



UNITED STATES
NUCLEAR REGULATORY COMMISSION

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RECORD

Mr. Juan R. Velasquez
United Nuclear Corporation
1720 Louisiana N.E., Suite 400
Albuquerque, NM 87110

SUBJECT: SEISMIC EVALUATION OF CHURCH ROCK TAILINGS IMPOUNDMENTS

Dear Mr. Velasquez:

The U.S. Nuclear Regulatory Commission staff has completed its re-evaluation of the seismic design aspects of the previously approved reclamation plan for United Nuclear Corporation's (UNC's) Church Rock, New Mexico, uranium mill and tailings site. The staff has concluded that UNC's design is acceptable, and the seismic design evaluation issue is closed.

Details of the staff review are discussed in the enclosed Technical Evaluation Report. If you have any questions, please contact the NRC Project Manager for the Church Rock site, Ken Hooks, at (301) 415-7777.

Sincerely,

Joseph J. Holonich, Chief
Uranium Recovery Branch
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards

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

Enclosure: Technical Evaluation Report

cc: Donald Williams, EPA Region 6
Kerrie Neet, NMED Superfund Section
Diane Malone, Navajo Superfund Proj.
Joe Virgona, DOE Grand Junction

LCRC 2.2

CHR 530.02(B)

TECHNICAL EVALUATION REPORT

DATE: September 10, 1997
DOCKET NO.: 40-8907 LICENSE NO. SUA-1473
LICENSEE: United Nuclear Corporation (UNC)
FACILITY: Church Rock Uranium Mill and Tailings Site
PROJECT MANAGER: Kenneth Hooks
TECHNICAL REVIEWER: Banad Jagannath, NRC
Simon Hsiung, CNWRA

BACKGROUND AND CONCLUSIONS:

The staff recently concluded that, based on the Atlas seismic review experience, there might be other sites for which the seismic stability analysis needed to be reassessed. As a first step in this effort, the Lawrence Livermore National Laboratory (LLNL) was contracted to look at the seismic characteristics associated with all the licensed tailings sites and provide information on recommended ground acceleration values.

In its review of UNC's Church Rock site, the staff and its contractors used the reclamation plan submitted by UNC on August 30, 1991. The reclamation plan described the reclamation design and provided drawings. The seismic stability of the critical slopes at stations 50+00 and 80+00 were evaluated using stratigraphy and soil design parameters provided in the licensee's report and considering the LLNL suggested peak ground acceleration (PGA). A PGA of 0.22g resulting from a maximum credible earthquake of 7.0 magnitude was used.

Based on the results of the analyses, it is concluded that the design of slope at station 50+00 is sufficient to withstand the PGA associated with the maximum credible earthquake. However, the design of slope at station 80+00 has a factor of safety of 0.92 under a seismic event of 0.22g PGA. It is noted that the LLNL report presented a regional evaluation of the available geologic and seismologic data to come up with a recommended PGA on a regional basis. LLNL recommended PGA is for a magnitude 7 earthquake with a probability of exceedence (PE) of 10^{-4} . This maximum level of earthquake is considered to be upper limit.

The staff reevaluated LLNL recommended PGA to determine the appropriate PGA for the Church Rock site. A reevaluation of available data by staff leads to a conclusion that a magnitude of 6.25 earthquake is appropriate for this site to comply with the requirement of being stable for 1,000 years to the extent reasonably achievable, and in any case for at least 200 years. The PGA for a 6.25 magnitude earthquake is 0.196g for a PE of 10^{-4} . A reevaluation of stability of embankment at station 80+00 using a PGA of 0.196g resulted in a factor of safety of 1.00, which satisfies the stability requirements in NRC Regulatory Guide 3.11. Therefore, the site meets criterion 4(e) of Appendix A to 10 CFR Part 40. No additional information from the Licensee is required at this time.

EVALUATION:

Seismic slope stability is a function of several factors including: 1) critical slope geometry, 2) subsurface stratigraphy, 3) soil strength parameters, and 4) PGA. This reevaluation considered all of these factors, and is discussed below.

Critical Slope Geometry

The steepest gradient of the slopes are 5H:1V at both stations 50+00 and 80+00. The stability of these steep slopes of the retention dams were evaluated.

Subsurface Stratigraphy

The site was modelled considering two soil types: 1) the tailings embankment fill soils, and 2) the foundation soils. For simplification, it was assumed that the tailings cover system and the armored slope at the toe were similar to the embankment fill. This assumption results in conservative strength parameters. Slope geometry, soil properties, and piezometric surface location were adopted from UNC's August 30, 1991 tailings reclamation plan. These were previously reviewed and accepted by NRC to be reasonable.

Soil Parameters

Soil parameters used in the slope stability analysis include dry and wet unit weight, friction angle, and cohesion. These were from UNC's August 30, 1991 reclamation plan and were deemed reasonable.

Peak Ground Acceleration

The seismic coefficient selected for the site was based on LLNL's report "Seismic Hazard Analysis of Title II Reclamation Plans" dated June 26, 1994. A PGA range of 0.06 to 0.22g was estimated for this site in the LLNL report. This estimate was based on the presence of two lineaments, the Pipeline Canyon and Wingate, located in the vicinity of the site. The Pipeline Canyon lineament trends east-northeast in the area of the tailings cell. No vertical or horizontal displacement has been measured along the lineament (based on examination of surface exposures) and no large-scale faulting is known to occur throughout the area. Therefore, based on an evaluation of information in LLNL report, the staff has determined that a PGA of 0.196g for a magnitude 6.25 earthquake is reasonable for this site. Since literature indicates that pseudo-static analyses are valid for PGA values less than 0.3g, and the slope is relatively flat, a horizontal seismic coefficient equal to two-thirds (i.e., 0.131) of a PGA of 0.196g was used in the pseudo-static stability analysis of slope at station 80+00. Slope at station 50+00 was stable under a seismic event with a PGA of 0.22g, therefore, the analyses was not repeated using a lower PGA recommended by the staff for this site.

Method of Analysis

The computer code PCSTABL5M was used to calculate the seismic factor of safety. A pseudo-static approach was used wherein the ground acceleration is modeled as a horizontal force. Regulatory Guide 3.11 defines the minimum acceptable factor of safety for seismic analyses as 1.0. A circular failure search mode was used in the staff's analysis. The analyses yielded a minimum factor of safety of 1.55 for station 50+00 with a PGA of 0.22g and 1.00 for station 80+00 with a PGA of 0.196. The factor of safety represents the ratio of the forces resisting failure to the forces tending to cause failure. Therefore, a factor of safety greater than 1.0 indicates a stable configuration and condition. Because actual seismically induced forces occur

over a relatively short period, a pseudo-statically calculated seismic factor of safety slightly less than 1.0 does not always result in excess slope deformations.

Based on the results of the analyses, the staff concludes that the design of the site is sufficient to withstand the peak ground acceleration associated with the maximum credible earthquake. Therefore, the site meets criterion 4(e) of Appendix A to 10 CFR Part 40.