UNC Responses to USNRC Group 2 RAI Clarification Comments
March 30, 2020

Comments provided from NRC (Yuan Cheng) dated January 7, 2020.

1. Questions as open items

a. Probable maximum precipitation: As indicated in the LAR, the licensee recently updated PMP depths that were generated by the Arizona Department of Water Resources (ADWR) PMP Evaluation Tool (ML19157A173). The updated 1-hour PMP depth is 6.14 inches averaged over the total area of the Pipeline Arroyo watershed. Other updated PMP depths for multiple duration from 2 hours to 6 hours are varied between 6.45 and 6.47 inches. These area-averaged PMP depths are within a small difference (0.02 inch). The staff considers the small difference to be questionable since the durations are in a large range from 2-hour to 6-hour. The licensee needs to explain the small difference of the PMP depths for 2-hour and 6-hour durations. **This is an open item to be resolved by the licensee.**

Response: *The PMP depths were generated using the GIS-based Arizona PMP tool that was published by the Arizona Department of Water Resources in 2013. At the time that the Northeast Church Rock remedial design was prepared, the Arizona PMP tool was the best available source of PMP estimates. (The boundaries of the tool extended to northwestern New Mexico and covered the Pipeline Arroyo Watershed.) The PMP tool provides the Depth-Area-Duration PMP values for Local Convective Storms, General Storms, and Tropical Storms. Given the relatively small size of the Pipeline Arroyo and the relatively rapid time of concentration, the Local Convective Storms control the flows in the Mill Site Channels and in the Pipeline Arroyo at the location of the proposed riprap chute. In response to the questioning from Mr. Cheng, Stantec has re-run the Arizona PMP tool to verify the generated values. Stantec notes that Stantec did not develop the PMP estimation tool and thus cannot directly confirm the quality of the data generated from the PMP tool except to note that (1) the PMP tool was developed using methods that have been accepted as the new industry standard by many states, including Arizona and New Mexico and (2) for local convective storms in the southwestern United States it is typical that local storm durations are often one hour or less; thus, it is not unexpected that PMP depths for local storms should vary little between one hour and six hours.*

Follow-up: NRC requested the addition of a footnote to Table 4 of Attachment I.1 to note that the small incremental difference between the 2- and 6-hour events is correctly derived from the PMP estimation tool. A revised Attachment I.1 is provided with this response document.

b. Current mesh-size (2 ft in x-direction and 2 ft in y-direction and 1 ft in z-direction) in Flow 3D model: Does using a smaller mesh-size in the model significantly change the maximum flow velocity?

Response: *An analysis of the sensitivity of the simulated velocities to the mesh size has not been performed; however, it is our judgement that decreasing the mesh size would have negligible impact on the design while requiring significantly more computation time. As an illustration of the relative resolution of the mesh size consider that the D_{50} of the riprap on the rock chute is 27-inches; so, the mesh size is already less than the median rock size (the base roughness element) on the chute. Further, the*

riprap design equations use average unit discharge (which we have approximated from a depth-averaged velocity) and average channel bed slope, so the refinement would provide little value from a design perspective.

Follow-up: Item closed, no further action.

c. Slope stability of Pipeline Arroyo banks: Is the slope stability of vertical banks evaluated along the Pipeline Arroyo for a PMF event?

The staff reviewed the Pipeline Arroyo with the Field Photographs 3, 4 and 5 of Appendix B of Attachment I.8 of Volume I of the LAR (ML18267A275) and visited the site on June 11, 2019. Based on the photographs and the site observation, the staff considers that the stiff slopes of stream banks are unstable, and the channel is an erosional pathway. The slope failures and the streambed erosions appear inevitable. Consequently, the licensee provided riprap chute design to prevent the bank slopes from failures and protect the streambed from erosions. But the licensee did not provide the slope stability study and streambed foundation bearing capacity for the riprap chute. The lack of those technical analyses and information is **an open item**.

Response: *Please refer to Drawings 9-9 and 9-10 and Photos I.7.3 and I.7.4 from Appendix I. Within the limits of the riprap chute, the design side slopes range from 5:1 (horizontal:vertical) to 2.5:1. Given that these slopes are generally mild from a slope stability standpoint (i.e., the slope angle is much less than the soil friction angle), a formal geotechnical stability study is not considered necessary. From an erosional stability perspective, the design includes the requirement to armor the slopes with riprap, which will protect the slopes from surface water erosion.*

Although not explicitly stated in the comment, Mr. Cheng also may be referring to the bank slopes downstream of the rock chute. Here, the observations from site visits made by Stantec agree with Mr. Cheng's observations. These downstream bank slopes are vertical and, in some places, several tens of feet tall. These vertical slopes could have localized slope failures. Based on our observations of the current conditions and review of the historical aerial images, this process has been occurring for many decades and will likely continue. The historical images of the site reveal that, periodic downstream slope failures notwithstanding, the Pipeline Arroyo alignment has not adjusted. This can be attributed to the downstream Pipeline Arroyo being sediment depleted causing downcutting and widening, but little or no lateral migration. The key to preventing both lateral migration and upstream headcutting is the riprap chute, which is designed to safely pass flood waters from the Pipeline Arroyo above the "nick-point" to downstream of the nick-point.

The comment from Mr. Cheng further notes that a bearing capacity analysis was not performed for the riprap chute. In the design of the riprap chute, the potential for settlement of the foundation was considered by the geotechnical team. The geotechnical team's review identified that the loads on the foundation soils will generally decrease (not increase), due to excavation depths prior to rock placement with the installation of the riprap chute because there will be a net cut of existing soils. Based on this finding, a bearing capacity analysis was determined to be unnecessary. In addition, foundation preparation and compaction requirements for the soil subgrade have been incorporated to limit any areas of localized settlement. An advantage of a riprap chute is

that the structure can withstand modest settlement of the foundation without impacting the performance of the chute.

Follow-up: Item closed, no further action.

d. Channel bed stability: Are deposition and erosion on the streambed examined even though the stream alignment has not changed since 1981? Does the foundation design for the Riprap Chute show that the design channel will not sink into the existing alluvium streambed?

Response: *See response to 1c.*

Follow-up: Item closed, no further action.

e. Inflow hydrograph: Does the licensee assign the inflow hydrograph of a PMF event to the boundary of a HEC-RAS 2-D model using the result of HEC-HMS modeling at the point J-R11us?

Response: *Yes. This is documented in the Boundary Conditions section of Attachment I.6 to Appendix I. It is also shown in Figure 2 and Figure 3 of Attachment I.6. Stantec checked the HMS model with the HEC-RAS model and found that the flows agree at inflow element J-R11us. Stantec did identify a small discrepancy between the HEC-HMS and HEC-RAS models at element J-12us. This difference is less than 1 percent at the peak flow, and; therefore, will have no impact on the design.*

Follow-up: Item closed, no further action.

f. Initial flow condition: Is 6,870 ft reasonable as an initial water surface elevation of the Pipeline Arroyo flood modeling (Page 4 of 5 in Attachment I.6 of Appendix I of the LAR)?

Response: *Page 4 explained that this initial condition was assigned to help provide numerical stability to the model. The effect of this initial condition is to start with some ponding at the base of the riprap chute. This initial ponding impacts only the start of the flood simulation – which was not important for design. From Page 4:*

> *"The initial condition helps provide numerical stability at the outflow boundary by artificially "wetting" the flow surface, preventing numerical instability in the model from a sudden inflow of water. Water surface elevation errors are insignificant because Stantec used the model to evaluate the maximum water depths and velocities, which occur after a significant amount of model time has passed. All increased water levels decrease to equilibrium within ten minutes of the 4.5 hours of simulation time."*

Follow-up: Item closed, no further action.

g. Depression Area: Is the blue area located at the southern part of the repository area correct (Figures 4b, 5b, and 6b of Attachment I.6)? Is this blue area a proposed depression storage area or an accumulation area for surface runoff?

Response: *This blue area is at the top of the repository – a relatively flat area. The figures show the maximum velocities, maximum shear stresses, and maximum depths. The blue area in Figure 4b and Figure 5b means that at some point in the simulation the modeled velocities in this area were between 0.0003 ft/s and 1 ft/s and the modeled shear stresses were between 0.0002 lbs/ft^2 and 0.5 lbs/ft^2, indicating overland flow. Note that the maximum depths in most of the area in question were just over 0.001 ft. Taken together, the flows in this area are nearly negligible and at the limits of what HEC-RAS can accurately render.*

Follow-up: Item closed, no further action.

2. License Conditions

a. Removal of Evaporation Ponds: Do the two existing evaporation ponds and the Branch Swale H as indicated in Section I.4.2 of Appendix I of the LAR need to be addressed in a License Condition as a next task to be completed after the proposed Reclamation Plan?

Response: *The determination during analyses was that the changes to the north and central cell would not impact the flow regimes in Branch Swale H and therefore no changes were made to the original design of that Branch Swale. Because this component of the cover was previously approved by NRC no changes are being proposed as part of this LAR.*

Follow-up: The timing of additional analyses related to the cover configuration after closure of the evaporation ponds will be discussed.

YC's Special note: In Section 4.1.2.4 of Volume I of the LAR, and in Section I.4.2 of Appendix I of Volume I of the LAR, the licensee indicated that the existing Branch Swale H has no outlet. In the future, the licensee plans to connect the swale to the reach of the downstream South Diversion Channel through the existing evaporation ponds. The existing two evaporation ponds will be removed at that time. The licensee assumes that the future Branch Swale H outlet will be restored as the NRC-approved reclamation design in 1991 (Canonie, 1991; NRC ADAMS ML17121A552) and the downstream South Diversion Channel will be completed per NRC-approved tailings reclamation plan, prior to license transfer. According to the licensee's indications as summarized above, the staff proposes that the following **license conditions** be included in the NRC's approval on the LAR.

Condition 1:
The impact on local drainage system in the areas adjacent to the two evaporation ponds needs to be reevaluated when the ponds are removed. The removal of the ponds provides extension space for the Branch Swale H to create its downstream outlet. To assure that a new future extension of the Branch Swale H through the pond removal area has enough discharge capacity for a PMF event, the licensee needs to provide technical information to NRC staff for the repository site safety evaluation.

Condition 2:
The licensee will provide NRC staff technical information related to the design of the South Diversion Channel associated with the new extension of the Branch Swale H. The NRC staff will evaluate the design of South Diversion Channel for a PMF event.

The above two license conditions are associated with the modifications to Source Material License Conditions 34 and 35. Those License Conditions 34 and 35 are indicated in the Sections 1.1 Licensing Background and 1.5 Effect on Existing License Conditions and Approved Reclamation of the Volume 1 of the LAR.

Response: *The evaluation of the capacity of the Branch Swale and the south diversion channel can be evaluated now as a response to a RAI or as a condition of approval of the LAR.*

Follow-up: Additional analyses related to the cover configuration will be performed to support closure of the evaporation ponds and provided for NRC's review prior to closure.

In Section 4.2.3 of Volume I of the LAR, the licensee indicated no flood control design for the downstream outlet of the sunken basin of the riprap chute. Consequently, the staff recognized that no riprap rock would be installed for preventing the downstream area of the basin outlet from erosion. Although no historical evidence of lateral migration of the Pipeline Arroyo was shown in a series of imagery data, the licensee recommended that a monitoring downstream area of the outlet basin in the Pipeline Arroyo would be needed to identify possible instabilities with the potential to migrate back toward the riprap basin due to downstream channel bank erosion. Based on the licensee's recommendation, the staff proposes License Condition 3 shown as follows:

Condition 3:
The licensee will annually provide the NRC with a monitory record, or the licensee will prepare a remedy plan related to the erosion at the outlet basin downstream area of the riprap chute in the Pipeline Arroyo. Based on the monitory record or the remedy plan provided by the licensee, the NRC staff will re-evaluate annually the sunken basin outlet and downstream channel protections against the lateral migration of the Pipeline Arroyo for a PMF event.

Response: *Appendix W Monitoring and Maintenance Plan includes provisions to inspect all riprap channels including the Jetty. Inspections of the completed structures will continue for a minimum of 5 years following construction. Items identified as requiring repair following inspection will be addressed per Appendix W.*

This is stated in Section I.7.3 of Appendix I. This comment was made without a detailed understanding of the downstream conditions of the Pipeline Arroyo. A risk analysis of the downstream area would likely show a downstream headcut that would migrate upstream and undercut the riprap chute to be a non-credible threat.

Follow-up: Item closed, no further action.

3. Licensee's corrections on Haul Routes are needed

a. Wrong indication: On Drawing 9-02, the licensee indicated the location of RUNOFF CONTROL DITCH with the circle label "1/9-08." The indicated location should be redirected from the west side of the Pipeline Arroyo to the dotted area with the circle label "F/9-04."

Response: *The leader line is not pointing to the Pipeline Arroyo. Rather, the leader is pointing to a dashed box that references the Sheet 9-08, which is a plan view of the Runoff Control Ditch. The call out label on the leader is correct.*

Follow-up: Item closed, no further action.

b. Inconsistent flood recurrent years: In Attachment A of Attachment D.1 of Appendix D, the calculation worksheet of "Calculation Worksheet for Roadside Ditches and Diversion Ditches" indicated "5-year, 24 Hour peak discharge" in the worksheet footnote. This "5- year, 24 Hour peak discharge" should be corrected to "10-year 24-hour peak discharge." The correction is to make consistency with the description of the second column of the worksheet table.

Response: *The label needs to be corrected to say 10-year, 24-hour. The design was originally done for the 5-year, 24-hour event but was later changed to the 10-year, 24-hour event. Evidently, the label was not updated.*

Follow-up: This item has been corrected. A revised Attachment D.1 is provided with this response document.

c. Inconsistent ditch depths: Table D.4-1, "Haul and Access Road Design Basis," in Section D.4.1 of Appendix D, indicates that the depths of all designed ditches are 1 foot. In fact, the depths of designed ditches are more than 1 foot. The licensee needs to correct the 1 foot on Table D.4-1 to match the ditch depths shown on the calculation worksheets in the Attachment A of Attachment D.1 of Appendix D. The licensee also needs to make the ditch depths shown on the calculation worksheets of Appendix D of Volume I consistent with the ditch depths shown on the Design Drawings in Volume II of the LAR.

Response: *Table D-4.1 lists a 1-foot ditch depth as the minimum allowable ditch depth. The actual ditch depths were designed to carry the 10-year peak flow, as listed in the calculation worksheets. The 1-ft depth listed on Table D-4.1 can be deleted to avoid confusion.*

Follow-up: This item has been corrected by deleting the "Ditch Detail" column of Table D.4-1 of Appendix D. A revised Appendix D is provided with this response document.

d. Froude Numbers for roadside ditch flows: Some of the licensee's calculated Froude numbers are extremely large and they appear unreasonable as shown in the last column of the calculation worksheet, entitled "Calculation Worksheet for Roadside Ditches and Diversion Ditches," in the Attachment A of Attachment D.1 of Appendix D. The licensee needs to provide the calculation details to the staff for confirming the correctness of calculated Froude numbers.

Response: *Stantec has identified an error in how these values were computed. The numbers can be corrected. Since Froude number was not used in the design, the error will not impact the design.*

Follow-up: The errors in the reported Froude number have been corrected. A revised Attachment D.1 is provided with this response document.

e. Overtopping flow: On Drawings 4-10 and 4-18 of Section 4 Haul Routes of Volume II Design Drawings, the licensee indicated that Culvert C-11 is a group of four corrugated metal pipes, each having 24" of diameter. The drawings show that the elevation difference between the culvert invert and the road top is 6 ft. The licensee computed headwater depth that is 28.83 ft at the culvert inlet (see Attachment A of Attachment D1 of Appendix D in Volume I of the LAR.) The 28.83 ft of headwater depth of a 5-year peak flow (281 cfs) exceeds the 6 ft of the ditch depth at the inlet. Thus, the capacity of culvert size is not adequate because of the overtopping flow. The staff suggests that the licensee revise the culvert design for the Culvert C-11 and check the culvert layout to fit the existing channel dimension of the Pipeline Arroyo. If the licensee intends to design an allowable overtopping flow, the licensee needs to design scour protection for the road.

Response: *Stantec is aware that the culverts at C11 are undersized for the 5-year or 10-year flood. If a 5-year storm were to occur during the temporary period when the haul road was in place, that the roadway would be overtopped at the C11 location. We judged the consequence of such an occurrence to be low and not justifying the expense of scour protection along the upstream and downstream face of the roadway at C11; however, installing scour protection, if required, will likely be less expensive than upsizing the culverts to be able to convey the estimated 5-year or 10-year peak flow.*

Follow-up: Item closed, no further action.

f. Inconsistent lengths of culverts: The staff finds that culvert lengths in Section 4 of Design Drawings of Volume 2 of the LAR are not consistent with the lengths in hydraulic computations for the designed culverts shown in Attachment A of Attachment D.1 of Appendix D of Volume I of the LAR. The inconsistencies are summarized as follows.

Culvert ID	Culvert Length shown on Design Drawings of Volume II of the LAR	Culvert Length shown in the Licensee's calculation worksheets (Attachment A of Attachment D.1 of Appendix D of the LAR)
C01	220	200
C03	65	70
C05	55	40
C10	60	40
C12	136	70
C13	56	47.5
C14	56	47.5
C15	65	85
C16	84	70

The staff suggests that the licensee needs to correct the inconsistent culvert lengths. The licensee needs to check the culvert sizes and their dimensional layout to fit

the available channel width and slope. The geometric data of dimensional layout should match the input data to the culvert hydraulic computations.

Response: *The culverts are not drawn to scale on the Section 4 drawings. A note indicating that the culverts are not to scale can be added to the drawings.*

Follow-up: This item has been corrected. Revised Section 4 drawings are provided with this response document.

g. Inconsistent pond labels: Comparing Drawing 3-01 of Section 3 of Volume II and Figure I.1-1P and Figure I.1-1E of Attachment I.1 of Appendix I, the staff finds that the ponds included in flood simulations are not consistently labelled, such as Pond 1 and Pond 2 on the Drawing 3-01 need to be switched.

Response: *Figure I.1-1E and Figure I.1-1P are elemental stick diagrams and have no directional basis; therefore, the comment that the ponds are not consistently labeled is only conjecture. In any case, because the model combines the flow from the ponds immediately downstream of the ponds, the pond labels have no bearing on the simulated flows or on the design.*

Follow-up: Item closed, no further action.

h. A confirmation for the NECR Mine Site Stormwater Controls: The staff does not review the stormwater controls for the NECR Mine Site. The licensee excludes the information of the stormwater controls that should be addressed in Appendix F of Volume I and Section 6 of Design Drawings. The exclusions are indicated by the licensee in a footnote shown on Page v of Volume I of the LAR. The footnote says,

> "*Note: appendix lettering is consistent with the design submitted to USEPA. Appendices and Drawing Sections specific to the NECR Mine Site, or to USEPA submittal requirements, have been excluded from the LAR submittal."*

Response: *Correct, the NRC staff is not reviewing the Mine Site Stormwater Controls design because they are not on the licensed facility.*

Follow-up: Item closed, no further action.

i. Incorrect date: At the end of the first paragraph of page 1-1 of Volume I of the LAR, the licensee stated,

> "(t)he tailings reclamation plan (Canonie, 1991) for the tailings disposal area (TDA) associated with the former mill was submitted by UNC on August 30, 1991 and approved by NRC on March 1, 1991."

As shown above, the staff finds that the NRC's approval date of March 1, 1991 is earlier than the licensee's submittal date of August 30, 1991. The licensee needs to correct either the submittal date or the approval date.

Response: *Per discussion with NRC on February 7, 2020, UNC/GE is not revising the referenced submittal or approval date.*

Follow-up: Item closed, no further action.

RAI 4.2-4
My review note:
Item 5 of RAI 4.2-4 remains open. The licensee does not answer this item. I believe this open item can be resolved in a public meeting through discussions and confirmations. The other items are satisfied with the licensee's responses.
I checked the licensee's updated NECR_95_HMS4.2.1 model and the
all necessary corrections as indicated in the RAI 4.2-4. I confirm that the updated model input data is consistent with the corrected data presented in the Volume I of the LAR.

Response: *Based on the call with NRC, Stantec understands that the open item refers to an inconsistency in the PMP value listed in Table 4 of Attachment I.1 with the value listed in other locations in the report and in the model results. Stantec has confirmed that the value listed in Table 4 of Attachment I.1 was listed incorrectly and can make correction to Table 4.*

Follow-up: This item has been corrected. A revised Attachment I.1 is provided with this response document.

RAI 4.2-5
My review note:
The licensee revised Table D1 instead of Table D2. Correcting Table D2 remains **as an open item**. In Table D2, the Tc and R should not be assigned as the same values in each row in the 12th and 13th columns of the Table D2 of Clark Unit Hydrograph Parameters for a 100-year storm.
Table G13 provides incomplete revisions, including the peak discharges. The licensee needs to make the peak discharges consistent with the modeling results. This correction of Table G13 remains as **as an open item**.

Response: *Updating Table D2 was not requested in RAI 4.2-5; however, there does appear to be a mistake in the reporting of some of the Tc and R values in Table D2. Table G13 also was not updated with the final model results, and this can be corrected.*

Follow-up: This item has been corrected. A revised Attachment I.1 is provided with this response document.