storm water controls, erosion protection, and grading for the Mine Site will be designed for stability during the 100-year, 24-hour storm.

Responses to EPA's UNC Design Advisory Team Supplementary Miscellaneous Comments on the NECR Design Work Plan, dated September 4, 2015

6. ***General****: The repository design will also be limited by the properties and quality of the economically available materials required for construction of the repository components. Additionally, the Pre-Design Studies Report dated October 31, 2014 has already evaluated and tested potential cover and erosion protection materials available for construction of the repository. These materials should be used to develop the design criteria if acceptable or alternative sources should be proposed and tested.*

   Response: Durability of some onsite materials was evaluated during the PDS. However, the quantity or sizes of the available material on site may not be sufficient for the entire Removal Action, in which case an additional source of durable rock will be identified and tested during the 30% design phase. The cover design approach, including a description of the analyses that will be performed to design the cover, is described in Appendix B of the Work Plan.

   All erosion protection material used for construction, whether sourced from off-site quarries or on-site stockpiles, will meet the design criteria provided in Appendix B.

Responses to EPA's Additional Comments on the NECR Design Work Plan, dated September 14, 2015

1. *There are a number of places in the Design Work Plan that Remediation Goals, Action Objectives, Performance Standards, Remedy Elements, and other items in the 2013 ROD and 2011 Action Memo or AOC are cited, referenced, summarized, or paraphrased. Please note that EPA is relying on the source documents for these items and if there are inconsistencies in language, the decision documents and/or AOC control.*

   Response: Comment noted.

4. *Please include referenced design documents in the Sharepoint site for easy reference. For example, Youd, et al. (2001) is cited several times throughout the document. Please include this journal article and other referenced resources that will be utilized for design in the Sharepoint site. Another example is the repair and redesign items from inspection comments from a 2003 NRC document.*

   Response: These documents will be uploaded to the Northeast Church Rock Mine Remedy Design Team site (Sharepoint) by December 1, 2015.

7. ***Page iv, Acronyms**: Please include FS as listed in Table 8-1. It seems that both FOS and FS are used to represent Factor of Safety in the Work Plan so please include both acronyms in the table.*

   Response: The Work Plan has been updated to designate FS as Factor of Safety.

9. ***Page 3-3, Section 3.5.1**: Please add, "prior to submission of deliverables to the regulatory agencies" after "UNC/GE is responsible . . . for approving all design deliverables" to avoid confusion about the approval process of deliverables (EPA vs. UNC/GE).*

   Response: The text in Section 3.5.2 has been revised to include this wording.

10. ***Page 3-4, Section 3.5.1**: NN EPA and NMED are in similar supporting agency roles to US EPA. Please use similar language to describe their responsibilities.*

    Please add, "NMED is the support agency to EPA Region 6 on the UNC Mill."

    Since we are not dealing with closure of a mine on state land, is the statement about MMD relevant?

    For the local community section, please revise the wording as follows, "Local residents will be provided with the opportunity for input on throughout the design process as well as during the NRC public comment period."

    Response: These items have been added to Section 3.5.2 of the revised Work Plan.

11. ***Page 3-4, Section 3.5.2**: Please include the Red Water Pond Road Community Association as having a representative on the Design Advisory Team, consistent with the Federal Agency 5-Year NAUM Plan.*

The "TAG" acronym for EPA stands for "Technical Assistance Grant" and is for the purpose of providing technical assistance to communities. To avoid confusion, please call the team "Design Advisory Team."

Response: These items have been clarified in Section 3.4.2 of the revised Work Plan.

14. ***Page 7-1, Section 7.1.1**: Three interim removal actions were conducted including the 2007 residential removal action.*

Response: This item has been added to Section 6.1 of the revised Work Plan.

15. ***Page 7-2, Section 7.2**: In the 30% design, please include more detail about the proposed additional studies including goals, data to be collected, etc. For example, what specific criteria will be evaluated for the jetty? Are there additional road scans that should be performed?*

Response: Comment noted. Goals and objectives of the proposed additional studies listed in Section 6.2 will be described in detail in the 30% Design.

16. ***Page 8-1, Section 8.1**: Section 19.10.5.507A of the NMAC is one of the ARARs included in the performance standards. The reclamation design of the mine site shall address all applicable performance standards, including the referenced NMAC.*

Response: Comment noted. This has been clarified in Appendix B of the revised Work Plan.

17. ***Section 8.2/Table 8-1**: Please number each design element and cross-correlate in Table 8-1*

Response: This information is included in Appendix B of the revised Work Plan.

19. ***Page 8-1, Section 8.2.1**: Include the criteria for compaction of the radon barrier.*

Response: This will be provided as part of the 30% design.

21. ***Page 8-3, Section 8.2.1**: How will the existing drainage swales within the radon barrier be addressed in the design?*

Response: This will be addressed using the results of the infiltration analyses for the new cover that will be developed during the 30% Design.

22. ***Page 8-4, Section 8.2.1**: Have the profiles been developed? If so, please provide the profiles.*

The flux model must show the flux for each year within the initial 10-year time period

Response: Preliminary profiles that include fill thicknesses of repository options included in the Work Plan have been developed, and preliminary flux modeling has been performed. These profiles will be revised during the 30% Design to be

specific to the 30% Design repository grading plan and will be included in the Design Report submitted as a part of the 30% Design submittal. The Design Report will include the flux for each individual year during the modeling period.

23. ***Page 8-4, Section 8.2.1**: EPA will evaluate potential impacts on groundwater due to compliance with RCRA performance standards cited in the 2013 ROD.*

    Response: Comment noted.

24. ***Page 8-4, Section 8.2.1**: Include a discussion of the role of transpiration in the cap design.*

    Response: The role of plants in the water balance and erosional stability will be addressed during the design phase. The ET Cover will include provisions to enable establishment of native vegetation. The vegetation will assist in removal of infiltrated water from the soil profile through transpiration. The UNSAT H modeling to be performed during the design will include vegetation. Vegetation parameters will include leaf area index (LAI), percent bare area, rooting density, rooting depth, and the time and extent of the year that transpiration occurs, as described in Section 3.3.1.4 of Appendix B of the revised Work Plan. For example, the model will not allow for removal of water from within the cover via transpiration during the winter when plants are dormant. These vegetation parameters will be derived from ongoing vegetation analog studies of disturbed and undisturbed stands of vegetation at the site. The study areas with undisturbed stands of vegetation are within the potential soil borrow areas.

25. ***Page 8-4, Section 8.2.1**: Has snow melt been considered during infiltration modeling?*

    Unsat infiltration modeling should also consider current vegetation that will reestablish over time as compared to the initial seed mix.

    Response: Comments noted. Snow melt has been considered during preliminary infiltration modeling. These inputs will be considered during the design process and preliminary analyses related to this will be submitted with the 30% Design package.

26. ***Page 8-6, Section 8.2.1**: What quantification will the cover cracking analysis provide and how will it impact the design?*

    Response: The cover cracking analysis will evaluate if the anticipated amount of differential settlement results in strain that exceeds the allowable tensile strain of the radon barrier. Exceeding the allowable tensile strain of the clay is assumed to result in cover cracking. The analysis will be used to prevent cracking of the existing radon barrier that would affect its performance as a foundation layer. The approach that will be used to evaluate the potential for cracking of the existing radon barrier is described in Appendix B of the revised Work Plan.

27. ***Page 8-6, Section 8.2.2**: Reference to a map would help this discussion to point out where the referenced features are including swales, North Diversion Channel, berms, jetty, settlement area, etc.*

Response: A map showing these features, as well as a discussion of how these features will be included in the design, is provided in Appendix B of the revised Work Plan.

28. ***Page 8-7, Section 8.2.2**: Discuss how other drainage issues are going to be addressed including the ponding north of the north cell and the diversion channels along the eastern site (sic) of the property.*

    Response: The 30% Design will include an evaluation of the erosion and sedimentation concerns summarized in the NRC letter dated January 7, 2003 (NRC, 2003). These concerns include sediment in the branch swales on the impoundment, sediment in the North Upstream Diversion Channel, stability of the North Upstream Diversion Channel berm, and damage and stability of the jetty. The stability and capacity of the existing drainage features such as the North Upstream Diversion Channel, Pipeline Arroyo, and any branch swales that will remain in place will be evaluated for stability during the design storm event. If analyses indicate that the drainage features do not meet the performance criteria, they will be redesigned for adequate stability. In addition, the drainage concern (expressed verbally by the agencies) regarding the area north of the northern embankment will be included. Site personnel indicated that drainage in the area north of northern embankment has been corrected. However, the design will evaluate drainage in this area for compliance with the design storm criteria and for erosional stability.

29. ***Page 8-7, Section 8.2.3**: If rock is sourced from Dilco Hill, the location and amount of rock removed needs to be considered for visual impacts of removing such rock.*

    Please reference the borrow area map to facilitate this discussion of borrow areas. Consider adding a table which borrow area characteristics (volume vs. haul distance, etc.)

    Response: Comment noted.

30. ***Page 8-8, Section 8.2.4**: Were other hauling methods such as use of a conveyor belt considered?*

    Response: Hauling methods and routes will be evaluated during the 30% Design. The conveyor belt hauling method has not been eliminated from hauling options.

32. ***Page 8-9, Section 8.2.7**: Please include a general description of the current location of the debris.*

    While it is anticipated that most or all of the debris can be appropriately included in the mine waste repository, there may be some debris that would be better disposed off-site. Therefore, be provisional in the language describing where debris would be disposed so as not to limit disposal options.

    Response: Detailed debris inventories of the Mine and Mill Sites are included in the PDS Reports (MWH, 2014a and 2014b). A general description of the location of the debris is provided in Appendix B of the Work Plan. The discussion of debris disposal has been revised and is included in Appendix B (Section 1.2) of the

revised Work Plan. However, offsite disposal is not the selected or preferred option.

36. ***Page 9-1, Section 9.1****: Please delete or rewrite the first sentence of the third paragraph. While EPA will attempt to coordinate the comments of the regulatory agencies, there may be interests or concerns that require direct communication between other agencies and GE. Therefore, we don't want to limit our options for communication. Similarly, since agencies generally have specific regulatory definitions of public comment periods, describing the Design Advisory Team review of design submittals as a public comment period may be confusing.*

    Response: Comment noted. This has been clarified in Section 7.2 of the revised Work Plan.

39. ***Figure 8-1, Schedule****: There is a schedule requirement in the SOW timeline (shown on the last page of the SOW) that is not accounted for in the draft workplan schedule. The Pre-Final NECR Mine Cleanup Verification and Revegetation Plan is due 90 days upon approval of the Preliminary Plan. The associated approval of the preliminary plan and 90 day requirement to submit the Pre- Final plan is not reflected in the proposed schedule. Please amend the schedule accordingly to explicitly show this SOW requirement.*

    It would be helpful to show or discuss the connection between deliverables. For example, what is the interplay between progress on the Environmental Report and approval of the 30% design. It would be helpful to be able to see the critical path for the project.

    Response: This item was included in the Draft Work Plan (see line ID 43 on Figure 8-1). However, the schedule included in the revised Work Plan has been revised to show these items more clearly (see Figure 7-1 of the revised Work Plan).

Responses to DOE's Comments on the NECR Design Work Plan (sent via email on September 16, 2015)

Minor Comments-These items should be addressed in the Preliminary (30%) Design Submittal

8. ***Section 4.2.1, pg. 4-1, Remediation Goals-From ROD and EE/CA****: 1st bullet- Is restoration of the mine land to an "unrestricted use"? (See comment 2) If this was stated, it would help clarify the intent.*

   Response: This is a direct quote from the EE/CA. The citation has been added to the revised Work Plan.

Major Comments- Response and resolution required

16. ***Section 6.2.2, The North Dome Option and 6.3, Preferred Repository Option:*** *neither discussion reflects the statement made in Table 6-1, Long-Term Maintenance- Erosional Stability- "high risk" for Option 1, and what is inferred by "high risk". Even as qualitative statements Erosion stability should be discussed further in evaluation of the alternatives in Section 6 of the Design Work Plan.*

    Response: This discussion has been revised and is included in Appendix A of the revised Work Plan.

17. ***Section 6.3 Preferred Repository Option, pg. 6.3****: The discussion seems to place higher emphasis on avoiding use of 4:1 slopes and riprap and the asserted visual impact (to whom? See minor comment 3). The impact is undoubtedly even less significant as the cell cover ages. DOE thinks that the construction of a robust cell would minimize the cost to GE of maintaining the cover. DOE also does not believe that (for ET covers), 9% slopes over a long period of time are erosional stable nor provide a suitable slope for an ET cover. It would appear that the functionality should be a greater consideration than visual impact in the discussion. Is there some criteria for proposing the 9% slope instead of one more suitable for ET? Only options that are viable should be included in the remedial alternatives.*

    Response: The inclusion of cover slopes as great as 9% is in line with Dwyer et al. (2007) which states: *"The 5% maximum EPA (1991) recommended top slope is to mitigate soil loss due to erosion of the topsoil. However, the surface treatment required for each cover system (rock/soil admixture) as described earlier in this section can prevent excessive erosion to greater slopes, generally as high as 10%."* As the repository grading plan is refined further, it will be adjusted in the 30% design to limit the rock size, shorten slope lengths, and limit top slopes to 5% or less. This is discussed in detail in Section 4 of Appendix A of the revised Work Plan. It is understood that gentle slopes are better for long-term erosion control as well as shorter slope lengths. This will be a high priority in optimizing the design in the 30% Design phase.

19. ***Section 8.2.1, pg. 8-5, Repository Design-Cover Erosional Analysis****: Discussion*

should include the side slopes. We generally use NUREG-1620, Rev. 1 (2003), Geotechnical Stability, Section 2.2.3 Acceptance Criteria:"(1) (b) Slope steepness is a minimum of five horizontal units (5h) to one vertical unit (1v) or less." The use of slopes steeper than 5h:1v is considered an alternative to the requirements in 10 CFR Part 40, Appendix A, Criterion 4(c). We believe the long term costs to GE will be reduced by using standard design criteria. We would like the technical discussion on why the guidance number of 5h:1v is impractical and the compensating factors and conditions incorporated in the slope design for assuring long-term stability for the steeper slope of 4h:1v.

Response: Side slopes of 4 horizontal units (4h) to one vertical unit (1v) side slopes were included based on NUREG-1757, Vol. 2 Appendix P, which states: *"It is important to reiterate that the requirements of 10 CFR Part 40 are very prescriptive and may have precluded the use of many types of erosion protection designs. The staff considers that the design criteria suggested in NUREG-1623 may be used at decommissioning sites using approaches that were not necessarily used in uranium mill tailings applications. For example, nearly all tailings sites were designed with disposal cell side slopes of about 1 vertical (V) on 5 horizontal (H). Based on the stability of erosion protection placed on much steeper slopes of stream channels, levees, and/or dam slopes, there is no reason why slopes steeper than 1V on 5H could not be used for the side slopes of disposal cells. The criteria in NUREG-1623 were not developed for use on specific slopes and may be adapted for steeper side slopes, as necessary. Minor changes to construction specifications, emphasizing careful rock placement on steeper slopes, may be the only added design consideration."* Erosion protection for the design slopes will be appropriately sized based on the design storm event for the site.

We concur that using standard design criteria will limit long-term costs. The disposal volume, repository area, and the erosion protection requirements for the slopes, as well as the ET requirements, are being considered in the design process.

20. ***Table 8-1, "Tailings Water Migration"**: a) Under Approach/Basis of Design, Use of UNSAT-H modeling for a 10-yr period is appropriate with the typical and wettest years for short term cover analysis; however, given that the cover will have a hydraulic conductivity no more than 1 x 10-7 cm/s (approximately 12 inches per year), moisture could move through the cover and only 10 feet into the tailings, if modeled for just 10 years. The long term drainage model, UNSAT-H should model drainage for 1,000 years (the design life of the disposal cell) as opposed to the proposed 10 year time frame to demonstrate that seepage from the disposal cell coupled with contaminant transport will not adversely affect groundwater in the long-term.*

b) Seepage occurs and is currently collected and treated from Title I Disposal Cells at the Rifle, CO and Durango, CO sites; as well as the CERCLA disposal cell at Monticello, UT. Each of these disposal cells has relocated uranium mill tailings placed with compaction specifications, e.g. dry density and water content, producing an initially unsaturated engineered fill. Unsaturated moisture movement occurs in these disposal cells that eventually leads to saturation and leachate generation over time. (Both Durango and

Monticello have ET covers.) Tailings in the existing disposal cells at the Church Rock site were placed by slurry resulting in tailings at higher initial moisture content. Thus, leachate generation should be evaluated and a ground water transport model performed to demonstrate ground water safety. Consequently, in Table 9-1, Anticipated Design Plans and Submittals, we recommend that a plan to address the leachate be included as part of the OMM or as a separate document.

Response: a) Comment noted. This will be considered during the 30% Design.

b) Our team has significant knowledge of the Durango site. The ET Cover portion of the Durango site is significantly smaller than the area of the side slopes covered in a deep layer of rock (see Figure 1). The Durango site also receives significantly more precipitation and has significantly less potential evapotranspiration than the NECR site.

Rock side slopes at the Durango site allow for 100% infiltration from precipitation and runoff from the ET portion of the cover. In essence, the whole cover allows close to 100% infiltration during a high intensity storm event. Also, the rock side slopes restrict the removal of infiltrated water via evapotranspiration. There are no plants on the Durango site cover and evaporation is restricted due to the reverse capillary barrier created. Thus leachate is significant at the site.

This is significantly different from the design approach that will be utilized at the Northeast Church Rock repository. This repository will be designed to allow water that infiltrates into the cover system to be removed via ET. Furthermore, rock surfaces will be minimized. Water balance modeling of the repository will provide data for the UNC Design Advisory Team to evaluate leachate and seepage concerns. Results of preliminary water balance modeling will be provided during the 30% Design. The suitability of leachate collection in the OMM Plan will be evaluated during the 30% Design.

Figure 1. Durango Cover System

Responses to NRC's Comments on the NECR Design Work Plan (sent via email on September 16, 2015)

1. *NRC was under the presumption that the license amendment application, including the environmental report, would undergo Pre-Application Audits at 30, 60, and 90 percent completion. Due to the technical and regulatory complexity of the proposed action, the NRC recommends that the development of the NRC license amendment application be completed in parallel with the design and environmental reports required by the EPA. The earlier development of the license amendment application would allow the NRC to perform Pre-Application Audits of the draft application prior to submission, to identify any major acceptance or technical review issues. The Pre-Application Audits would allow NRC review of the technical and environmental analyses used to support the repository design within the context of NRC regulatory requirements.*

   Response: Comment noted. The value of the audits is under consideration by GE/UNC and the design review team; recognizing that there are trade-offs to the project schedule under the AOC whichever way the project proceeds.

4. *The models and equations proposed in the design analyses have not been determined to be acceptable for use by the NRC at this time due to the limited information provided in the work plan.*

   The NRC will require an evaluation of the models and equations to ensure that they are appropriate for conditions and consistent with guidance. Additionally, the final repository design must be supported by design analyses that use specifications and conditions that are consistent with the final design unless the design analysis is more conservative than elements used in the final design, e.g., the seepage estimates would be considered conservative if the overall thickness of the overlying material was reduced in the final design.

   Response: Comment noted.

5. *The NRC does not agree with the qualitative design criteria used in Section 8.2 to select the three repository options or the proposed option. The design process should be cyclical and initially driven by simple conservative calculations or assumptions that can be refined with complex solutions based actual conditions. The NRC understands that the proposed repository design option will be modified to conform to conclusions of the completed analyses discussed in the work plan. The repository design will also be limited by the properties and quality of the economically available materials required for construction of the repository components. Additionally, the Pre-Design Studies Report dated October 31, 2014 has already evaluated and tested potential cover and erosion protection materials available for construction of the repository. These materials should be used to develop the design criteria if acceptable or alternative sources should be proposed and tested.*

   Response: Comment noted. Additional quantitative information is included in Appendix A of the revised Work Plan. A description of preliminary analyses and results will be included as part of the 30% Design submittal. Rock stockpiled onsite

is insufficient for repository construction. Additional rock sources will be proposed, evaluated, and tested as part of the 30% design process.

6. *A cost benefit analysis should be performed to assure that the selected design would provide maximum protection to public health and safety over the 1000-year performance period based on a design that is cost effective. NUREG-1620 states that "All site-specific licensing decisions based on Appendix A criteria or proposed alternatives will consider the risk to health and safety and the environment and the economic costs involved." Additional information and guidance can be found in NUREG-1620 Volume 1.*

   Response: Comment noted. A cost benefit analysis will be performed for selected aspects of the repository design, as a part of the 30% design process.

8. *The Design Work Plan states that it also fulfills the requirement of the Design Criteria Report. The NRC expected at minimum, conservative design calculations and assumptions to be included in the Design Criteria Report. The design criteria used for the selection of the preferred option should be based on the results of the design analyses described in the work plan. The results of the design analyses should be presented in the 30 Percent Design Report to support the preferred repository option.*

   Response: A Design Criteria report is included as Appendix B of the revised Work Plan. Results of preliminary calculations for the repository concepts are included in Appendix A of the revised Work Plan. Results of the design analyses will be presented in the 30% Design Report.

12. ***The criteria of "Long-Term Maintenance - Erosional Stability" listed in Table 6-1** is only addressed in a relative manner by classifying each of the designs as high, medium or low risk. No supporting calculations are presented. To determine a range of erosion protection designs that are compatible with an ET-type cover, screening calculations using the methods presented in NUREG-1623 should be conducted. These screening calculations could provide a range of stable slope-length configurations to inform the conceptual design.*

   Response: This information is included in Appendix A of the revised Work Plan.

13. ***Limiting footprint to the existing Tailings Disposal Area (TDA):***

    The new repository design was limited to the footprint of the existing Tailings Disposal Area (TDA). The NRC provided comments on EPAs Engineering Evaluation and Cost Analysis (EECA) by letter dated February 23, 2009. The NRC considered co-disposal within the licensed tailing disposal cells at the UNC Church Rock Mill Site as the most viable Alternative (Alternative 5) proposed by EPA. The requirement to constrain non-11e(2) byproduct material within the existing licensed tailings disposal cells appeared to be based on the selected alternative rather than an NRC requirement.

    The DOE also supported Alternative 5A, provided that the non-byproduct material be incorporated so that it was indistinguishable from the existing NRC licensed by-product material. The NRC agrees with DOEs condition and will only consider expanding the

disposal area with unilateral support from all agencies and concurrence from NRCs Office of General Council.

Response: Comment noted.

17. ***Specific comments and concerns were emailed to EPA on January 20, 2015 [Accession Number: ML15008A104]. The following comments and concerns were not discussed in the current Design Work Plan:***

    a. *The ten-year period to allow evaluation of the impacts of settlement, as well as anticipated reduction in surface infiltration due to the repository configuration and ET cover system is not expected to be sufficient to capture the peak rate of drainage resulting from consolidation of the existing tailings. The effectiveness of the cover system design must be based on long-term performance.*

    b. *The NRC staff disagrees that the average climate data over a ten-year period will provide conservatism in the model. The model should be based on daily historical climate conditions. [And based on long-term performance.]*

    c. *The NRC staff would expect an evaluation to be initiated once an increased rate of drainage resulted from consolidation. The level of complexity required to determine groundwater impacts should be dependent on the resulting level of increased flux. If the increased rate of flux appears to be minimal, a simplistic and highly conservative analysis may be appropriate to evaluate groundwater impacts.*

    Response: Comments noted. Results and a detailed description of preliminary flux modeling will be included in the Design Report submitted as a part of the 30% Design package. Flux will be shown for individual years to allow evaluation of each profile for both existing and post-construction conditions.

20. ***Section 8.2.1 (p. 8-4)*** *states that, "Ten years was selected because preliminary analysis indicates the flux calculations approach steady-state at that time." The references for this preliminary analysis should be provided.*

    Response: Comments noted. Results and a description of preliminary flux modeling will be included in the Design Report submitted as a part of the 30% Design package.

Responses to NMED's Comments on the NECR Design Work Plan, dated August 28, 2015

2. *The information MWH provided in the design work plan indicates that the Option 2 design would meet some of the requirements that a similar unit at a copper mine facility would be subject to such as design storm event and long-term static slope stability. However, two design criteria are not met. These include the relatively small top surface area that has no slope indicated which would likely result in ponding, and the proposed cover thickness is less than 36 inches.*

   Response: The top surface of the selected concept will be designed with a minimum slope to provide adequate drainage. Concepts presented in Appendix A of the revised Work Plan are each assumed to have a 3.5-foot thick cover. This thickness is preliminary pending design analyses for the 30% Design.

References:

Blight, Geoffrey E., 2013. *Unsaturated Soil Mechanics in Engineering Practice*. CRC Press, Boca Raton, FL.

Dwyer S., 2011. *Evaluation of Consolidation and Water Storage Capacity Related to Placement of Mine Material on the Existing UNC Mill Site Tailings Impoundment*, Northeast Church Rock Mine, Gallup, NM. May.

Dwyer, SF, R. Rager, and J. Hopkins. 2007. *Cover System Design Guidance and Requirements Document. Los Alamos National Laboratory report LA-UR-06-4715.* April.

Francois, B., S Alager, M.S. El Youssoufi, D. Ubals Picanoyl, L. Laloui, and C. Saix. *Compression tests on sandy silt at different suction and temperature levels. ASCE Geotechnical Special Publication No. 157 – Computer Applications in Geotechnical Engineering. Proceedings of Geo-Denver 2007 sponsored by the ASCE Geo-Institute.*

Fredlund, M.D., Fredlund, D.G., and Wilson, W.G., 2000. *Estimation of Volume Change Functions for Unsaturated Soils, Asian Conference on Unsaturated Soils*. May 18 – 19, Singapore.

MWH Americas, Inc. (MWH), 2014a. *Pre-Design Studies, Northeast Church Rock Mine Site Removal Action, Northeast Church Rock Mine Site*. Prepared for United Nuclear Corporation and General Electric Corporation. October 31.

MWH Americas, Inc. (MWH), 2014b. *Pre-Design Studies, Northeast Church Rock Mine Site Removal Action, Church Rock Mill Site*. Prepared for United Nuclear Corporation and General Electric Corporation. October 31.

U.S. Department of Energy (DOE), 1989. *Technical Approach Document, Revision II.* DOE/UMTRA 050425-002, December.

U.S. Environmental Protection Agency (USEPA), 1991. *Environmental Protection Agency, Seminar Publication: Design and Construction of RCRA/CERCLA Final Covers. EPA/625/4-91/025.* U.S. Nuclear Regulatory Commission (NRC), 2008. *Regulatory Guide 3.11 Design, Construction, and Inspection of Embankment Retention Systems for Uranium Mills, Rev. 2*, December.

NRC, 2003. *Erosion Protection Design Concerns Identified at Recent Site Visit* (TAC No. L52459), letter. January 7.

Sowers, George F., 1979. *Introductory Soil Mechanics and Foundations: Geotechnical Engineering – 4th Edition*. Macmillan Publishing Co., Inc. New York, New York.