MAR 29 1989

MEMORANDUM FOR: Ray Gonzales,
Uranium Recovery Field Office, R IV

FROM: Joel Grimm
Operations Branch
Division of Low-Level Waste Management
and Decommissioning, NMSS

SUBJECT: REVIEW OF UNC RECLAMATION PLAN,
CHURCH ROCK, NEW MEXICO

I have reviewed portions of the UNC-Church Rock reclamation plan you requested. The plan is mostly a description of how the Yang method for predicting lateral stream erosion was used to show that the site will not be affected by widening of Pipeline Arroyo. This methodology is not familiar to me, so I cannot critique the data, methods, or outcome. On the other hand, lateral erosion is probably not the only process that could alter Pipeline Arroyo, and have a potential impact on tailings stabilization. Also, the applicant's analysis included only relatively large floods, considering neither day to day nor month to month erosion. Finally, the approach left out quite a number of geologic and geomorphic variables, and includes many assumptions which I do not believe are supported. I would like to run through them one-by-one.

Channel Pattern

Using Yang's method to calculate lateral stream erosion requires an assumption that a straight stream pattern is the stable configuration for Pipeline Arroyo. Potential conversion of the channel from straight to meandering or braided during the performance period has not been addressed. A meandering channel will likely result in localized and accelerated lateral erosion along the channel near the tailings pile. The rate of this accelerated erosion may not present a problem, but that needs to be verified.

To address this question, I would first determine the channel pattern exhibited before mining and milling took place. Even if the channel was straight, it may have been inherently unstable, and on a threshold of rapid and erosive change. Another technique one could use is to observe similar nearby drainage basins. The channel patterns they exhibit are likely to be the stable pattern for Pipeline Arroyo.

Conversely, the applicant could try two different approaches. First, demonstrate that a different channel pattern will not result in failure of the site and design in meeting the standards. Or, finally, the applicant could apply design features and materials which would maintain a straight channel throughout the performance period.

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Channel Stability

The applicant has attempted to demonstrate that the tailings will be stable from lateral erosion of Pipeline Arroyo during the required performance period. However, the applicant has not considered the potential effects of accelerated vertical erosion of Pipeline Arroyo. Channels and entire drainage basins in New Mexico, and much of the western U.S., are notorious for deep and rapid incision during the past century. Based on my observations of USGS topographic maps of the area, Pipeline Arroyo and its tributaries are not an exception. Furthermore, this process is usually more extensive in channels which are altered by humans (Schumm and others, 1984), like Pipeline Arroyo. Channel lowering in Pipeline Arroyo may have potential impacts upon stability of the tailings which the applicant has not considered. One such impact is discussed in the next section.

The applicant could perform a simple analysis which could determine if Pipeline Arroyo is likely to experience further gullying. Previous geomorphic studies have determined that stability of a channel against downcutting is a factor of the valley slope and upstream drainage area. To summarize, a channel may be intrinsically unstable if the valley gradient/drainage area relationship exceeds some threshold condition. This relationship has been established for a number of geographic areas, and is summarized in Wells and Gardner (1985), Nelson and others (1983), and Schumm and others (1984).

My preliminary analysis shows that Pipeline Arroyo at the UNC location far exceeds a threshold for channel stability, compared with data for previously studied basins. This could be shown incorrect, however, if the applicant performed a detailed analysis of the drainage basin and other neighboring tributaries of the Puerco River. Such a study would identify incised and unincised channel segments, and determine their valley gradients and basin areas. Plotting these data would allow interpretation of the threshold limit for channel stability in the Church Rock area. If the results show the basin does not exceed a threshold condition, then one probably has reasonable assurance that the channel is not likely to become incised.

Effects of Channel Lowering

The local base level for the uranium mill tailings is the channel of neighboring Pipeline Arroyo. When any base level is lowered, points upstream are likely to erode in order to reach equilibrium with the new base level. In this case, runoff from 10:1 sideslopes will flow to a lower elevation, resulting in oversteepening, and the initiation of rills and gullies (an unprotected 10% slope is likely to develop rills and gullies anyway). In this light, the applicant's assumption that Pipeline Arroyo will not experience downcutting is not conservative, as they state

on page 8 of their response. The applicant's analysis has shown only that the embankment sideslopes are wide enough to protect the tailings from exposure due to lateral erosion of Pipeline Arroyo. Headcutting, assuming it is initiated, is likely to be much more rapid. Wells and Gardner (1985) have documented evidence that channels in northwestern New Mexico can develop tributaries that erode headward 1 to 12.5 meters per year. Even if headcutting occurs here an order of magnitude slower, 100 to 1250 meters of headcutting could occur in 1000 years; 20 to 250 meters in 200 years.

The potential for gully development and headward cutting to the tailings should be analyzed by the applicant. An acceptable approach is the gully intrusion prediction method developed by Nelson and others (1986). Application of such a method will provide a conservative approach to determine if gullies can be expected to form, how deep they may erode, and the extent to which they will cut headward during the performance period. I believe the applicant can use this analysis to provide reasonable assurance that gullying will not affect the reclaimed tailings.

I can go into more detail and make more specific recommendations if you need them. Feel free to contact at FTS 492-0569.

ORIGINAL SIGNED BY

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ACNW YES ☐ NO ☒

SUBJECT ABSTRACT: Review of United Nuclear Corp. Reclamation Plan, Church Rock Uranium Mill, New Mexico

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