

POOR ORIGINAL

TESTIMONY OF
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U.S. NUCLEAR REGULATORY COMMISSION
BEFORE THE
SUBCOMMITTEE ON ENERGY AND THE ENVIRONMENT,
OF THE COMMITTEE ON INTERIOR AND INSULAR AFFAIRS
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I am pleased to be here today to discuss with you the Nuclear Regulatory Commission's (NRC) activities regarding the failure of the dam at the United Nuclear Corporation's (UNC) uranium mill tailings disposal site at Church Rock, New Mexico. In this testimony I will address each of the major areas of interest outlined in your September 19, 1979 letter to Chairman Hendrie asking us to appear today at this hearing.

The United Nuclear uranium milling operation was licensed by the State of New Mexico in May 1977. New Mexico is an Agreement State operating under terms and conditions of an agreement signed on April 3, 1974, authorized under Section 274 of the Atomic Energy Act of 1954.

The accident at the site occurred on July 16, 1979. The State officials notified NRC's Office of State Programs of the accident on July 16, 1979, and on July 17, 1979, the State Environmental Improvement Division requested NRC technical assistance in evaluating the accident and in aiding the State in dealing with the public health hazards resulting from the accident. We responded by dispatching technical staff to the State on July 18, 1979 and we have continued our effort up to the present.

In the matter of this accident, we are participating not only as a result of the State's request for technical assistance but also as an agency exercising joint regulatory jurisdiction. This joint jurisdictional role for the NRC is a result of the Commission's determination that the Uranium Mill Tailings Radiation Control Act of 1978 requires NRC/State concurrent jurisdiction over uranium mill tailings in Agreement States.

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At the onset, we chose not to issue orders to the mill operator concerning operation of the mill or regarding cleanup operation. We were agreeable with the State taking the lead in dealing with the operators as long as we were assured that our regulatory responsibilities were considered in State actions. As I will note later, the time did come on October 12, 1979, that we felt that the issuance of an order by the NRC was necessary.

The scope of our activities regarding the accident and its aftermath thus far includes preliminary evaluations of the probable cause of the breach in the dam, the plans proposed by the operators to repair the dam, the overall integrity of the embankment system, and the clean-up and decontamination of the affected area. We are using not only direct NRC staff but also our geotechnical consultants. We are carrying out our activities in conjunction with personnel from the licensee, the State of New Mexico, and the Albuquerque Office of the U.S. Army Corps of Engineers, who had been called in by Governor King, and the U.S. Environmental Protection Agency.

We have reviewed the company's evaluations of the probable cause of the accident and generally concur with the reported findings. The dam was located on a site containing alluvial soils overlying bedrock having an irregular surface. Depths of alluvium ranged from less than 20 feet up to a maximum of about 100 feet.

Consolidation tests were conducted on samples of the alluvial soils during the preconstruction design phase and after construction of the starter

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embankment. These tests indicated that settlement of about 5 percent would result from the loading of the embankment under dry conditions. After addition of water, additional settlement ranging from 1-1/2 percent to 13 percent was experienced due to collapse of the soil structure. As a result of the potential for large compression of the alluvium and because of the irregular bedrock surface, large differential settlement of the dam occurred. Settlement in excess of 3 feet was measured in January 1979 by a consultant to United Nuclear Corporation. As a result of differential settlement, cracks developed in the embankment. Longitudinal cracks, parallel to the dam axis, were observed in several locations prior to the failure. Transverse cracks, perpendicular to the dam axis and extending nearly to the downstream shell, have been observed in the breach area after the failure. These cracks caused high pore water pressure to be developed within the embankment when tailings water was allowed to come into direct contact with the embankment.

For some time period immediately prior to the failure, tailings water was maintained in direct contact with the embankment near the breach area. The high pore water pressure in the embankment resulted in a decrease in the strength of the embankment and caused instability to develop. After the instability was created, the large flow of water through the cracks resulted in internal erosion which accelerated the breach. One factor which may have helped to accelerate the internal erosion is the fact that the high acidity of the tailings water causes the embankment soil to be highly dispersive.

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We are currently reviewing the operator's evaluation regarding the stability and overall integrity of the remaining portions of the embankment for future use. We are in the initial stages of this review and have no conclusions as yet. The operator has proposed a staged plan to make some modifications to the impoundment to allow for resumption of milling operations. It was during the evaluation of this plan on October 12, 1979, that the NRC issued an order to United Nuclear Corporation that they cannot resume operations until we complete our review. While we were still awaiting information from the operator necessary to review their interim plan, we received word initiated by a television news cast on October 12, 1979 in Albuquerque that the State was seriously considering authorizing the resumption of operations. During the course of numerous telephone conversations with various officials of the State of New Mexico and the United Nuclear Corporation on that same day the NRC received varying and conflicting reports as to whether resumption of the mill was contemplated before NRC could complete its evaluation. We issued the order to assure that this would not happen. We are now working with the operator to resolve outstanding issues.

In addition to the evaluations already noted we are going one step further. Following our review of aerial photographs of the mill vicinity and on-site observations we have serious reservations about the current tailings impoundment site relative to long-term stability. The large upstream rainfall catchment area and the close proximity to a major arroyo (stream) would seem to provide a high potential for surface water erosion of the embankment over

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the time period necessary to contain the uranium tailings. We feel very strongly that a comprehensive study of alternate tailings sites and disposal methods must be performed expeditiously. If our concerns regarding the current site cannot be satisfactorily resolved, we would not concur with more than limited use of this site while a new tailings site is being developed.

Our long-term concerns have been discussed with the State and United Nuclear Corporation management both by letter and meetings. It is our understanding that United Nuclear has initiated an alternate site study. We are ready to coordinate a review with the State of any forthcoming proposal as soon as it is submitted.

I should add that arrangements have already been made for our geotechnical and hydrology consultants to assess each of the Agreement States' uranium tailings impoundment systems in conjunction with our current responsibilities under the Tailings Act. We will certainly extend the scope of the tailings dam assessments relative to the findings in this case.

We have also reviewed our docket files on the tailings dams at operating mills in non-Agreement States and in all but one case, differential settlement was satisfactorily addressed in our geotechnical evaluation. The exception is a dam that was authorized in 1971 and the documentation doesn't specifically indicate that differential settlement was addressed. However, no evidence of excessive differential settlement leading to cracking has shown up in our routine inspection of this dam.

We specifically asked us to discuss the accident and its relationship to our recently proposed regulations.

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The NRC has just proposed regulations which specify requirements for uranium mill tailings disposal. If there is no objection, I would like to supply for the record a copy of those regulations as they appeared in the Federal Register on August 24, 1979. These proposed rules are based on a study that took several years and culminated in the Generic Environmental Impacts Statement (GEIS) on uranium milling, issued in the spring of this year. It is also based on our practical licensing experience of several years, during which time we carried out a major program of upgrading tailings disposal practices in States that we regulate. Furthermore, of course, the regulations incorporate the various provisions of the Mill Tailings Act concerning institutional controls, such as land ownership requirements, required for proper tailings disposal.

The regulations identify certain siting and design features which must be incorporated into tailings disposal programs to assure long-term isolation and containment of tailings without continuing active maintenance. More specifically, the regulations identify burial of tailings below the surrounding grade, either in mined out open pits or in specially excavated pits, as the preferred mode of tailings disposal. In this way, dams such as the one which failed at the Church Rock mill are avoided.

Below grade burial is favored primarily because of the protection it provides the tailings disposal area from the continuing wind and water erosion that will occur over the thousands of years that the tailings will

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remain hazardous. This method of disposal also has the obvious side benefit of eliminating the potential for rapid and large failure during the period of active milling operations when there are large quantities of tailings solutions to contain such as occurred in the Church Rock case.

The proposed regulations recognize that below grade burial may not be practicable in all cases and specify certain design and siting requirements which must be followed when tailings are impounded behind dams above grade to assure long term isolation and stability. For example, the regulations require that tailings be impounded near the head end of a drainage area to eliminate, or reduce as much as possible, the potential for water erosion; very gradual embankment slopes protected by course rock or stabilized with vegetation are required, again, to reduce effects of wind and water erosion.

We have proposed these regulations primarily with new tailings disposal operations in mind. We will apply the provisions of these regulations to the maximum extent practicable on operating mills. Obviously, after many millions of tons of tailings have been generated at a site, it is more difficult to make fundamental change in the way tailings are being disposed of, such as to move tailings from a location having high erosion potential to another, more suitable site.

In some cases, however, such as appears to be the case with the Church Rock mill, this may be warranted. The mill has operated for only a few years and relatively few tailings have been impounded at the site. As I mentioned earlier, the site appears from our review so far to have very poor erosion characteristics, and we have informed the operator of the need to explore seriously the impoundment of tailings at a different site.

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In answer then to the question of how our proposed regulations relate to the failure of the Church Rock dam, the thrust of our regulations is clearly to avoid where possible the use of dams for tailings containment. The Church Rock incident underscores the prudence of this goal.

I would like now to discuss our response regarding cleanup and decontamination. We have established with the State a comprehensive sampling and monitoring program which will, first, identify all areas that have been contaminated, and second, monitor the cleanup of affected areas. Soil and stream-water samples are being taken along the entire length of the potentially contaminated stream, including areas of Arizona. The monitoring program is being conducted by State and NRC personnel with some assistance from the operator.

To provide the kind of independent radiological assessment capabilities required in this case, and to rapidly process samples as cleanup progresses, the NRC has set up on-site a specially equipped mobile laboratory. This laboratory was brought to the site when it became clear that the State did not have the capability to rapidly process samples as is required to assure that the cleanup efforts will be conducted in a full and expeditious manner by the mill operator.

Estimates of the amount of tailings released from the failure have varied, but it appears that at least about 100 million gallons of acidic tailings solutions and 11 hundred tons of tailings solids escaped from the tailings impoundment area before the break in the dam could be closed. Most of the solids were deposited in an area very near the impoundment in a backup

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containment area on operator property and in an adjacent stream, the so-called "Pipeline Arroyo." The solutions travelled in the Pipeline Arroyo to the Rio Puerco which flows through Gallup, New Mexico, a town about 20 miles southwest of the mill site, and into Arizona. By evaporation and by percolation into the stream bottom, the spilled solutions eventually dissipated at a point estimated by visual observations to be about 20 miles into Arizona.

The Pipeline Arroyo stream and Rio Puerco run in channels which, except for periods of heavy rain, are very small streams. The release of tailings solutions resulted in a flow which filled the entire channel, contaminating the normally dry bottom portions, or "terraces," as they passed. The result as indicated by our measurements was a widespread contamination of the terraces wetted by the released solutions. The contamination levels appear to be uniformly above natural soil concentrations of thorium-230 radioactivity. There are isolated areas on the terraces where contamination is quite concentrated, being as high as 100 to 500 times background levels. These are, in many cases, areas where solutions became stranded in isolated pools after the spilled solutions passed. The monitoring effort has been aimed at identifying these areas of concentrated contamination and the cleanup effort has consisted of removing these concentrates.

Let me summarize, then, in general terms what the potential health impacts of this incident have been and are. The most immediate hazard resulting from the incident related to the drinking of or having skin contact with the tailings solution which is highly acidic. This condition existed at

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Church Rock for only a short period of time, probably a day or two, until the water from upstream mining operations and the natural alkalinity of the stream bed neutralized the tailings solution. The radioactivity in the tailings is not of a nature to be an immediate health risk. Certainly, however, if concentrations of the tailings are left in the arroyo they would constitute a health hazard to the local public over the long run.

The two sources of potential public exposures to radioactivity in this case are contaminated soils and water.

We have advised the State of what would be acceptable cleanup levels of the contaminated terrace soils. Various potential exposure paths which affect human health were evaluated with respect to the levels of radioactive contamination that would exist in the arroyo following cleanup. Specifically, we looked at the following potential pathways of exposure from contaminated soil: inhalation of radon, direct gamma exposure, direct inhalation of contaminated windblown particulates, and ingestion of water or foods contaminated by windblown particulates or leached activity. Potential exposure from these pathways following cleanup will be small fractions of established radiation exposure limits of the Commission (10 CFR 20) and the Environmental Protection Agency (40 CFR 190). We are recommending a cleanup to a very low level of residual soil contamination in keeping with the basic philosophy that exposures to any radioactivity should be reduced to the maximum extent reasonably achievable.

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The other important pathway of concern involves human consumption of livestock and animals which drink water from the affected stream or from nearby wells. It is our understanding that there is no direct human consumption of stream water in the areas that have been contaminated.

From limited data available on radioactivity in surface stream water, it appears that thorium-230 in the stream is remaining at elevated levels. The stream water is apparently picking up and transporting thorium that was deposited in the stream beds at the time of the incident. Notwithstanding this, exposures to individuals eating livestock which drink from the stream at observed levels will be fractions of EPA and NRC exposure limits. It is more difficult to assess the potential for exposure through use of wells near the affected stream. We do not as of yet have firm data to determine the extent to which concentrated tailings solutions have percolated into groundwater. Radioactivity that may be present will tend to be removed in the subsoils by a natural adsorption process and be diluted by groundwater. Nonetheless, just as with surface water contamination, this is a matter which must be watched by continued monitoring by the operator, State and NRC.

Following completion of cleanup, the NRC, possibly jointly with the State, will issue a report. The report will document satisfactory completion of the cleanup, will be a full statement of the environmental impacts that have occurred, and will recommend what ongoing monitoring should take place to confirm that there will no be a later problems such as contamination of wells near the stream from seepage into groundwater.

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I might note that we have made a special effort to respond to the concerns of the people living near the affected stream, particularly the Navajo. The NRC staff has met personally with representatives of the Navajo Nation to review with them our efforts. As a result of that meeting, members of the Navajo Environmental Protection Commission are participating in the cleanup monitoring program with NRC and State personnel. We believe we have attended to the specific health concerns that have been raised, including sampling areas along the stream that the Navajo have pointed out as being used for stock watering.

Concerning our relationship with EPA in this matter, we are in frequent contact with the EPA exchanging data and technical assessments we have conducted. We have kept EPA abreast of our actions as far as setting cleanup levels and monitoring cleanup operations are concerned. We will be consulting with them formally as we write our final report on the incident and cleanup operation.

In summary, the immediate health hazard resulting from the failure was the freestanding tailings solutions that existed for a day or two before the solutions were diluted. The tailings themselves are not of a nature to be an immediate health risk but if left in the arroyo would constitute a health hazard to the local public over the long term. Analysis so far indicates that radioactivity in stream water is appreciably above background levels but below limits specified in our regulations. Continued close monitoring of stream water and wells will be required. NRC has been working with and will continue to work with the State regarding clean-up operations and geotechnical analysis of the site. As I have stated, the thrust of our proposed regulations is clearly to avoid where possible the use of dams for

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tailings containment. The Church Rock incident underscores the prudence of this goal. This solution is more readily adapted for new sites versus existing ones. I would like to emphasize that this testimony was prepared as a result of our analysis and evaluation of the data to this date and our testimony may be affected by further analysis and evaluation of the data to be performed in the next few months. We would welcome the opportunity to testify at any future hearing on this subject and/or provide you more current information should you require it.

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