MILL TAILINGS DAM BREAK AT CHURCH ROCK, NEW MEXICO

OVERSIGHT HEARING

BEFORE THE

SUBCOMMITTEE ON ENERGY AND THE ENVIRONMENT

OF THE

COMMITTEE ON INTERIOR AND INSULAR AFFAIRS HOUSE OF REPRESENTATIVES

NINETY-SIXTH CONGRESS

FIRST SESSION

ON

MILL TAILINGS DAM BREAK AT CHURCH ROCK, NEW MEXICO

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MILL TAILINGS DAM BREAK AT CHURCH ROCK, NEW MEXICO

MONDAY, OCTOBER 22, 1979

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON ENERGY AND THE ENVIRONMENT,
COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,
Washington, D.C.

The subcommittee met pursuant to notice at 9:55 am. in room 1324, Longworth House Office Building, Hon. Morris K. Udall (chairman of the subcommittee) presiding.

The CHAIRMAN. The subcommittee will come to order.

On July 16 of this year a uranium mill tailings impoundment dam failed, releasing 93 million gallons of contaminated liquid and 1,100 tons of hazardous solid waste into an arroyo near Church Rock, N. Mex. The radioactive and chemically dangerous materials were carried to the Rio Puerco, through Navajo Indian grazing lands, near the city of Gallup, N. Mex., and about 20 miles into the State of Arizona, leaving contaminated residue over a distance of close to 100 miles.

This morning we will hear of the social disruption and hardship this accident has caused the Navajo people and of the economic difficulties it has created both for the United Nuclear Corp. and for its employees.

Our concern in these matters derives from three areas of the Interior Committee's jurisdiction, dam safety, on which we have legislated; Indian affairs and finally regulation of the nuclear industry. We go back today to the issues that have been repeatedly brought before this subcommittee and before the Congress as a whole.

We have made a Federal commitment to insure the safety of all dams—the failure of which could threaten populations. This committee remembers back to the West Virginia spill in 1972, the Teton Dam failure in 1976, and the Toccoa in Georgia in 1977. We have had years of dam safety hearings, reviews, and studies by various agencies. We have implemented layers of regulatory guidance and provided new Federal authority to assure safe construction and operation of these structures.

With regard to uranium mill tailings specifically, this committee produced, and Congress enacted, tough legislation last year to assure that these impoundments would be properly constructed and monitored. We committed the Federal Government to a multimillion-dollar program to clean up the hundreds of thousands of tons of tailings that have been dumped in sloppy and haphazard fashion over large regions of the Southwest. It ought to be unneces-

sary today to reiterate that the Congress and this committee will not tolerate the subtle but potentially catastrophic contamination of the regions where uranium mining is done.

Although there is a measure of uncertainty in our assessment of the health impacts of the tailings spill at Church Rock, it is likely that the levels of contamination in the area will not result in loss of human life if the spill is properly cleaned up. It is important to note, however, that all of the contaminated material will never be completely removed from the environment. This accident shows the incremental and subtle nature of the contamination produced by uranium milling operations. Since 1959 there have been five other tailings spills involving millions of gallons of hazardous liquids.

In most cases, response to the spills has been to fence off contaminated areas from public use indefinitely. In one case, 35,000 gallons of tailings slurry was released into the Colorado River. After an accident at another United Nuclear Corp. facility in New Mexico, 55 cubic yards of solids completely covered the company's grind mill and mill yard, near the homes of some company employees, and remains there today.

Pound by pound and acre by acre these materials have not been judged to constitute an immediate threat to public health. But if we continue to heap them on each other we will have great difficulty in the next century, if not before, and see substantial portions of the American West with threatened ground water systems upon which the people there rely.

The behavior of the regulatory agencies in response to this threat will be crucial. As I think the record compiled this morning will show, no amount of statutory authority will provide protection for the public if those in charge of implementing authority fail to do so in a conscientious manner. In the case of the Church Rock tailings site, at least three and possibly more Federal and State regulatory agencies had ample opportunity to conclude that such an accident was likely to occur. Before the dam was licensed, the company's own consultant predicted that the soil under this dam was susceptible to extreme settling which was likely to cause the cracking and subsequent failure of the structure.

This information was incorporated in the company's license application materials, which were reviewed by the State of New Mexico's dam safety engineer, by the State environmental improvement division and by the U.S. Nuclear Regulatory Commission. The company's geotechnical consultant noted prior to construction of the dam, that:

> Because of the highly stratified nature of borrow areas, proper inspection will be particularly critical for the project. Continuous inspection by qualified geotechnical engineering technicians will be necessary.

Yet there is indication that none of the regulatory authorities required detailed independent assessments of the company's construction practices. The cracks which eventually led to the failure began to appear in December of 1977, and grew worse. There is some question whether the company was monitored to assure that proper mitigating measures were being undertaken.

To assist us in preparing for this hearing, the subcommittee requested a review of the pertinent engineering assessments and licensing materials by Dr. Bruce Tschantz, a dam safety expert and

professor of civil engineering at the University of Tennessee. Dr. Tschantz indicated that the materials raise serious questions regarding why the specific dam design was approved, as well as whether the dam was ever constructed as originally designed. Dr. Tschantz indicated that the quality assurance procedures available to prevent the Church Rock accident were probably not applied.

The Army Corps of Engineers has also reviewed the Church Rock site materials since the accident, and its conclusions support the questions raised by Dr. Tschantz. The corps report made a number of points:

One. A zone of tailings against the upstream face of the dam was incorporated in the company's dam design to help buttress the structure in light of its likely settlement problems. This design aspect was not met.

Two. The cracking of the dam which appeared in 1977 and subsequent cracking identified by the company in 1978 were not reported by the company to the State regulatory agencies. The Army Corps report notes that:

> Since this information was of utmost significance and paramount in the evaluation of the safety of the structure at the time when cracking was first observed, not only the owner of the structure, but also the State Engineer Office should have been contacted and informed of these conditions."

Three. The design of the dam did not incorporate all the necessary protective measures recommended by the company's engineering consultant. Had the dam been constructed in accordance with the approved design and had recommended materials been used in construction, according to the corps, "it is possible that the failure would not have occurred."

In July of this year, very soon after the Church Rock spill, this subcommittee held an oversight hearing on the Nuclear Regulatory Commission's agreement States program, under which the State of New Mexico is permitted to license tailings impoundments.

At that time the subcommittee perceived significant problems with the NRC's management of this program, and these problems have surfaced again with respect to this site. The Commission promised at that hearing that it would thoroughly review the desirability of having technical work for the program carried out by the essentially nontechnical Office of State programs. We would like to know the progress of that review.

Another issue raised at the earlier hearing of this subcommittee was whether the agreement States are providing the kind of costly technical review work that is required for the licensing of these huge and hazardous operations. If the States are not able to provide the necessary oversight, it is possible that the benefits of local regulations may have to be sacrificed by removing the more complex regulatory problems from the agreement States program.

With regard to the health impacts of the Church Rock tailings spill, we have worked with Henry Waxman's staff from his Subcommittee on Health and the Environment. We want to assure that the affected people and their land and waters are carefully watched for any signs of long-term radiological damage. Mr. Waxman's subcommittee and the Interior Committee plan to pursue in the future the general question of the affect of the uranium mining industry on the Indian nations.

Representatives of the Navajo Nation will lead off our testimony this morning. We will have four witnesses from the tribe, each of whom has promised to keep their testimony to a maximum of 5 minutes, for which we are grateful.

Before we proceed, Mr. Lujan, do you have any opening comments?

Mr. LUJAN. Thank you, Mr. Chairman.

I would hope we do not get into the State versus Federal regulation argument in this particular hearing. Let me just make an aside note here that there have been, I understand, 19 dam failures in the last 20 years, and only one has been in a State where there is State agreement. The others have been all under Federal regulations, but that aside, we should discuss that at a later date.

I would hope that at today's hearing we might be able to look at the accident and see how we can prevent them in the future. I am convinced that we are going to have others. There have been some all along. There will continue to be some, but maybe we might try to focus this hearing in the direction of, How do we make it safe? Are there other alternatives?

I, some time ago, asked for some abandoned minesites, where some of the tailings could go. We had in the Mill Tailings Act a provision whereby we could look at leaching out the undesirable elements in the mill tailings. I notice that that was not one of the options that came out. However, I am continuing to pursue that option. I think that is one area that we might look at. But I think that today we ought to try to focus on what are some of the alternatives, rather than move in the direction of should it be the State or the Federal Government that regulates these activities.

We certainly cannot afford to close down all activity. I am sure there will be that kind of proposal, but I would like to see it attacked, how do we make it safer, what are the alternatives if this is not the way to do it. Let us find a safe way to do it because it is vital to the Nation that we get these kinds of resources.

The CHAIRMAN. If we can now have the Navajo witnesses come forward, we have scheduled Mr. Frank Paul, tribal vice chairman, Mrs. Helen George, chairman of the Church Rock Chapter, and whoever else is on your Navajo team here. Could we get all of them up at the table—Mrs. George, Mr. Harold Tso, and Dr. Gesell.

[The following additional material has been submitted for the hearing record by the panel of witnesses representing the Navajo Nation: Prepared statements of Frank E. Paul (with attachments), Dr. Thomas F. Gesell, Harold W. Tso, and a document entitled "Fact Sheet for the United Nuclear Corp. Church Rock Spill." The material referred to above may be found in the appendix. See table of contents for page numbers.]

PANEL REPRESENTING THE NAVAJO INDIAN NATION CONSISTING OF: FRANK E. PAUL, VICE CHAIRMAN, NAVAJO TRIBAL COUNCIL; DR. THOMAS F. GESELL, CONSULTANT TO THE NAVAJO NATION; HAROLD W. TSO, DIRECTOR, NAVAJO TRIBAL ENVIRONMENTAL PROTECTION COMMISSION; AND HELEN GEORGE, MEMBER, CHURCH ROCK ACTION COMMITTEE

Mr. PAUL. Chairman Udall, members of the subcommittee, I would like to express my gratitude, as well as the gratitude of the Navajo Nation, both for the subcommittee taking the time to hold this important hearing today, as well as for the opportunity to appear before you to discuss the United Nuclear Corp. Tailings Dam break at Church Rock on July 16, 1979.

Let me introduce the members of the Navajo delegation. With me today are some of the delegation sitting here. I will introduce the ones that are here. Mr. Harold Tso, the founding executive director of the Navajo Environmental Protection Commission. He is also a noted columnist. He is on the far right. Then I have Mrs. Helen George, a member of the Church Rock Action Committee, a committee which was formed to deal with the UNC spill. She is immediately to my left. Then I have with me, to my immediate right, Dr. Thomas F. Gesell, recently of the staff of the President's Commission on Three Mile Island. Dr. Gesell has been retained by the Navajo Nation as a consultant on the matter that is the subject at hand.

I do have other members of the tribe staff in the audience, but they will not be testifying here unless they are called upon. Also at this time, at the conclusion of my statement, I will ask the subcommittee for an opportunity for Dr. Gesell, Mr. Harold Tso, and Mrs. Helen George to make brief presentations to the subcommittee.

First, all of us are, of course, available for any questions you might have for us to answer.

My statement today begins in a somewhat unusual way because I am going to begin at the end and set forth the Navajo Nation's agenda for dealing with the UNC spill and related matters.

What we want, what we think is appropriate to deal with this incident and the uranium industry in general is this:

First, we want the lands and water and people and livestock who have been contaminated by the UNC spill decontaminated. We want our land, our people, our livestock, and our way of life restored as nearly as possible as it was before UNC and Kerr-McGee and their friends came to our land.

Second, we want the UNC mill to remain closed until such time as a safe and sane method of dealing with uranium tailings is devised, tested, and implemented.

Third, we want no more mills to be constructed on or near the Navajo Nation unless such mills are completely safe and have completely safe waste disposal systems.

Fourth, we want a single agency in whom we have confidence to have responsibility over all aspects of radiation hazards arising from the nuclear industry. This includes mining, dewatering, milling, waste discharge, and containment, as well as transport and storage of uranium and uranium-related resources.

Fifth, we want the establishment of definite plans for dealing with accidents in the uranium industry to be developed, to be tested, and to be ready to be implemented when such incidents occur. We also want sufficient resources of both people and material to be readily available to implement such emergency plans so that our people, our land, our livestock and our livelihood will not once again be abused as it has been so often in the past.

Having set forth what we want, let me give you some background as to why we want it and why it is necessary for the protection of our people, our land, and our way of life.

First, it is important to keep in mind that the UNC spill has threatened not only the Church Rock community—though that is bad enough. This spill has spread down the Rio Puerco and to the Little Colorado River, thus threatening not only the Navajo checkerboard communities in New Mexico, but also the communities of Gallup, Chambers, Sanders, Holbrook, Winslow, Ariz.

Second, it is also important to keep in mind that the UNC incident does not exist in a vacuum. We Navajos have already had to contend with abandoned mines, mills, and tailings at Cameron, the rare metals site at Tuba City, Ariz.; Mexican Hat, Utah; Shiprock, Sanostee, Monument Valley, and stretching all the way south and east to Anaconda and Grants, N. Mex.

Third, while we appreciate this committee's interest and concern, we do note that a smaller incident at Three Mile Island commanded a Presidential Commission. Yet today's hearing represents the first serious national concern for this incident, and it is now over 3 months since the dam failed.

Fourth, we note that while we call for a single agency to deal with all uranium industry environmental, health, and safety issues, we are not abandoning our own Navajo Nation's responsibility to share in the planning and implementation of laws and regulations designed to protect our own people and our own land. We must respect the special relationship between the Navajo Nation and the United States Government, exemplified in our treaties of 1850 and 1868 which call for us to be equal partners with the United States in shaping our destiny and determining our future.

While for now the United States must bear the greatest burden and responsibility in policing the uranium industry, we want to share in that responsibility and gradually assume a greater role both in developing laws and regulations which we will abide by.

We recognize that energy is a priority matter on the agenda of this country. This is peacetime, however, and the vast majority of uranium produced from Navajo lands is used to produce electricity in nuclear powerplants. The needs and concerns for safety and health and environmental protection must therefore be evaluated as they would be for coal production or oil or gas and other energy-producing elements, and not as if one were talking about producing a material from a unique source which was critical to the defense of this country in wartime.

We do recognize, however, that environmental protection costs money, and that our resources must be competitive in both the world economy as well as the economy of the United States. We want to be part of the decisionmaking process, since questions of

whether our resources will be developed, and at what costs, will affect the future of our people and our land.

We are unwilling to submit to either the tyranny of the exploitation by energy companies like UNC, whose only interest is in the almighty dollar, or in the tearing up of regulations by Federal agencies like the Office of Surface Mining, who are unelected and responsible to no one else other than their own desires, to experiment with the future of America.

The United Nuclear Corp. tailings dam break of July 16, 1979, was not the first example of corporate irresponsibility in the Navajo Nation. I would like to briefly set forth for the subcommittee the history of irresponsibility of the uranium industry in the Navajo Nation.

As early as the 1940's, the Navajo uranium resource was being exploited, as Navajos rallied in yet another way to aid America's defense effort. Through the old Atomic Energy Commission, working hand in hand with our trustee, the Bureau of Indian Affairs, about 160 uranium mines in nine areas of the Navajo Nation produced ore for milling in nearby uranium mills.

The Navajo people directly involved were never advised as to the potential dangers and hazards in the mining and milling process. As a result, hundreds if not thousands of Navajo uranium miners are contaminated from the dust and air in the mines commonly called dog holes in which they worked. Navajo families used scrap rock that are left available in the uranium mines in building their homes. In general, the uranium mining industry within the Navajo Nation proceeded without any regard for the health and safety of the Navajo people.

When mines were abandoned, they were simply left as they had been on the last day of mining. The mines remained a danger to people who live in the area, particularly livestock and children.

Uranium mining, both within the Navajo Nation and adjacent to rivers, streams, and washes which flow through the Navajo Nation—such as the mill at Durango, Colo.—repeatedly polluted water sources within the Navajo Nation.

The most lasting consequence of the uranium industry in the Navajo Nation is the waste from that industry which is scattered in tailings piles throughout the Navajo Nation. I carefully use the word "scattered" because in our dry, sandy, and windy land leaving dangerous waste products so that they may be blown everywhere the winds will take them was and is a threat to the health and safety of the general public. While recently passed legislation when implemented, will reduce or remove this hazard, for over 20 years our people have had to live with the ghostly reminder of the hazards of the uranium industry.

Throughout this entire period, the Navajo Nation was taken for granted as some kind of proving ground or national sacrifice area in which the defense and energy needs of the United States would be given priority, but the health and safety and long-term economic needs of the Navajo people were ignored.

When one reviews the debate now raging in New Mexico over the establishment of a nuclear waste dump in southeast New Mexico, and the tritium controversy in Arizona, and nuclear disposal site questions throughout the country, one can appreciate

that such questions are now given great consideration both by the Government and the citizenry.

What is disturbing to me, and what is disturbing to the communities of the Navajo Nation which are presently dealing with the uranium industry, is that our country knew better. Research into the problems of uranium and radiation had been going on for many, many years. The public policy of the Atomic Energy Commission, however, was that uranium was safe, and neither the Federal Government, the State governments, nor the uranium companies did enough to make sure the mines and mills were in fact safe.

Now we are told that some 60 uranium mines may be operating within the next 10 years on or near Navajo lands. This will mean another 10 uranium mills with all the problems that milling of uranium has produced over the years.

Time does not permit a full discussion of all the possible adverse consequences arising from the UNC spill and associated uranium mining and milling. I would like to mention, however, the contamination of aquifers from mining activities, the danger of contamination of aquifers from in situ leaching of uranium, as well as the waste of water from the dewatering process.

As I stated earlier, I will have other people testify and bring out the facts relating to possible contamination of water aquifers. We are also concerned with the possible contamination of both surface water and groundwater sources from uranium and uranium wastes improperly stored.

It did the people of the Church Rock community no good to know that the United Nuclear mill, whose tailings dam failed on July 16, 1979, was actually located on State land. The livestock which may be contaminated, the people whose health was and is endangered can take no comfort from the fact that the dam was not on Navajo land. Our people had and will continue to have to suffer the consequences of the misdeeds of the uranium industry, and it is therefore only appropriate that we be protected from this industry.

Turning to the UNC spill in particular, we are concerned that the present array of Federal and State agencies, all of which have some finger in the pie of regulation of the uranium industry, have shown themselves incompetent and unable to do the job of protecting the people from the industry.

Somehow United Nuclear Corp. was permitted to locate a tailings pond and dam on an unstable geologic formation. Somehow UNC was allowed to design an unsafe tailings dam not in conformity to its own design criteria. Somehow UNC was permitted to inadequately deal with warning cracks that had appeared over 2 years prior to the date the dam failed. Somehow UNC was permitted to continue a temporary dam for 6 months beyond its design life. Somehow UNC was permitted to have a tailings dam without either an adequate contingency plan or sufficient men and material in place to deal with a spill. Somehow UNC was permitted to deal with the spill by doing almost nothing.

Somehow the State of New Mexico did nothing to remedy the omissions and misdeeds of UNC. Not only has UNC contaminated our land and endangered our people and livestock, but they have been disrespectful of our laws and policies.

Let me simply conclude by stating that it is our position that all environmental, health and safety related aspects of the uranium industry—at least within our lands and which affect our people—ought to be dealt with by a single agency.

To separate responsibility for the many facets of the uranium industry which can produce serious hazards to man and his environment has proved a bad idea. This fragmentation of authority and responsibility between Federal, State, and environmental improvement divisions, EPA, and others, has created a situation in which irresponsible corporations, like UNC, are able to do nothing or do little and get away with it.

It is time that the Congress exercised its authority and responsibility and fulfill the obligations of the U.S. treaty with the Navajo Tribe of Indians under which we were promised that the United States would remove bad men among the whites who came to our lands and did us and our property harm, as well as compensate us for the harm and damages, and also make the uranium industry safe. Only if the uranium industry is safe will the Navajo Nation be willing to support the energy development needed if America is to achieve a safe energy independence.

I again thank the committee for this opportunity and ask that Dr. Thomas Gesell and Mr. Tso and Mrs. George be given an opportunity to make brief statements.

The CHAIRMAN. Thank you, vice chairman. We have a long witness list today, people from the industry and the other agencies. I thought we had an understanding that we would try to limit the Navajo delegation to about 5 minutes each in your opening presentation. It would help us with the time if you would try to summarize. Who is next?

Mr. PAUL. Dr. Gesell.

The CHAIRMAN. Dr. Gesell.

Dr. GESELL. Thank you, gentlemen, for permitting me to testify. I have a Ph. D. in health physics and am associate professor in health physics of the University of Texas School of Public Health. Most of my research has dealt with man's alteration of the natural radiation environment. Most recently I served on the staff of the President's Commission on Three Mile Island.

I was asked by the Navajo Nation to examine the documents which they had collected concerning the Church Rock dam break and to present some of my findings to you. Previous testimony has provided an overview of the situation; I will focus on a few important details.

The Navajos have been told that part of the reason for the slowness of the cleanup is the lack of a "textbook" for handling such spills. This lack of a "textbook" or criteria has been attributed to the uniqueness of the event. While this spill is indeed the largest of its kind, at least 15 previous accidental releases of tailings slurry have occurred in the industry from 1959 to 1977. Seven of these releases involved dam failures, six involved pipeline failures, and two resulted from flooding. In at least 10 of the events, tailings slurry reached a watercourse. If indeed there is no textbook on how to handle a tailings slurry spill, it may be time to write one.

I will now turn to a more technical subject. An essential issue here is potential health effects, both to those now living in the

vicinity of the spill and to future generations. I do not have to elaborate the uncertainties surrounding the health effects of low-level radiation to this committee. Over the past months the National Academy of Sciences, National Research Council, BEIR committee scientists have been continually meeting in order to reconcile serious disagreements centering on the complex problem of low-level radiation effects in humans in order to issue their now overdue report.

Rather than estimate doses and health effects associated with this spill, I will attempt to make an analogy with a different situation. When plutonium was found in the soils in the vicinity of the Rocky Flats plant in Colorado, appeal was made to the State of Colorado and the Federal Government for guidance. The State of Colorado issued an interim standard of two disintegrations per minute of plutonium per gram of soil for unrestricted use. This is the equivalent of slightly less than one picocurie per gram.

When uranium ore is milled by the acid leach process, thorium-230 is preferentially mobilized and becomes the greatest radioactive constituent of the mill tailings solution. Thorium-230 is similar in its chemical and radiological properties to plutonium-239. They are both heavy metals of low solubility. They both emit alpha particles of similar energy. They have half-lives of comparable magnitude, and they are both bone seekers.

Those similarities are reflected in the occupational standards for their control promulgated by State and Federal agencies. For inhalation, the standards for plutonium-239 and thorium-230 are essentially identical, with thorium-230 being more restricted in the "insoluble" configuration. For ingestion, the standard for thorium is more respective than that for plutonium in the "soluble" configuration and approximately equal in the "insoluble" configuration.

Recent recommendations of the International Commission on Radiological Protection have left the standards for inhalation of both thorium-230 and plutonium-239 essentially unchanged. For ingestion of slightly soluble materials, however, the standards for both have been reduced by a factor of slightly greater than five. Thus, based on the standards for control, thorium-230 is at least as hazardous as plutonium-239. It should be controlled in relation to its hazard potential and not dismissed lightly because it is a "natural" radionuclide.

Even though thorium and plutonium present an essentially equivalent hazard potential, there are compelling reasons for not applying the Colorado standard for plutonium of 0.9 picocuries per gram to this situation. The Colorado standard is for land on which housing is to be built. No housing is possible in the Arroyo or the Rio Puerco. The natural level of plutonium-239 is essentially zero while thorium-230 exists at an average concentration of 1 picocurie per gram in ordinary soils and may exhibit considerable variation. Nevertheless, thorium-230 should be treated with extreme caution.

Another topic I would like to discuss is the pathways by which the released radioactivity may come in contact with humans. Thorium-230, in order to cause human health effects, must enter the body. This will occur primarily by ingestion and inhalation. I have examined the pathway analyses performed by a consultant to the mill operator and by the Nuclear Regulatory Commission.

Although mutton is a staple of the Navajo diet, the consultant's analysis did not include the water-sheep-man pathway. The NRC analysis was more complete, but did not include direct contact with the sediments by children who play or herd animals in the water course. Both analyses did involve conservative assumptions, however, in keeping with good health physics practice.

For ingested thorium, the magnitude of the hazard is strongly dependent upon the fraction of the thorium which is absorbed by the digestive system of both livestock and man. This fraction is widely assumed to be one or two parts in 10,000, but the assumption is not based on a great deal of experimental evidence. Because of the uncertainty in this factor, as well as others, one should interpret the dose estimates cautiously.

Finally, I wish to discuss the environmental data which have been gathered in connection with this spill. The data do not hold up well under critical analysis. Consider the results of the external gamma-ray measurements provided by the mill operator to the Navajo. The background measured after the spill in the Gallup area is reported as 11 to 12 microroentgens per hour. On the same page, the aerage background in Gallup is stated to be 189,000 microroentgens per year, which is equivalent to 2 microroentgens per hour. While the spill would not necessarily be expected to increase the background, it would certainly not be expected to reduce it by a factor of 2.

The radionuclide data are similarly inconsistent. For example, 1 month after the spill the mill operator took a sample of surface water in the Rio Puerco near Gallup and reported a concentration of 2.8 picocuries per liter of thorium-230. On the same day, the State of New Mexico took a sample near Gallup and obtained a concentration of 500 picocuries per liter.

For the period of July 19, 1979, to August 17, 1979, the largest value of thorium-230 in water downstream reported by the mill operator was 30.3 picocuries per liter. This was the highest of 35 samples taken at seven locations at five separate times. The State of New Mexico Environmental Improvement Division on the other hand obtained values ranging from 200 to 2,600 picocuries per liter. Either of these sets of data could be in error, and there is even a possibility that the levels could fluctuate that much. Nevertheless, this degree of variation in the data suggests that the environmental situation is not yet fully understood.

In conclusion, when responses to this and possible future spills are being considered, the following should be kept in mind:

One, thorium-230 is the principal radionuclide released, but the others must also be considered.

Two, the hazard potential of thorium-230 is as great if not greater than plutonium-239.

Three, all pathways for exposure must be considered in making a valid assessment of the health consequences of a spill.

Four, more information should be obtained on the behavior of thorium-230 in animals and man.

Mr. WEAVER. Thank you very much.

The next witness, please, and I would appreciate it very much if we could keep the time down.

Mr. Tso. Mr. Chairman, members of the subcommittee, my name is Harold Tso. I am director to the Environmental Protection Commission of the Navajo Tribe. Our staff has been involved with activities related to uranium development. These activities include identifying and monitoring areas with abandoned mines or millsites, collection of environmental samples for laboratory analyses, review of proposed mining and reclamation plans, examination of environmental reports, assessment of impact statements and investigating complaints submitted by local Navajos.

As a result of these activities, it has become clear to us that the Navajo Tribe had its share of problems with uranium extraction and purification. These problems are explained below.

These mills were located on water courses either active or inactive and depend on the local water source. When we compared this against the United Nuclear dam we were surprised to find out that the United Nuclear dam was located above the surface, while those of previous uranium activities were located below the surface.

Since the spill of United Nuclear, our staff has determined that more than 49 parcels of land, either as sections or portions thereof, and located downstream from the breach site have been impacted, and I would call to the committee's attention the fact that the Rio Puerco confluences with the Little Colorado River near Holbrook, Ariz., and from thence to the Colorado River near Cameron, Ariz., which is the site of Grand Canyon. This certainly suggests interregional transport of pollutants.

In terms of the monitoring program, the Navajo Tribe has had a sad experience with monitoring in previous activities. While the Navajos saw that tailings and other wastes were discharged into adjacent storage area, they were surprised to learn that radium-226 and other contaminants were discharged from the mills into nearby water courses as well as from the Durango, Colo., into the Animas River in sufficient quantities as to alarm public health officials.

These Navajo people were later informed that the San Juan Basin Radium Research Project was established at Farmington, N. Mex., in the early 1960's, as one of several Federal efforts, to define radiological impacts of uranium mining and milling.

As a student I recall at least two newspaper reports of fish kills below the Shiprock millsite. Recently in 1977 while dismantling the Shiprock mill buildings and monitoring that activity, our staff found approximately $100,000 worth of U_3O_8 dust of about 25 percent assay between two layers of roofing material, and in examining this problem, we were surprised to learn from reports such as *Klevin, et al.,* that insufficient control of discharged uranium dust to the outside environments of processing buildings was a concern of health physicists and that this concern was not implemented in Navajo uranium mills of that date.

Turning to the UNC spill, our review and monitoring of sampling data provided us upon request indicate deficiencies which should be corrected and incorporated in the UNC plan.

Extend the monitoring plan to include all areas or personnel which are employed or impacted by uranium processing. For example, alternative ore storage areas, bioassay, livestock. We do not know whether there are Federal requirements to periodically ex-

amine for radiological purposes, local people who work in uranium mines, live adjacent to uranium processing operations, or use water from streams impacted by such operations. Or for that matter, to maintain examination units near the operations.

We would request that the plan be amended to include provisions for quality assurance of data. As Dr. Gesell has presented in his statement, this may be a reason why there is a discrepancy in data that he has examined.

There needs to be included provisions and procedures to perform monitoring for manufacturing purposes.

There should be declared a use of procedures to neutralize excess acid and to abate contaminants in unanticipated releases.

You should require provision for periodic review of the monitoring program.

Our staff surveyed the Rio Puerco for gamma-emitting radionuclides with a portable radiological instrument. Generally speaking, they found radioactivity in decreasing levels from the breach site to the New Mexico-Arizona State line. With some exceptions, the radioactivity levels approximated background levels. These exceptions were due to areas of slow flow, Rio Puerco tributaries contaminated from backflow of the spill, and the breach site.

Concern for radiological contamination of Rio Puerco predominated impacts due to chemicals—for example, sulfates, alkaline elements, organics, and toxic elements. It has not been determined how much solubilized salts were carried downstream with the spill solution for deposit or absorption.

The role of these salts as exchange material within Rio Puerco soils for radiological or other contaminants is now sufficiently understood to warrant oversight or lack of concern. We hear explanations and assurance from UNC that salt encrustations on a streambed are the result of natural forces. We do not agree that existing salt encrustation in the Rio Puerco streambed is the result of natural forces. The prespill streambed did not exhibit the salt encrustations we see today.

A serious lack in current monitoring programs managed by regulatory agencies is the inability and, perhaps, capability of laboratories to deliver data in a timely fashion. We understand that samples submitted to EPA laboratories to evaluate Rio Puerco contamination were possibly in competition with samples from the Three Mile Island incident.

We understand that criteria to clean up the Rio Puerco were submitted by U.S. Environmental Protection Agency, New Mexico Environmental Improvement Division and United Nuclear Corp. to the Nuclear Regulatory Commission. We do not know if cleanup criteria have been agreed upon by participating entities.

The criteria, we hear, are based on historical data from previous uranium operations, from preoperational or baseline data and are based on the presence of thorium-230 and radium-226 as critical radionuclides. If the criteria are also predicated on the existence of radionuclides in the Rio Puerco prior to the UNC spill, we do not agree. We believe that the criteria should include radiological information which antedates all uranium activities on the Rio Puerco. The discharge of mine waters from Kerr-McGee Mine No. 1 represents a bias to the criteria.

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In this connection, we believe that the existing standard of 2,000 picocuries of thorium-230 per liter of dischargeable milling waste waters is too high. Such a standard, if not revised, could pose serious problems for future cleanup criteria.

Chairman Udall, members of the subcommittee, this concludes my remarks. With your permission, Mrs. Helen George has some remarks.

Mr. WEAVER. Thank you. Mrs. George.

Mrs. GEORGE. Good morning, honorable members of the committee and guests. The tailings spill of July 1979 has impacted the community so that all the affected communities have been sent reeling with uncertainty, confusion, and bitterness. This incident has only led to the people's distrust of uranium development activities in people's back yards, as is happening all over Navajo occupied and owned land.

The distrust has been fed in part by the responsible agencies unpreparedness and weakness in dealing with the resulting contamination of a primary livestock watering source, and the people have begun to realize that the responsible agencies are not fully prepared to consider the impacts happening in the natural and human environment, particularly in the human environment.

In all the people's efforts to deal with the tailing spill, we have only been told that this incident does not warrant an emergency, and people have tried to get assistance, to determine what type of contamination, the magnitude of the contamination that has resulted, but we have not been told exactly how long the people are to continue to not use the wash, and whether their livestock are contaminated or not. All these questions have just made the people more uncertain about the uranium industry.

For example, when the Rio Puerco wash became contaminated with this tailing spill, the livestock, children, and people were exposed to the contamination, and the livestock drinking from the wash appeared to have been contaminated, and so health officials have told people not to eat their livestock, and so most of the people have tried to not eat their livestock, but the problem comes when the people, who have limited resources, have no alternative source of food, and so we have requested of the food stamp program to get emergency issuance to the people, so that alternative sources of food could be found.

But we ran into a stone wall when out of region 6 the denial came for our request. Yet what are the people supposed to do? If they cannot eat their livestock, what alternative source of food can they have? If they continue to eat the livestock, are they being contaminated? These are questions that people are asking, and people are very much concerned about what has happened, because for centuries, ever since the people emerged out of this Earth, the Earth has nourished us and has given us life.

Job programs come and go, food stamp programs come and go, welfare systems come and go, but the earth remains, and this is where the people get their life from. Their existence comes from the earth itself, just as the earth itself gave us birth. Yet this very day our existence is being threatened, and people cannot help but feel confusion about what has happened, because when the uranium development industry comes in, they tell people, "You will be

given jobs. Your living standards will improve," but if these types of accidents happen such that the earth is ruined, then what type of alternative do we have? Are we going to take the jobs and destroy the earth, or can we continue to live and keep the earth safe, and not worry about jobs?

Part of the problem with trying to deal wth this incident is the varying land status in our area. The people do not understand the different types of land in the checkerboard area, and it is incomprehensible to the people to base and govern activities on imaginary lines. How can the Navajo Tribe protect its citizens if these jurisdictional problems are not answered, and if nothing is done about these problems?

Mr. WEAVER. Thank you very much, Mrs. George.

I want to thank you all for very, very moving and penetrating testimony. You know this committee has held many hearings on the nuclear industry, and we constantly hear of background radiation. We constantly hear that the granite in our buildings throws off as much radiation as comes from various other sources. What is not said is that this background radiation is very dangerous. What is not said is that this background radiation, normal radiation in our world today, is probably a major cause of cancer and mutations that occur in all of us.

You know, many, many, many years ago in geological time the radiation in this world was too great for life. It has gradually died down, allowing life to exist, and it allows us to exist because it is not so great in background that it kills us all at once. But what we are doing today, and what you are here testifying about before us today is concentrating this radioactivity. We are taking it from the earth and putting it together in a highly concentrated form. It is a very dangerous process, concentrating it at 3 percent enrichment to go into nuclear plants, or 97 percent enrichment to go into hydrogen bombs—whatever we do, the concentration of this radioactivity is a threat to life, and you are here testifying in that regard.

I know, Mr. Paul, you said they have come into your land. I can tell you they come into my land too, and I am deeply outraged by this, and I will do everything I can to stop this concentration of radioactivity. I have but one question, and that is, I read in the paper several months ago something about Indians, and I do not know whether they were Navajos or not, working in mines down in the Southwest, who, after working 20 or 30 years, began to die of cancer. Do you know anything about this? Is this your tribe and your people? Can you respond to that or is that something you do not know about?

Mr. Tso. Mr. Chairman and committee members, yes, that is the Navajo Tribe. In the Red Valley portion of the Navajo Reservation, there have been some families of previous uranium miners who have submitted their complaints about uranium impacts to their health, to Senator Domenici, and to I believe that committee, as part of the congressional effort toward miners benefits compensation. And yes, that is on the Navajo.

Mr. WEAVER. I thank you.

The Washington Post reported several months ago that there were a couple of deaths now occurring, much greater than average for that particular kind of illness. Do you know?

Mr. Tso. The medical doctors who have been working on the case, Mr. Chairman and members of the subcommittee, believe that it is attributable to working in the mines in the 1940's and 1950's, and even later.

Mr. WEAVER. I thank you.

The gentleman from New Mexico.

Mr. LUJAN. Thank you, Mr. Chairman.

Dr. Gesell, you have been hired by the Navajo Tribe as the expert which you are in this field. We can take two positions, extreme positions, I suppose. On the one hand close down all uranium mining, and as a consequence close down reactors and nuclear submarines and all. We can go that direction.

I would prefer the approach that we make these activities as safe as possible. Have you made any recommendations to the Navajo Tribe as to how this can be accomplished? I spoke in my opening statement of alternatives, that accidents are going to happen in whatever field there is. Of course, we are concerned about the effects of these accidents. Have you given any thought and any recommendations to the Navajo Tribe as to how to make these activities safer?

Dr. GESELL. Mr. Congressman, I would first like to say that I agree with you that we must use our uranium resources. The Navajo agree also that we want to use these resources. We are not trying to shut down the nuclear industry, by any means.

I have made a number of recommendations to the Navajo. One is most important. Their lands are impacted by these milling and mining operations, and they must somehow independently assure themselves of the safety of these operations. I have recommended this to them and I think they will try to move in the direction of some sort of a tribal authority to work either independently or with Federal or State agencies to receive environmental statements for prospective mills, to inspect the mills after they are complete, to assure safety of the dam, to try to get a more environmentally sound tailings management methodology.

Mr. LUJAN. What I was getting at is this: In all of the studies, all of the statements you have indicated that the thorium and the plutonium in the mill tailings is a serious problem. All of the studies and all of the environmental impact statements and all of the reports are not going to minimize that danger at all. It seems to me that the tack we ought to take then, is to do it differently than we are doing it now if that is not a safe way. We have had testimony from the Nuclear Regulatory Commission that it is more dangerous to smoke one cigarette than to stand on top a pile of those mill tailings. I have a little trouble with that statement. But if they are dangerous, have you made any recommendations or is there any thought being given to putting it in abandoned mines, or leaching out the radium and the plutonium and the thorium, or putting it back where it came from as we do in the coal mining area? Once you burn it in that Four Corner area, they take the cinders and put them back in the mine that they came from. Are there any recommendations or is there any thought being given to any of those alternatives?

Dr. GESELL. Yes; a great deal of thought has been given to disposing of tailings in several tentative ways. They are by no

means original with me. One notion is, as you suggest, to put them back in the mines. This may present some problems from an occupational health perspective because you would have more people moving things back into the mines.

Another point is to use nearby strip mining areas where you strip, say, coal out. You might be able to put the tailings in and then reclaim the land and dispose of them in this way.

Yes indeed, not to evade your question, but certainly alternative strategies for better management are in order.

Mr. LUJAN. Mr. Paul mentioned that licensing went on without too much consideration given to any of these things.

Do you know if disposal of the tailings is part of the licensing review?

We were confronted here the other day on the Mill Tailings Act with the existence of some 22 piles of tailings. What are we going to do about them? It was a dumb way to do it; to move them to some other place. About 25 years from now we are going to move them from that place to some other place. But within the licensing and review down there, is that kind of consideration taken into account?

Dr. GESELL. Yes; in the licensing application the companies must state how they are going to manage the tailings, and this should be reviewed then by the regulatory agencies.

Mr. LUJAN. And they all say we are going to pile them here until they dry out, or do whatever they are going to do?

Dr. GESELL. Yes; the usual procedure is to take the waste product, which is slurry, and put into it a pondlike configuration, and allow the liquid to evaporate. What you wind up with when the mill is closed is a dry tailing pile. This is the management situation.

Now, the worse way to do it is put in a water course where, if not during the operation, certainly subsequently, these things will be eroded away. A better way is to put it below grade so that you would not expect erosion to carry the tailings away.

Possibly an even better approach would be the ones that are being suggested now, that we have mentioned previously, put them back in underground mines or back in reclaimed strip mines.

Mr. LUJAN. Did you follow closely the kids that were taken up to Los Alamos; all of those followups to the break? Did you follow that? I am interested in what the final results were. I understand there was nothing wrong with the kids who had been playing around there. Maybe that is exaggerated again. Can you tell me what they found as physical effects and environmental effects? Could you give us the background on that?

Mr. TSO. Congressman and members of the subcommittee, we followed the data on the kids, and even though the data came back as basically radioactivity resembling background, the data really is not interpreted correctly, because there was no previous data on these kids, and this is what led me to make my previous statement that there is no Federal requirement to sample part of the population that the particular industry is going to impact for whatever contaminants may be one of the impacts. And I think for this reason the data came back essentially zero, but it is not really good data in the sense that there was nothing to compare it to.

So for the moment, we can probably satisfy ourselves with the statement that there is nothing there.

Mr. LUJAN. Do you know these kids personally?

Mr. TSO. I do not. Mrs. George perhaps does.

Mrs. GEORGE. Yes, sir.

Mr. LUJAN. Have you talked to them about how they feel? Or visited with them?

Mr. TSO. I will let Mrs. George answer that.

Mrs. GEORGE. A couple of the children had been exposed by contact with the water itself, swam in the water, and one of them had a burn, looked like burns on his feet and he had problems with his eyes tearing and burns in the nostrils as well, and the other people, two of them were exposed by direct contact with the water, the one—actually three I think it was—and one by possible inhalation and the other people had, one person had drunk the water, too.

The mother of one of the 5-year-old boys was very concerned because of having gotten exposed, the child had diarrhea.

Mr. LUJAN. Thank you, Mr. Chairman.

Mr. WEAVER. The gentleman from the Virgin Islands.

Mr. EVANS. Thank you.

I want to pursue that a wee bit further. The elements involved. Was any attempt made to compare the monitoring of the children exposed with a similar group from another Navajo Tribe or another tribe that was exposed so that you could really decide whether it was background or not?

Dr. GESELL. No; there were no controls at all.

Mr. EVANS. Something in the bone does not show up very often in diarrhea and so forth, what is being done to monitor these children as they grow?

Dr. GESELL. None that I know of. No plans were made for a followup on these individuals.

Mr. EVANS. Thank you, Mr. Chairman.

Mr. WEAVER. Thank you.

Again I want to thank you very much for your very valuable testimony. We appreciate very much your coming.

Mr. J. David Hann, executive vice president and chief operating officer, United Nuclear Corp.

Mr. Hann, I want to thank you for coming and note that all these committees always run behind, but we do have a long list of witnesses and I notice that you have a very well prepared but very long statement. I wondered if you could be as brief as possible?

[Prepared statement of J. David Hann, with attachments, may be found in the appendix.]

STATEMENT OF J. DAVID HANN, EXECUTIVE VICE PRESIDENT AND CHIEF OPERATING OFFICER, UNITED NUCLEAR CORP., ACCOMPANIED BY LAWRENCE A. HANSEN, ASSISTANT PROFESSOR OF ENGINEERING, ARIZONA STATE UNIVERSITY AND CONSULTANT TO SERGENT, HAUSKINS & BECKWITH; TODD MILLER, MANAGER OF ENVIRONMENTAL OPERATIONS FOR MINING AND MILLING DIVISION; AND DR. NOEL SAVIGNAC, MANAGER OF ENVIRONMENTAL SERVICES, MINING AND MILLING DIVISION

Mr. HANN. Yes sir.

Mr. WEAVER. All of what you say, however, will be of great interest to the committee.

Mr. HANN. My name is J. David Hann. I am executive vice president and chief operating officer of United Nuclear Corp. I welcome the opportunity to appear before this committee to discuss our mill tailings dam breach. Since we have supplied substantial technical data, in writing, I will not repeat that in detail.

My statement today will cover a brief description of our Northeast Church Rock, N. Mex. operation; the design and licensing of the tailings dam; the occurrence of the breach, its effects and the actions we have taken; the conclusions as to the cause of the breach and the stability of the remainder of the dam; our cleanup and monitoring program; and finally, an assessment of the consequences of this event.

I have with me Lawrence A. Hansen, assistant professor of engineering at Arizona State University and a consultant to the engineering firm of Sergent, Hauskins & Beckwith, I also have with me Todd Miller, manager of environmental operations for our mining and milling division, who directed the comprehensive sampling and cleanup program, and Mr. Noel Savignac, manager of environmental services for our mining and milling division. Dr. Savignac is a health physicist specializing in radiation and is chairman of the Uranium Environmental Subcommittee of the American Mining Congress. At the appropriate time, we would be happy to answer any questions you may have.

United Nuclear's principal business is the production of uranium and nearly all of that production is in New Mexico. We have been mining and milling uranium in the State for approximately 20 years. We employ more than 2,300 people in New Mexico, with an annual payroll of approximately $45 million. Our total expenditures in the State are more than $140 million annually.

Our largest uranium mine, and the largest operating underground uranium mine in the United States is at Church Rock, N. Mex., 20 miles northeast of the city of Gallup. The uranium ore from that mine is processed at our nearby Church Rock mill. The mine employs more than 800 people and the mill about 150. More than 200 are Navajo people. We are one of the largest employers in the area.

This mill provides more than half of our uranium production. Last year it produced about 2 million pounds of U^{308}, or enough to provide the annual reload fuel needs of 5 million nuclear powerplants, each capable of generating 1 million kilowatts of electricity. To replace this electricity by using oil would require about 50 million barrels.

At full production, the Church Rock Mine contributes more than one-half million dollars per year in royalties to the Navajo Tribe.

The uranium mined in United Nuclear's mines in New Mexico is found in clayey sandstone deposits. Each ton of ore contains only 2 to 3 pounds of uranium, which is extracted in the milling process. At our Church Rock mill the sandstone is crushed and treated with dilute sulfuric acid, about a 2-percent solution, which dissolves the uranium. The uranium solution then goes through a number of concentration and purification stages before emerging as uranium concentrate or yellowcake. The sand and clay, after a number of washing stages to remove as much of the uranium as possible, is transported by pipeline to the tailings area, along with the tailings liquid.

It is important to today's discussion to understand the nature of uranium mill tailings. The solid tailings are essentially sand and clay, but retain a small fraction of the original uranium of the ore, along with other natural constitutents not removed in the milling process. The concentrations of these constitutents in the tailings are found in natural surface outcroppings. The tailings are not considered occupationally hazardous, and large quantities of both the ore and the tailings are handled on a day-to-day basis by mine and mill personnel.

An important reason for confinement of uranium mill tailings solids is to reduce future potential health hazards from very long-term release of radon gas, a factor that is not significant in this tailings spill. I might mention the one point earlier that we do insert approximately half of our solid tailings back into the mine for filling purposes.

The tailings liquid is a dilute acid solution containing, among other things, process chemicals and small amounts of low level radioactive materials and heavy metals from the ore. If a person fell into our tailings pond, the water would not taste good and his eyes would smart from the acidity, but his health would not be endangered from toxicity or contact with the liquid. Although this liquid is certainly not suitable for consumption, it is not considered a highly toxic material even in undiluted form.

In the case of this spill, the liquid was soon diluted by stream waters and rain. By the time the acidity was reduced enough for the water to be drinkable, its toxicity posed no health danger. The technical data previously furnished to the committee contains detailed chemical analyses of the tailings solids and tailings liquid.

New Mexico is an agreement State under the Atomic Energy Act. The organization primarily responsible for uranium mill licensing is the New Mexico Environmental Improvement Division (EID). This agency's licensing process is nearly identical to that of the Nuclear Regulatory Commission, including the requirement of an environmental report. I have a copy of the report the company provided them.

The EID relies upon the New Mexico State Engineer's Office for approval of structural tailings dam design. The State Engineer's Office is an experienced organization that has reviewed over 600 dams in New Mexico. Here are copies of rules from the State Engineering Office that I would like to make available to the committee for their record.

[EDITOR'S NOTE.—The rules from the State Engineering Office referred to above had not been received at time of printing; and will be placed in the committee's files when submitted.]

Mr. HANN. The EID also invites comments from many Federal and State agencies and other interested parties. In the case of the Church Rock mill, comments were received from the Nuclear Regulatory Commission, the Environmental Protection Agency, and the Bureau of Indian Affairs. We look to the State agencies for direction in licensing matters and concur with Chairman Udall's position that licensing authority is a matter for agreement States until 1981, as stated in the letter of April 26, 1979, signed by the principal authors of the Uranium Mill Tailings Radiation Control Act.

The Church Rock tailings impoundment was designed and constructed by experienced engineering and construction firms with extensive use of independent experts. The design conformed to the NRC Regulatory Guide 3.11 entitled "Design, Construction and Inspection of Embankment Retention Systems for Uranium Mills." During the review process the NRC proposed a revision to this guide, and the dam design was modified to conform to the guideline revision.

The tailing retention dam is an earthen dam having a packed clay core. The initial structure was a starter dam, with its cross section shaped like a trapezoid, ranging from 12 to 38 feet in height, 60 feet thick at the crest and up to 180 feet thick at the base. The plans approved provided that this low embankment was, in time, to be increased in height and thickness. The raising process, which had just commenced at the time of the breach, was to include a sand drainage blanket and additional instrumentation as added safety features to insure the long-term stability of the dam.

The tailings pond area is divided into three sections by cross dikes. A breach in the dam occurred early in the morning of July 16, resulting in the release of a fraction of 1 percent of the total tailings solids and about 280 acre-feet of tailings liquids from the southernmost of the three ponds into an arroyo, or canyon, which feeds into another arroyo called the Rio Puerco. I want to emphasize that much of the tailings solids was captured in a catchment basin at the base of the dam. The portion that did enter the arroyo was, for the most part, deposited within a very few miles downstream.

The breach was discovered about 6 a.m. We immediately stopped discharging into the tailings area and shut down the mill. We were able to quickly construct a temporary dike in front of the breach, and by 7:50 a.m., the flow from the tailings pond had been stopped.

The State environmental improvement division was notified of the spill by 7:30 a.m., followed by the NRC and mine safety and health administration. Officials of the city of Gallup were contacted and news of the spill was broadcast by local radio stations. By 7:55 a.m., the Navajo speaking mill personnel were dispatched to personally notify residents downstream, in accordance with the State approved contingency plan, and by 11:40 a.m., all residences required to be notified had been contacted.

This is a sparsely settled area, and only 17 families reside within the 3-mile distance covered by the plan. Some 32 family groups reside within a 2-mile range of the arroyo and the Rio Puerco

between our mill and Gallup. These inhabitants were also notified that, as a precautionary measure, drinking water would be made available for their needs.

By 8:10 a.m., drinking water in gallon bottles was on its way to the millsite to be distributed to local residents. At 2:30 p.m., the first tank truck hauling water for livestock left the millsite. United Nuclear has continued to provide both drinking and livestock water to residents downstream on a daily basis. To date, over 1 million gallons of water have been distributed.

By 8:20 a.m. that first day, surface water sampling was initiated. Sampling still continues. By noon, mill personnel had been dispatched to track the flow in the Rio Puerco. The flow was followed, photographed and sampled until noon on the 19th, when a small trickle reached its farthest point, near Sanders, Ariz., about 25 miles from the New Mexico border.

On July 17, sediment sampling in the arroyo and the Rio Puerco was initiated and cleanup operations were begun on the afternoon of the 18th. I will return to a discussion of the cleanup and an assessment of the effects of the spill later in this presentation.

The cause of the breach has been investigated thoroughly and independently by two professional engineering firms. I have here copies of the reports prepared by the two engineer firms. They are available for the committee.

[EDITOR'S NOTE.—The committee is including in the hearing record two UNC summaries of dam failure investigation. The committee also has on file extensive history of UNC impoundment and detailed investigation of failure.]

[The two documents to be printed in the record may be found in the appendix. See table of contents for page numbers.]

Mr. HANN. The results of their work have been reviewed by representatives of the EID, State engineer, NRC, U.S. Army Corps of Engineers, and the Environmental Protection Agency. Both engineering firms and all of these agencies concur that the breach was caused by differential settling of the dam resulting in transverse cracking, followed by internal erosion. The cracking resulted from uneven settling of the dam between areas of shallow and deeper bedrock.

Some settling of the dam was expected. However, a unique rock point beneath the breach, at which point the bedrock drops off sharply to the north, east, and west, served as a fulcrum, resulting in the transverse cracking. This unusual configuration of the bedrock was only discovered during the investigation of the breach.

As a precaution, a sand beach was normally maintained on the upstream side of the dam as a buffer between the tailings liquid and the dam proper. In the area of this transverse crack, tailings liquid temporarily exceeded the sand beach and came in contact with the dam. We believe that this was the initial source of fluids that started the internal erosion subsequent to the cracking. Without the transverse crack, the contact of liquid with the dam would not have created a breach.

The independent engineering firms have also analyzed the remainder of the tailings embankment and confirmed that the northern portion of the embankment and the divider dikes that we proposed to use initially on restarting, are stable. The bedrock

under the remainder of the dam does not have any configuration similar to the rock point under the breach. These findings have been reviewed by each of the agencies concerned. The State engineer has concurred and has approved such a startup with certain additional precautions.

I would mention that there was unrelated rotational settlement and cracking in 1977, which was repaired under the supervision of a professional engineering firm.

Turning to the spill itself, approximately 1,100 tons of tailing solids and 280 acre-feet—100 million gallons—of tailings liquid escaped. The liquid discharge partially filled the arroyo and the Rio Puerco, creating limited flash flood conditions similar to those experienced in the area during typical summer cloudbursts.

The arroyo and the Rio Puerco are normally dry except for a flow of treated mine water from our own and another uranium mine in the area. This water is used by some of the Navajo for watering livestock.

Immediately following the spill, the water in the Rio Puerco was not suitable for consumption by livestock. However, the acidity made the stream water distasteful, and it was observed that the livestock avoided it. Tests of livestock tissue samples by the New Mexico Department of Health and Environment, the Indian Health Service, and the Center for Disease Control showed no detectable effects on livestock from the spill.

Mine water flow and rain diluted the stream content to such an extent that by July 19—3 days after the spill—all of our surface water samples showed the radioactivity of the water in the arroyo and the Rio Puerco to have returned to an acceptable level.

Because much of the initial flow seeped into the ground, concern has been expressed about possible contamination of wells. The hydrology of the area makes significant groundwater contamination highly unlikely. We have sampled alluvial wells within three-fourths of a mile of the Rio Puerco from the millsite to the Arizona border, and found no contamination due to the spill.

Although much of the solid tailings was captured in the catchment basin at the base of the dam, some was carried downstream. Our immediate actions were directed at cleaning up any visible deposits while starting sampling and monitoring programs to determine the location and extent of any contamination. These sampling and monitoring programs are still continuing.

Over 4,000 sediment samples, 4,500 gamma measurements and 300 other samples have been taken in United Nuclear's assessment process. These sampling efforts permit comparison of present streambed conditions with prior conditions and with the cleanup criteria. United Nuclear has used the independent laboratories as well as its own radiological/environmental laboratory in this program. Testing has included not only sediments, but also air, surface water, ground water, runoff and the testing of livestock, and vegetation. As results from the sampling program become available, they are used to guide cleanup work. I have available here a copy of the cleanup report prepared and submitted to the EID.

[The cleanup report referred to above has been placed in the committee files.]

Mr. HANN. Where possible, mechanical equipment has been used in the cleanup operation. However, due to streambed conditions, most of the cleanup operation has consisted of manual labor. Cleanup crews from the mill have worked during daylight hours shoveling streambed sediment into buckets for transfer into drums or vehicles to be returned to the mill tailings area. Such a cleanup process, though tedious and time consuming, is considered to be thorough. We have removed more than 3,500 tons of potentially affected sediment from the streambed, to a distance of more than 10 miles from the mill. All of this work has been performed by our Church Rock personnel. To date, more than 15,000 man-hours have been applied to the cleanup operation.

The combination of these cleanup efforts and natural effects, such as rain, has largely restored normal conditions in the area.

During the cleanup process, we used criteria based on an NRC position paper on land cleanup in decommissioning uranium millsites. This paper identifies radium-226 as the critical element and proposes suitable limits. Radium-226 contamination can be determined either by direct soil measurements or by gamma radiation measurements above the ground.

A gamma radiation survey has been taken inside the arroyo and the Rio Puerco to a distance of 60 miles to Sanders, Ariz. More than 80 percent of the measurements show equal or lower levels of radiation inside the streambed than the background outside. Where the radiation inside the bed is higher than outside, it generally appears to result from natural outcropping of low grade uranium ore. The survey taken inside the streambed showed average gamma radiation levels consistently lower than the year round average level in the city of Gallup—well below the limiting gamma measurements suggested by the NRC for uranium mill decommissioning.

At this time there appears to be no health problem in connection with radium concentrations.

The EID has ordered decontamination to significantly lower levels for radium than those of the NRC working paper, and also set a separate standard for thorium-230. Virtually all of the recent measurements show radium levels below even those set by the EID. Most of the samples show thorium-230 levels lower than those specified by EID. For those that fall outside the standard, we believe that at least some of these measurements are due to natural background, and we are working with EID to clarify this situation. Our cleanup program is continuing.

It is the opinion of our professional staff that there was no substantial radiological danger created by the spill, and to date all published reports of tests of humans and livestock confirm this opinion. Whole body counts and urinalyses of six Navajo people identified as having had contact or exposure to the spill area were conducted by the Los Alamos Scientific Laboratory, in conjunction with the Indian Health Service, the Church Rock Action Committee, and the Center for Disease Control. The published results of these tests confirmed that the radiation levels and levels of uranium and thorium in their daughters were normal in every respect compared to those in the general population.

Since July 16, beginning with personal notification of the residents downstream, frequent contacts have been made with the Navajo people, various tribal entities and community organizations in the Gallup area. United Nuclear has regularly and routinely made the environmental sampling results available to the local communities, and the Navajo Tribe's Environmental Protection Commission and the media.

We wish to express our thanks to the people of New Mexico and particularly those in the Gallup area, who have supported our efforts to correct this situation and resume operation.

In summary, our conclusions and assessment with regard to this incident are that:

One. The tailings dam was designed in accordance with the best engineering practice and met all design criteria established by the Nuclear Regulatory Commission and the State of New Mexico.

Two. Failure of the dam was due primarily to a unique subsurface bedrock configuration.

Three. Except for the initial tailings water flood, which was comparable to typical flash floods caused by local rainstorms, the spill did not and does not represent a significant hazard to local residents or to downstream communities.

Four. United Nuclear has acted with responsibility and dispatch in cleaning up the spill, communicating with and aiding local residents and working with Government and local authorities.

Five. Two independent engineering firms, as well as State and Federal agencies, agree that operations can be safely resumed.

United Nuclear has maintained that work force intact during this period. We are concerned that continued denial of permission to restart our mill will force us to reduce our work force substantially, resulting in severe hardship to the local community.

We appreciate your patience and in the interest of completeness, I would like to ask Professor Hansen to very, very briefly give you some specifics on the dam.

Mr. HANSEN. Mr. Chairman, what is shown here is an aerial photograph of the Church Rock dam. Our particular interest this morning is with the south end of it where the breach occurred in this area, near bedrock, that has been stated.

Immediately following the breach, that afternoon members of the firm of Sergent, Hauskins & Beckwith arrived to make an initial investigation of the breach area. The next week a more thorough investigation was done, 26 exploration borings, 14 test trenches, and investigations of all faces of the breach and areas both inside the breach area and below the breach area.

What we have stated and found is that a unique bedrock situation, such as this bedrock shown in red, comes down, levels off below, the embankment drops, again has resulted in the formation of a crack due to differential settling. We mean it put a certain load on soil that was initially level. If that has x amount of settling, oil compressable here and half of that much here, this will, of course, settle more resulting in a horizontal strain at the top of the embankment, that results in a crack.

This crack, with water flowing through it, would result in internal erosion and create the breach. It does not start except something on the order of a 1-inch crack.

As it ended up, the breach at the end was approximately 35 feet across the top, 50 feet deep and was centered over this point in the bedrock here. But this is looking along the axis of the dam. If we go 90 degrees to the axis or transverse and look at the bedrock profile we will see it also has a point in that direction as well, rising out and down again. It is sitting on a fulcrum and it can bend this way and this way and this way.

So, it was much more severe than was anticipated, although settling was considered in the design of the dam and was accepted there would be some differential settling.

Mr. LUJAN. How deep is the bedrock?

Mr. HANSEN. Looking at the dimensions, approximately 60 feet from the top down to the bottom. It slopes off here something on the order of 10 degrees in either direction. This resulted in then cracking.

In my investigation I found sand covered crevices throughout the embankment area shown in blue here, as well as a crack running at this point. These were well within the embankment but with the tailings that had been placed in front of the upstream face of the dam, these cracks were filled from that sand and in fact, the sand beach that was maintained helped to prevent a failure up to the time until the water rose above that.

We can go through an analytical analysis and go from the settlement profile drawn here and calculate from that the horizontal movement. I will not get too technical, just to show you can end up in the area of the breach here, a horizontal strain of the order of 0.5 percent, although there was no great deal of research down in the area.

What kind of horizontal strains can cause a crack? In this case, 0.5 percent is probably 2½ times as much as what has been indicated previously to be the upper limit for cracking.

In a comparison, now, looking at the other sections of the dam, this was just the south end we were dealing with, the south abutment, and the question has been raised, what about the stability of the rest of the dam, particularly the north abutment?

I have shown here the bedrock profile at the south abutment. I have shown what the bedrock file looks like at the north abutment. There are two things here. One, the depth of the bedrock is approximately half as much, meaning you have much less settlement and much less of a possibility of these kinds of horizontal movements.

Second, it has no dip in it, it is uniformly going down. If you go through the same sort of analysis of strain—I will superimpose here—the red indicating the strains at the north end and the same kinds of things computed, the strains and horizontal movements at the north end compared with in black the south end, the net result is although we calculated 0.5 percent horizontal strain at the north end, we have only 0.5. So it appears we do not have a problem with the bedrock abutment at the north end.

Also, in terms of starting up, two things that will occur are, one, a filter will be placed near the center cohesive core of the dam, which is what cracked, and downstream there will be a very broad, in this case approximately 150 foot broad shell, granule shell shown. Both of these are precautions against cracks that form and

will erode, if possible. Indeed our calculations show factors of safety of 2.3 in it.

Similarly, since the cross dike now that was shown in the first slide, becomes part of the system, because it is only the north end will be opened up, we have to look at the stability of it, and in this case, it shows a factor of safety of 1.9.

That kind of concludes my formal presentation. One, we have horizontal-vertical cracking transversing the embankment that water flowed through causing erosion.

This situation was unique because of the bedrock profile. We do not have the same problem in the north end and it appears the rest of the dam is stable.

There are four points I would briefly like to address that were presented in the opening statement.

First, the upstream buttress fill or tailings part of the dam was not part of the original design but, nonetheless, was maintained. Quality control, as evidenced by the more than 1,200 compaction tests made during construction of the dam was also maintained. The protective measures that were discussed as not being followed were to be part of the raised dam. What we are talking about in the last two slides are not necessary part of the original dam. They were not specified for the starter dam.

The cracks in 1977 that appeared were of a different origin and are not related to the cracking and failure of the dam. They are of a different sort of mechanism.

And finally, the consultants never have stated that the dam was likely to fail from differential of settlement. They did point out there would be a problem of differential settlement but it should be designed for problems.

Thank you for your time.

The CHAIRMAN. Mr. Hann, why did you not do anything in 1977; that is, the company, when you had the report stating difficulty with the dam?

Mr. HANN. In the cracking in 1977?

The CHAIRMAN. Yes.

Mr. HANN. We did consult with engineering firms and sought advice from them to determine the best method to address those crackings and we did institute at their suggestion and recommendation, repairs of those cracks in 1977. That was done and we were in communication with the State, the State engineer's office about this, and we did implement corrective measures on those cracks.

The CHAIRMAN. Where is this operating mill located relative to Gallup, N. Mex.?

Mr. HANN. It is about 20 miles northeast of Gallup.

The CHAIRMAN. Well inside the New Mexico border at that point?

Mr. HANN. Yes sir.

The CHAIRMAN. In the interest of time, I am not going to pursue a lot of questions I had.

Mr. Weaver.

Mr. WEAVER. Thank you, Mr. Chairman.

I think the record stands for itself. I have just a quick question for you, Mr. Hann, and that is, can you comment on the great variations in sampling of radioactivity that was in the testimony

by Dr. Gesell, 2,300 pycometers in one sample and 30 in another. Can you give us any reason for that?

Mr. HANN. I would like to ask Todd Miller to address that question.

Mr. MILLER. I have not seen that information from the State. My feeling is that that is a difference in the analytical technique, that the State was looking at the total constituent in the liquid, and our results are all reported therein lies the difference very easily.

Also, there is a potential that would differentiate time and locations of samplings. There can be differences up and down that stream.

Mr. WEAVER. Very good.

Mr. Hann, do you consider background radiation dangerous?

Mr. HANN. I am not sure that we know at this point in time. I believe in general, no, that it is not significantly dangerous but we do not totally know enough information about that.

Mr. WEAVER. I certainly agree that is one of the problems we face with many of these radioactive chemical questions we face in society, that the link between the toxicity or deleterious effects might be 20 to 30 years, might not be traceable along its path, but radiation is dangerous, is it not?

Mr. HANN. Yes, in sufficient doses.

Mr. WEAVER. Therefore, background radiation is likely dangerous. I do not know what I said earlier in my remarks. I meant to say that background radiation very likely causes cancer, mutation, I did not want to say that it did, because I agree with you, we do not have everything spelled out. But my concern is added and my remarks to the previous witnesses are that it is even dangerous in our whole species to further concentrate radioactivity and that is why I opposed the further processing of uranium, the digging out of the ground, concentrating of it in various forms.

It is nothing against you personally, I want to tell you right now, you are doing your job and I understand you have a job you feel must be done, and we just have a difference of opinion.

Mr. Chairman, I have to leave, and I wondered if we could ask Mr. Dircks of the Nuclear Regulatory Commission, the same question that I just asked, and that is: Is background radiation dangerous? I would like to get his comments on that in the record. Would that be all right?

The CHAIRMAN. Yes.

Mr. WEAVER. Thank you, Mr. Hann.

The CHAIRMAN. Mr. Lujan.

Mr. LUJAN. Thank you, I am kind of interested in the charts because they explain a little better and we were able to understand. Frankly, a lot of the stuff is so technical that it is way above me, but I do understand the lines on the chart.

I would like to ask you now: You know what happened was because the bedrock was like this at the north end and then dropped off. At the south end it was all right, then dropped off and where it drops off that is where the break occurred. That is pretty easy for someone like me to understand. That if it settled too much over here and did not settle here you get a crack.

You know that now. Did you not know it at the time the dam was built?

Mr. HANN. I will let Professor Hansen answer. I will answer in layman's terms.

In the sense of the construction of the dam it is a very low height dam, first of all. There were readings taken, corings taken along the length of the dam, and they were felt to be sufficient. In fact, in dams of this height, they do not normally take that many corings.

But no, we did not know at this point in time the time and particulars and details. I will let Professor Hansen explain the number of corings and drillings since the breach to explore and determine this particular.

Mr. HANSEN. As I stated, there were 26 borings made. There are some with 14 test trenches put in just in the area of the breach and surrounding it. This is from one area approximately 300 feet long and a mile long dam is a very large number of borings.

Mr. LUJAN. How far apart?

Mr. HANSEN. Overall, an average of about 50 feet. But that depends on which direction you are going and where you are looking.

Mr. LUJAN. What you are saying is you did not know there was that sharp a drop in the bedrock that could have caused the break like this?

Mr. HANSEN. Not in the transverse direction, sir.

Mr. LUJAN. Because my following question was going to be is there any difference between the way this dam was built and other mill tailings ponds.

Mr. HANN. A significant difference between this and other mill tailings in a pond normally are constructed from the tailings from the mill process. This is an earthen dam, compacted earthen dam and it is constructed in an entirely different fashion.

Mr. LUJAN. I have not seen this one although I have seen mill tailings piles where a machine moves along and the dam is built as you go along. You are saying this is not the case with this one. There was a dam built and then the mill tailings are piled up against it?

Mr. HANN. Yes, it is an earthen dam in which we flow into it both the solid and liquid from the tailings process providing a tailing embankment on the upstream side and tailing liquids are contained and evaporate out of the impoundment pond.

Mr. LUJAN. Why did you do it different than other mill tailings?

Mr. HANN. This was a proposal by the Nuclear Regulatory Commission as to a change in the design of the dam. This was supposed to be a very current, good, excellent dam and a concept that would be very effective and we think it is a good dam design.

Mr. LUJAN. If it had not broken.

Mr. HANN. Yes; but we believe that the breach was like many things that you undertake, they have a risk, and we undertook this. There was a circumstance that was not foreseen at the time.

Mr. LUJAN. It seems to me like it is an attempt to do the things that I was talking about, if you were in the room when I made my opening statement, doing it in a safer way, yet something happened and it did not work out.

Mr. HANSEN. Have you got any ideas as to how we might do it safer, dig a hole in the ground, and make sure that they are not above ground, so that there is no breaking point?

Mr. HANN. Most tailings impoundments do use the tailings sand and if this had been a tailings embankment of that type, this type of breach would probably not have occurred. As far as the impoundment process is in general that will vary from area to area of the country, in particular in New Mexico, as opposed to Wyoming, for example, more problems that could result from ground water effects.

I think you have to review and look at each situation in particular, by each area of the country and we are doing that, and we are looking and continuing to look at alternative ways of disposal of tailings. I mentioned before that we undertook a program to return a portion of the tailings sands underground for fill in the mine.

Mr. LUJAN. Let me ask you another question in the area of something that I have been trying to get DOE and others to do as far as mill tailings are concerned. During the testimony on the Mill Tailings Act, we were told that someone, some town or county, I wish I could remember specifically where it was, the tailings were clean enough they were going to use them for constructing an airport, of the buildup. That took me in the direction of cleaningup the tailings.

Do you think that that is possible, that you can clean up the tailings where you eventually end up with very innocuous sand that you could use for for an airport or highway construction?

Mr. HANN. I think that can be done and it can be done. One of the proposals as I understand it that has been made is to partially bury it and then cover with a blacktop type material, and that could be done, too.

Mr. LUJAN. To leech out the——

Mr. HANN. Not to leech out but at least cleanup and then to leave the solid portion covered so that there——

Mr. LUJAN. You are not talking about drying it up?

Mr. HANN. It would have to be dried up.

Mr. LUJAN. You meant, for example, the uranium that is left in the tailings, thorium, whatever, a lot of those elements can be taken out to where you end up with just a pile of sand.

Mr. HANN. That can be done and we do undertake the recovery of the solid materials to remove most of the materials and dispose of them. They can be done that way.

Mr. LUJAN. Would you then say the tailings are not harmful?

Mr. HANN. Yes.

Mr. LUJAN. You can stand on there and if you do not smoke it would not be too bad. If you did, it would be worse. Is that what you are saying?

Mr. HANN. Yes.

Mr. LUJAN. Why then was there such great concern, if you say that they are not particularly dangerous, I got the impression that it was a disaster?

Mr. HANN. That is not the case, and as I mentioned in my statement, that the material in the tailings did not present a health hazard. It was distributed across down the arroyo. That distribution, that is not in accordance with any plan or any rule

but it did not contribute, it was not a harmful level. We do not truly know the long-term effect but our belief is that does not represent a risk to the inhabitants. It was not a catastrophe in that sense.

We have learned a great deal over the last 5, 10, 15 years, about radiation. We are learning more and we are taking more precautions as we undertake the removal of the ore from the ground and we will follow them. It is our company philosophy to do so. But we do not understand all aspects of it. But we are attempting to improve and to correct and assure that it is a safe operation.

Mr. LUJAN. Let me ask one more question, Mr. Chairman. I know I am taking an awful lot of time. The two testimonies we have heard this morning are really at variance one with the other.

Do you have a communications gap with the Navajo Tribe or are they kept informed? You tell us you distributed water to the people and advised them the thing could happen, yet the previous testimony says you go along merrily on your way. Do you do these services for these individuals that are living there and felt no responsibility to communicate with the tribe or——

Mr. HANN. We have maintained contact with the tribe to keep them informed. I believe, as an opinion, there is much concern because of the unknown. There has been a lot of activity in the area of individuals that have come into the area, who have stated and indicated that there is grave concern and you have the layman like myself who may not fully understand this, who are being exposed to, I would say, statements that are not directly pertinent, indicating that it is a very severe problem when it was not, given the circumstances.

You have a Navajo people who are not sure what they should do. You cannot blame them. We have tried to maintain communications with them to explain what is available to try to work with them, but it is very difficult, a very widespread group of people and a lot of assistance. Many people that came on the reservation as a result of this, that have contributed their opinion that may not have contributed to the whole solution of the problem.

Mr. LUJAN. Thank you, Mr. Chairman.

The CHAIRMAN. Mr. Evans.

Mr. EVANS. Thank you, Mr. Chairman.

Mr. Hann, on page 2 of your statement, you make the very general statement that even if a person fell into the dam he would not be hurt very much and that as soon as the acidity was diluted enough to make it palatable it would not impose any health hazards.

Considering the lack of knowledge of radiation, the fact that we are constantly lowering the permissive levels, are those not rather strong statements to make?

Mr. HANN. My statement was if you were to fall in there would not be a health hazard, but at this point in time we do not think exposure to that degree, we assume that you would come out, you would get rinsed off and cleaned up and out of there.

Mr. EVANS. I understand that. But in view of the fact that these levels are constantly being lowered, is that not a strong statement to make? I certainly think it is.

Mr. HANN. No sir, I guess I do not believe that to be the case.

Mr. EVANS. The second thing is, we know that hindsight is 20-20, or close to it, but in view of the fact that this difference in the bedrock level could be determined, and considering this was not just a pond to hold rainwater but toxic water, is it not true that if more boring was done closer together you could have detected this and raised a red flag before that was completed?

Mr. HANN. That is also possible. In hindsight many things have been and will be learned from that.

Mr. EVANS. What I am trying to bring out is, from the history of this first time we detected radiation, there has been a steady lowering, it goes for everything, has not the time been reached when we should build in a reserve factor which is not mandated by law because of these accidents? It would cost a little more to build the plant but would it not perhaps have avoided expense in the long run?

Mr. HANN. I think as we learn more we will apply——

Mr. EVANS. Let us get a little bit ahead, I would suggest.

Mr. HANN. My point is we have learned a great deal from this particular circumstance. We felt we did have adequate safeguards and measures in this, the dam itself, because we complied with the most recent Nuclear Regulatory Commission specifications and requirements. Had the dam been built to those specifications, we were attempting to put into that the most up to date safety features, and we had a circumstance that was not foreseeable.

Mr. EVANS. Thank you.

The CHAIRMAN. A couple of quick questions. The company expresses great surprise here today that the dam burst and yet you talk about being surprised to hear of the unusual geographic formation of bedrock. Did not in 1976 your own consultant predict extreme settling by a factor of more than 10 more than normal? I am referring to the Sergent, Hauskins & Beckwith report of 1976?

Mr. HANSEN. I will answer that. Yes, I do not remember the exact numbers. I seriously doubt we could have predicted 10 times the settlement normal. We were associated with that problem. We think that any dam that is built next to a bedrock abutment has this potential.

The CHAIRMAN. You knew you had cracks and you knew the consultants told you what they were and what was causing them and you really did not take much action.

Mr. HANSEN. Wait a minute, you left me there.

The CHAIRMAN. You had the consultants report in 1976, 3 years before this happened, predicting settling beyond the normal factor. You had the cracks that were called to the company's attention in 1977 and yet no additional beach sand was provided nor were steps taken, as I gather from the testimony, to do something to keep the cracks from breaking down the structure.

Mr. HANSEN. There was beach sand placed. It was unfortunate tailings water did get above the beach sand.

The CHAIRMAN. Why did you not have more beach sand?

Mr. HANN. We did maintain a beach sand on the face of the dam. It was not a requirement in the initial design that be done. The water level in this particular case, we surmised did go above that. We were making every attempt to keep the beach there. Whether the water level goes above the beach the beach was there.

You must remember that the beach level water was in contact with the beach. In point of time we surmised it went above the beach. I do not think that we in the initial Sergent, Hauskins specifications, they predicted that there would be large settlement and I believe the predictions that they put forward at that time have generally been confirmed as to what has happened in the dam in terms of the settlement over the length of the dam.

The CHAIRMAN. We have a time problem this morning. I do not want to pursue it further. Thank you very much. We appreciate your help.

We will hear now from Mr. Dircks, NRC, Office of Nuclear Material Safety and Safeguards.

[Prepared statement of Hon. William J. Dircks, with attachments, many be found in the appendix.]

STATEMENT OF HON. WILLIAM J. DIRCKS, DIRECTOR, OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS, U.S. NUCLEAR REGULATORY COMMISSION

The CHAIRMAN. Mr. Dircks, we are, as usual, out of time here, short of time, and we have the rather complete and comprehensive statement you put together. Are you going to be able to summarize it and hit some high points?

Mr. DIRCKS. I will skip through it, Mr. Chairman, and I hope everyone can follow my skipping.

The United Nuclear Corp. uranium milling operation was licensed by the State of New Mexico in May 1977. New Mexico is an agreement State.

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 techncial 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.

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 cleanup 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.

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 Corp. As a result of differential settlement, cracks developed in the embankment.

We currently are 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 yet although we were very close to making some decisions. It was during the evaluation of this plan on October 12, 1979, that the NRC issued an order to United Nuclear Corp. that they cannot resume operations until we complete our review.

In addition to the evaluations already noted we are going one step further. Following our review of aerial photographs of the mill vicinity and onsite observations we have serious reservations about the current tailings impoundment site relate to long-term stability. 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 satisfactory 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 Corp. 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 nonagreement 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 does not 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.

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

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.

[The excerpt from the Federal Register may be found in the appendix.]

The CHAIRMAN. Thank you.

Mr. DIRCKS. 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.

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.

Mr. LUJAN. Excuse me, I would like for you to go back. I cannot follow in the whole statement.

Mr. DIRCKS. It is on page 6.

Mr. LUJAN. The alternative, that way it would be avoided?

Mr. DIRCKS. 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 changes 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. 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 in a different site.

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 onsite an especially equipped mobile laboratory.

Estimates of the amount of tailings released from the failure have varied, but it appears that at least a 100 million gallons of acidic tailings solutions and 1,100 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 containment area on operator property and in an adjacent stream, the so-called Pipeline Arroyo. The solutions traveled in the Pipeline Arroyo to the Rio Puerco

which flows through Gallup, N. Mex., a town about 20 miles southwest of the mill site, and 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 become 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.

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 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 tailing 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. 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).

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 absorption 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 be no later problems such as contamination of wells near the stream from seepage into groundwater.

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.

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 them formally as we write our final report on the incident and cleanup operation.

I think I could end that statement here.

Mr. LUJAN. Thank you very much, Mr. Dircks. It is certainly a very all inclusive statement.

Let me ask you how complicated do you anticipate that the cleanup will be? Is it a mammoth job or would it be rather routine?

Mr. DIRCKS. It is a complicated job and I think we are estimating that it will take several months, 3 to 4 months before the stream or the wash can be allowed for normal use.

Mr. LUJAN. Will you be taking that contaminated ground and moving it and burying it?

Mr. DIRCKS. Yes, the company is doing that and they will do it to our criteria that we are establishing.

Mr. LUJAN. Let me address the whole question of agreement States. There seems to be in the air something about rescinding these agreements or maybe not unilaterally rescinding them but working out something so that the whole question comes back to NRC and that the primary responsibility is not with these States. Do you think that the Church Rock break would have occurred anyway even if it were the sole responsibility of NRC or is the State in some way, was the State in some way—I will not use the word negligent—but perhaps was not as thorough as the NRC might have been?

Is that the general feeling around NRC?

Mr. DIRCKS. I do not think it is a general feeling.

Mr. LUJAN. I do not mean to pit you one against the State or anything like that. What I am really leading to is obviously—I suppose by my questions you might determine that I am fairly comfortable with the expertise that exists in the States—just as a way to addressing that question, what the feelings of NRC would be.

Mr. DIRCKS. It is one of these things we are learning as we go along. As you know, we have in the Commission the past couple of years made available to the agreement States technical assistance from our staff. I think the more we can do that the better off future licensing actions will be.

Mr. LUJAN. Are you saying let us continue the agreements that we have with the States but NRC provide the States with technical assistance in the areas that NRC might be stronger in than the States would be?

Mr. DIRCKS. I think that is the major approach.

Mr. LUJAN. I was interested in your statement where you speak of using mined out pits or excavated pits for disposal. I gathered from the testimony that your thinking is it would not be unreasonable to require those mines that have not been in operation for many years to go ahead and move those tailings into maybe some mined out areas or excavated pits? Is that the general thinking at the moment?

Mr. DIRCKS. That is the general thinking. If it is at all practicable we should move toward the below ground, below grade disposal of tailings. That is emphasized in the regulation. We recognize though, you have cases where it is not practicable, such as mills that have been in operation for a number of years it is not practicable. There we will take special care to look at the existing dam structures.

Mr. LUJAN. We are talking about abandoned mine sites that have been there for many, many years, moving those to more stable areas. If that were the case, why could we not do it with operating mines?

Mr. DIRCKS. I think in those cases we are going to take them—you are referring to the 22 cases in the residual cleanup program—I think we have to take a look at those on a case by case basis. In some cases some of these mill tailings sites are very close to existing populated urban areas. I think there the expense may warrant moving them completely away from that area. In fact, we are recommending that in several cases.

Mr. LUJAN. In the work on mill tailings and removal of mill tailings, why did NRC not consider what I would call a mining of the tailings for the objectionable materials that might be in there, even though that was an operation that was open that the legislation specifically called for? Did you feel that it was not a workable solution?

Mr. DIRCKS. We just did not feel the technology was there and, of course, if an entrepreneur had the idea that it could be done economically, we would review it, but so far there has been very little attempt to move and further refine these tailings to make them into usable materials.

Mr. LUJAN. That was the testimony that we had. In some cases if the material in there were profitable, we had two or three mining companies testify that, as a matter of fact, they were doing it in Colorado, I think Ranchers Exploration & Development Co. was doing it.

On the other side, if we are going to spend $300 million to remove them from one place to another, which in my opinion, says we will move them there, we will stabilize them, 25 years from

now, the elements, the weather, will take care of that and we are going to have to move them again. It might be a little wiser step to use that $300 million, if that were enough, to clean up the piles?

Mr. DIRCKS. Yes, I think in the Ranchers' case what they wanted to do was extract the uranium, further extract it——

Mr. LUJAN. Uranium and vanadium?

Mr. DIRCKS. That was an active case under licensing review and we did not have any objection to that, to that proposal.

Mr. LUJAN. Thank you, Mr. Chairman.

The CHAIRMAN. Mr. Dircks, do you agree with the Army Corps of Engineers that United Nuclear did not adequately respond to the consultant's recommendations that you referred to in your testimony?

Mr. DIRCKS. We have not reviewed that Corps of Engineers report.

The CHAIRMAN. Your testimony on page 3 says these tests indicated that settlement of 5 percent resulted from the loading of the embankment under dry conditions. After addition of water, additional settlement ranging from 1½ to 13 percent was experienced due to collapse of the soil structure; and you also say settlement in excess of 3 feet was measured in January 1979 by a consultant to the United Nuclear Corp.

I am not asking you to pass judgment—maybe I am asking you to pass judgment—would that not indicate a failure to adequately respond to these warnings, cracks, reports?

Mr. DIRCKS. There were significant warnings appearing before the dam broke and, yes, I think that is the troubling part of it.

The CHAIRMAN. All right, we will excuse you at this time. Thank you very much.

Our next witness is Mr. Clayton, deputy director of the Environmental Improvement Division, State of New Mexico.

[Prepared statement of Cubia Clayton and an addendum may be found in the appendix.]

STATEMENT OF CUBIA CLAYTON, DEPUTY DIRECTOR, NEW MEXICO ENVIRONMENTAL IMPROVEMENT DIVISION, ACCOMPANIED BY FRED ALLEN, NEW MEXICO STATE ENGINEER'S OFFICE; AND BRUCE GARBER, CHIEF COUNSEL, NEW MEXICO ENVIRONMENTAL IMPROVEMENT DIVISION

Mr. CLAYTON. Good morning, Mr. Chairman, my name is Cubia Clayton. I am deputy director of the New Mexico Environmental Improvement Division. With me is Mr. Fred Allen of the New Mexico State Engineer's Office, and Mr. Bruce Garber, who is chief counsel for our division.

I appreciate the opportunity to appear before the committee today to discuss the tailings dam failure at Church Rock, N. Mex., which occurred on July 16, 1979. Five of the issues raised by the committee have been addressed by individuals with the New Mexico State Engineer's Office and Mr. Fred Allen is here to present those findings to the committee. I will address those issues not treated by Mr. Allen. My statement is intended to provide a general overview. I will, of course, respond to any further questions the committee might have.

The facts briefly are as follows:

About 6:45 a.m. on the morning of July 16, an employee of United Nuclear Corp. observed a break in the tailings dam located at Church Rock, N. Mex. The mill was shut down by 7 a.m. that morning and appropriate authorities, including the New Mexico Environmental Improvement Division were notified. The flow was stopped by 7:50 a.m with a temporary dike. It appears that the release consisted of approximately 1,100 tons of tailings and 95 million gallons of tailings solution. The flow which was confined to Pipeline Canyon and the Rio Puerco, extended to the New Mexico-Arizona State line and beyond the area of Sanders, Ariz.

EID field personnel were on the UNC site by 9 a.m. to insure the mill was shut down, the breach plugged effectively, and early damage assessment and sample collection were instituted. Shortly after noon, a team from EID and the State Engineer's office were on site for preliminary dam failure analysis and to coordinate sample collection for environmental damage analysis. A formal mill shutdown order was issued by EID to company officials by 4 p.m. although it would be noted that UNC had voluntarily shut down, as noted earlier.

The stop order was followed on July 18 by an EID cleanup order and an additional stop order from the State Engineer's office. On July 13, 1979, UNC was issued cleanup instructions giving cleanup criteria and considerable additional cleanup requirements by EID. An administrative order was issued by the Environmental Protection Agency on August 9, 1979, and a stop order by the Nuclear Regulatory Commission on October 13, 1979.

Extensive monitoring and sample collection efforts by both UNC and EID were begun on July 16, the day of the breach, in an effort to quantify the extent of the spill, and to provide information necessary for cleanup. Those efforts are continuing to this day and will continue into the future. There was some difficulty in obtaining speedy laboratory analysis, and on September 22, 1979, the Nuclear Regulatory Commission arranged for a field laboratory to be placed on site.

The laboratory has been analyzing approximately 70 samples per day since its arrival and has been of great value in locating areas in need of cleanup. As of October 12, United Nuclear Corporation has removed approximately 3,150 tons of material from the arroyo and deposited it to the tailings area. Those efforts will continue until total cleanup has been accomplished. To place the amount of time and effort expended to date in some perspective, it might be noted that our water pollution control section has had five geohydrologists involved for a total of more than 300 man-days.

Our radiation protection section has had five specialists and two technicians involved for a total of more than 350 man-days, and seven other field personnel have been involved for more than 50 man-days. This does not include the effort from our State laboratory system or the effort required by the New Mexico State Engineer's office.

The result of monitoring efforts to date may best be summarized as follows. On the day of the spill, we observed an immediate and dramatic response in surface water. Trace elements and radionuclides were present in extremely high concentrations. As would be expected, there was not a comparable response in ground water. At

present, the surface water appears to have undergone significant recovery, but is not yet back to prespill quality. There has been a gradual increase in some contaminant levels in ground water as detected at the nearest observation well. Nothing we have found to date indicates any hazard to human health; however, we feel that continued long-term monitoring is essential.

There have been many State and Federal agencies involved since the dam failure occurred. In addition to the New Mexico Environmental Improvement Division and the New Mexico State Engineering Office which have primary jurisdiction, there has also been involvement by the Nuclear Regulatory Commission, the Environmental Protection Agency, the U.S. Corps of Engineers, the Indian Health Service, the Bureau of Indian Affairs, and the Center for Communicable Disease Control. All agencies involved have made contributions of one kind or another.

I might insert parenthetically, Mr. Chairman, in particular not only during the spill incident but for quite a long time one Federal office which has been and continues to be of particular help to our agency is the Office of State Programs in the Nuclear Regulatory Commission.

The agreement States program has not been without problems. There are certainly examples where failures have occurred in agreement States including, unfortunately, the most recent example in New Mexico. It should be pointed out, however, that there have also been failures where the Federal Government has had exclusive jurisdiction. The art of tailings management is developing so rapidly and is as yet so far from providing the definitive answer that any regulatory authority has had and will continue to experience problems.

Under section 274 of the Atomic Energy Act, the U.S. Nuclear Regulatory Commission has the responsibility for evaluating State programs and terminating the State's jurisdiction if it is not adequate to protect public health and safety. At this time there is no basis for such determination in New Mexico.

There are several advantages to maintaining the agreement States program. The first is that from the Federal Government's point of view, it is cost-effective in that except for technical assistance, it is an entirely State-funded program. There is also ample evidence that the State is in a much better position to respond quickly in emergency situations. At least in New Mexico, because of our agency's other environmental protection mandate and staffing, there is opportunity for a more comprehensive review of license applications than is generally possible at the Federal level.

Again I might insert parenthetically, Mr. Chairman, that the latest licensing action by the Environmental Improvement Division consisted of a denial of a discharge plan required under our ground water regulations. That denial was subsequently upheld by the New Mexico Supreme Court.

Finally, there is the question of the implications our agency has drawn from this incident for future mill tailings licensing. The first and most obvious is that we need to substantially increase our inspection activities over uranium mills during the operation, post-operation, and reclamation phases. The EID must carefully consider any proposed new tailings site in relation to the surrounding

drainage and ground water sources, and we must consider alternative schemes including those which would eliminate the need for any retention dams.

That concludes my remarks, Mr. Chairman. Mr. Allen will present the remarks from the State Engineer's office.

The CHAIRMAN. Mr. Allen, how much of a presentation do you have? I am getting in a real time bind here with two more witnesses. We are compiling our overall hearing record and the prepared testimony is very good in this respect, but if you could give us a couple minutes' highlight of what you think we ought to know, we will have the balance of your statement for the file.

Mr. ALLEN. Thank you, Mr. Chairman. My name is Fred Allen, chief of the technical bureau for the New Mexico State Engineer's Office.

We have addressed five of the issues that you requested in your September 1979 letter. Issue No. 1 goes to the causes of failure. I think that has been addressed. We concur with the consultants' reports.

With respect to whether or not this dam is unique, I think that has been covered earlier. There is the earthen embankment, with the Church Rock Dam constructed entirely of tailings beginning with the small starter dam.

Issue No. 3, a detailed description of UNC's response to the accident and the request to the State. The State Engineer issued an order on July 18 to the company requiring that they make an investigation of the cause of the failure. Reports were submitted on September 5.

On October 3, UNC requested State Engineer approval of discharge into the existing central pond cell, and newly constructed great borrow pit. They have made a request for this interim operation, allowing about 54 days. The State Engineer approved the request on October 5, on the conditions, among others, that all discharge be under the supervision of a New Mexico registered engineer, limited elevations of the liquids, and that sand beaches be maintained of at least 150 feet in dimension.

Issue No. 6, comparison of the tailings impoundment structure design approved for licensing by the State with tailings impoundment structure as it existed at the time of the accident. And were the aspects of the approved structure design not implemented which might have helped prevent the July dam failure. The approved plans and specifications require a sandy drain zone on the downstream portions of the dam. This drain zone was not constructed to full height in the southern half of the dam, and it was entirely omitted in the northern half.

At the breach section near the southern end of the dam, about one-third of the height of the drain zone was omitted. It is the consensus of the engineers involved in the review and evaluation of failure, that had the drain zone been constructed according to the approved plans and specs, and had the tailings beach been in place as recommended by the corporation's engineers it is likely that failure would not have occurred.

Issue 7. A summary of any implications you might draw for future New Mexico mill tailings licensing.

The State Engineer has concluded that all dams being constructed by the use of tailings, or otherwise, to impound mill discharges must be considered dams under construction which must be under the supervision of a registered professional engineer.

On September 13, 1979, the State Engineer issued orders to the owners of uranium tailings dams, over which he has jurisdiction, requiring the submission of qualifications of professional engineers who will supervise the continuing construction of the tailings dams. Further, a status report certifying safety of the dam will be required before any impoundment may be initiated.

With respect to issue 6 a description of any activities planned or underway in the State to assess other existing tailings structures for possible similar problems, on July 20, Governor King requested assistance from the Albuquerque District Corps of Engineers.

Mr. Chairman, you are quite familiar with that report. You made several references to it. Thank you.

The CHAIRMAN. Mr. Lujan, do you have questions?

Mr. LUJAN. Yes, I do, Mr. Chairman. I want to compliment Mr. Clayton and Mr. Allen on the information that they brought to us today. It appears from reading the statement that you have things well in hand. I am particularly impressed here, the break occurred at 6:45 EID. Field personnel were there 2 hours later. The breach had already been fixed. There was no more flow as of 7:50. That is 1 hour and 5 minutes after the break. Then we are led to believe that NRC has complained that they are not getting enough information in order to make determinations fully 2 months before NRC issued their stop order. The EID in the State of New Mexico had already done so.

It seems to me like you are right on top of it. Within a month you already had criteria to clean it up, and how to go about it and what they had to do. Your testimony shows that the corporation got these guidelines and started moving the contaminated ground water—what is it, 3,150 tons of material were removed from the arroyo in the contaminated area. So I think that speaks very well for continuing the agreements with States.

You compare this with Three Mile Island and it is really no comparison in terms of response. The State has really done an excellent job as far as I am concerned, and I commend you for it.

Mr. CLAYTON. Thank you.

The CHAIRMAN. Too bad we cannot have all the other 49 States operating as your State does.

Mr. LUJAN. I might say, Mr. Chairman, the experience of the State of New Mexico in this area certainly proves that it can be done, and that the other States ought to be willing and able to do it, because it is demonstrated here that that is the way to go because of the efficiency of the operation.

The CHAIRMAN. Not all witnesses get this kind of praise.

Mr. LUJAN. Not all witnesses come in with the excellent response that occurred in this case.

The CHAIRMAN. We had better get them out of here before somebody complains. Thank you very much. We will now hear from Mrs. Harrison, the regional administrator for the Environmental Protection Agency.

[Prepared statement of Adlene Harrison may be found in the appendix.]

STATEMENT OF ADLENE HARRISON, REGIONAL ADMINISTRATOR, REGION 6, ENVIRONMENTAL PROTECTION AGENCY, ACCOMPANIED BY KIRK F. SNIFF, CHIEF, GENERAL ENFORCEMENT SECTION, REGION 6; FLOYD L. GALPIN, AND ALLAN RICHARDSON, OFFICE OF RADIATION PROGRAMS

Mrs. HARRISON. I was just hoping that Mr. Lujan would have as much praise for me. I would be willing to give up all of my testimony.

I have with me, in case we field questions, Mr. Floyd Galpin from our Office of Radiation Programs on my right; and Kirk Sniff, who is a branch chief of enforcement for region 6. I do not think my statement is too long, Mr. Udall. I have been asked to discuss the Environmental Protection Agency's response to the recent uranium tailings spill near Church Rock, N. Mex.

Since May of 1977, United Nuclear Corp.—UNC—has operated a uranium mill near Church Rock, N. Mex. UNC's Church Rock mill has a tailings pond which receives and contains waste materials from the milling process. On July 16, 1979, the tailings pond dam failed. This resulted in a discharge of approximately 93 million gallons of contaminated wastewater into a tributary of the Rio Puerco and subsequently into the Rio Puerco itself. EPA has determined that the flow attributable to the spill continued down the river, through Gallup, N. Mex., and ultimately terminated at a point near the community of Sanders, Ariz. Within that area, the spill raised the level of the river for a short period of time and left some residual ponds and deposits in the river channel and on the banks.

An incident of this nature and magnitude is of special concern to EPA. From the outset, our principal interest has been in identifying and reducing any threat which the spill poses to human health. In that regard, we have been especially concerned with the possible contamination of public drinking water supplies, the environmental threat to surface water and ground water quality, and the impacts on livestock insofar as they affect humans.

On August 15, 1979, EPA requested the Indian Health Service to take samples from wells in the area. These samples were taken about 5 weeks ago and we expect results in the near future. I might note that these wells are not public water systems within the meaning of the Safe Drinking Water Act. In addition, we have taken steps to identify other long-term hazards, to reduce the exposure of persons to the contaminated materials, and to see that cleanup is carried out in a timely and effective manner. I will detail our actions later.

Before discussing EPA's immediate response to the spill, I would like to briefly outline the overall regulatory framework. The UNC Church Rock mill is licensed by the State of New Mexico pursuant to an agreement between the State and the U.S. Nuclear Regulatory Commission—NRC. The New Mexico Environmental Improvement Division, in its capacity as the primary regulatory authority over the mill, has acted as the lead agency in the investigation and has supervised the abatement and cleanup efforts.

A number of Federal agencies, including EPA, the Indian Health Service, and the NRC, have contributed valuable sampling, analytical and technical assistance to the effort. The Environmental Protection Agency has acted under authority of the Clean Water Act, which regulates discharges of pollutants into waters of the United States. However, in this case, UNC's tailings pond—like most tailings ponds—did not have a discharge until the spill occurred. Consequently, it did not require a Federal discharge permit. In addition, EPA has participated in a ground water monitoring program under the Safe Drinking Water Act, which is designed to protect public drinking water supplies.

Now I would like to describe EPA's specific response to the UNC spill and follow that discussion with the Agency's preliminary conclusions regarding the impacts of the spill. EPA's response was immediate and positive. This response involved the coordinated efforts of four EPA units: EPA region 6 in Dallas; EPA region 9 in San Francisco; the Office of Radiation Programs in Washington; and the Environmental Monitoring and Support Laboratory in Las Vegas, Nev.

On July 16, 1979, the day of the spill, the State of New Mexico requested EPA to obtain aerial photographs of the spill area. EPA flew the mission that day and has since conducted two followup missions. On the day after the spill, EPA contacted the State to ascertain whether the spill presented any immediate threat to drinking water supplies in the area, especially at Gallup, N. Mex. The State assured us that there was no imminent hazard but agreed to take a closer look. EPA immediately dispatched an emergency response contractor to the spill area.

The contractor met with representatives of the company and the State, discussed the status of the spill, and inspected and photographed the spill area. On July 19, 1979, EPA conducted a stream survey from the spill site to Chambers, Ariz. We observed no discernible flow at Chambers—an indication that the spill did not reach that point.

On July 20, 1979, EPA took water and sediment samples at four locations: (1) Upstream from the tailings pond but downstream from the UNC and Kerr-McGee mine discharges; (2) at the tailings pond itself; (3) from sediment deposited immediately downstream from the breach; and (4) at a point downstream from the immediate flood plain. These samples were dispatched to two different laboratories for heavy metals and radiological analyses.

On August 1, 1979, we took followup samples at the four previous locations plus four additional downstream sites. In addition, EDPA has cooperated with the States of New Mexico and Arizona, the Indian Health Service, and the NRC to establish continuing monitoring programs for the Rio Puerco and adjacent shallow ground water sources and to assess the impacts of the spill on the health of human beings and livestock.

However, EPA's response has not been limited to the scientific measures mentioned above. First of all, EPA has actively supported a series of orders issued by the State of New Mexico directing UNC to cease all discharges into the tailings pond and ordering the company to institute a thorough cleanup program with respect to radioactive and chemical contaminants. In that regard, EPA has

provided the State with technical assistance, including interim guidelines for cleanup and analytical support.

Second, on August 9, 1979, EPA issued its own administrative order under the Clean Water Act charging UNC with an unauthorized discharge in violation of the act. EPA's order directed the company to file a detailed report within 30 days on the cause of the breach, impacts of the spill, remedial measures to prevent future discharges, cleanup measures, and other appropriate information. On September 10, 1979, EPA received UNC's report. On October 19, 1979, the Agency amended its administrative order to extend UNC's cleanup program into Arizona and to require monitoring in association with the cleanup.

Third, on September 14, 1979, I convened a meeting of affected Federal and State agencies to review all findings and to coordinate future activities.

We had been attempting to schedule such a meeting since August 24. At the meeting we established an information clearinghouse and refined our monitoring plans, especially with respect to a comprehensive well-sampling program to be coordinated by the Indian Health Service.

Finally, on that same day, I met with Chairman Peter MacDonald of the Navajo Nation to discuss the spill and to brief him on our efforts to deal with it. This meeting was called because of the chairman's concerns about the potential impacts of the spill on the health of citizens of the Navajo Nation. As a result of the meeting, EPA and the Navajo Nation issued a joint statement on the status of the UNC spill and established a temporary working group to determine Navajo needs in the area of environmental protection, with special emphasis on radiation and the UNC spill. Because of the Navajo's concerns, we also asked NRC to provide the Navajos with temporary alternative water supply.

As you can see, the Environmental Protection Agency has devoted a great deal of effort to the UNC investigation. We will continue to do so as we assess long-term effects and consider all technical and legal remedies. Our work to date forms the basis for the following conclusions:

First. We have no evidence that the spill has adversely affected any public drinking water supplies covered by the Safe Drinking Water Act. However, shallow ground water sources in the immediate vicinity of the Rio Puerco may have been affected by the spill. Consequently, the Indian Health Service has—with EPA's assistance—initiated a long-term monitoring program to determine effects, if any, and to obtain data to form the basis for appropriate action.

Second. Radiation, acidity, and heavy metals readings in water from the Rio Puerco have returned to background levels.

Third. The presence of salt deposits in the Rio Puerco Basin apparently derived from the UNC spill has been the source of some concern. However, UNC's cleanup of the deposits is progressing and, at this time, we do not believe that the salts represent a hazard.

For the benefit of the subcommittee, I have provided you with a list of documents and data pertaining to the UNC spill. If you wish

to review any of these documents, please contact me and we will make appropriate arrangements.

In conclusion, let me assure you that EPA is taking every step necessary to protect the public health and environment in the impacted area.

I thank you members of the committee. If you have any questions, we would be happy to try and field them.

The CHAIRMAN. Thank you for your statement. Mr. Lujan.

Mr. LUJAN. Thank you, Mr. Chairman.

I think EPA deserves a pat on the back, too. I may not be as I was with my own constituents, but I think the response of EPA was immediate, was thorough, and continuing. I feel kind of in a different area. Normally it is EPA fighting for refuse plants and these sorts of things. It is really great to be able to be complimentary about your agency. Thank you.

The CHAIRMAN. Thank you very much.

Mrs. HARRISON. Thank you.

The CHAIRMAN. Our last witness today is Mr. Paul Robinson.

[Prepared statement of Paul Robinson may be found in the appendix.]

STATEMENT OF PAUL ROBINSON, ENVIRONMENTAL ANALYST, SOUTHWEST RESEARCH AND INFORMATION CENTER, ALBUQUERQUE, N. MEX.

Mr. ROBINSON. My name is Paul Robinson, environmental analyst for the Southwest Research and Information Center, a nonprofit organization from Albuquerque, N. Mex. I have prepared a written statement which I will summarize quite briefly but there are several key points I would like to bring out.

First, I think it is important to note that there are more United Nuclear employees in this room today than there were cleaning up the spill for its first month, and that is why on August 13 the Environmental Improvement Division of New Mexico was required to write a letter saying you only have 6 to 10 people cleaning up, let us get on it.

As a result of this first month of contamination, I believe that the spill is uncleanable.

The CHAIRMAN. Is what?

Mr. ROBINSON. Is uncleanable.

The CHAIRMAN. Uncleanable.

Mr. ROBINSON. We have evidence of increase of sulfate, which is a primary indicator of the spill. At 2 foot of depth we have about a 30-percent increase in sulfate in the only ground water wells within a quarter mile of the stream, so we have increased at a 30-foot depth. This is very fast for ground water movement, and has been a cause of some concern amongst those following the spill in detail.

The total volume cleaned up by United Nuclear is about 3,100 tons. That represents less than 1 percent of the volume spilled, not including contaminated material, so we have had very little cleanup. The amount of radium in this spill equals something like 4 to 40 million maximum allowable body burdens. These are Mr. Weaver's low-level exposures.

The cleanup of less than 1 percent of this material means that these large numbers of maximum allowable body burdens of radioactive material and the other materials found in the spill are moving through the Rio Puerco system into Arizona, heading toward Lake Mead in the sediments of the Rio Puerco and the Little Colorado. We should not expect to find this material in the surface waters, because waters come from upstream, come from different sources. The contaminants have seeped into the shallow ground water system, what is called the Vadose Zone, and there they lie, and that is why we see these salts showing up at the surface, and why we see this contamination at depth.

It is also important to note that not only was there differential settling in the bedrock below the dam; there was differential settling in the material in the dam itself. The Jacobs-Wahler report, the Corps of Engineers report are sources for this information. What this indicates is that the dam was not built properly. I believe that the Corps of Engineers allegation that there was a lack of quality control during the construction of the dam is very much on point.

The cracks which are due to an unknown source during the 1977 period were the results of this differential settling, according to the Jacobs-Wahler report.

Given the spill and the causes of the spill as both design and construction failures and operational failures, what can be done to get this operation back on its feet, because the company is losing somewhere around $200,000 or more a day in yellow cake production. It is a severe limitation on their ability to turn a profit this year perhaps, so I would think that what we need to do is come up with a tailings management scheme which cannot fail.

The company has shown itself unable to build the way they were licensed, and unable to operate in the way they were licensed, so I think what that means is going below grade into the existing mine, and using a pit at the surface which cannot fail.

The company is currently licensed by the Environmental Improvement Division to dispose of about 700,000 tons of tailings per year in its mine. This is called backfilling. They are already approved to do this. I believe that this is the way they should be disposing of their tailings primarily, and that they should be encouraged or required to operate under this backfill approval.

Now there is insufficient volume in the mine to put all of the material back in. It expands as it is milled, so I believe that there are above-grade pits needed, or at-grade pits needed, and these can be at site or using existing mines in the area, but I believe that there are tailings management scenarios which will allow the company to get back into operation, and will allow New Mexicans to have uranium mining without having to risk their ground water.

One last point. When we talk about uranium being pulled out, we also have to understand that 85 percent of the radioactivity is left in tailings, 85 percent of the original radioactivity of the other, so the uranium represents very little of the radioactivity, and so when we are talking about the tailings, we are talking about removing most of the radioactivity.

I also, along with Mr. Lujan, like this concept of total milling. We can get some of the companies to put out molybdenum, for

example, but the radionuclides as yet do not have a market. I think if we look at the cost of this spill and cleanup, that we begin to see the economics of this total milling concept change.

I believe that I will end with that, unless there are any questions.

The CHAIRMAN. A good contribution to our hearings this morning as to the points you make. You have given us a lot of information here to consider. Mr. Lujan.

Mr. LUJAN. Thank you very much. I am pleased with your testimony because it goes along with my thinking as to what to do with the tailings. One thing about the economics. As far as the company is concerned, we are spending $300 million to move those abandoned mill tailings piles to someplace else. Certainly if we are going to be spending that kind of money, eventually we will in moving the present piles to someplace else when they become unacceptable, we could spend some of that money in cleaning them up. There is money to be made on what is left in there, but some of the properties, as you say, are not commercial.

Let me ask you just one question. On the backfilling question, in this particular mine, are there crevices or mined-out areas that you could logically put it back into, and the men still continue working in other areas?

Mr. ROBINSON. That is currently being done or had been done by United Nuclear. They need some of the stopes, as these are called, which are filled up with material, in order to improve the roof, and it increases efficiency as well as keeping the roof up.

One of the problems, though, is that this approval is only again for design approval. Just like for the dam there is no operational control. You will notice on the graphics of the dam a trench on the northern end of the dam. That is the trench the company has been using to backfill out of, and that is dangerously close to the underpinnings of the dam. This has been mentioned in several of the documents. While they were backfilling and it is a good concept, they were using the wrong location to backfill from, and this operational control is very important in terms of the design work, and these operational controls have been one of the main problems with the spill.

Mr. LUJAN. You say they are backfilling now? They bring out the tailings and let them dry out somewhat—I imagine, though I do not know; this is the first time I have heard of this—but let it dry out a little bit, and then cart it back into the open spaces in the mine?

Mr. ROBINSON. What I believe they do is they take the coarse solids from the tailings, wash those, and then slurry them into the mine itself. Just one thing occurs to me. I personally would not recommend your accepting Mr. Udall's jump in the pond. The tailings in the material had a pH of 1, very highly acidic, and that is why one should not jump in it. It is not safe material.

Mr. LUJAN. As you see, there are few enough of us on this side of the aisle. It is just a scheme on the part of the majority to stifle the opposition voice. That is what it is all about.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you, Mr. Robinson.

That concludes our hearings this morning.

[Whereupon, at 12:50 p.m., the subcommittee adjourned.]

A P P E N D I X

Additional Material Submitted for the Hearing Record

STATEMENT OF FRANK E. PAUL, VICE CHAIRMAN, NAVAJO TRIBAL COUNCIL BEFORE THE SUBCOMMITTEE ON ENERGY AND ENVIRONMENT, COMMITTEE ON INTERIOR AND INSULAR AFFAIRS, UNITED STATES HOUSE OF REPRESENTATIVES, WASHINGTON, D. C., OCTOBER 22, 1979

CHAIRMAN UDALL, MEMBERS OF THE SUBCOMMITTEE:

I WOULD LIKE TO EXPRESS MY GRATITUDE, AS WELL AS THE GRATITUDE OF THE NAVAJO NATION, BOTH FOR THE SUBCOMMITTEE TAKING THE TIME TO HOLD THIS IMPORTANT HEARING TODAY, AS WELL AS FOR THE OPPORTUNITY TO APPEAR BEFORE YOU TO DISCUSS THE UNITED NUCLEAR CORPORATION TAILINGS DAM BREAK AT CHURCH ROCK ON JULY 16, 1979.

LET ME INTRODUCE THE MEMBERS OF THE NAVAJO DELEGATION:

WITH ME TODAY IS THE CHAIRMAN OF THE INTERIM COMMITTEE ON RADIATION HAZARDS, MR. RAYMOND L. LANCER. MR. LANCER IS A RESIDENT AND COMMUNITY OFFICIAL FROM THE AFFECTED AREA, AS WELL AS THE DIRECTOR OF OUR DIVISION OF INTERNAL AFFAIRS AND THE CHAIRMAN OF THE NAVAJO BOARD OF ELECTION SUPERVISORS.

MR. HAROLD TSO IS THE FOUNDING EXECUTIVE DIRECTOR OF THE NAVAJO ENVIRONMENTAL PROTECTION COMMISSION, AS WELL AS A DISTINGUISHED NUCLEAR CHEMIST.

MR. RAYMOND TSO IS THE CHIEF PROSECUTOR OF THE NAVAJO NATION.

MS. HELEN GEORGE IS A MEMBER OF THE CHURCH ROCK ACTION COMMITTEE, WHICH WAS FORMED TO DEAL WITH THE UNC SPILL.

DR. THOMAS F. GESELL, RECENTLY OF THE STAFF OF THE PRESIDENT'S COMMISSION ON THREE MILE ISLAND, HAS BEEN RETAINED BY THE NAVAJO NATION AS A CONSULTANT ON THESE MATTERS.

MS. MAELY TRIMIAR IS A SPECIAL ASSISTANT IN THE OFFICE OF THE CHAIRMAN, AND MR. LARRY RUZOW IS AN ATTORNEY WITH OUR GENERAL COUNSEL'S OFFICE.

MR. JAMES T. NAKAI, JR., IS A NAVAJO TRIBAL COUNCIL DELEGATE WHO LIVES NEXT TO THE MILL SITE.

FOLLOWING THE CONCLUSION OF MY STATEMENT, I WILL ASK THE SUBCOMMITTEE FOR AN OPPORTUNITY FOR DR. GESELL, MR. HAROLD TSO AND MS. HELEN GEORGE TO MAKE BRIEF PRESENTATIONS TO THE SUBCOMMITTEE. ALL OF US ARE AVAILABLE TO RESPOND TO ANY QUESTIONS WHICH EITHER THE SUBCOMMITTEE OR ITS STAFF MAY HAVE.

LET BE BEGIN BY SAYING THAT IT IS INDEED A PLEASURE TO APPEAR BEFORE CONGRESSMAN UDALL AND NOT BE DISCUSSING THE NAVAJO-HOPI LAND DISPUTE. I AM SURE THAT IT IS AN EQUAL PLEASURE AND RELIEF FOR CONGRESSMAN UDALL.

MY STATEMENT TODAY BEGINS IN A SOMEWHAT UNUSUAL WAY BECAUSE I'M GOING TO BEGIN AT THE END AND SET FORTH THE NAVAJO NATION'S AGENDA FOR DEALING WITH THE UNC SPILL AND RELATED MATTERS.

WHAT WE WANT, WHAT WE THINK IS APPROPRIATE TO DEAL WITH THIS INCIDENT AND THE URANIUM INDUSTRY IN GENERAL IS THIS:

> FIRST, WE WANT THE LANDS AND WATER AND PEOPLE AND LIVESTOCK WHO HAVE BEEN CONTAMINATED BY THE UNC SPILL DECONTAMINATED. WE WANT OUR LAND, OUR PEOPLE, OUR LIVESTOCK AND OUR WAY OF

LIVE RESTORED AS NEARLY AS POSSIBLE AS IT WAS BEFORE UNC AND KERR-MCGEE AND THEIR FRIENDS CAME TO OUR LAND.

SECOND: WE WANT THE UNC MILL TO REMAIN CLOSED UNTIL SUCH TIME AS A SAFE AND SANE METHOD OF DEALING WITH URANIUM TAILINGS IS DEVISED, TESTED AND IMPLEMENTED.

THIRD: WE WANT NO MORE MILLS TO BE CONSTRUCTED ON OR NEAR THE NAVAJO NATION UNLESS SUCH MILLS ARE COMPLETELY SAFE AND HAVE COMPLETELY SAFE WASTE DISPOSAL SYSTEMS.

FOURTH: WE WANT A SINGLE AGENCY IN WHOM WE HAVE CONFIDENCE TO HAVE RESPONSIBILITY OVER ALL ASPECTS OF RADIATION HAZARDS ARISING FROM THE NUCLEAR INDUSTRY. THIS INCLUDES MINING, DEWATERING, MILLING, WASTE DISCHARGE AND CONTAINMENT, AS WELL AS TRANSPORT AND STORAGE OF URANIUM AND URANIUM RELATED RESOURCES.

FIFTH: WE WANT THE ESTABLISHMENT OF DEFINITE PLANS FOR DEALING WITH ACCIDENTS IN THE URANIUM INDUSTRY TO BE DEVELOPED, TO BE TESTED, AND TO BE READY TO BE IMPLEMENTED WHEN SUCH INCIDENTS OCCUR. WE ALSO WANT SUFFICIENT RESOURCES OF BOTH PEOPLE AND MATERIAL TO BE AVAILABLE TO IMPLEMENT SUCH EMERGENCY PLANS SO THAT OUR PEOPLE,

OUR LAND, AND OUR LIVESTOCK WILL NOT ONCE AGAIN BE ABUSED AS IT HAS BEEN SO OFTEN IN THE PAST.

HAVING SET FORTH WHAT WE WANT, LET ME GIVE YOU SOME BACKGROUND AS TO WHY WE WANT IT AND WHY IT IS NECESSARY FOR THE PROTECTION OF OUR PEOPLE, OUR LAND, AND OUR WAY OF LIFE.

FIRST, IT IS IMPORTANT TO KEEP IN MIND THAT THE UNC SPILL HAS THREATENED NOT ONLY THE CHURCH ROCK COMMUNITY -- THOUGH THAT WOULD BE BAD ENOUGH. THIS SPILL HAS SPREAD DOWN THE RIO PUERCO AND TO THE LITTLE COLORADO RIVER, THUS THREATENING NOT ONLY THE NAVAJO CHECKERBOARD COMMUNITIES, BUT ALSO THE COMMUNITIES OF GALLUP, CHAMBERS, SANDERS, HOLBROOK, WINSLOW, ETC.

SECOND, IT IS ALSO IMPORTANT TO KEEP IN MIND THAT THE UNC INCIDENT DOES NOT EXIST IN A VACUUM -- WE NAVAJOS HAVE ALREADY HAD TO CONTEND WITH ABANDONED MINES, MILLS AND TAILINGS AT CAMERON, THE RARE METALS SITE AT TUBA CITY, MEXICAN HAT, UTAH, SHIPROCK, SANOSTEE, MONUMENT VALLEY, AND STRETCHING ALL THE WAY SOUTH AND EAST TO ANACONDA AND GRANTS.

THIRD, WHILE WE APPRECIATE THIS COMMITTEE'S INTEREST AND CONCERN, WE DO NOTE THAT A SMALLER INCIDENT AT THREE MILE ISLAND COMMANDED A PRESIDENTIAL COMMISSION. YET TODAY'S HEARING REPRESENTS THE FIRST SERIOUS NATIONAL CONCERN FOR THIS INCIDENT, AND IT IS NOW OVER THREE MONTHS SINCE THE DAM FAILED.

FOURTH, WE NOTE THAT WHILE WE CALL FOR A SINGLE AGENCY TO DEAL WITH ALL URANIUM INDUSTRY ENVIRONMENTAL, HEALTH AND SAFETY ISSUES, WE ARE NOT ABANDONING OUR OWN RESPONSIBILITY TO SHARE IN THE PLANNING AND IMPLEMENTATION OF LAWS AND REGULATIONS DESIGNED TO PROTECT OUR OWN PEOPLE AND OUR OWN LAND.

THE SPECIAL RELATIONSHIP BETWEEN THE NAVAJO NATION AND THE UNITED STATES GOVERNMENT, EXEMPLIFIED IN OUR TREATIES OF 1850 AND 1868 CALL FOR US TO BE EQUAL PARTNERS WITH THE UNITED STATES IN SHAPING OUR DESTINY AND DETERMINING OUR FUTURE.

WHILE FOR NOW, THE UNITED STATES MUST BEAR THE GREATEST BURDEN AND RESPONSIBILITY IN POLICING THE URANIUM INDUSTRY, WE WANT TO SHARE IN THAT RESPONSIBILITY AND GRADUALLY ASSUME A GREATER ROLE BOTH IN DEVELOPING LAWS AND REGULATIONS WHICH WE TOO MUST OBEY IN OUR OWN DEVELOPMENT PLANS, AS WELL AS ENFORCING AND IMPLEMENTING THOSE LAWS AND REGULATIONS.

WE RECOGNIZE THAT ENERGY IS A PRIORITY MATTER ON THE AGENDA OF THIS COUNTRY. THIS IS PEACETIME, HOWEVER, AND THE VAST MAJORITY OF URANIUM PRODUCED FROM NAVAJO LANDS IS USED TO PRODUCE ELECTRICITY IN NUCLEAR POWER PLANS. THE NEEDS AND CONCERNS FOR SAFETY AND HEALTH AND ENVIRONMENTAL PROTECTION MUST THEREFORE BE EVALUATED AS THEY WOULD BE FOR COAL PRODUCTION OR OIL OR GAS, AND NOT AS IF ONE WERE TALKING ABOUT PRODUCING A MATERIAL FROM A UNIQUE SOURCE WHICH WAS CRITICAL TO THE DEFENSE OF THIS COUNTRY IN WAR.

ENERGY IS CRITICALLY IMPORTANT TO THE NAVAJO PEOPLE BECAUSE WE APPRECIATE HOW IMPORTANT IT IS IN OUR HOPES FOR A BETTER LIFE. OUR OWN PEOPLE HAVE SUFFERED FROM AN ENERGY SHORTAGE THAT LONG PREDATES THE ARAB OIL EMBARGO OR ANY OF THE OTHER EVENTS WHICH HAVE BROUGHT ENERGY SHORTFALLS TO THE CONSCIOUSNESS OF THE REST OF THESE AMERICAN PEOPLE.

WE ARE CONCERNED, HOWEVER, AS TO WHAT THE PRICE OF ENERGY DEVELOPMENT HAS BEEN, WHAT IT IS TODAY, AND WHAT IT WILL BE IN THE FUTURE. THE LONG HISTORY OF THIS COUNTRY HAS SHOWN THAT CORPORATIONS ENGAGED IN ENERGY DEVELOPMENT ARE ALMOST WITHOUT EXCEPTION UNRESPONSIVE TO THE NEEDS AND GOALS OF THE SOCIETY AS A WHOLE. CORPORATIONS ENGAGED IN ENERGY DEVELOPMENT HAVE SHOWN CONCERN FOR ONLY THE MONEY WHICH CAN BE MADE FROM ENERGY DEVELOPMENT.

FROM THE ABANDONED COAL MINES IN THE SOUTHEAST TO THE ABANDONED URANIUM MINES AND TAILINGS PILES AND PONDS WHICH LITTER THE WESTERN LANDSCAPE (INCLUDING THOSE TO WHICH I REFERRED EARLIER), TO THE ABANDONED SURFACE MINES THROUGHOUT THE COUNTRY, IT IS CLEAR THAT THE EXPLOITATIVE HISTORY AND NATURE OF ENERGY DEVELOPMENT MEANS THAT ENERGY DEVELOPERS WERE, ARE, AND WILL BE, IRRESPONSIBLE IN DEALING WITH THE COMMUNITIES AND LAND AND PEOPLE WHOM THEIR OPERATIONS IMPACT AND AFFECT.

WE DO RECOGNIZE, HOWEVER, THAT ENVIRONMENTAL PROTECTION COSTS MONEY; THAT THERE IS NO SUCH THING AS A "FREE LUNCH";

AND THAT OUR RESOURCES MUST BE COMPETITIVE IN BOTH THE WORLD ECONOMY, AS WELL AS THE ECONOMY OF THE UNITED STATES.

WE WANT TO BE PART OF THE DECISION-MAKING PROCESS, SINCE QUESTIONS OF WHETHER OUR RESOURCES WILL BE DEVELOPED AND AT WHAT COSTS WILL AFFECT THE FUTURE OF OUR PEOPLE AND OUR LAND. WE ARE UNWILLING TO SUBMIT TO EITHER THE TYRANNY OF EXPLOITATION BY ENERGY COMPANIES LIKE UNC WHOSE ONLY INTEREST IS THE ALMIGHTY DOLLAR, OR THE TYRANNY OF REGULATION BY FEDERAL AGENCIES LIKE THE OFFICE OF SURFACE MINING WHO ARE UNELECTED AND RESPONSIBLE TO NO ONE ELSE THAN THEIR OWN DESIRES TO EXPERIMENT WITH THE FUTURE OF AMERICA.

THE UNITED NUCLEAR CORPORATION TAILINGS DAM BREAK OF JULY 16, 1979, WAS NOT THE FIRST EXAMPLE OF CORPORATE IRRESPONSIBILITY IN THE NAVAJO NATION. I WOULD LIKE TO BRIEFLY SET FORTH FOR THE SUBCOMMITTEE THE HISTORY OF IRRESPONSIBILITY OF THE URANIUM INDUSTRY IN THE NAVAJO NATION.

AS EARLY AS THE 1940'S, THE NAVAJO URANIUM RESOURCE WAS BEING EXPLOITED, AS NAVAJOS RALLIED IN YET ANOTHER WAY TO AID AMERICA'S DEFENSE EFFORT. THROUGH THE OLD ATOMIC ENERGY COMMISSION, WORKING HAND AND HAND WITH OUR TRUSTEE, THE BUREAU OF INDIAN AFFAIRS, ABOUT 160 URANIUM MINES IN NINE AREAS OF THE NAVAJO NATION PRODUCED ORE FOR MILLING IN NEARBY URANIUM MILLS.

THE NAVAJO PEOPLE DIRECTLY INVOLVED WERE NEVER ADVISED AS TO THE POTENTIAL DANGERS IN THE MINING AND MILLING PROCESS

AS A RESULT, HUNDREDS IF NOT THOUSANDS OF NAVAJO URANIUM MINERS WERE CONTAMINATED FROM THE DUST AND AIR IN THE MINES COMMONLY CALLED "DOG HOLES" IN WHICH THEY WORKED. NAVAJO FAMILIES USED SCRAP ROCK FROM URANIUM MINES TO USE IN BUILDING THEIR HOMES. IN GENERAL, THE URANIUM MINING INDUSTRY WITHIN THE NAVAJO NATION PROCEEDED WITHOUT ANY REGARD FOR THE HEALTH AND SAFETY OF THE NAVAJO PEOPLE.

WHEN MINES WERE ABANDONED, THEY WERE SIMPLY LEFT AS THEY HAD BEEN ON THE LAST DAY OF MINING. THE MINES REMAINED A DANGER TO PEOPLE WHO LIVE IN THE AREA, PARTICULARLY LIVESTOCK AND CHILDREN.

URANIUM MINING, BOTH WITHIN THE NAVAJO NATION AND ADJACENT TO RIVERS, STREAMS AND WASHES WHICH FLOW THROUGH THE NAVAJO NATION (SUCH AS THE MILL AT DURANGO) REPEATEDLY POLLUTED WATER SOURCES WITHIN THE NAVAJO NATION.

THE MOST LASTING CONSEQUENCE OF THE URANIUM INDUSTRY IN THE NAVAJO NATION IS THE WASTE FROM THAT INDUSTRY WHICH IS SCATTERED IN TAILINGS PILES THROUGHOUT THE NAVAJO NATION. I USE THE WORD "SCATTERED" ADVISEDLY BECAUSE IN OUR DRY, SANDY, AND WINDY LAND LEAVING DANGEROUS WASTE PRODUCTS SO THAT THEY MAY BE BLOWN EVERYWHERE THE WINDS WILL TAKE THEM, WAS AND IS A THREAT TO THE HEALTH AND SAFETY OF THE GENERAL PUBLIC WHILE RECENTLY PASSED LEGISLATION WHEN IMPLEMENTED WILL REDUCE OR REMOVE THIS HAZARD, FOR OVER TWENTY YEARS OUR PEOPLE HAVE HAD TO LIVE WITH THE GHOSTLY REMINDER OF THE HAZARDS OF THE URANIUM INDUSTRY.

THROUGHOUT THIS ENTIRE PERIOD, THE NAVAJO NATION WAS TAKEN FOR GRANTED AS SOME KIND OF PROVING GROUND OR "NATIONAL SACRIFICE AREA" IN WHICH THE DEFENSE AND ENERGY NEEDS OF THE UNITED STATES WOULD BE GIVEN PRIORITY, BUT THE HEALTH AND SAFETY AND LONG TERM ECONOMIC NEEDS OF THE NAVAJO PEOPLE WERE IGNORED.

WHEN ONE REVIEWS THE DEBATE NOW RAGING IN NEW MEXICO OVER THE ESTABLISHMENT OF A NUCLEAR WASTE DUMP IN SOUTHEAST NEW MEXICO AND THE TRITIUM CONTROVERSY IN ARIZONA AND NUCLEAR DISPOSAL SITE QUESTIONS THROUGHOUT THE COUNTRY, ONE CAN APPRECIATE THAT SUCH QUESTIONS ARE NOW GIVEN GREAT CONSIDERATION BOTH BY THE GOVERNMENT AND THE CITIZENRY.

WHEN THE URANIUM INDUSTRY DECIDED TO TURN OUR LANDS INTO A URANIUM WASTE DUMP AND WHEN UNC DECIDED TO TRY OUT A NEW METHOD FOR DISPOSING OF TAILINGS LAST JULY 16TH, HOWEVER, WE WERE NOT CONSULTED, BUT WE ARE ASKED TO LIVE WITH THE CONSEQUENCES.

WHAT IS DISTURBING TO ME AND WHAT IS DISTURBING TO THE COMMUNITIES OF THE NAVAJO NATION WHICH ARE PRESENTLY DEALING WITH THE URANIUM INDUSTRY, IS THAT OUR COUNTRY KNEW BETTER. RESEARCH INTO THE PROBLEMS OF URANIUM AND RADIATION HAD BEEN GOING ON FOR MANY, MANY YEARS. THE PUBLIC POLICY OF THE ATOMIC ENERGY COMMISSION, HOWEVER, WAS THAT URANIUM WAS SAFE, AND NEITHER THE FEDERAL GOVERNMENT, THE STATE GOVERNMENTS, NOR THE URANIUM COMPANIES DID ENOUGH TO MAKE SURE THE MINES AND

MILLS WERE IN FACT SAFE.

AS A RESULT, THERE WERE INADEQUATE MONITORING PROGRAMS. MILLS WERE SITED IN LOCATIONS WHICH WERE AS FOOLISH AS THAT OF UNITED NUCLEAR CORPORATION -- ON OR ADJACENT TO MAJOR WATER RESOURCES (GROUND AND SURFACE) AND MAJOR DRAINAGE AREAS. ALL THE ACCUMULATED KNOWLEDGE OF THE SCIENTISTS OF THIS COUNTRY WHICH WOULD HAVE BEEN USED TO PROTECT THE NAVAJO PEOPLE AND THE NAVAJO LAND BROUGHT NO BENEFIT, NO PROTECTION, AND NO INSURANCE THAT THE URANIUM INDUSTRY IN THE NAVAJO NATION WAS SAFE.

NOW WE ARE TOLD THAT SOME 60 URANIUM MINES MAY BE OPERATING WITHIN THE NEXT TEN YEARS ON OR NEAR NAVAJO LANDS. THIS WILL MEAN ANOTHER TEN URANIUM MILLS WITH ALL THE PROBLEMS THAT MILLING OF URANIUM HAS PRODUCED OVER THE YEARS.

TIME DOES NOT PERMIT A FULL DISCUSSION OF ALL THE POSSIBLE ADVERSE CONSEQUENCES ARISING FROM THE UNC SPILL AND ASSOCIATED URANIUM MINING AND MILLING. I WOULD LIKE TO MENTION, HOWEVER, THE CONTAMINATION OF AQUIFERS FROM MINING ACTIVITIES, THE DANGER OF CONTAMINATION OF AQUIFERS FROM IN SITU LEACHING OF URANIUM, AS WELL AS THE WASTE OF WATER FROM THE DEWATERING PROCESS.

(AS A SIDELIGHT, IT IS COMMON PRACTICE IN THE URANIUM MINING INDUSTRY TO MIX WATER FROM THE AQUIFER WITH WASTE WATER FROM MINE OPERATIONS AND THUS, LET THIS, THE MOST PRECIOUS RESOURCE IN THE SOUTHWEST, BE TREATED LIKE GARBAGE.)

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WE ARE ALSO CONCERNED WITH THE POSSIBLE CONTAMINATION OF BOTH SURFACE WATER AND GROUND WATER SOURCES FROM URANIUM AND URANIUM WASTES IMPROPERLY STORED.

WHILE SOME OF THE URANIUM COMPANIES HAVE CLEVERLY SITED THEIR MILLS ON PRIVATE OR STATE ENCLAVES WITHIN NAVAJO INDIAN COUNTRY, THE PROBLEM CAUSED BY THE URANIUM INDUSTRY AFFECTS OUR PEOPLE, OUR LAND, AND OUR COMMUNITIES.

IT DID THE PEOPLE OF THE CHURCH ROCK COMMUNITY NO GOOD TO KNOW THAT THE UNITED NUCLEAR MILL, WHOSE TAILINGS DAM FAILED ON JULY 16, 1979, WAS ACTUALLY LOCATED ON STATE LAND. THE LIVESTOCK WHICH MAY BE CONTAMINATED, THE PEOPLE WHOSE HEALTH WAS AND IS ENDANGERED CAN TAKE NO COMFORT FROM THE FACT THAT THE DAM WAS NOT ON NAVAJO LAND. OUR PEOPLE HAD AND WILL CONTINUE TO HAVE TO SUFFER THE CONSEQUENCES OF THE MISDEEDS OF THE URANIUM INDUSTRY, AND IT IS THEREFORE ONLY APPROPRIATE THAT WE BE PROTECTED FROM THIS INDUSTRY.

TURNING TO THE UNC SPILL IN PARTICULAR, WE ARE CONCERNED THAT THE PRESENT ARRAY OF FEDERAL AND STATE AGENCIES ALL OF WHICH HAVE SOME FINGER IN THE PIE OF REGULATION OF THE URANIUM INDUSTRY, HAVE SHOWN THEMSELVES INCOMPETENT AND UNABLE TO DO THE JOB OF PROTECTING THE PEOPLE FROM THE INDUSTR

SOMEHOW, UNITED NUCLEAR CORPORATION WAS PERMITTED TO LOCATE A TAILINGS POND AND DAM ON AN UNSTABLE GEOLOGIC FORMATION. SOMEHOW, UNC WAS ALLOWED TO DESIGN AN UNSAFE TAILINGS DAM NOT IN CONFORMITY TO ITS OWN DESIGN CRITERIA. SOMEHOW,

UNC WAS PERMITTED TO INADEQUATELY DEAL WITH WARNING CRACKS THAT HAD APPEARED OVER TWO YEARS PRIOR TO THE DATE THE DAM FAILED. SOMEHOW, UNC WAS PERMITTED TO CONTINUE A TEMPORARY DAM FOR SIX MONTHS BEYOND ITS DESIGN LIFE. SOMEHOW, UNC WAS PERMITTED TO HAVE A TAILINGS DAM WITHOUT EITHER AN ADEQUATE CONTINGENCY PLAN OR SUFFICIENT MEN AND MATERIAL IN PLACE TO DEAL WITH A SPILL. SOMEHOW, UNC WAS PERMITTED TO DEAL WITH THE SPILL BY DOING ALMOST NOTHING.

SOMEHOW THE STATE OF NEW MEXICO DID NOTHING TO REMEDY THE OMISSIONS AND MISDEEDS OF UNC. NOT ONLY HAS UNC CONTAMINATED OUR LAND AND ENDANGERED OUR PEOPLE AND LIVESTOCK, BUT THEY HAVE BEEN DISRESPECTFUL OF OUR LAWS AND POLICIES. WHEN UNC WANTED A ROAD TO AN ALLOTTMENT, INSTEAD OF COMING TO US AND THE BIA FOR CONCURRENCE, THEY JUST BULLDOZED A ROAD. WHEN WE TOLD THEM TO GIVE EMPLOYMENT PREFERENCE TO NAVAJOS AT THEIR MILL BECAUSE IT WAS IN NAVAJO INDIAN COUNTRY, THEY REFUSED, EVEN IN LIGHT OF A DECISION OF THE COURT OF APPEALS OF THE TENTH CIRCUIT, UPHOLDING INDIAN PREFERENCE. WHEN OUR TRIBAL CHAIRMAN TRIED TO VISIT THE SITE OF THE DAM BREAK, HE WAS SENT AWAY BY UNC GUARDS.

LET ME SIMPLY CONCLUDE BY STATING THAT IT IS OUR POSITION THAT ALL ENVIRONMENTAL, HEALTH AND SAFETY RELATED ASPECTS OF THE URANIUM INDUSTRY -- AT LEAST WITHIN OUR LANDS AND WHICH AFFECT OUR PEOPLE -- OUGHT TO BE DEALT WITH BY A SINGLE AGENCY.

WHILE PARTS OF THE JURISDICTIONAL TANGLE ARE PRESENTLY BEFORE THE COURTS, THIS IS WHAT IT LOOKS LIKE AT THE PRESENT TIME: MINE SAFETY IS HANDLED BY MSHA AND THE STATE MINE INSPECTOR.

DISCHARGE OF WATERS FROM DEWATERING OPEATIONS IS SUBJEC TO AN EPA NPDES PERMIT.

MILLS ON NAVAJO LAND NEED AN NRC PERMIT.

MILLS OFF NAVAJO LAND NEED AN NMEID PERMIT.

DAMS NEED A STATE ENGINEER'S PERMIT.

TAILINGS PONDS NEED AN NRC OR A NMEID PERMIT.

PONDS THAT CAN AFFECT A PUBLIC WATER SOURCE ARE REGULATED BY EPA.

AIRBORNE RADIATION IS REGULATED BY BOTH EPA AND NMEID.

THE STATE ENGINEER HAS SOME AUTHORITY OVER DEWATERING ACTIVITY, BUT APPARENTLY NOT ENOUGH TO PREVENT HARM TO EXISTING WELLS.

ADD TO ALL THIS THE CHECKERBOARD LAND PATTERN IN MUCH OF THE EASTERN NAVAJO AGENCY AND OUR OWN NAVAJO REGULATORY PROGRAM AND YOU CAN SEE WHY THERE ARE LOOPHOLES AND OVERLAPS AND JUST "WHO KNOWS"?

TO SEPARATE RESPONSIBILITY FOR THE MANY FACETS OF THE URANIUM INDUSTRY WHICH CAN PRODUCE SERIOUS HAZARDS TO MAN AND HIS ENVIRONMENT, HAS PROVED A BAD IDEA. THIS FRAGMENTATION OF AUTHORITY AND RESPONSIBILITY HAS CREATED A SITUATION IN WHICH IRRESPONSIBLE CORPORATIONS, LIKE UNC, ARE ABLE TO

DO NOTHING OR DO LITTLE AND GET AWAY WITH IT.

IT IS TIME THAT THE CONGRESS EXERCISED ITS AUTHORITY AND RESPONSIBILITY AND FULFILL THE OBLIGATIONS OF THE UNITED STATES' TREATY WITH THE NAVAJOS UNDER WHICH WE WERE PROMISED THAT THE UNITED STATES WOULD REMOVE BAD MEN AMONG THE WHITES WHO CAME TO OUR LANDS AND DID US AND OUR PROPERTY HARM, AS WELL AS COMPENSATE US FOR THE HARM, AND ALSO MAKE THE URANIUM INDUSTRY SAFE. ONLY IF THE URANIUM INDUSTRY IS SAFE WILL THE NAVAJO NATION BE WILLING TO SUPPORT THE ENERGY DEVELOPMENT NEEDED IF AMERICA IS TO ACHIEVE A SAFE ENERGY INDEPENDENCE.

I AGAIN THANK THE COMMITTEE FOR THIS OPPORTUNITY AND ASK THAT DR. THOMAS GESELL AND MR. TSO AND MS. GEORGE BE GIVEN AN OPPORTUNITY TO MAKE BRIEF STATEMENTS.

ATTACHMENT 1

THE NAVAJO NATION
WINDOW ROCK, NAVAJO NATION (ARIZONA) 86515

July 31, 1975

PETER MACDONALD
CHAIRMAN, NAVAJO TRIBAL COUNCIL

WILSON C. SKEET
VICE CHAIRMAN, NAVAJO TRIBAL COUNCIL

Environmental Improvement Agency
Radiation Protection Section
State of New Mexico
Post Office Box 2348
Santa Fe, New Mexico 87503

RECEIVED
AUG 4 1975
OCCUPATIONAL HEALTH AND RADIATION DIVISION

ATTENTION: Mr. Alphonso A. Topp Jr., Environmental Scientist III

Dear Mr. Topp :

Thank you for your kind consideration in extending me an invitation to one hour briefing by a United Nuclear Corporation representative. I understand the briefing will concern itself with an application for Radioactive Material License for a proposed Uranium mill at Church Rock, McKinley County, New Mexico. Further, I understand the briefing will be held on August 25, 1975 at a time and location to be determined by yourself after sufficient affirmative responses have been obtained. Please consider this letter my affirmative response.

May I reiterate one comment from our telephone conversation yesterday? The Navajo Nation desires meetings which deal with Navajo resources and Navajo impacts to be held at or near the site of the proposed project. I realize that the Agency may be financially limited in its activities, however, the Navajo Nation would like to see "...the whites of the Santa Fe bureaucrats' eyes..." as well as those of the company. The PR could not do the Agency any harm.

Again, thank you for your consideration.

Shown it & discussed w/ ELK Stay Aug

Sincerely,

THE NAVAJO NATION

Harold W. Tso

Harold W. Tso, Executive Director
Environmental Protection Commission

HWTso/gj

Attachment

xc: Ed Plummer, Superintendent, Eastern Navajo Agency
Ernest C. Bocenti, President, Eastern Navajo Council

xc: Don Meyer, Chief, Environmental Health, Indian Health Service
Edward T. Begay, Councilman, Church Rock Chapter
Fred Young, Environmental Protection Commission Chairman
Aaron Bond, Director, NMEIA
Roger DAvis, Director, Recreational Resources

ATTACHMENT 2

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF INDIAN AFFAIRS
DIVISION OF FACILITIES ENGINEERING
FEDERAL OFFICE BLDG. & U.S. COURTHOUSE
P. O. BOX 1248
ALBUQUERQUE, NEW MEXICO 87103

JUL 27 1976

IN REPLY REFER TO

JUL 23 1976

Alphonso A. Topp Jr.
Environmental Improvement Agency
State of New Mexico
P. O. Box 2348
Santa Fe, NM 87503

Dear Mr. Topp:

We have had the opportunity to review the applications for license renewal for the Anaconda and Kerr-McGee Uranium Mills and the revised United Nuclear Corporation plans for Church Rock. Thank you for notifying us of their availability.

We have focused our review upon possible impacts on the nearby Indian land and people. Our comments are as follows:

1. Kerr McGee Uranium Mill at Ambrosia Lake

   a. Page 2 mentions 5.9% unemployment in Valencia County. Since the source of the information was not found, we were unable to check into accuracy. We feel, however, that the statement is misleading at best since our information indicates unemployment among Indians in the area is considerably higher. Our purpose in pointing this out is that if unchallenged, such statements of relatively low unemployment could lead to a relaxation of efforts to provide employment opportunities for Indians.

   b. The section on Seismology (page 14) should probably be updated to mention the small earthquake which occurred on January 4, 1976 northwest of the site (the US Geological Survey Earthquake Information Service in Denver has the data).

   c. Pages 25 and 26 discusses air quality monitoring techniques. We question the usefulness of the precaution if the samples are taken at six month

intervals as stated. We recommend that the air be sampled at least monthly and during any periods of equipment malfunction or prolonged air inversions.

d. The document mentions monitoring 40 seepage wells around the tailings pond. We did not note any discussion of the reporting procedures. We would appreciate learning where these reports will be available for inspection in case any questions arise.

e. The document seems silent on the disposal of domestic liquid and solid wastes, the supply of domestic and process water, and the flow of traffic to and from the mill. Since portions of the Navajo Reservation appear to adjoin the Kerr McGee property, the effect of these factors on land use in the area concerns us.

f. We were impressed by the thoroughness of the discussion of radiological health. Their concern for the health of the worker is commendable.

2. The Anaconda Mill near Bluewater

a. Since this mill is somewhat remote from the Reservation, our review was more cursory than for the Kerr McGee document.

b. Pages 30 and 31 discuss air sampling noting that air samples are taken "periodically" and if asked they will initiate reporting requirements of 10 CFR 40.65. We would recommend that they be more specific.

3. The United Nuclear Mill at Church Rock

a. Since this application was accompanied by a complete environmental study, many of our questions were answered more completely than by the other two reports. However, as with the Kerr McGee document, we feel the relatively low employment figures given for McKinley County are misleading (93.8% page 2-10). On the contrary, high unemployment among Indian people is almost endemic and encouragement of employment opportunity is needed.

b. The comment on seismology given earlier holds for the United Nuclear report as well.

c. We found no discussion of monitoring seepage from the tailings reservoir. We would be interested in the extent and reporting procedures of this program.

d. While the report mentions dewatering the mine at a rate of 1400 gpm, it seemed silent on the effect on ground water, particularly in the Morrison Formation. We are quite interested in their drawdown measurements in nearby monitoring wells so that storage and transmissibility may be computed.

e. This brings up a problem we had throughout the document, i.e. reporting procedures were not described. Will the data obtained from the various monitoring programs be collected and made accessible in one location, and if so how often and in what form?

While our comments indicated some questions which bother us, we were pleased to review the material and gratified that it was so complete. The Environmental Improvement Agency is to be commended for having these companies publish such expansive environmental data. By making this information available to the public, the EIA is doing much to protect the environment and health of the people of New Mexico. Thank you.

Sincerely yours,

Acting
Chief, Division of Facilities
Engineering

MAR 2 6 1976

ATTACHMENT 3

Mr. Russell F. Rhoades, Chief
Occupational Health and Radiation
Protection Division
Environmental Improvement Agency
State of New Mexico
P.O. Box 2348
Santa Fe, New Mexico 87503

Dear Mr. Rhoades:

The staff review of the radiological health and safety aspects of the application and environmental statements by the United Nuclear Corporation for licensure to conduct uranium milling operations at Church Rock, New Mexico, has been completed.

The staff comments are attached. The material you submitted for review is being returned under separate cover.

Sincerely,

G. Wayne Kerr, Chief
Agreements and Exports Branch
Division of Fuel Cycle and
Material Safety

Enclosure:
As stated

Eugene M. Pleasant

MAR 15 1976

REVIEW OF UNITED NUCLEAR CORPORATION,
CHURCH ROCK MILL APPLICATION FOR
THE STATE OF NEW MEXICO

The application for Radioactive material license and the applicant's environmental report by United Nuclear Corporation have been reviewed for radiological health and safety omissions.

The application for radioactive material license indicates that the methods, frequency and standards for calibration of instruments and analytical techniques are described in the environmental report. While a general commitment to perform calibrations for survey instruments and analytical methods is stated, the information submitted is not specific enough to judge the adequacy of the program. Additional information about the calibration procedures for the determination of sensitivities of analytical instruments and survey instruments should be provided along with the confidence level of the calibration method. If commercial services are to be used for determination of radiation or chemical quantities, the applicant should indicate whether any procedures for submission of blind samples or other checks of adequacy are planned.

In the United Nuclear Corporation's environmental report, one method briefly discussed for tailings disposal was return of tailings sands to the mine as backfill. This alternative of tailings disposal was not discussed in detail.

The environmental report should address the hydrogeological aspects of the disposal of tailings in the mine, particularly after the mine is

CERTIFIED TRUE COPY
Eugene M. Pleasant

MAR 15 1976

closed. The possible contamination of a water table by leaching of radiological and chemical agents from the tailings should be discussed if such potential exists.

ATTACHMENT 4

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VI
1600 PATTERSON
DALLAS, TEXAS 75201

August 19, 1976

Dear Russ:

Sorry to be a little tardy in responding to your request to provide NMEIA a review of United Nuclear Corporation's application for license of their Churchrock Uranium Mill.

As you are aware, EPA is not officially required to review such applications to the State. However as I discussed with you, I am pleased, on a personal basis, to review such material that you send me and give you my personal opinions on the quality and adequacy of the information supplied.

This United Nuclear application is very thorough and well done. They have provided answers to all of the anticipated environmental problems. If I have any concern, it is that United Nuclear carry out their scheduled monitoring of the surface water runoff into the unnamed arroyo very carefully since 99% of the radioactive wastes may end up there. Observations should be made and samples taken after one of the infrequent cloud bursts that occur in the area to be sure no unexpected problems occur when there is a great deal of water flowing. This water must be maintained suitable for consumption by livestock and wild animals.

The sampling of some of the deep wells in the area should be carried out regularly to be sure seepage does not occur causing their contamination. This water may not be required immediately for use by people in the area but it could be needed in the not too distant future.

The tailings pond and potential tailings piles problems have been addressed, but these areas will also need to be monitored carefully during the life of the project to be sure radiation levels remain as low as expected. Air will need to be sampled downwind of tailings piles to be sure radiation levels do not become excessive. Estimates which show radiation levels to exposed people will remain below NMEIA standards must be maintained. Since 99.8% of the solid material taken from the mine ends up as waste, it's handling as back fill for the mine

and to serve as the dam and build up at the tailings pond is important. The radiation in these areas and around any temporary tailings or ore piles will need to be checked regularly, also. Because of the nature of the liquid wastes in the pond, seepage from it, if any, should also be determined over a period of time.

Fortunately, this is a low population area, about 1,000 people within a five-mile radius, and so exposure of the general populace to radiation should be fairly easily controlled. United Nuclear's planned monitoring for radiation exposure of their work force appears adequate.

The United Nuclear personnel designated to handle the project look very qualified to do a good job. The organization of this staff looks good. The training of personnel which they indicate will be carried out needs to be a continuous process - new personnel need initial training, old personnel can be helped with refresher courses.

I was pleased to see that United Nuclear is planning to use an archeological team to work with them as the excavations are started for the plant. This will insure that archeological findings are recorded and preserved.

Since there are a number of other mines and mills within a 50 mile radius of this mill site, overall complimentary effects will need to be observed by NMELA to be sure nothing untoward is happening.

In summary, I think United Nuclear has supplied you with a very adequate report and if they follow the procedures they outline, their application for this mill should be granted. I would remind you again that this is not an official EPA review and opinion, but my own which I hope may be of some help to you.

I am returning the application documents under separate cover to Pat Donahoe as he requested.

Sincerely yours,

Henry J. Kerp
Senior Science Advisor

cc: Pat Donahoe

STATEMENT OF DR. THOMAS F. GESELL, CONSULTANT TO THE NAVAJO NATION, BEFORE THE SUBCOMMITTEE ON ENERGY AND ENVIRONMENT, COMMITTEE ON INTERIOR AND INSULAR AFFAIRS, UNITED STATES HOUSE OF REPRESENTATIVES, WASHINGTON, D.C., OCTOBER 22, 1979.

Thank you gentlemen for permitting me to testify. I have a Ph.D. in Physics with emphasis in Health Physics and am an Associate Professor of Health Physics at the University of Texas School of Public Health. Most of my research has dealt with man's alteration of the natural radiation environment. Most recently I served on the staff of the President's Commission on Three Mile Island. I was asked by the Navajo Nation to examine the documents which they had collected concerning the Church Rock Dam break and to present some of my findings to you. Previous testimony has provided an overview of the situation; I will focus on a few important details.

The Navajo have been told that part of the reason for the slowness of the clean-up is the lack of a "textbook" for handling such spills. This lack of a "textbook" or criteria has been attributed to the uniqueness of the event. While this spill is indeed the largest of its kind, at least fifteen previous accidential releases of tailings slurry have occurred in the industry from 1959 to 1977. Seven of these releases involved dam failures, six involved pipeline failures and two resulted from flooding. In at least ten of the events, tailings slurry reached a watercourse. If indeed there is no "textbook" on how to handle a tailings slurry spill, it may be time to write one.

COMPARISON WITH PLUTONIUM-239

I will now turn to a more technical subject. An essential issue here is potential health effects, both to those now living in the vicinity of the spill and to future generations. I do not have to elaborate the uncertainties surrounding the health effects of low level radiation to this committee. Over the past months the National Academy of Sciences, National Research Council, Beir Committee Sci-

entists have been continually meeting in order to reconcile serious disagreements centering on the complex problem of low level radiation effects in humans in order to issue their now overdue report.

Rather than estimate doses and health effects associated with this spill, I will attempt to make an analogy with a different situation. When plutonium was found in the soils in the vicinity of the Rocky Flats Plant in Colorado, appeal was made to the state of Colorado and the Federal Government for guidance. The state of Colorado issued an interim standard of two disintegrations perminute of plutonium per gram of soil for unrestricted use. This is the equivalent of slightly less than one picocurie per gram.

When uranium ore is milled by the acid leach process, thorium-230 is preferentially mobilized and becomes the greatest radioactive constitutent of the mill tailings solution. Thorium-230 is similar in its chemical and radiological properties to plutonium-239. They are both heavy metals of low solubility. They both emit alpha particles of similar energy. They have half-lives of comparable magnitude, and they are both bone seekers. Those similarities are reflected in the occupational standards for their control promulgated by State and Federal agencies. For inhalation, the standards for plutonium-239 and thorium-230 are essentially identical, with thorium-230 being more restricted in the "insoluble" configuration. For ingestion, the standard for thorium is more restrictive than that for plutonium in the "soluble" configuration and approximately equal in the"insoluble" configuration. Recent recommendations of the International Commission on Radiological Protection have left the standards for inhalation of both thorium-230 and plutonium-239 essentially unchanged. For ingestion of slightly soluble materials, however, the standards for both have been reduced by a factor of slightly greater than five. Thus, based on the standards for control, thorium-230 is at least as hazardous as

plutonium-239. Thorium-230 should be controlled in relation to its hazard potential and not dismissed lightly because it is a "natural" radionuclide.

Even though thorium and plutonium present an essentially equivalent hazard potential, there are compelling reasons for not applying the Colorado standard for plutonium of 0.9 picocuries per gram to this situation. The Colorado standard is for land on which housing is to be built. No housing is possible in the Arroyo or the Rio Puerco. he natural level of plutonium-239 is essentially zero while thorium 230 exists at an average concentration of 1 picocurie per gram in ordinary soils and may exhibit considerable variation. Nevertheless, thorium-230 should be treated with extreme caution.

EXPOSURE PATHWAYS

Another topic I would like to discuss is the pathways by which the released radioactivity may come in contact with humans. Thorium-230, in order to cause human health effects, must enter the body. This will occur primarily by ingestion and inhalation. I have examined the pathway analyses performed by a consultant to the mill operator and by the Nuclear Regulatory Commission. Although mutton is a staple of the Navajo diet, the consultant's analysis did not include the water-sheep-man pathway. The NRC analysis was more complete, but did not include direct contact with the sediments by children who play or herd animals in the water course. Both analyses did involve conservative assumptions, however, in keeping with good health physics practice.

For ingested thorium, the magnitude of the hazard is strongly dependent upon the fraction of the thorium which is absorbed by the digestive system of both livestock and man. This fraction is widely assumed to be one or two parts in 10,000, but the assumption is not based on a great deal of experimental evidence. Because of the uncertainty in this factor, as well as others, one should interpret the dose estimates cautiously.

ENVIRONMENTAL DATA

A substantial amount of environmental data have been gathered in connection with this spill. The data do not hold up well under critical analysis. Consider the results of the external gamma ray measurements provided by the mill operator to the Navajo. The background measured after the spill in the Gallup area is reported as 11-12 microroentgens per hour. On the same page, the average background in Gallup is stated to be 189,000 microroentgens per year, which is equivalent to 21 microroentgens per hour. While the spill would not necessarily be expected to increase the background, it would certainly not be expected to reduce it by a factor of two.

The radionuclide data are similarly inconsistent. For example, one month after the spill the mill operator took a sample of surface water in the Rio Puerco near Gallup and reported a concentration of 2.8 picocuries per liter of thorium-230. On the same day, the state of New Mexico took a sample near Gallup and obtained a concentration of 500 picocuries per liter. For the period of July 19, 1979 to August 17, 1979, the largest value of thorium-230 in water downstream reported by the mill operator was 30.3 picocuries per liter. This was the highest of 35 samples taken at seven locations at five separate times. The state of New Mexico Environmental Improvement Division on the other hand obtained values ranging from 200 to 2,600 picocuries per liter. Either of these sets of data could be in error, and there is even a possibility that the levels could fluctuate that much. Nevertheless, this degree of variation in the data suggests that the environmental situation is not yet fully understood.

GROUND WATER

As a result of the spill, additional radioactivity may enter the groundwater and contaminated wells in the vicinity of the wash and the Rio Puerco. The extent of this contamination is impossible to predict and may take many years to occur.

Prompt clean up of the spill materials would have reduced the chance that groundwater will become contaminated. Water resources in this area are already high in radioactivity due to both natural and man-made contributions. Failures to perform a proper cleanup will only make the groundwater problem worse. In any case it is important that groundwater sources near the watercourse be monitored for future contamination.

COMPARISON WITH THREE MILE ISLAND

This spill may be compared with the much publicized accident at Three Mile Island. At Three Mile Island, the radiation doses to the surrounding population were essentially stopped two weeks after the accident. The radioactive gasses are dispersed or decayed. No further risk is entailed. The total average dose to the population was less than 1 millirem. Nothing can be done to reduce the radiological impact of Three Mile Island. The tailings spill on Navajo land is quite different. The radioactivity is in the form of heavy metals with extremely long half lives. This radioactivity does not disperse or decay rapidly. The population in the area will continue to receive radiation dose to some degree for many years. In this case, however, something can be done. Radiation dose to the Navajo people and its associated risk will be reduced in proportion to the amount of radioactivity that is cleaned up. Things can and should be done to reduce the risk to the Navajo people.

PRESUMPTION OF NO PROBLEM

Documents prepared by the mill operator and its consultants occasionally reveal a presumptive attitude which I believe is unwarranted. I will cite two examples:

1) In a letter to the Tribal Council dated August 17, 1979 the mill operator states that they "...would like to make arrangements with the Navajo people

in the area to sample any wells to assure that no hazard to the public health exists." Should water be tested by someone who is going to assure that no hazard exists? Would it not be better to test to determine if a hazard exists?

2) In a report to the mill operator, its consultant states that "water sample analyses will confirm minimal contribution and is expected to confirm that this path does not provide a significant dose to man." I can appreciate that this wording is reassuring to the mill operator but it can hardly be reassuring to the Navajo.

WHOLE BODY COUNTING

Five children and one adult were taken to Los Alamos Scientific Laboratory for whole body counting. The Navajo were assured that there was no contamination of the children. Such a statement, while seemingly reassuring cannot be strictly accurate. Thorium-230, the principal alpha emitting material associated with the spill is very difficult to detect in small amounts. No lower limit of detection was stated for the tests. An Indian Health Service Physician, Dr. Jorg Winterer requested the data from Los Alamos Scientific Laboratory for independent evaluation. He was told that the data would be difficult to produce and that in any case Dr. Winterer would not be able to interpret the data. Full disclosure of any data which may relate to the health of the Navajo children would seem to be in order.

REGULATORY AUTHORITY

The poor siting of the tailings dam and its subsequent failure suggest that the state of New Mexico may not have the resources to adequately protect the health of the Navajo people where it is impacted by uranium mining and milling. After the accident it responded responsibly by suspending the operation of the mill and requiring a clean up. It has been clear, however, that the Federal Government, through the Nuclear Regulatory Commission, has provided the bulk of the technical

support essential to the clean up of the spill. Since the Federal Government is responsible for Indian Lands, and since the NRC has more resources than the State Government, it may be appropriate to allow the NRC to regulate Uranium mining and milling operations that can be expected to have an impact on Indian Lands.

CLEAN UP

The Navajo realize that the spill was an accident, and they also know that it is impossible to clean up entirely. I have reviewed a draft of the clean up criteria being prepared by the Nuclear Regulatory Commission. I believe that they are at reasonable levels. The radiation levels that will be experienced by the Navajo after clean up should be small except for the potential but unknown contaminaton of groundwater. Furthermore, the level of thorium-230 permitted to remain in the sediments, 30 picocuries per gram is 15 to 30 times the normal soil background levels; the mill operator is clearly not being asked to remove every trace of the spill. I also urge that the spill be cleaned up in a timely fashion for three important reasons.

1) to reduce the radiation exposure that is presently occurring to the Navajo because material is present at levels above the cleanup criteria.

2) to allow the Navajo to return to the lifestyle which they enjoyed prior to the spill as soon as possible.

3) to reduce the infiltration of radioactivity into groundwater.

In conclusion, when responses to this and possible future spills are being considered, the following should be kept in mind;

1) Thorium-230 is the principal radionuclide released, but the others must also be considered.

2) The hazard potential of thorium-230 is as great if not greater than plutonium-239.

3) All pathways for exposure must be considered in making a valid assessment of the health consequences of a spill.

4) More information should be obtained on the behavior of thorium-230 in animals and man.

STATEMENT OF HAROLD W. TSO, DIRECTOR
NAVAJO TRIBAL ENVIRONMENTAL PROTECTION COMMISSION

BEFORE THE SUBCOMMITTEE ON ENERGY AND ENVIRONMENT
OF THE COMMITTEE ON INTERIOR AND INSULAR AFFAIRS

UNITED STATES HOUSE OF REPRESENTATIVES
WASHINGTON, D.C.

October 22, 1979

Chairman Udall, Members of the Subcommittee:

My name is Harold W. Tso. I am Executive Director to the Environmental Protection Commission of the Navajo Tribe.

Staff to the Environmental Protection Commission have been involved with activities related to uranium development. These activities include identifying and monitoring areas with abandoned mines or millsites, collection of environmental samples for laboratory analyses, review of proposed mining and reclamation plans, examination of environmental reports, assessment or impact statements and investigating complaints submitted by local Navajos.

As a result of these activities, it has become clear to us that the Navajo Tribe had its share of problems with uranium extraction and purification. These problems are explained below.

1. Siting of the mills and waste areas.

   Our examination of these areas indicate that most of the millsites were located adjacent to or near water drainage areas which are either active or periodically active depending the water source. In addition, we found that these milling wastes were located below the existing surface elevation. When we compared the manner in which these milling wastes were stored with that of UNC, we were surprised to

find that the UNC dam was located above the existing elevation and that there was a slight dip in elevation toward Rio Puerco. We were told that this method of waste storage was "state of the art". Vice-Chairman Frank E. Paul's questions in this regard deserve answers.

Since the UNC spill, we have determined that more than 49 parcels of land, either as sections or portions thereof, and located downstream from the breach site have been impacted. It should be noted here that the spill traversed a major part of the Rio Puerco before it disappeared into the soil, that the Rio confluences with the Little Colorado near Holbrook, Arizona and empties into the Colorado River near Cameron, Arizona. This is surely inter-regional transport of pollutants. It is also a potential source of contamination for Navajolands near Winslow and Cameron. Finally, Navajos and non-Navajos use water from shallow wells located in, adjacent or near water courses for culinary and livestock purposes.

2. Monitoring Program.

During the 1950's and 1960's, local Navajos saw that tailings and other wastes were discharged into adjacent storage areas. They were surprised to learn that radium-226 and other contaminants were discharge from the mills into nearby water courses

as well as from the Durango, Colorado mill into the Animas River in sufficient quantities as to alarm public health officials. These Navajo people were later informed that the San Juan Basin Radium Research Project was established at Farmington, New Mexico in the early 1960's, as one of several federal efforts, to define radiological impacts of uranium mining and milling. As a student I recall at least two (2) newspaper reports of fish kills below the Shiprock millsite. Finally, while dismantling the Shiprock mill building in 1977, U_3O_8 dust of about 25% assay was discovered by our staff between two layers of roofing material at the Shiprock mill building. We were again surprised to learn from reports such as Klevin et. al. that insufficient control of discharged uranium dust to the outside environment of processing buildings was a concern of health physicists and that this concern was not implemented in Navajo uranium mills of that time.

Our review of monitoring and sampling data provided us, upon request, indicate deficiencies which should be corrected and incorporated in the UNC plan.

a) Extend monitoring program to include <u>all</u> areas or personnel which are employed or impacted by uranium processing (e.g. alternative ore storage areas, bioassay, livestock, etc.). We do not know whether there are federal requirements to

periodically examine, for radiological purposes, local people who work in uranium mines, live adjacent to uranium processing operations or who use water from streams impacted by such operations. Or for that matter, to maintain examination units near the operations.

b) Amend plan to include provisions for Quality Assurance of data.

c) Include provisions and procedures to perform monitoring for emergency purposes.

d) Declare use of procedures to neutralize excess acid and to abate contaminants in unanticipated releases.

e) No provision for periodic review of monitoring program.

Our staff surveyed the Rio Puerco for gamma-emitting radionuclides with a portable radiological instruments. Generally speaking, they found radioactivity in decreasing levels from the breach site to the New Mexico-Arizona stateline. With some exceptions, the radioactivity levels approximated background levels. These exceptions were due to areas of slow flow, Rio Puerco tributaries contaminated from backflow of the spill, and the breach site.

Concern for radiological contamination of Rio Puerco predominated impacts due to chemicals (e.g. sulfates, alkaline elements, organics and toxic elements). It has not been determined how much solubilized salts were

carried downstream with the spill solution for deposit or absorption. The role of these salts as exchange material within Rio Puerco soils for radiological contaminants is not sufficiently understood to warrant oversight or lack of concern. We hear explanations and assurance from UNC that salt encrustations on a streambed are the result of natural forces. We do not agree that existing salt encrustation in the Rio Puerco streambed is the result of natural forces. The pre-spill streambed did not exhibit the salt encrustations we see today.

A serious lack in current monitoring programs managed by regulatory agencies is the inability and, perhaps, capability of laboratories to deliver data in a timely fashion. We understand that samples submitted to EPA laboratories to evaluate Rio Puerco contamination were possibly in competition with samples from the Three Mile Island incident.

3. Rio Puerco Clean up.

We understand that criteria to clean up the Rio Puerco were submitted by U.S. Environmental Protection Agency, New Mexico Environmental Improvement Division and United Nuclear Corporation to the Nuclear Regulatory Commission. We do not know if clean up criteria have been agreed upon by participating entities.

The criteria, we hear, are based on historical data from previous uranium operations, from pre-operational

or baseline data and are based on the presence of Thorium-230 and Radium-226 as critical radionuclides. If the criteria are also predicated on the existence of radionuclides in the Rio Puerco prior to the UNC spill, we do not agree. We believe that the criteria should include radiological information which antedates all uranium activities on the Rio Puerco. The discharge of mine waters from Kerr-McGee Mine No. 1 represents a bias to the criteria. In this connection, we believe that the existing standard of 2000 picocuries of Thorium-230 per liter of dischargeable milling waste waters is too high. Such a standard, if not revised, could pose serious problems for clean up criteria.

Chairman Udall, members of the Subcommittee, this concludes my remarks. With your permission, Ms. Helen George has some remarks.

FACT SHEET FOR THE UNITED NUCLEAR CORPORATION CHURCHROCK SPILL

On July 16, 1979, United Nuclear Corporation reported that their Churchrock tailings dam breached between 5:00 am and 6:00 am. This was based upon a report that shift personnel drove a vehicle across the dam at 5:00 am. Flood control gauges downstream indicated that the breach occurred at approximately 1:00 am.

Geotechnical investigation revealed discrepancies between the design and the construction and operation of the dam. Seepage monitors were not in place. The design height of the dam above the tailings liquid (5 feet) was not maintained. The "sand beach" which was to prevent direct contact between the acidic tailings liquid and the earthen dam was not of adequate height.

Following the breach, sand tailings, fine particles and acidic tailings solution were discharged into Pipeline Arroyo and thence into the Rio Puerco. Flow apparently ceased in Arizona near Sanders, across the reservation. Approximately 1100 tons of tailings and 100,000,000 gallons of liquid were discharged.

Mill tailings and liquid contain radioactivity at concentrations much greater than ordinary soils and waters. While ordinary groundwater may contain around 1 picocurie per liter of radium-226 and thorium-230, mill tailings typically contain 150,000 picocuries per liter of thorium-230 and 400 picocuries per liter of radium-226. Ordinary soils contain about 1 picocurie per gram of both radium-226

2.

and thorium-230, while typical mill tailings contain 450 and 430 picocuries per gram respectively.

Once released to the general environment these radionuclides may reach man by a variety of pathways including inhalation of windblown dust, radon-222, and radon-222 daughters. Livestock that water and graze in the arroyo may transmit radioactivity through the food pathway. Direct contact with the released tailings especially by children who play in the arroyo constitutes another pathway. The released radionuclides may enter the groundwater near the arroyo and the Rio Puerco to some extent.

Thorium-230, the principal radionuclide involved in the spill, is quite similar chemically and radiologically to plutonium-239. In fact the current "maximum permissable concentration" for thorium-230 is 2½ times more restrictive than that for plutonium-239. Recent information from the International Commission on Radiological Protection indicates that radiotoxicity of injested thorium is about 5 times greater than the currently accepted value.

The effects of low level radiation on humans are uncertain. Radioactivity is unquestionably carcinogenic at high levels. It is prudent to assume a direct "linear, non-threshold" relationship between dose and effect. From this assumption it follows directly that radiation exposures should be kept as low as reasonably achievable.

December 6, 1979

Honorable Joseph Hendrie
Chairman, Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Chairman Hendrie:

I am writing with several inquiries regarding the Commission's Agreement States program and uranium mill tailings control. Events this year have served to increase my concern about these activities.

The shut-down of the American Atomics plant in Tucson, Arizona and the uranium mill tailings dam break in New Mexico both indicated a lack of adequate oversight of Agreement States' licensing practices on the part of the NRC. Commissioner Gilinsky agreed that the Agreement States program had severe shortcomings at a Subcommittee hearing in July, and indicated that the Commission would undertake a thorough review of the oversight criteria in use by the Commission. It was disturbing to me, therefore, that the Commission decided to admit Rhode Island as a new Agreement State before the Commission had completed its review of the program.

The Congress this year modified the Agreement States program by correcting the Uranium Mill Tailings Control Act to end dual licensing of tailings disposal and milling in the Agreement States. I supported this correction with the understanding that the Commission would ensure that states' licensing programs would be carried out with safety and diligence. In this regard, I believe that one way to increase technical resources available to the Agreement States would be to use the divisions of the Commission which review NRC license applications to review licensing activities in the Agreement States. I am aware

that Commission divisions in addition to the Office of State Programs do now assist in program evaluation. But, it seems to me that their role in inspection and enforcement or review of specific licensing actions could be expanded.

My specific questions are as follows:

1) Does the Commission agree with me that it would be productive to involve more fully and formally the Commission's licensing divisions in review of Agreement States' licensing activities?

2) Since the dual licensing arrangement has ended, what role is the Commission playing in reviewing mill tailings impoundments in Agreement States in light of the dam break at Church Rock? What is the status of reviews being carried out by the Agreement States?

3) At our hearing on the Church Rock dam failure in October, there was a discrepancy in testimony regarding the State of New Mexico's action on milling and tailings licenses. A state official, Cubia Clayton, testified that because of the state licensing agency's "other environmental protection mandate and staffing, there is opportunity for a more comprehensive review of license applications than is generally possible at the federal level." Another witness, representing Southwest Research and Information Center, claimed that although four licenses in New Mexico came up for renewal in 1976, "licenses have not been renewed and the companies are still in operation." The witness, Paul Robinson, also claimed that "New Mexico has never renewed a single uranium mill license in its history of its Agreement State status dating back to 1974."

I understand license renewal to be an important means of reviewing or requiring improvements for milling and disposal operations. What is the Commission's policy regarding relicensing? What is the normal time frame for processing license renewals? What is the status of license renewals in the State of New Mexico? What is the status of license renewals in other Agreement States where uranium milling operations are licensed?

4) The Uranium Mill Tailings Control Act requires that Agreement States programs be carried out in a manner equivalent to the Commission's. While there existed dual licensing authority, the Commission was setting licensing requirements for new operations in Agreement States. Since the States have begun carrying out all licensing activities, have substantive licensing requirements remained equivalent to those the Commission had imposed?

5) It has been suggested by members of Congress and witnesses at our hearings that research and development on improved methods of tailings control be increased. What recommendations can the Commission make in this regar

6) What is the current status of the clean-up being conducted by United Nuclear Corporation of contamination resulting from the Church Rock spill?

7) What is the status of groundwater and well monitoring in the area affected or potentially affected by the spill?

8) United Nuclear Corporation representatives at our hearing stated that the Church Rock tailings impoundment met "all design criteria established by the NRC," including Regulatory Guide 1.101. Did the Church Rock facility meet all NRC's impoundment design criteria?

Because of my interest in more direct participation of NRC's licensing staff in Agreement States reviews, I would appreciate receiving the comments of those divisions in your responses, where appropriate.

Please provide the information I have requested by January 30, 1980.

Sincerely,

MKUdall

MORRIS K. UDALL
Chairman

March 6, 1980

The Honorable John F. Ahearne
Chairman, Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Chairman Ahearne:

It is now close to three months since I sent you a request for information regarding the uranium mill tailings spill at Church Rock, New Mexico and the Agreement States program. It is one full month since January 30, the date by which you were requested to furnish this information, and which I thought was a liberal deadline by which the Commission could address the relatively straightforward questions raised. I'm discouraged by the fact that I have not received this information yet.

Since sending that letter on December 6, I have continually received related indications of concern from other groups. The States of New Mexico and Arizona and the Conference of Radiation Control Program Directors, Inc., have written to indicate their opposition to termination of the Agreement States program, among other things. Of course, my letter to you did not suggest that the Agreement States program be eliminated. Rather, I asked the Commission whether it believed the program could be improved by increased formal utilization of the divisions which issue licenses for the Commission for review of Agreement States licensing activities.

This suggestion for possible improvement was made in part as a result of information brought forward at our hearing on the Church Rock spill. The record showed that NRC's review of the United Nuclear Corporation tailings dam plan by NRC's licensing divisions (not the Office of State Programs, which referred the plan for review)

to have been extremely cursory and not to have identified the problems raised in existing UNC reports which finally lead to the dam's failure. Perhaps this clarification of my question will speed the Commission's deliberations on the response to my letter. I hope my letter can be treated separately from the Commission's full review of its Agreement States program, which I understand to have been taking place at least since last July.

Another area of continuing concern to which I have been alerted involves the long-term impacts of the Church Rock spill and efforts to avoid such spills in the future. The Navajo Tribe, and other Indian groups nationwide whose lands have uranium development potential, have appeared among the most concerned, judging by their contact with me or my staff. I would appreciate your providing me with information which has been of interest to these and other groups, as follows:

> In my letter of December 6, I requested information on the status of groundwater monitoring in the area affected by the Church Rock spill. I have now received comments from the Southwest Research and Information Center of New Mexico that State Environmental Improvement Division records show significant contamination of at least one well near Gallup since the impoundment failure. The data is also alleged to show significant contamination of groundwaters near Navajo Tribal lands due to normal current operation of the UNC impoundments. A copy of the information I received is attached. Please comment on the accuracy of this data, and on the implications of these levels of contamination in terms of health impacts and in terms of the safety of the UNC operation.

I would appreciate a response to this letter and to my letter of December 6 as soon as possible.

Sincerely,

MORRIS K. UDALL
Chairman

attachment

(ENCLOSURE I)

SOUTHWEST RESEARCH AND INFORMATION CENTER February 22, 1980

Ms. Andrea Dravo
House Interior Committee
1337 Longworth House Office Bldg.
Washington, D.C. 20515

Dear Ms. Dravo:

I am writing to provide you with documentation of groundwater contamination resulting from the UNC-Churchrock spill. Enclosed is a copy of two New Mexico Environmental Improvement Division groundwater monitoring data sheets from Churchrock.

One sheet shows groundwater quality at the NMEID well east of the "Hogback" near Gallup; this well is set in alluvial material 15 miles downstream of the spill site. This well is screened at the 30-40 feet depth interval and designed to monitor groundwater from that depth. The other side of the sheet shows data from UNC monitoring wells installed October 31, 1979 sampling was from the north side of the tailings dam at Churchrock, at a depth of up to 60 feet.

The "Hogback" well data shows data both before and after the spill(7905211430 is a sample taken at 1979, May(5), 21st at 2:30 p.m.(1430 hrs.), before the spill; and 7908021135 was taken at 1979, August 2nd at 11:35 a.m., after the spill). The data shows gross contamination of the groundwater waters at 30-40 of depth by September 25, 1979(last column of readings) for the gross alpha radiation, uranium natural, sulfate and magnesium categories as summarized below:

	May 21, 1979	September 29, 1979
Gross alpha(pCi/l)	27±25	304±16
Uranium natural(mg/l)	59.0	590.0
Sulfate(mg/l)	647.3	1829
Magnesium(mg/l)	41.97	128.7

A factor of ten increase is noted for the gross alpha and U-natural, a factor of three increase in sulfate and magnesium can be seen . Though this level of contamination has been noted 15 miles downstream of the spill site, no sampling of waters at similar depths near the spill site has been conducted. The extent of pollutant loading of this groundwater along the spill route has not been assessed even though significant contamination has been identified.

The groundwater monitoring wells north of the tailings dam tell an even more important story. The two wells(201 and 202) were drilled to monitor "potential" seepage from the first post-spill interim tailings pits. The first waters from the

P.O. BOX 4524 ALBUQUERQUE NEW MEXICO 87106 505 - 242-4766

monitoring wells indicate contamination worse than that downstream of the spill. PH, acidity of the water, is at 4.1 and sulfate is 6000-7000 mg/l. The pre-spill groundwaters for the "Hogback" well can appropriately be used for background comparison. These new wells have only been sampled for the parameters listed. There are likely to be radioactive materials in these solutions but they have yet to be assessed.

The seepage at this north end of the dam was not a result of the dam failure and identified after the October 22, 1979 hearings on the implications of the spill.. The seepage indicates loss of containment of large volumes of contaminated material off site(north into the Navajo Reservation) from normal operation of the dam. Dr. Gale Billings of UNC, is designing a seepage circulation system in an attempt to remedy this situation (with a program similar to the United Nuclear-Homestake Partner Mill Tailings Seepage Collection System). The extent of contamination already points out the inadvisability of continued use of the existing impoundment.

These data have been compiled by John Dudley NMEID Geohydrologist. He is forwarding to me more recent data which I will mail to you when it is received.

I appreciate your continued interest in this dad but important incident. Please feel free to contact me at the below address for additional questions.

Sincerely,

Wm. Paul Robinson

Paul Robinson
Environmental Analyst

PR/mmb
Enclosure

Sample Identification / Sampling Date	WELL-201 (11-5-79)	WELL-202 (11-5-79)	
Aluminum (mg/l)			
Arsenic (mg/l)			
Barium (mg/l)			
Boron (mg/l)			
Cadium (mg/l)	95.8	81.9	
Chloride (mg/l)			
Chromium (mg/l)			
Cobalt (mg/l)			
Conductivity (umhos/cm)	4450 @ 16°C	4700 @ 14°C	
Salinity (parts per Thousand)	3	3.5	
Cyanide (mg/l)			
Fluoride (mg/l)			
Iron (mg/l)			
Lead (mg/l)			
Magnesium (mg/l)			
Manganese (mg/l)			
Molybdenum (mg/l)			
Nitrogen (Ammonia) (mg/l)			
Nitrogen (Nitrate) (mg/l)			
Nickel (mg/l)			
pH 25°C	4.16	4.05	
Selenium (mg/l)			
Silver (mg/l)			
Sodium (mg/l)			
Sulfate (mg/l)	6293.1	7080.4	
Total Dissolved Solids (mg/l)	9911	11834	
Total Mercury (mg/l)			
Vanadium (mg/l)			
Zinc (mg/l)			
Total Uranium (mg/l)			
Radium-226 (pCi/l)			
Radium-228 (pCi/l)			
Thorium-230 (pCi/l)			
Gross Alpha (pCi/l)			
Gross Beta (pCi/l)			

UNC MONITORING WELL DATA - GRANTSVILLE

LOCATION: SW¼, SE¼, SW¼, SW¼, Section 8, T15N, R17W

Parameter/Date-Time	7904251500	7910041230	7905311430	7908021155 (5,11)	7908201715	7909251616	[illegible]
Water Level from MP ft	13.09	12.23	12.96	12.69	12.19	12.24	12.31
Water Level Elevation	88.74	89.60	88.87	89.14	89.64		
M. P. Elevation Ft. (Ref. arbitrary datum)	101.83						
pH	7.3	7.0	6.8	6.75	7.0	6.9	
Temp °C	12.9	13.5	12.0	12.7	14.0	13.5	
Uncorrected Field Cond. µmho	1210	1000	1350	1510	1810	2900	
G. Alpha → pCi/l	9.8 ±3.0	0.0 ± 3.5	27 ± 25	21 ± 5	9 ± [illegible]	30 ± 16	
Ra-226 pCi/l	0.11 ± .05	<.10	.50 ± .06	<0.1	0.3 ± [illegible]		
Ra-228 pCi/l	0.0 ± 0.5						
Pb-210							
As	<5.0	<5.0	<5.0	<5.0	[illegible]	6.0	
Ba	[illegible]		<100	100	[illegible]	790	
Cd				<1.0		<1.0	
Pb				<5.0		<5.0	
Mo	[illegible]	<5.0	<5.0	<10.0	[illegible]	<10.0	
Se	[illegible]	<5.0	6.0	6.0	[illegible]	5.0	
U-nat. → mg/l		42.6	54.0	56.0	[illegible]	590.0	
I				<10.0	[illegible]	43.6	
Zn				<500		<250	
O_2+NO_3 mg/l	0.041	0.22	0.25	0.27	2.06	2.62	
H_3 mg/l	0.210	0.176	0.31	0.74	0.055	<.01	
OD							
mg/l	123.2	116.4	198.4	227	335.6	500 s	
mg/l	2.73	6.7	3.9	3.5	5.46	4.7	
mg/l	236.9	154.1	154.1	213.9	204.7	266.8	
O_3 mg/l	443.1	304.9	242.2	278.3	240.8	349.2	
mg/l	40.92	31.3	72.5	84.5	111.5	106.9	
→ mg/l	550.5	414.6	647.3	882.9	1115	1829	
mg/l	1149.0	938	1334	1577	2128	3154	
Cond. -25°C µmh	1736	1380	1842	2039	2526	3549	
→ mg/l			41.93	37.7	81.7	128.7	
mg/l				<500	[illegible]		
mg/l				<.25	2.25		

EID GROUNDWATER MONITORING DATA 30'-WELLS E OF [illegible]

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

March 17, 1980

The Honorable Morris K. Udall, Chairman
Committee on Interior and Insular Affairs
United States House of Representatives
Washington, D. C. 20515

Dear Mr. Chairman:

Thank you for your letter of December 6, 1979, raising several questions about the NRC Agreement States Program and the Church Rock dam failure. Answers to these questions are enclosed.

At the outset, I would like to report that the Commission is considering a number of actions which touch on your concerns about the conduct of NRC's Agreement States Program. For example, the Commission will decide in the next several months on the future role of the Office of State Programs, and on revised criteria for assessing the radiological safety programs of the Agreement States. Since the Commission has not yet decided on these actions, only preliminary answers can be provided to your questions which have policy implications (Questions 1, 4, and 5). I have, however, included complete answers to questions requesting factual information (Questions 2, 3, 6, 7, and 8) and to your concern over the Commission's decision to admit Rhode Island as an Agreement State.

In the near future, I will be responding to the concerns addressed in your March 6, 1980 letter regarding groundwater monitoring results in the area affected by the Church Rock spill.

Sincerely,

John F. Ahearne

Enclosure:
Responses to Questions

cc: Rep. Don Clausen

ANSWERS TO QUESTIONS

in December 6, 1979 Letter

From Chairman Udall

GENERAL QUESTION: Concern Over Admission of Rhode Island as Agreement State.

ANSWER

Your letter raised one issue that your questions did not address. You mentioned you were disturbed by the Commission's decision to admit Rhode Island as an Agreement State in view of the impending changes in the evaluation criteria. The Commission did not consider the shortcomings of the criteria to be of sufficient significance to warrant a moratorium on admitting new States. The Commission acted according to Section 274 of the Atomic Energy Act, which states that the Commission shall enter into an agreement after a finding of compatibility and adequacy. The Rhode Island submission satisfied the requirements of the NRC criteria for a Section 274 agreement. Commissioners Gilinsky and Bradford did not concur in this decision.

QUESTION 1: Does the Commission agree with me that it would be productive to involve more fully and formally the Commission's licensing divisions in review of Agreement States' licensing activities?

ANSWER.

The Agreement States Program was, until 1976, a part of the Office of Nuclear Material Safety and Safeguards (NMSS). At that time, the Commission transferred the Program to the newly created Office of State Programs (OSP).

The Commission is now reconsidering this decision. The Commission's deliberations, which will take several months to complete, are likely to lead to more clearly defined involvement of licensing offices in the review of Agreement States' licensing activities. During the course of our deliberations, we will solicit the views of the various offices on the options. We will inform you of the results of these deliberations when they are complete. Commissioner Gilinsky favors the transfer of OSP's functions to NMSS.

QUESTION 2: Since the dual licensing arrangement has ended, what role is the Commission playing in reviewing mill tailings impoundments in Agreement States in light of the dam break at Church Rock? What is the status of reviews being carried out by the Agreement States?

ANSWER:

The NRC performs two roles related to mill tailings impoundments in Agreement States. First, the NRC provides technical assistance to States that request it for specific licensing cases. This involves the NRC licensing staff very directly in evaluating specific technical issues in individual cases. These evaluations are documented in reports which are provided to the States.

The NRC staff also provides technical assistance, at the request of the States, with respect to evaluations and corrective actions associated with specific incidents.

Second, the NRC is required by the amendment to the Uranium Mill Tailings Radiation Control Act (UMTRCA) to ensure that the Agreement States fulfill the technical and procedural requirements of the UMTRCA to the maximum extent practical. In a January 3, 1980 letter, the NRC staff informed the Agreement States of the procedures the staff considers necessary for them to meet the requirements of the UMTRCA, and of the NRC offer of technical assistance to help the States comply with UMTRCA during the interim period before the UMTRCA becomes fully effective in 1981. A key step that the staff considers should and can be taken by Agreement States in connection with their licensing actions is to prepare documented assessments for public review and comment.

With regard to the embankment failure at Church Rock, the NRC has issued an information bulletin to the Agreement States so that they can take appropriate actions regarding their reviews of mill tailings impoundments. The bulletin contains (1) a description of the probable cause of the Church Rock failure, and (2) NRC recommendations for the inspection and review of tailings embankment retention systems to reduce the probability of the recurrence of such a failure. In addition, personnel from the staffs of the Offices of State Programs, Nuclear Reactor Regulation, Inspection and Enforcement, and Nuclear Materials Safety and Safeguards were dispatched to New Mexico to assist the State in its evaluation of the dam failure at Church Rock and the environmental impacts of the failure. We have requested the States to inform the NRC staff of the action they are taking; the staff will provide technical assistance to the States as requested.

According to the States involved (Texas, New Mexico, Colorado, Washington, and Arizona), the impoundments of all Agreement States except for Arizona have been inspected either by the Corps of Engineers or by the State Engineer. Arizona is planning to return this part of their program to the NRC. The other four States expect inspection reports in the next several weeks.

QUESTION 3: At our hearing on the Church Rock dam failure in October, there was a discrepancy in testimony regarding the State of New Mexico's action on milling and tailings licenses. A state official, Cubia Clayton, testified that because of the state licensing agency's "other environmental protection mandate and staffing, there is opportunity for a more comprehensive review of license applications than is generally possible at the federal level." Another witness, representing Southwest Research and Information Center, claimed that although four licenses in New Mexico came up for renewal in 1976, "licenses have not been renewed and the companies are still in operation." The witness, Paul Robinson, also claimed that "New Mexico has never renewed a single uranium mill license in the history of its Agreement State status dating back to 1974."

I understand license renewal to be an important means of reviewing or requiring improvements for milling and dispoal operations. What is the Commission's policy regarding relicensing? What is the normal time frame for processing license renewals? What is the status of license renewals in other Agreement States where uranium milling operations are licensed?

ANSWER.

With reference to the testimony of Paul Robinson, the claim that New Mexico has never renewed a uranium mill license since becoming an Agreement State is true. Upon becoming an Agreement State in 1974, New Mexico assumed responsibility for four licenses which are due to expire in 1976. All four licensees applied for renewal and are being allowed to continue to operate during the renewal review. This is consistent with NRC's policy which allows continued operation while an application for license renewal is under review. In 1979, the New Mexico Environmental Improvement Board adopted revisions to the State regulations which the State believes will conform to the requirements of UMTRCA. This will require significant changes in the mill applicants' environmental report for renewal. New Mexico will review the renewal applications of these four mills under the new regulations of January 1980. One other mill license will expire in July 1980.

On January 28, 1980, New Mexico licensed a new mill (Bokum). Based on an environmental assessment of the mill prepared for the State of New Mexico (copy attached), the NRC staff concluded that the Bokum tailings management concept is acceptable subject to the conditions itemized in the assessment.

Regarding your question on NRC's relicensing policy, we feel that license renewal reviews provide a regular periodic opportunity for a systematic evaluation to determine if a facility is operating in a manner to assure public health and safety and to minimize environmental hazards to as low as reasonably achievable.

In May 1977, the NRC issued interim criteria for uranium mill tailings management in the form of a Branch Technical Position. This position noted how the licensing staff would implement these criteria for existing tailings piles as well as for developing programs for new positions. The NRC has utilized these interim criteria to evaluate and upgrade the tailings management program for all operations in Non-Agreement States, most of them in conjunction with license renewal reviews. It has been the experience of the licensing staff that working with the operators to develop an acceptable tailings management program for an existing facility is a much more difficult and time consuming task than reviewing a new proposal where options are virtually unlimited.

This will be particularly true in New Mexico where the largest tailings piles exist and where remedial action plans are expected to be the most difficult to develop and implement. The licensing staff urged New Mexico in early fall, 1978, at a meeting in Santa Fe, New Mexico to initiate the process by requiring existing mill operators to perform an environmental impact study of their tailings pile and propose tailings reclamation alternatives for regulatory review. This first step in the review process could take as long as one year to complete. It takes two additional years for the NRC to review the licensee's study proposing alternative tailings programs in terms of NRC licensing requirements; to document the NRC evaluation and state conclusions, including changes the staff finds necessary in the licensee's proposal, and receive public comments; to resolve these comments; and to issue the final document with specific proposed license conditions.

As shown in Enclosures 1 and 2, the NRC staff repeated its recommendations that New Mexico act as promptly as possible to develop programs meeting NRC criteria for managing tailings at existing sites. Enclosure 3 is the New Mexico response to the NRC staff recommendations. The State of New Mexico's Environmental Improvement Board adopted regulations to require applications to review alternative tailings management methods in November 1979. These regulations are not yet effective.

There are six conventional uranium mill licensees in Agreement States other than New Mexico. Three of these, one in Washington and two in Colorado, have applied for license renewals. In Washington, the license of Dawn Mining Company expired on August 31, 1979. Assuming the successful resolution of certain technical problems, the State intends to complete action on the renewal application in late 1980.

In Colorado, Union Carbide and Cotter Corporation have applied for renewals. Since the expiration of the Union Carbide license on July 31, 1975, the Company has tried unsuccessfully on two occasions to prepare environmental reports acceptable to the State. If the Company's current effort is successful, the State hopes to decide on the renewal application in mid-1980.

The Cotter license expired on January 31, 1978. The State is delaying consideration of the renewal application pending the outcome of a non-safety-related investigation of the Corporation and the outcome of litigation against both the Corporation and the State regarding a recent authorization of expansion of Cotter's activities.

QUESTION 4: The Uranium Mill Tailings Control Act requires that Agreement States programs be carried out in a manner equivalent to the Commission's. While there existed dual licensing authority, the Commission was setting licensing requirements for new operations in Agreement States. Since the States have begun carrying out all licensing activities, have substantive licensing requirements remained equivalent to those the Commission has imposed?

ANSWER.

The Commission is presently considering revised criteria for judging the effectiveness of Agreement States' programs. Once the Commission has decided on new criteria, the NRC will be able to improve its ability to evaluate the extent to which the States' programs are equivalent to that of the NRC.

In the meantime, the licensing staff is providing technical assistance to some Agreement States in support of their licensing actions. This assistance essentially includes an independent environmental evaluation which would conform with the requirements of Section 204e of UMTRCA. All but a few of these cases are evaluations related to new projects.

The four Agreement States with active conventional uranium mills (i.e., Colorado, New Mexico, Texas, and Washington) committed to adopt the requirements resulting from the final generic environmental impact statement (GEIS) on uranium milling prior to the passage of the UMTRCA in November 1978. Although all of the Agreement States generally agree with the interim tailings management criteria the NRC issued in May 1977, and New Mexico is attempting to promulgate regulations for tailings management that are consistent with these criteria (See response to Question 3), the NMSS staff is not aware of the extent to which the criteria are being applied in cases where they have not provided technical assistance. This is because there have been no independent documented evaluations in support of Agreement State licensing actions. However, in all cases where the NRC has been requested to provide technical evaluations, the 1977 interim criteria have been applied and, therefore, the review and conclusions are consistent with NRC actions. The Office of State Programs has requested the appropriate Agreement States to provide information on the extent which the States have applied the NRC's interim tailings management criteria.

Until the States have developed their compliance procedures, the NRC cannot begin to review individual mill licensing actions of Agreement States as is necessary to assure that these actions comply with the requirements of UMTRCA. However, the NRC is evaluating Agreement State regulation in general to determine areas that do not meet UMTRCA requirements, and, as noted in the response to Question 2, is offering technical assistance to help ensure that the requirements are met. The States are attempting to obtain the needed legislation and resources to conduct the type of review required by the passage of UMTRCA. Although the NRC's proposed regulations pertaining to uranium mill licensing have not yet been promulgated in final form, the NRC is encouraging the Agreement States to implement the UMTRCA requirements and the technical guidance issued by NRC to the extent practicable.

6

QUESTION 5: It has been suggested by members of Congress and witnesses at our hearings that research and development on improved methods of tailings control be increased. What recommendations can the Commission make in this regard?

ANSWER.

Because we had not completely developed our program prior to submission of the FY80 budget, we have delayed expansion of the scope of the program until FY 1981 and beyond. To minimize the impact of these delays, we are working closely with DOE to assure that our respective research programs are coordinated and that they will complement each other. Until an expanded research program can be developed, research is being conducted by NRC which will identify methods which can be employed to minimize impacts to groundwater. Also, we plan to begin projects which will identify techniques which might permit safe return of tailings to deep uranium mines for disposal, and to examine the feasibility of utilizing alternative mill leaching processes which potentially remove contaminants from mill tailings to a greater extent than is possible from current conventional leaching methods.

The Commission does plan to expand its uranium milling research program in FY 1981. A broad program was developed and initiated during FY 1976 to provide a technical basis for preparation of the generic environmental impact statement (GEIS) on uranium milling and the associated regulations on tailings management and disposal (44 FR 50015). As a result of our experience in developing rules, and with tailings disposal problems at specific sites, as well as the knowledge learned through this research, we may require a much larger program than was originally anticipated and budgeted for.

QUESTION 6: What is the current status of the clean-up being conducted by United Nuclear Corporation of contamination resulting from the Church Rock spill?

ANSWER.

The staff has not closely monitored the actual cleanup operations (conducted on-site inspections and the like) since the Tailings Act was amended and the NRC's authority to license in Agreement States was eliminated. We understand that, as of January 1980, cleanup of contamination has been completed in the most heavily affected areas near the mill. The operator has a contractor crew of about 20 people using moderate to heavy duty equipment (such as front end loaders, bulldozers, and dump trucks) to remove about seven to eight truck loads of contaminated soil per day from the arroyo to the mill tailings area. As of mid-January, about 207,460 cubic feet of contaminated soil has been removed from the affected arroyo and returned to the tailings impoundment. The cleanup crew has usually been working six days a week since early November, and cleanup of the remaining "hot spots" may take several more months to complete.

While we were involved in a dual licensing role, we worked with the State to establish cleanup criteria and we issued a radiological assessment in support of this. We also provided sophisticated mobile laboratory facilities to process over 3,000 soil samples to guide the cleanup efforts. In our current role, we are continuing to provide sample analysis as requested by the State and will be assisting the State with technical resources to establish definitive cleanup verification procedures. We will provide assistance to the State in preparing a final report on the incident and cleanup.

QUESTION 7: What is the status of groundwater and well monitoring in the area affected or potentially affected by the spill?

ANSWER

NRC involvement in monitoring the impacts of the incident has focused primarily on defining the extent of soil contamination needing cleanup. The responsibility for monitoring groundwater contamination rests with the State of New Mexico, State of Arizona, the Indian Health Service, and the Environmental Protection Agency. A joint monitoring program of these agencies is being conducted on wells at selected locations near affected sections of the Rio Puerco. The program, which will run for about one year, will consist of monitoring wells in the following communities: Church Rock, Gallup, Mentmore and Manuelito in New Mexico; and, Lupton, Houck, and Sanders in Arizona.

QUESTION 8: United Nuclear Corporation representatives at our hearing stated that the Church Rock tailings impoundment met "all design criteria established by the NRC," including Regulatory Guide 1.101. Did the Church Rock facility meet all NRC's impoundment design criteria?

ANSWER.

In a post-incident analysis, the NRC staff concluded the initial dam design, which was approved by New Mexico, did not meet all of NRC's impoundment criteria. The following areas in the design of the Chruch Rock facility are considered inadequate in meeting NRC criteria and conservative engineering practice:

1. Stability analysis: The results of stability studies completed by the applicant prior to the dam failure are not acceptable. The results are unacceptable because the shear strengths adopted for the foundation soils and used in the stability studies did not adequately anticipate the significant loss in shear strength caused by the wetting of foundation soils resulting from the tailings pond impoundment. The factors of safety computed in the submitted stability studies are therefore based on unconservative soil shear strengths and a direct comparison cannot validly be made with minimum factors of safety that are listed in Regulatory Guide 3.11, "Design, Construction, and Inspection of Embankment Retention Systems for Uranium Mills."

2. Settlement studies: Settlement and potential cracking within the retention embankment was addressed and analyzed in design. However, the extent of the analysis was not sufficient to properly estimate the magnitude of the settlement problem over the collapsible foundation soils. A more detailed evaluation of settlement would likely have resulted in design measures that would have provided a satisfactory engineering solution against harmful embankment cracking.

3. Dam safety instrumentation: Basic instrumentation (piezometers and movement devices) to monitor the retention embankment's performance and safety was not installed as suggested in Regulatory Guide 3.11.

Enclosures:
1. Ltr to T. E. Baca from R. A. Scarano dated 10/3/79
2. Ltr to T. E. Baca from R. A. Scarano dated 12/4/79
3. Ltr to R. A. Scarano from T. E. Baca dated 10/18/79
4. Environmental Assessment by NRC staff to Bokum mill tailings management concept

ENCLOSURE 1

OCT 3 1979

Mr. Thomas E. Baca, Director
Environmental Improvement Division
P. O. Box 968, Crown Building
Santa Fe, New Mexico 87503

Dear Mr. Baca:

As you are probably aware the NRC has, over the last couple of years, embarked on a systematic program of requiring an upgrading of tailings management programs for uranium mills in non-agreement states. We have accomplished this by requiring each mill operator to perform a detailed study of alternative methods of tailings management and submit it in support of their license renewal application.

We recommend that you require those mills within your jurisdiction operating under timely renewal to perform this study and submit it within six months for regulatory review. Alternative methods of tailings management should be evaluated in conformance with the performance objectives listed in the Branch Technical Position transmitted to you by G. Wayne Kerr in May, 1977 (copy enclosed).

Please let me know if you cannot comply with this request.

Sincerely,

Original Signed by

Ross A. Scarano, Chief
Uranium Recovery Licensing Branch
Division of Waste Management

Enclosure:
As stated

UNITED STATES NUCLEAR REGULATORY COMMISSION MAY 13 1977

BRANCH POSITION - URANIUM MILL TAILINGS MANAGEMENT
Fuel Processing and Fabrication Branch

Background

A major expansion in the uranium industry is taking place. Many times more uranium will be extracted in the upcoming decades than has been extracted so far. This requires that the NRC examine very closely the past problem areas encountered in the uranium industry and make sure they are not compounded on an even larger scale.

The first major portion of the industry within the licensing jurisdiction of the NRC is uranium milling. The major problem encountered in past milling operations is the management of tailings generated by the milling process. Although the concentration of radioactivity in the tailings is relatively low, control measures are necessary because of the large quantities involved and because of the long half-life of the parent radionuclides that are present.

The management of mill tailings has received increasing attention and interest in recent years from involved federal and state agencies and from environmental conservation groups. This interest has resulted from studies carried out during the last decade which have indicated that uranium mill tailings, if not properly managed and controlled, could present a potential public health hazard. The most vivid example, of course, is the situation that occurred in Grand Junction. The remedial actions determined necessary to correct the misuse of tailings in the construction of homes, schools, and other public structures are continuing at substantial cost to the Federal Government and the State of Colorado.

In addition, final technical resolution and financial responsibility for the disposition of tailings at the 22 "inactive" sites being evaluated by ERDA will further increase public, state, and local as well as congressional concern with prevention of similar problems in the future.

It is incumbent on NRC and the uranium industry to assure that current and future licensed milling operations do not result in similar situations.

Towards this end, the NRC staff has developed performance objectives for an acceptable tailings management program based on the most up-to-date technology available today.

Position

The staff is of the opinion that an acceptable tailings management program will vary depending on site or region specific parameters, such as geology, hydrology, and meteorology. Viable methods of tailings

management for a specific mill location may include classic impoundment behind a dam, deep mine burial, open pit mine burial, specially excavated pit burial, or even elimination of radioactive waste by process variations.

Considering the many variables involved, the staff will use the following performance objectives to determine the adequacy of proposed site specific tailings management programs.

Siting and Design

1. Locate the tailings isolation area remote from people such that population exposures would be reduced to the maximum extent reasonably achievable.

2. Locate the tailings isolation area such that disruption and dispersion by natural forces is eliminated or reduced to the maximum extent reasonably achievable.

3. Design the isolation area such that seepage of toxic materials into the groundwater system would be eliminated or reduced to the maximum extent reasonably achievable.

During Operations

4. Eliminate the blowing of tailings to unrestricted areas during normal operating conditions.

Post Reclamation

5. Reduce direct gamma radiation from the impoundment area to essentially background.

6. Reduce the radon emanation rate from the impoundment area to about twice the emanation rate in the surrounding environs.

7. Eliminate the need for an ongoing monitoring and maintenance program following successful reclamation.

8. Provide surety arrangements to assure that sufficient funds are available to complete the full reclamation plan.

Implementation

All objectives will be considered and satisfied during the review of proposed tailings management programs for new milling operations.

Current licensees' tailings management programs will be reviewed to determine the best way to apply objectives 4 through 8 to the extent practicable.

During the course of license renewal reviews, the locations of existing tailings areas will be reviewed considering objectives 1 through 3 to determine if sufficient cause exists to require an alternate disposal location for tailings generated by future milling operations and the relocation of existing tailings at the time of mill decommissioning.

58-567 O - 80 -- 8

ENCLOSURE 2

DEC 04 1979

Mr. Thomas E. Baca, Director
Environmental Improvement Division
P. O. Box 968, Crown Bldg.
Santa Fe, New Mexico 87503

Dear Mr. Baca:

Based on the May 17, 1979, Commission determination that the Uranium Mill Tailings Radiation Control Act (UMTRCA) of 1978 gave NRC concurrent jurisdiction over tailings in Agreement States, the NRC issued a general license to possess tailings. The August 24, 1979, Federal Register notice of the Commission action also noted that the authority to possess, own, or receive title to tailings under the general license was subject to NRC remedial orders as necessary to protect the public health and safety.

Accordingly, Mr. John J. Linehan of my staff and Mr. Mike Mustain, NRC Region IV, visited the operating mills in New Mexico on September 20 and 21, 1979, to determine if any immediate remedial actions should be taken at operating tailings disposal areas.

As you know, Congress has recently passed an amendment to the UMTRCA of 1978 to make it clear that the NRC has no direct licensing responsibility over tailings materials in Agreement States for at least the three-year period following enactment of UMTRCA. Accordingly, we are hereby transmitting our observations and recommendations and urge you to take appropriate licensing actions. We will, of course, provide any technical assistance you might need in this matter.

You will note that one of the recommendations is to require the operators to perform a study of alternative methods of managing the existing and future uranium tailings and was the subject of my October 3, 1979, letter to you. We feel this is a matter of utmost importance and again recommend that this effort be initiated as soon as possible.

Sincerely,

Original Signed by

Ross A. Scarano, Chief
Uranium Recovery Licensing Branch
Division of Waste Management

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

NOV 16 1979

MEMORANDUM FOR: Ross A. Scarano, Chief
Uranium Recovery Licensing Branch

FROM: John J. Linehan, Section Leader
Uranium Recovery Licensing Branch

SUBJECT: REPORT ON SITE VISITS TO SOHIO, ANACONDA, KERR-MCGEE AND UNC HOMESTAKE PARTNERS URANIUM MILLS IN NEW MEXICO

Dates: September 20 and 21, 1979

Participants: M. Mustain, I & E, Region IV
J. Linehan, WMUR

Purpose:

To familiarize NRC staff with the conditions of tailings areas at operating uranium mills in New Mexico and to determine if, under the NRC's concurrent jurisdiction over tailings in New Mexico, any immediate remedial actions should be taken at operating tailings disposal areas. During a September 6, 1979 telephone conversation with J. Linehan, T. Wolff, New Mexico Environmental Improvement Division (EID), declined NRC's invitation for EID personnel to accompany NRC on these site visits.

Discussion:

Discussions of the site visits to each of the four mills are attached.

Recommendations and Conclusions:

Based on the attached discussions, it is recommended that we take the actions, listed below, at all four sites. Since the problem areas and areas of concern identified at the four sites are similiar in type, although they differ greatly in severity or extent as evidenced by a comparison of the discussion of the Anaconda visit with the discussion of the Kerr-McGee visit, it is felt the following actions are needed across the board:

1) Require all four licensees to develop and implement a program for interim stabilization or interim reclamation of all tailings not covered by standing water. The program should include written operating procedures and weekly documented inspections to determine the effectiveness of the program.

2) Require geotechnical engineering studies to be performed and submitted by all four licensees regarding the stability of the existing dams.

Site inspections of all four dams by a geotechnical engineer from the NRC or an NRC consultant, should also be conducted.

3) Require performance and submittal of a detailed alternative study on future tailings disposal at each of the mills as well as a study of alternative methods of reclaiming existing and future tailings.

4) Require submission of all environmental data for our review and implementation of an environmental monitoring program that is comparable to that specified in our Branch Position-Operational Radiological Environmental Monitoring Programs for Uranium Mills.

The above actions should be taken in the immediate future and not delayed until time of license renewal review.

The main concern I have after visiting these sites is that there was, in general, no indication from licensees that there are design studies or data to assure that these operating tailings dams meet our Regulatory Guide 3.11 criteria. In addition, it is clear that the advances we have made over the past several years in the design of tailings dams and development of systematic planned tailings management, including interim stabilization, and reclamation programs are not being implemented in New Mexico. As evidenced by a statement from Kerr-McGee, that the State had made no modifications to their old AEC license since New Mexico became an Agreement State, it seems that there is no sense of urgency being expressed by New Mexico to their licensees to improve or upgrade tailings management at operating facilities.

It should be noted that the above findings are based on approximately 2 to 3 hour site visits and only on information provided by the licensees during these visits. While additional and more detailed information may modify our findings somewhat, it is felt that these findings reflect the actual situations at these tailings disposal sites.

M. Mustain, Region IV concurred in this report on November 16, 1979.

John J. Linehan, Section Leader
Uranium Recovery Licensing Branch
Division of Waste Management

Enclosures:
As stated

MILL: Sohio

DATE OF VISIT: September 21, 1979

CONTACT: J. Bazemore

DISCUSSION:

The Sohio facility is a 500 ton per day acid leach mill. The tailings impoundment is an above-ground impoundment built on natural materials with an engineered earthen starter dam to the west that keys into the natural topography on the north and south. In addition, there is also a small saddle dam to the east. The dam has been lifted by the upstream method by spigotting of tailings. These upstream lifts were not engineered and there appeared to have been no specific engineering controls or license conditions on these lifts. The only piezometers in the dam are located in a drainage blanket. Additional piezometers are scheduled to be installed in the near future.

The dry tailings beaches, as well as the upstream dam lifts (spigotted tailings), appeared to be crusted and there was no visible evidence of blowing tailings. However, there was no monitoring data (air and soil) readily available to verify that blowing was not a problem. There appeared to be some water erosion on the downstream face of the dam.

The licensee has no firm interim stabilization or reclamation plan.

The licensee did not have environmental monitoring data readily available, but promised to send this data (air and water) in the immediate future. This environmental data, depending on its comprehensiveness, may allow a determination of whether or not there is a problem with blowing tailings or seepage to groundwater.

While Sohio staff indicated that there was supposed to be 150 feet of beach and 5 feet of freeboard, it appeared in some areas that this beach requirement was not being met.

MILL: Anaconda

DATE OF VISIT: September 20, 1979

CONTACT: E. Leany

DISCUSSION:

The Anaconda facility is a 6000 ton per day acid leach mill with an above-grade tailings disposal impoundment. The tailings impoundment consists of an earthen embankment on all sides. The downstream face of the embankments appeared to have approximately a 2:1 slope and were covered in some areas with vegetation. In addition, there appeared to be no erosion of the earthen downstream face of the embankment. The upstream slope is rip-rapped in areas where necessary. Anaconda presently has a private consultant performing a stability study on the impoundment.

Liquid from the tailings impoundment is transferred to four above-grade evaporation ponds with PVC on the bottom and sides and a three foot freeboard is maintained.

During the visit it was quite windy, yet there was no evidence of blowing of tailings from tailings areas within the impoundment not covered by water. These areas appeared to be heavily crusted over. (However, from the embankment we observed a large plume of dust rising from the UNC Homestake tailings area in the distance.)

In addition, there is an old carbonate tailings area at the site that has been covered with soil and naturally revegetated.

A review of monitoring data for the first six months of 1979, which appeared to be very well organized and documented, showed the following:

a) Groundwater - U-nat, Ra-226, and Th-230 are well below applicable MPCs and Ra-226 is also well below the drinking water standard of 3 pCi/l. Some data showed unusually high levels of Cl and SO4, but values were high both up and down gradient of the tailings and evaporation areas.

b) Air - both within the restricted area and off-site U-nat, Th-230, Ra-226, and Pb-210 are all well below the applicable MPCs based on high volume particulate samples (1 wk/month). Rn data (1 wk/month) showed levels of approximately .3 pCi/l which is well within the applicable MPC.

There is no firm detailed reclamation plan for the site at the present time.

MILL: Kerr-McGee

DATE OF VISIT: September 20, 1979

CONTACT: J. Cleveland

DISCUSSION

The Kerr-McGee facility is a 6000 ton per day acid leach mill. The tailings impoundment is made of tailings and raised by downstream spigotting (no cycloning). There was very little ponded water in the impoundment. Water is decanted to approximately three foot deep evaporation ponds (16 total) some of which are unlined, others of which have hypalon liners.

There was considerable evidence of seepage at the toe of the dam. Kerr-McGee has dug a ditch down to the Manco Shale, which is approximately 100 feet thick, to intercept this seepage which is then pumped back to the tailings impoundment. There are no piezometers in the dam.

Kerr-McGee has no program for interim stabilization to control blowing of tails and relys solely on crusting. There was considerable visible evidence of blown tailings and erosion of the dam (constructed of tailings) noted during the visit. Kerr-McGee indicated that measurements show that the tails used for dam construction contain 50 to 60 pCi of Ra-226 per gram of tailings.

Environmental monitoring data was reviewed during the visit. While there were reams of data, the data seemed to be poorly organized. Air particulate data was analyzed for gross alpha and there was no break down of radionuclides. Perimeter radon daughter measurements for two samples in 1979 showed values less than 0.01 WL. Groundwater data indicated a seepage problem out to approximately one-half mile. The licensee has approximately 100 wells, but most data was kept in corporate offices in Oklahoma and was therefore unavailable. Available data showed Ra-226 levels at the toe of the dam and at the site boundary of up to 16 pCi/l (drinking water standard 3 pCi/l), U levels of 1.7 mg/l, and Chloride levels of up to several thousand mg/l (drinking water standard 250 mg/l and livestock water standard 1500 mg/l). It should be emphasized that, although the data reviewed was only spotty, it is evident that there is a major groundwater contamination problem. Kerr-McGee indicated that they may install pump down wells to control the groundwater contamination problem.

Available gamma survey data showed gamma levels of 0.02 - 0.03 mr/hr within the site boundary and less than 0.02 mr/hr outside.

Kerr-McGee has no firm detailed reclamation plan but is studying alternatives at the present time. Future plans for tailings disposal are to raise the existing impoundment as necessary.

MILL: UNC Homestake Partners

DATE OF VISIT: September 20, 1979

CONTACT: J. Parker

This mill is a 3,000 ton per day alkaline leach process. Tailings are discharged to an above-grade impoundment made of tailings that appeared to be approximately 100 feet high. The dam is raised four to five feet per year with cycloned tailings. Tailings liquid from the impoundment (pH 9.5-10) is recycled back to the mill. UNC maintains five feet of freeboard (measured monthly) and 50 feet of beach. There are piezometers in the dam that are read every two weeks. There are two operators stationed at the tailings impoundment 24 hours per day.

During the site visit there was no visible evidence of blowing and tailings seemed to be crusted. However, later in the day while at Anaconda we observed a plume rising from UNC Homestake's tailings pile. UNC - Homestake relies essentially on crusting to control blowing tailings. They have used chemical sprays on certain susceptible areas in the past, but have no formal interim stabilization program.

In addition to the operating pile there is an old abandoned pile which has been partially revegetated. UNC owns all the land that both tailings areas are on.

A review of random environmental monitoring data showed the following:

Water: Data shows Ra-226 approximately 1 pCi/l (drinking water standard 3 pCi/l), As less than 0.01 mg/l (drinking water standard 0.05 mg/l), sulfate both on- and off-site and at background locations up to 1800 mg/l (drinking water standard 250 mg/l), nitrate up to 46 mg/l (drinking water standard 10 mg/l), and Se up to 1.0 mg/l (drinking water standard 0.01 mg/l).

Air: Particulate data from perimeter locations and locations outside the site perimeter showed concentrations of Ra-226, Th-230, and U-nat to be well below the applicable MPCs.

The licensee has done two sets of vegetation surveys to date but analysis has not yet been completed. Gamma surveys at 250 feet contours are scheduled to be done in the future every six months.

The licensee has a seepage intercept and collection well system to control movement of seepage and has reached an agreement with the state for groundwater cleanup. The licensee estimates that it will take five to eight years after the end of the life of the tailings pile to complete groundwater cleanup. In addition, the licensee is delivering water to two nearby subdivisions. However, the licensee feels that contamination of the subdivision's groundwater is not being caused by them, as evidence by the lack of contamination between the tailings pile and subdivision.

A study is presently being performed by a private consultant on alternative reclamation plans. UNC - Homestake's future plans are to raise the sides of the impoundment as necessary to contain future tailings.

ENCLOSURE 3

Bruce King
GOVERNOR

George S. Goldstein, Ph.D.
SECRETARY

Lucy J. Gordon, M.S., M.P.H.
DEPUTY SECRETARY

STATE OF NEW MEXICO
ENVIRONMENTAL IMPROVEMENT DIVISION
P.O. Box [illegible], Santa Fe, New Mexico 87503
(505) 827-5271
Thomas E. Baca, M.P.H., Director

L Lab Lubenau

October 18, 1979

Ross A. Scarano, Chief
Uranium Recovery Licensing Branch
Division of Waste Management
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Scarano:

During May 1979, the Division presented proposed revisions to the regulations Governing Health and Environmental Aspects of Radiation to the Environmental Improvement Board. The proposed regulations require applicants to review alternative tailings management methods. We expect to be informed of the Board's decision on the proposed amendments in the near future. Implementation of a procedure similar to that of the NRC's is expected to be promulgated by the Board.

adopted Nov. 16, 1979.

Sincerely,

Original signed by Thomas E. Baca

Thomas E. Baca
Director

TEB/gws

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

FEB 04 1980

Mr. Thomas E. Baca, Director
Environmental Improvement Division
P. O. Box 968, Crown Building
Santa Fe, New Mexico 87503

Dear Mr. Baca:

Enclosed is the environmental assessment related to the proposed Bokum Resources Corporation Marquez Uranium Mill that we have prepared at your request. The scope of this assessment has been limited in conformance with the outline contained in the letter from your Mr. G. W. Stewart to Ms. M. Krug of my office dated January 8, 1980. Please note that, as we agreed upon, geotechnical evaluations of the embankments to be utilized in the tailings management program are not included in this assessment. If your staff have any questions regarding this assessment, feel free to have them contact Mr. H. Miller of my staff at FTS: 427-4103.

In summary, we conclude that the Bokum tailings management program is acceptable subject to the imposition of the recommended license conditions noted in the report.

To confirm an offer made in prior communication, we would be pleased to participate with the state in any public hearings or information meetings in support of the recommendations and conclusions contained in this assessment.

Please let me know if we can be of further assistance in this matter.

Sincerely,

Ross A. Scarano, Chief
Uranium Recovery Licensing Branch
Division of Waste Management

Enclosure (2 copies):
As stated

cc: Dr. Ted Wolff, NMEID
w/ 2 copies of enclosure

STATEMENT OF J. DAVID HANN

EXECUTIVE VICE PRESIDENT AND CHIEF OPERATING OFFICER

UNITED NUCLEAR CORPORATION

BEFORE THE

SUBCOMMITTEE ON ENERGY

AND THE ENVIRONMENT

OF THE

COMMITTEE ON INTERIOR

AND INSULAR AFFAIRS

October 22, 1979

My name is J. David Hann. I am Executive Vice President and Chief Operating Officer of United Nuclear Corporation. I welcome the opportunity to appear before this committee to discuss our mill tailings dam breach. Since we have supplied substantial technical data, in writing, I will not repeat that in detail. My statement today will cover a brief description of our Northeast Church Rock New Mexico operation; the design and licensing of the tailings dam; the occurrence of the breach, its effects and the actions we have taken; the conclusions as to the cause of the breach and the stability of the remainder of the dam; our cleanup and monitoring program; and finally, an assessment of the consequences of this event.

I have with me Lawrence A. Hansen, Assistant Professor of Engineering at Arizona State University, and a consultant to the engineering firm of Sergent, Hauskins & Beckwith, who did extensive studies on the cause of the breach. I also have with me Todd Miller, Manager of Environmental Operations for our Mining and Milling Division, who directed the comprehensive sampling and cleanup program, and Dr. Noel Savignac, Manager of Environmental Services for our Mining and Milling Division. Dr. Savignac is a health physicist specializing in radiation and is chairman of the Uranium Environmental Subcommittee of the American Mining Congress. At the appropriate time, we will be happy to answer any questions you may have.

United Nuclear's principal business is the production of uranium and nearly all of that production is in New Mexico. We have been mining and milling uranium in the state for approximately 20 years. We employ more than 2300 people in New Mexico, with an annual payroll of approximately $45 million. Our total expenditures in the state are more than $140 million annually.

Our largest uranium mine, and the largest operating underground uranium mine in the U. S., is at Church Rock, New Mexico, 20 miles northeast of the city of Gallup. The uranium ore from that mine is processed at our nearby Church Rock mill. The mine employs more than 800 people and the mill about 150. More than 200 are Navajo people. We are one of the largest employers in the area. This mill provides well over half of our uranium production. Last year it produced about two million pounds of U_3O_8, or enough to provide the annual reload fuel needs of five large nuclear power plants, each capable of generating one million kilowatts of electricity. To replace this electricity using oil would require about 50 million barrels. At full production, the Church Rock Mine contributes more than one half million dollars per year in royalties to the Navajo tribe.

The uranium mined in United Nuclear's mines in New Mexico is found in clayey sandstone deposits. Each ton of ore contains only two to three pounds of uranium, which is extracted in the milling process. At our Church Rock mill the sandstone is crushed and treated with dilute sulfuric acid (about a 2% solution), which dissolves the uranium. The uranium solution then goes through a number of concentration and purification stages before emerging as uranium concentrate or yellowcake (U_3O_8). The sand and clay, after a number of washing stages to remove as much of the uranium as possible, is transported by pipeline to the tailings area, along with the tailings liquid.

It is important to today's discussion to understand the nature of uranium mill tailings. The solid tailings are essentially sand and clay, but retain a small fraction of the original uranium of the ore, along with other natural constituents not removed in the milling process. The concentrations of these constituents in the tailings are just those of the ore, and similar concentrations can be found in natural surface outcroppings. The tailings are not considered occupationally hazardous, and large quantities of both the ore and the tailings are handled on a day to day basis by mine and mill personnel. An important reason for confinement of uranium mill tailings solids is to reduce future potential health hazards from very long term release of radon gas, a factor that is not significant in this tailings spill.

The tailings liquid is a dilute acid solution containing, among other things, process chemicals and small amounts of low level radioactive materials and heavy metals from the ore. If a person fell into our tailings pond, the water would not taste good and his eyes would smart from the acidity, but his health would not be endangered from toxicity or contact with the liquid. Although this liquid is certainly not suitable for consumption, it is not considered a highly toxic material even in undiluted form. In the case of this spill, the liquid was soon diluted by stream waters and rain. By the time the acidity was reduced enough for the water to be drinkable, its toxicity posed no health danger. The technical data previously furnished to the Committee contains detailed chemical analyses of the tailings solids and tailings liquid.

New Mexico is an agreement state under the Atomic Energy Act. The organization primarily responsible for uranium mill licensing is the New Mexico Environmental Improvement Division (EID). This agency's licensing process is nearly identical to that of the Nuclear Regulatory Commission,

including the requirement of an environmental report.* The EID relies upon the New Mexico State Engineer's office for approval of structural tailings dam design. The State Engineer's office is an experienced organization that has reviewed over 600 dams in New Mexico. The EID also invites comments from many federal and state agencies and other interested parties. In the case of the Church Rock mill, comments were received from the Nuclear Regulatory Commission, the Environmental Protection Agency and the Bureau of Indian Affairs. We look to the state agencies for direction in licensing matters and concur with Chairman Udall's position that licensing authority is a matter for Agreement States until 1981, as stated in the letter of April 26, 1979, signed by the principal authors of the Uranium Mill Tailings Radiation Control Act.

The Church Rock tailings impoundment was designed and constructed by experienced engineering and construction firms with extensive use of independent experts. The design conformed to NRC Regulatory Guide 3.11 entitled "Design, Construction and Inspection of Embankment Retention Systems for Uranium Mills." During the review process the NRC proposed a revision to this guide, and the dam design was modified to conform to the guideline revision.

The tailings retention dam is an earthen dam having a packed clay core. The initial structure was a starter dam, with its cross section shaped like a trapezoid, ranging from 12 feet to 38 feet in height, 60 feet thick at the crest and up to 180 feet thick at the base. The plans approved provided that this low embankment was, in time, to be increased in height and thickness. The raising process, which had just commenced at the time of the breach, was to include a sand drainage blanket and additional instrumentation as added safety features to insure the long-term stability of the dam.

The tailings pond area is divided into three sections by cross dikes. A breach in the dam occurred early in the morning of July 16, resulting in the release of a fraction of one percent of the total tailings solids and about 280 acre-feet of tailings liquids from the southernmost of the three ponds into an arroyo, or canyon, which feeds into another arroyo called the Rio Puerco. I want to emphasize that much of the tailings solids was captured in a catchment basin at the base of the dam; the portion that did enter

* Applicant's Environmental Report on the Church Rock, New Mexico Uranium Mine and Mill, 2 vols., UNC-ER-1, 1975.

the arroyo was, for the most part, deposited within a very few miles downstream.

The breach was discovered about 6:00 A.M. We immediately stopped discharging into the tailings area and shut down the mill. We were able to quickly construct a temporary dike in front of the breach, and by 7:50 A.M. the flow from the tailings pond had been stopped.

The State Environmental Improvement Division was notified of the spill by 7:30 A.M., followed by the NRC and Mine Safety and Health Administration. Officials of the city of Gallup were contacted and news of the spill was broadcast by local radio stations. By 7:55 A.M., Navajo-speaking mill personnel were dispatched to personally notify residents downstream, in accordance with the state-approved contingency plan, and by 11:40 A.M., all residences required to be notified had been contacted. This is a sparsely-settled area, and only 17 families reside within the three-mile distance covered by the plan. Some 32 family groups reside within a two-mile range of the arroyo and the Rio Puerco between our mill and Gallup. These inhabitants were also notified that, as a precautionary measure, drinking water would be made available for their needs.

By 8:10 A.M., drinking water in gallon bottles was on its way to the mill site to be distributed to local residents. At 2:30 P.M., the first tank truck hauling water for livestock left the mill site. United Nuclear has continued to provide both drinking and livestock water to residents downstream on a daily basis. To date, over one million gallons of water have been distributed.

By 8:20 A.M. that first day, surface water sampling was initiated; sampling still continues. By noon, mill personnel had been dispatched to track the flow in the Rio Puerco. The flow was followed, photographed and sampled until noon on the 19th, when a small trickle reached its farthest point, near Sanders, Arizona, about 25 miles from the New Mexico border.

On July 17, sediment sampling in the arroyo and the Rio Puerco was initiated, and cleanup operations were begun on the afternoon of the 18th. I will return to a discussion of the cleanup and an assessment of the effects of the spill later in this presentation.

The cause of the breach has been investigated thoroughly and independently by two professional engineering firms. The results of their work have been reviewed by representatives of the EID, State Engineer, NRC, U. S. Army Corps of Engineers

and Environmental Protection Agency. Both engineering firms and all of these agencies concur that the breach was caused by differential settling of the dam resulting in transverse cracking, followed by internal erosion. The cracking resulted from uneven settling of the dam between areas of shallow and deeper bedrock. Some settling of the dam was expected; however, a unique rock point beneath the breach, at which point the bedrock drops off sharply to the north, east and west, served as a fulcrum, resulting in the transverse cracking. This unusual configuration of the bedrock was only discovered during the investigation of the breach.

As a precaution, a sand beach was normally maintained on the upstream side of the dam as a buffer between the tailings liquid and the dam proper. In the area of this transverse crack, tailings liquid temporarily exceeded the sand beach and came in contact with the dam. We believe that this was the initial source of fluids that started the internal erosion subsequent to the cracking. Without the transverse crack, the contact of liquid with the dam would not have created a breach.

The independent engineering firms have also analyzed the remainder of the tailings embankment and confirmed that the northern portion of the embankment and the divider dikes that we propose to use initially on restarting are stable. The bedrock under the remainder of the dam does not have any configuration similar to the rock point under the breach. These findings have been reviewed by each of the agencies concerned. The State Engineer has concurred and has approved such a startup with certain additional precautions.

I would mention that there was unrelated rotational settlement and cracking in 1977, which was repaired under the supervision of a professional engineering firm.

Turning to the spill itself, approximately eleven hundred tons of tailings solids and two hundred eighty acre-feet (100 million gallons) of tailings liquid escaped. The liquid discharge partially filled the arroyo and the Rio Puerco, creating limited flash flood conditions similar to those experienced in the area during typical summer cloudbursts.

The arroyo and the Rio Puerco are normally dry except for a flow of treated mine water from our own and another uranium mine in the area. This water is used by some of the Navajo people for watering livestock.

Immediately following the spill, the water in the Rio Puerco was not suitable for consumption by livestock. However, the acidity made the stream water distasteful, and it was

observed that livestock avoided it. Tests of livestock tissue samples by the New Mexico Department of Health and Environment, the Indian Health Service and the Center for Disease Control showed no detectable effects on livestock from the spill.

Mine water flow and rain diluted the stream content to such an extent that by July 19---three days after the spill--- all of our surface water samples showed the radioactivity of the water in the arroyo and the Rio Puerco to have returned to an acceptable level.*

Because much of the initial flow seeped into the ground, concern has been expressed about possible contamination of wells. The hydrology of the area makes significant groundwater contamination highly unlikely. We have sampled alluvial wells within 3/4 of a mile of the Rio Puerco from the mill site to the Arizona border, and found no contamination due to the spill.

Although much of the solid tailings was captured in the catchment basin at the base of the dam, some was carried downstream. Our immediate actions were directed at cleaning up any visible deposits while starting sampling and monitoring programs to determine the location and extent of any contamination. These sampling and monitoring programs are still continuing.

Over 4000 sediment samples, 4500 gamma measurements and 300 other samples have been taken in United Nuclear's assessment process. These sampling efforts permit comparison of present stream bed conditions with prior conditions and with the cleanup criteria. United Nuclear has used independent laboratories as well as its own Radiological/Environmental Laboratory in this program. Testing has included not only sediments, but also air, surface water, ground water, runoff and the testing of livestock and vegetation. As results from the sampling program become available, they are used to guide cleanup work.

Where possible, mechanical equipment has been used in the cleanup operation. However, due to stream bed conditions most of the cleanup operation has consisted of manual labor. Cleanup crews from the mill have worked during daylight hours shoveling stream bed sediment into buckets for transfer into drums or vehicles to be returned to the mill tailings area.

* NMEIA Regulations for Governing the Health and Environmental Aspects of Radiation, New Mexico Environmental Improvement Agency, 1973, and 10 CRF 20, Standards for Protection against Radiation, U. S. Nuclear Regulatory Commission, 1979.

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Such a cleanup process, though tedious and time-consuming, is considered to be thorough. We have removed more than 3500 tons of potentially affected sediment from the stream bed, to a distance of more than 10 miles from the mill. All of this work has been performed by our Church Rock personnel. To date more than 15,000 man-hours have been applied to the cleanup operation.

The combination of these cleanup efforts and natural effects, such as rain, has largely restored normal conditions in the area.

During the cleanup process, we used criteria based on an NRC position paper on land cleanup in decommissioning uranium mill sites.* This paper identifies radium-226 as the critical element and proposes suitable limits. Radium-226 contamination can be determined either by direct soil measurements or by gamma radiation measurements above the ground.

A gamma radiation survey has been taken inside the arroyo and the Rio Puerco to a distance of 60 miles (to Sanders, Arizona). More than 80% of the measurements show equal or lower levels of radiation inside the stream bed than the background outside. Where the radiation inside the bed is higher than outside, it generally appears to result from natural outcropping of low-grade uranium ore. The survey taken inside the stream bed showed average gamma radiation levels consistently lower than the year-round average level in the city of Gallup---well below the limiting gamma measurements suggested by the NRC for uranium mill decommissioning.

At this time there appears to be no health problem in connection with radium concentrations.

The EID has ordered decontamination to significantly lower levels for radium than those of the NRC working paper, and also set a separate standard for thorium-230. Virtually all of the recent measurements show radium levels below even those set by the EID. Most of the samples show thorium-230 levels lower than those specified by EID. For those that fall outside the standard, we believe that at least some of these measurements are due to natural background, and we are working with EID to clarify this situation. Our cleanup program is continuing.

It is the opinion of our professional staff that there

* "Staff Technical Position for Interim Land Cleanup Criteria for Decommissioning Uranium Mill Sites", NRC, 1978.

was no substantial radiological danger created by the spill, and to date all published reports of tests of humans and livestock confirm this opinion. Whole body counts and urinalyses of six Navajo people identified as having had contact or exposure to the spill area were conducted by the Los Alamos Scientific Laboratory, in conjunction with the Indian Health Service, the Church Rock Action Committee, and the Center for Disease Control. The published results of these tests confirmed that the radiation levels and levels of uranium and thorium and their daughters were "normal in every respect compared to those in the general population."

Since July 16, beginning with personal notification of the residents downstream, frequent contacts have been made with the Navajo people, various tribal entities and community organizations in the Gallup area. United Nuclear has regularly and routinely made the environmental sampling results available to the local communities, the Navajo Tribe's Environmental Protection Commission and the media.

We wish to express our thanks to the people of New Mexico and particularly those in the Gallup area, who have supported our efforts to correct this situation and resume operation.

In summary, our conclusions and assessment with regard to this incident, are that:

1. The tailings dam was designed in accordance with the best engineering practice and met all design criteria established by the Nuclear Regulatory Commission and the Stare of New Mexico.

2. Failure of the dam was due primarily to a unique subsurface bedrock configuration.

3. Except for the initial tailings water flood, which was comparable to typical flash floods caused by local rain storms, the spill did not and does not represent a significant hazard to local residents or to downstream communities.

4. United Nuclear has acted with responsibility and dispatch in cleaning up the spill, communicating with and aiding local residents and working with government and local authorities.

5. Two independent engineering firms, as well as state and federal agencies, agree that operations can be safely resumed.

-8-

United Nuclear has maintained its work force intact during this period. We are concerned that continued denial of permission to restart our mill will force us to reduce our work force substantially, resulting in severe hardship to the local community.

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UNC MINING AND MILLING

Division of United Nuclear Corporation
A UNC RESOURCES Company

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4801 Indian School Road, N E
Albuquerque, New Mexico 87110
Telephone 505/265-4421

July 20, 1979

Mr. Thomas E. Baca
Director, New Mexico Environmental Improvement Division
P.O. Box 968
Santa Fe, New Mexico 87503

Dear Mr. Baca,

Pursuant to the request of the New Mexico Environmental Improvement Division, United Nuclear Corporation presents this report to the Division concerning the breach of the tailings impoundment at UNC's uranium milling facility located near Church Rock, New Mexico, Monday, July 16, 1979. The report includes a determination as to the cause of the breach, a review of sampling procedures, a plan for clean-up and decontamination based upon the sampling results, and a proposal for the resumption of operation of the milling facility.

The report is based upon the results of all investigative data available at this time. I trust you will find it complete and satisfactory to the Division.

UNC is grateful for the Division's complete cooperation and assistance in helping the company to deal most effectively with this difficult incident.

Sincerely,

D. D. Turberville
President

DDT:ga

UNITED NUCLEAR CORPORATION

MINING AND MILLING DIVISION

REPORT

STABILITY AND INTEGRITY ASSESSMENT

of

NORTHEAST CHURCH ROCK TAILINGS DAM

July 20, 1979

INDEX

INTRODUCTION

In response to the official request of Mr. Al Topp of the Environmental Improvement Division, State of New Mexico, the Mining and Milling Division of the United Nuclear Corporation has diligently, and with dispatch, initiated an intensive and vigorous investigative program into the cause, or causes, of this most unexpected breach of a segment of the Church Rock earthen embankment tailings dam located near the south abutment. This approach included the immediate marshalling of UNC's top management forces and backup staff to institute a most comprehensive cleanup program to minimize, as far as practicable under the circumstances, the ensuing tailings spill effects upon the surrounding community and its environment.

To this end, the Mining and Milling Division of UNC immediately commissioned independent and respected professional engineering expertise in the endeavor, to assist in pinpointing the cause or causes surrounding this most unfortunate occurrence, and the exploration of consequential and potential developing effects thereof, if any, upon the remainder of the present dam structure, including the dam expansion construction program presently underway.

This well-planned investigative program and in-depth probing for the pertinent facts was also initiated to establish whether the present dam structure has or has not been compromised in any other manner, or that the dam has or has not suffered any consequential structural effects or deleterious stability consequences thereof in any fashion.

In addition, the vigorous review of the cause and effects of the breach was also targeted to establish for all concerned whether this occurrence could not possibly be experienced again, and where found prudent by the results of this review, to implement an immediate refinement and bolstering of the present tailings deposition operations and tailings dam surveillance monitoring procedures.

Further, the long-range planning of UNC along this vein is under review and evaluation, and will conform to the latest proven techniques.

Concurrently with the above activities, UNC initiated an in-depth plan of action to pinpoint the potential contaminating effects of the tailings spill upon the surrounding environment. This program entailed the prompt development of a detailed sand deposition and water sampling procedure for immediate implementation in areas where tailings sand depositions were most likely to take place, including the taking of water samples at appropriate locations to pinpoint the areas along the spill route requiring cleanup attention. Thus, UNC was able to bring to bear all of its available forces in a concerted and meaningful cleanup operation.

As each sample was taken in a potentially contaminated area, its location was recorded before cleanup activities commenced, and associated test results of each sample were recorded accordingly. Upon the completion of cleanup operations of each affected area, resampling and retesting of the cleaned up areas was made once again for the recording and comparison of the effectiveness of the cleanup efforts associated with each area. Where test readings of a specific area did not meet expectations, a re-cleanup of the area was conducted.

To assure that proper lab testing procedures were conducted and coordinated with the above activities, UNC implemented a detailed and appropriate lab analyses program.

At the same time, a planned course of action was established by UNC to properly dispose of all collected contaminants and lab waste samples within the confines of the tailings dam.

All appropriate data resulting from the above program is duly recorded and included in this report to attest to the effectiveness of the cleanup efforts of UNC.

The culmination of the above efforts was directed ultimately to the resumption of milling operations at Church Rock and in keeping with this thrust, a detailed plan for the Resumption of Operations was developed and stands ready for immediate implementation upon the approval to do so by your office and associated governing agencies.

The orderly and detailed steps to resume operations in the north area of the tailings dam, the related timing for activation of the two-cell containment areas therein and methods of deposition and protective arrangements for these areas are provided for in the planning by UNC. In addition, a constant surveillance program was developed to insure that the integrity of the dam can be monitored and any required actions to improve developing conditions can be immediately addressed.

The United Nuclear Corporation Mining and Milling Division is convinced that all of the above planning and associated efforts assure that the present dam stability has not been impaired, is structurally sound, and considerable safeguards are incorporated not only in the new construction of the dam but in the north portion of the dam to insure a safe return to operations. A plan by UNC, in association with Sergent, Hauskins & Beckwith, for repairing the breached portion of the dam is underway and as soon as it is available, UNC will present the results thereof to your office and associated governing offices for review.

The appendices included within this report will support in detail all of the items noted above.

ENCAPSULATED OBSERVATIONS, CONCLUSIONS, AND
PLANNED OPERATIONS AND MONITORING SURVEILLANCE IMPROVEMENTS

1. CAUSE OF TAILINGS DAM BREACH

The cause of the dam breach near the south abutment was due to a unique combination of conditions:

A. The breach that occurred near the southern end the dam is a unique situation inasmuch as it is located in a transition zone between nearly incompressible bedrock and deep compressible alluvial foundation conditions and where an abrupt change in bedrock and thickness of alluvium occurs.

B. A vertical crack, or a system of cracks, occurred perpendicular to the dam, which was created by a differcntial settlement of an unexpected magnitude located in the transition zone noted above and underlying the breached segment of the dam.

C. Compounding this condition was the occurrence of erosion through these differential settlement cracks caused by the untimely presence of a shallow depth of free liquids contacting the upstream face of the dam in that general vicinity.

Since it was necessary to use cycloned sands to produce a sand drainage blanket for the new dam lift construction at the downstream face of the dam, it was felt that the small time intervals during which interruptions in the maintaining of a continuous sand frontage beach along the upstream face of the dam during spigoting operations would occur, would not compromise the earthen containment dam. This appeared to be a valid approach since no other outside compromising conditions were anticipated to occur simultaneously to compound this temporary condition. This combination, and the lack of a complete fronting sand beach, thus precluded the healing-sealing effect of this missing portion of the sands beach at the settlement crack area noted. The breach of the dam thus ensued.

2. DISCHARGE DESCRIPTION, CLEANUP, AND MONITORING

The breach resulted in a discharge of approximately 288 acre-feet of tailings solution and 1100 tons of tailings solids into the surrounding area. The impact of this release is being assessed through analysis of numerous samples taken of the flow and the stream sediments. Present data show a total of 100 miliCuries of radium-226 and 60 mili-Curies of uranium in the solids which escaped from the impoundment.

Cleanup activities commenced on Wednesday evening and have proceeded throughout the daylight hours since that time. Initial gross alpha results indicated higher concentrations in side arroyos where eddying occurred, therefore cleanup has been concentrated in those areas. More recent results show radium-226 levels well below those allowed, under Appendix A, Part 4 of the New Mexico "Regulations Governing the Health and Environmental Aspects of Radiation," for discharges to unrestricted areas. We now propose to utilize a cleanup criteria of 3.0×10^{-5} microCuries of radium-226 per gram of sediment. Detailed sampling of side arroyos will allow identification of localized contamination and hence precise efficient cleanup.

Monitoring activities will be expanded to a more comprehensive program which will involve additional groundwater monitoring wells adjacent to the toedam, four (4) new surface water sampling locations, and two (2) alluvial well sampling points.

3. RESUMPTION OF OPERATIONS

In order to resume operations as expeditiously as possible at the Church Rock mill, and to give assurances that all possible refinements and necessary safeguard and backup additions are incorporated, not only into the reactivation of the north half of the dam but also the entire containment dam structure, UNC developed a very detailed sequence of startup operational procedures contained in an appended compilation.

In summary, the detailed sequences include in-depth planning for the safe resumption of operations as follows:

An operating plan covers the physical description of the north impoundment area followed by a detailed description for the initial deposition area preparations which include various methods for providing a protective and continuous sand beach adjacent to all earthen constructed and compacted splitter dikes contained within the north portion of the dam, plus the fronting of all dam upstream faces in use.

Included in this plan is a description of how the continuing lifting of the dam construction operations will be coordinated in these areas.

Additionally, a comprehensive tailings dam surveillance format was developed, including responsive communication method groundrules, reporting methods, and the inauguration of a more responsive reaction format to be followed in the event of the spotting of unusual conditions occurring at the dam.

This detailed plan also provides for periodic aerial photo reconnaissance and recording of mill throughput rates of depositions to monitor the rate of growth of the tailings pond depositions for comparison means.

SAMPLING PROCEDURE

Samples were taken in the arroyo in areas where deposition was most likely to take place. These locations were selected randomly.

Procedure

1. Visually inspect locations for signs of lighter colored sands.
2. Determine extent of flow during runoff.
3. Determine number of samples needed. This is based on the size of the area exposed.
4. Survey area near the surface (1 foot) with Micro-R survey meter. Use any anomalies in the readings as sample selection points. If anomalies do not exist, take sample an equal distant apart beginning at water's edge and ending at edge of flood plain if previous flow is indicated. Samples were taken parallel to stream flow where possible.
5. Using a 250 ml plastic beaker sample was scooped along the surface at a depth of 1 inch until beaker was full. Sample was then placed in a plastic bag and sealed.
6. Areas where backflow occurred i.e. side arroyos were sampled due to the fact that at flood stage these areas had the calmest water thereby allowing for greater deposition.

Sample Preparation

1. Samples were taken to lab where a portion was removed, placed on a planchet and dried. The remainder was then dried in an oven and later pulverized for chemical analysis.
2. The dried planchet sample was analysed for gross alpha and compared to river sample taken upstream of the spill.
3. A Ra-226 standard was used to determine gross alpha activity of the planchet per surface area of the planchet.

BREACH WATER

Sample Location	pH 7-16-79	7-19-79
Upstream at Ford in Road	8.87	8.66
Falls above spill	8.90	8.68
Tailings Solution above Toe Dam	1.05	
Pinedale Road Crossing	1.40	5.07
State Road 566 Bridge	1.41	4.48
Arroyo behind El Paso Refinery	2.49	5.62
Hogback on East end of Gallup	2.69	6.28
Maloney Avenue backflow	6.01	6.56
Weigh Station 9 miles east of Arizona border	8.18	6.00

BREACH WATER

Sample Location	U (mg/l) 7-16-79	7-19-79
Upstream at Ford in Road	0.71	0.81
Falls above spill	0.79	0.80
Tailings Solution above Toe Dam	6.17	
Pinedale Road Crossing	6.49	0.02
State Road 566 Bridge	7.49	0.03
Arroyo behind El Paso Refinery	6.81	0.01
Hogback on East end of Gallup	6.31	0.04
Maloney Avenue backflow	5.24	0.24
Weigh Station 9 miles east of Arizona border	0.51	0.01

BREACH WATER

Sample Location	Ra - 226 (pCi/l) 7-16-79
Upstream at Ford in Road	2.5
Falls above spill	5.5
Tailings Solution above Toe Dam	1262.1
Pinedale Road Crossing	100.2
State Road 566 Bridge	545.9
Arroyo behind El Paso Refinery	53.0
Hogback on East end of Gallup	23.0
Maloney Avenue backflow	14.8
Weigh Station 9 miles east of Arizona border	3.4

DAM BREACH
STREAM SEDIMENT SAMPLES
7-17-79

Site Number	Sample Number	Radium-226 x 10^{-5} uCi/gm	Description
1	1	1.0	10 miles below property line
	2	1.1	
2	3	1.3	7.5 miles below property line
	4	1.2	
	5	1.1	
3	6	1.3	6.5 miles below property line
	7	0.6	
	8	0.5	
	9	0.2	
	10	0.5	
4	11	0.4	566 Bridge, 5 miles below property line
	12	0.7	
	13		
	14	1.1	
	15	1.4	
5	16	2.2	Pinedale Bridge, 4 miles below property line

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DAM BREACH
STREAM SEDIMENT SAMPLES
7-17-79

(Continued)

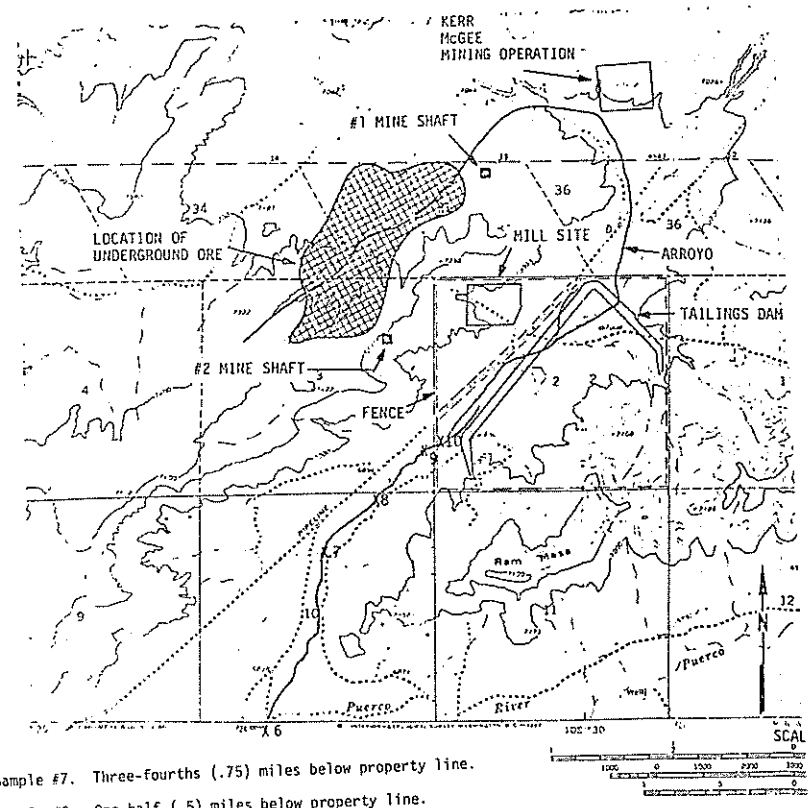
Site Number	Sample Number	Radium-226 x 10^{-5} uCi/gm	Description
6	17	2.4	Below Puerco confluence, 1.5 miles below property line
	18	1.4	
	19	1.5	
	20		
	21		
	22		
7	23	5.0	3/4 mile below property line
	24	1.3	
	25	0.4	
	26		
8	27		1/2 mile below property line
	28	9.4	
	29	14.0	
	30	4.1	
9	31	8.7	500 yards below property line
	32	2.6	
	33		
	34		
	35	10.6	
	36	7.6	

DAM BREACH
STREAM SEDIMENT SAMPLES
7-17-79

(Continued)

Site Number	Sample Number	Radium-226 x 10^{-5} uCi/gm	Description
10	36		Above and below the spill inside property lines
	37		
	38		
	39		
	40		
	41		
	42		
	43		
	44		
	45		
11	46	0.4	Upstream above tailings area
	47	0.6	

DAM BREACH STREAM SEDIMENT SAMPLES



Sample #7. Three-fourths (.75) miles below property line.

Sample #8. One-half (.5) miles below property line.

Sample #9. Five hundred (500) yards below property line.

Sample #10. Above and below the spill inside the property line.

DAM BREACH STREAM SEDIMENT SAMPLES

Sample #1. Ten (10) miles below property line.

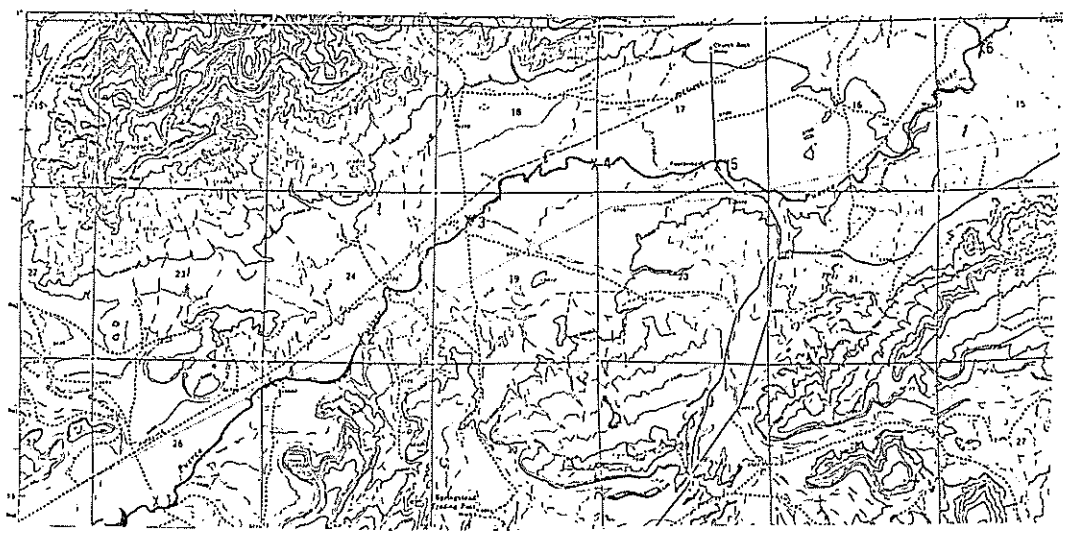
Sample #2. Seven and one-half (7.5) miles below property line.

Sample #3. Six and one-half (6.5) miles below property line.

Sample #4. 566 Bridge, Five (5) miles below property line.

Sample #5. Pinedale Bridge, Four (4) miles below property line.

Sample #6. Below Puerco confluence, one and one-half (1.5) miles below property line.



CLEANUP PROCEDURE

Utilizing data obtained in initial sampling, cleanup has been initiated upstream of the Pinedale Road crossing. The following procedure is being used.

Procedure

1. Identify side arroyos where tailings may have been deposited.
2. Sample middle of area as per sampling procedure.
3. Using shovels, skim top four (4) inches of material into five (5) gallon buckets. Remove material from the entire area up to the high water line and down to the mouth of the side arroyo.
4. Deposit the mud into 55 gallon drums on the back of a flatbed or pickup truck.
5. As each location is cleared, sample the area as closely as possible to the original sites.
6. Use a cherry picker to dump the full drums of mud into the tailings area .
7. Samples will be prepared and analyzed following the sampling procedure. Follow-up analysis for Uranium, Radium-226 and Thorium-230 will also be performed.
8. Locations will be considered clean when Radium-226 levels are below 3.0×10^{-5} microcuries per gram.

MONITORING PROGRAM

Groundwater

Number of Locations: Five (5) additional wells for a total of 11. New wells to be located adjacent to the toe dam.

Frequency: Quarterly, with analysis for the parameters in List A (Attached).

Method: Bailed sample

Reporting: Quarterly, as complete analysis is available.

Surface Water

Number of Locations: Four (4) additional locations downstream for a total of six (6) sites ranging from one (1) mile above the dam to thirty (30) miles below.

Frequency: Quarterly, with analysis for the parameters in List B (Attached).

Method: Grab sample

Reporting: Data will be available from the Manager of Environmental Operations on request.

Alluvial Wells

Number of locations: Two (2), downstream of the tailings area.

Frequency: Quarterly, with analysis for the parameters in List B (Attached).

Method: Dictated by pumping apparatus at each location.

Reporting: Data will be available from the Manager of Environmental Operations on request.

LIST A

Aluminum	Mercury
Arsenic	Molybdenum
Barium	Nickel
Boron	Nitrate
Chloride	pH
Chromium	Selenium
Cobalt	Silver
Copper	Sulfate
Cyanide	Total Dissolved Solids
Fluoride	Uranium
Iron, Total	Zinc
Lead	Radium - 226
Manganese	Radium - 228

LIST B

Arsenic	Nitrate
Barium	pH
Cadnium	Selenium
Chloride	Silver
Chromium	Sulfate
Copper	Turbidity
Cyanide	Uranium
Fluoride	Zinc
Iron, Total	Gross Alpha
Lead	Radium - 226
Manganese	Radium - 228
Mercury	

RESUMPTION OF OPERATIONS

SUMMARY

In order to resume operations, tailings deposition can be accomplished in the north area. This area is divided into roughly two (2) equal halves, central and north. The central part can be ready for operation by Thursday evening, July 19, 1979. This will give an operating life of nineteen (19) days. The north tailings structure will be raised 5 feet in order to utilize all the northern part of the north tailings impoundment area. The raising of this structure increases the operating life by thirty (30) days for a total of forty-nine (49) days. This work can be completed by Wednesday, July 25, 1979.

Twenty-four (24)-hour surveillance of the tailings structure and the tailings line is proposed to insure safe operating conditions.

Cyclone deposition of coarse sands is recommended for good segregation to utilize the underflow sands for the continuing placement of the sand drainage blanket during the present dam expansion-construction phase.

OPERATING PLAN

The north tailings area can be used for tailings deposition and containment upon notification by the State agencies that operations can be resumed.

1. Physical Description of North Area

The north half of the total tailings area is bounded to the south by the central dike now being used by the construction subcontractor as a haulage road trending approximately N30°W, to the west by the tailings containment structure which runs approximately N50°E, to the north by the continuing tailings containment structure in a W-E orientation, to

the east by the natural sloping terrain.

The north area is further divided into two approximately equal areas by previous sand deposition and by a natural hill near the center of this area. An equipment access road has been built over the sand beds which delineates the division sharply. The area immediately adjacent and north of the central structure, hereafter designated as the central part, has an area of 15 acres, and the extreme north area 12 acres. The extreme north area has a free board of 5'1" and therefore is not immediately usable as a deposition area.

2. Initial Deposition Area Preparation

In order to safely contain tailings in the central area, a protective sand beach must be established adjacent to the center dike on the tailings deposition on inboard and outboard sides. The sand can be deposited with a drag line extending 50 feet from the dike and averaging approximately 5 feet thick by 700 feet long for a total of approximately 3,000 yd^3. The critical sand beach deposition lies mainly to the east where tailings solution contacts the center dike. This critical volume to be filled with sand will require approximately 1,000 cubic yards. This work was completed Thursday, July 19, 1979.

The second work item for initial area preparation consists of building a ramp 10 feet high for cyclone placement over the existing access road which parallels the tailings dam and is approximately 100 feet east of the dam. The ramp and the cyclone placement were also completed Thursday, July 19, 1979. The cyclone operation will continue to provide coarse sands for the sand blanket construction once operations are resumed. By placing the cyclones at an elevated position, setups can be minimized. A cyclone bypass line shall be provided as well as an auxiliary tailings line to spigot in the central area.

In summary, the critical item of initial area preparation is to place the 3,000 cubic yards fronting the east half of the central

structure. Once this is done, the area can safely receive tailings. The remaining 4,000 tons can be placed on the cyclone July 20th. Placement is for optimization of coarse sands segregation. Thus, milling operations can be safely resumed by Friday, July 20, with a potential tailings deposition life of 19 days.

3. Secondary Deposition Area Preparation

The central structure and the north structure will be raised a minimum of 5 feet to increase the deposition life by 30 days more for a total of 49 days, allowing time for the remedial work at the south end of the tailings containment structure. This work is presently underway and is scheduled for completion July 25.

After these structures have been raised, sand beach placement can commence at the extreme north end.

At the center section of the tailings structure and fronting it for approximately 600 feet, a trench has been excavated to remove the sands for mine backfill. This trench is now flooded with tailings solution and will be pumped out before filling with sands to establish a beach. This trench will then be filled with sands to establish a beach fronting the north tailings structure. This work is to be accomplished within the 19-day operating life of the central pond.

Once this work is done and while cyclone operations continue at the center pond, the crossroad can continue to be lifted so that a two-cell operating mode can continue where cyclone underflow deposition is carried out predominantly to the central pond and the cyclone overflow can be directed predominantly to the extreme north pond.

4. Tailings Containment Area Surveillance

4.1 The tailings dikes shall be continually patrolled. A complete round consists of a starting point at the east end of the central structure to the intersection of the main tailings structure, then

north on the main structure to the extreme north end. Then continuing south on the toe dam so that any seepage emanating from the main structure can be readily observed, then continuing south out of the main structure to inspect the temporary plug, to the original point of departure. It shall be necessary at the south end to establish a ramp parallel to the tailings line to gain access from the toe dam to the main tailings structure.

This surveillance shall be performed by the tailings operator in the Four Wheel Drive tailings truck equipped with a spotlight for night surveillance and a CB radio for communications with the duty officer at the mill guardhouse.

The tailings operator shall call the duty officer once every hour on the hour to signal all clear. If this communication is not performed as directed every hour, the duty officer is directed to try to make radio contact with the tailings operator. After five minutes, if this attempt fails, the duty officer is to contact the security roving patrol to drive to the tailings area and investigate the delay of communications on the part of the tailings operator. A log will be kept at the guard-house of all radio communications with the tailings operator. This log will be transmitted daily to the Operations Superintendent. The tailings operator is also directed to relate any problems to the duty officer so that this information can be relayed to the Mill Foreman on afternoon or night shift and to the General Mill Foreman on day shift so that corrective action can be initiated by these supervisors.

Each round will last approximately one hour under normal conditions. The tailings operator will submit a shift report to the Mill Foreman, a copy of which will be transmitted to the Environmental Coordinator. The purpose of the surveillance rounds is to note:

1. Conditions of sand beach extent to assure a minimum of 10-ft. width;
2. Tailings pipe, so see that leaks have not developed;
3. Cyclone overflow discharge to avoid close proximity to the sand beach to prevent erosion of the sands;
4. Be on the lookout for seepage at the toe of the main

embankment;

5. Inspect the temporary interceptor dike at the south end for potential leakage.

The Mill Foreman on duty has at his disposal all the maintenance and work force of the mill. In addition, he has at his disposal two 4-1/2 cu. yd. loaders which can be used for earth work should it become necessary to prevent spillage. The Mill Foreman is to contact his supervisors for all incidents that cannot be adequately corrected by forces under his disposal.

Training of the tailings operators and supervisors will continue to be conducted further to instill awareness of immediate response to correct any deficiencies that could become serious if not acted upon immediately.

The Maintenance Superintendent is directed to make a general inspection of the tailings area daily and to note any particular condition of the tailings line so that corrective action can be initiated.

4.2 Aerial photographs will be taken on the day of resumption of operations and weekly thereafter until the time the south area is in service.

4.3 Rate of deposition will be recorded as indicated by mill throughput.

UNITED NUCLEAR CORPORATION
CHURCH ROCK TAILINGS IMPOUNDMENT DAM

Evaluation of Probable Cause of July 16, 1979 Failure

by

JACOBS ENGINEERING GROUP INC.
and
WAHLER ASSOCIATES

August 22, 1979

INTRODUCTION

The United Nuclear Corporation dam impounding tailings and raffinate from the Church Rock mill was observed to have been breached early on July 16, 1979. This evaluation of the probable cause of failure is based on documents reporting on conditions prior to construction of the starter dam, design reports, plans and specifications approved for construction, construction testing records, post construction drill logs and results of laboratory tests of samples, post failure drill hole and trench logs, laboratory test results, site observations, photographic evidence, and personal interviews. Most of the laboratory tests have been completed and presented in final form and most of the other data has been assembled in documentary form. However, some of the long term tests are continuing but it is not anticipated that this additional test data will be significantly different from that presently available.

Available data are being assembled by Sergent, Hauskins & Beckwith and are available from them or United Nuclear Corporation and are not repeated in this evaluation. Jacobs Engineering Group and Wahler Associates were not involved with the tailings impoundment dam at the United Nuclear Corporation project at Church Rock prior to the failure. Our evaluation of the failure is based on factual data supplied by others (no drilling, sampling, testing, surveying or other field or laboratory investigations have been performed by Jacobs or Wahler).

PROBABLE CAUSE OF FAILURE

Based on factual and photographic evidence made available, personal interviews, and on-site observations of post-failure conditions, the failure is probably due to cracking with subsequent internal erosion. This cracking resulted from differential settlement which resulted from different rates of consolidation of the heterogeneous foundation. The cracking may not have extended to the downstream slope and the failure of the extreme downstream portion may have been due to other common causes of failure where a high hydraulic gradient exists.

PROBABLE CAUSE OF FAILURE - continued

Previous cracking of the embankment is well documented by observations made in December 1977 and photographs of the cracks in July 1978 when they were still visible. Cracks were observed from the area of the breach to approximately station 45+50 (Kaiser Engineers stationing) or along 1,250 feet of the starter dam.

These observed cracks were generally oriented from about a 45 degree angle to the axis of the dam to parallel to the dam and extended from the tailings deposits to and beyond the downstream edge of the dam crest. The embankment cracks probably resulted from differential settlements of the embankment caused by different rates of consolidation in the heterogeneous alluvial foundation.

The consolidation rates were variable and also accelerated as the deeper alluvial deposits gradually became saturated. The shallower alluvium did not reach saturation in the area of the breach or where cracking was observed in December 1977. The rate and pattern of saturation were probably influenced by the direct exposure of the heterogeneous alluvial strata to reservoir fluid at the deep (30± feet) excavation face created by borrowing in extremely close proximity along the southerly portion of the dam alignment.

The non-uniform and steeply inclined bedrock profile and backfilled arroyo (See Figure 1) and the configuration of the bedrock contours (see Figure 2) jutting from the near vertical rock face above the general level of the alluvial valley floor influenced the non-uniform consolidation and stress distribution in the embankment.

The embankment (especially the selected clayey zone) is dense, moderately strong, and quite stiff. Although purposely placed at moisture contents several percent wet of modified ASSHO (and thus near or slightly wet also of compactive efforts actually obtainable during construction) the resulting stiffness (or brittle-like quality) would be conducive to crack formations. The low plasticity materials (silts, sands, and lean clays) are readily erodible.

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PROBABLE CAUSE OF FAILURE - continued

During preconstruction geotechnical investigations in 1976 the difficult site characteristics and unfavorable soils properties were recognized. Collapsible dry desert soils, differential settlements in transition zones between rock foundations and alluvial foundations, wet-side placement to achieve less stiff embankment, clean cohesionless granular zones not susceptible to cracking, piping through transverse cracks, and drain zone elements were considered and discussed.

Pre-failure data supporting this tentative cause of failure evaluation follows:

1. Six two-dimensional consolidation tests of alluvium either from the foundation soils or nearby similar soils under overburden loading representative of the 45 feet starter embankment height indicated consolidations of 5 percent without inundation. With loadings representative of the 70 feet enlarged dam consolidations were in the order of 7 percent and increased an additional 1-1/2 to 13 percent when saturated.

2. Five consolidation tests on unsaturated foundation samples obtained after the starter dam was completed exhibited consolidations of 1-1/2 to 9-1/2 percent additional when inundated.

3. The steep left abutment bedrock profile and associated rapidly increasing depth of alluvium is revealed by the pre-construction and pre-failure drill hole logs.

4. Bedrock configuration and contours are generally discernible from pre-construction photos and maps indicating steep and irregular bedrock profiles and contours.

Post failure exploration supporting the tentative evaluation follows:

1. Two vertical and one horizontal cracks have been found in the embankment at the side of the breach. The vertical cracks are filled with

PROBABLE CAUSE OF FAILURE - continued

tailings sand and are in positions such that they are probably not due to stress relief resulting from the breach. The horizontal crack may be filled with sand.

2. Vertical cracks located near the center of the breach in the upstream bench and near the sides of the breach run subparallel to the breach and are filled with bentonite -- evidencing previous cracking in the area and the remedial action taken.

3. Steep abutment bedrock profile and saturation of alluvium at depth under the crest and downstream toe and saturation of all alluvium upstream of the crest as evidenced by post-failure drilling, sampling, and laboratory tests.

Other modes of failure considered and rejected:

1. Sabotage -- No evidence and it is not plausible that the type of failure could have been perpetrated without detection.

2. Overtopping -- High water mark well below the crest of the dam.

3. Failure of structure -- No structure in the vicinity of the breach.

4. Erosion by tailings line failure -- All evidence indicates that tailings lines were not in a position to cause the breach should they have failed.

5. Piping (without substantial cracking) -- All evidence indicates that the embankment and upper alluvium downstream of the dam are not saturated (possible exception in cracked areas) and upward flow of fluids that could have caused piping are not likely to have occurred.

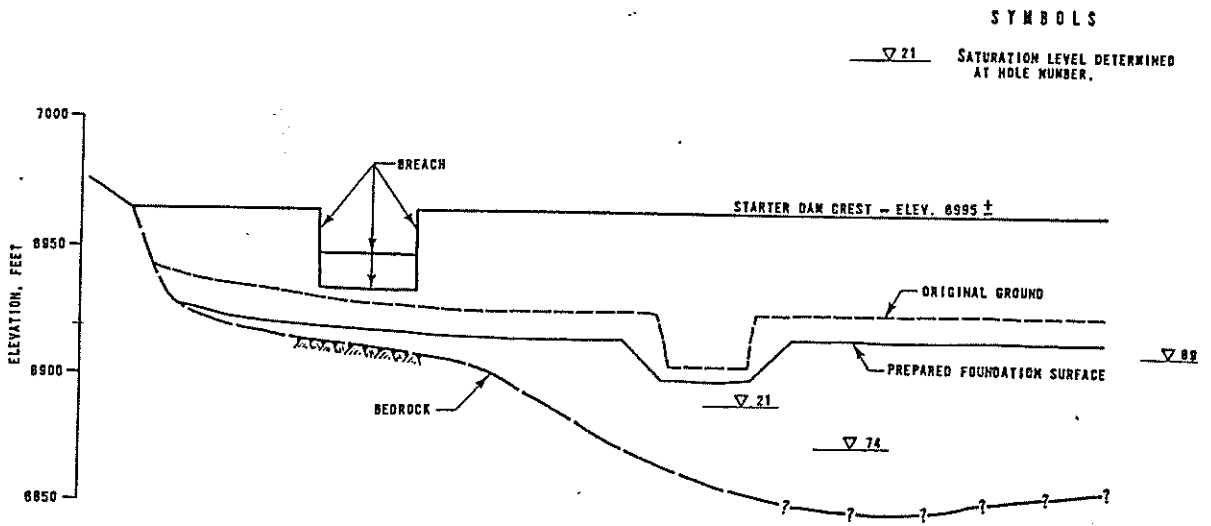
PROBABLE CAUSE OF FAILURE - continued

6. Slope instability -- The low dam and wide crest would require a deep failure to extend from the downstream to the reservoir. The narrowness of the breach would not accommodate this type of slope failure. The upstream slope was buttressed with tailings sands and a failure in this direction is not plausible. Drill holes and trenches in the dam, breached area, and downstream of the breach indicated no disturbance of the layered materials. Preliminary post-failure strength tests indicate that strength values used in design analyses were conservative and moisture content determinations indicate that the phreatic surface developed was not higher than that assumed during analyses. Therefore stability analyses appear to be conservative and indicate that a slope failure would not occur.

7. Raffinate - soil reaction -- The embankment and foundation was not saturated with raffinate to the extent that this would be considered a plausible prime reason for failure.

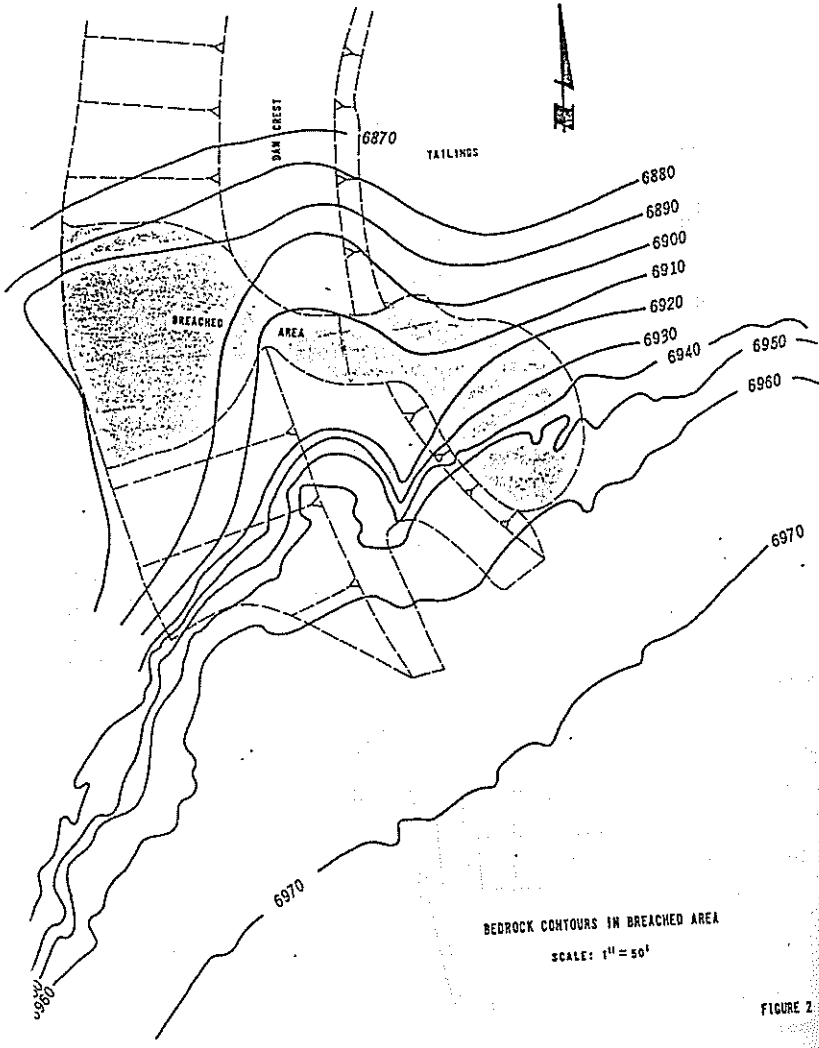
8. Dispersive soils -- Pinhole dispersion tests indicate that the materials are not dispersive when the pH of the raffinate was above 2 and the materials were dispersive when the pH is below 2 (normal pond liquid). Since such a small portion of the dam or foundation in areas near the breach are saturated this reaction is not believed to be the cause of failure. However, dispersion could have accelerated the loosening of material along sides of a crack and contributed to extension of the crack and internal erosion.

9. Dessication cracks -- Moisture contents of the embankment at significant depths below the surface are near placement moisture contents and cracks from drying are not considered a viable cause of failure.



PROFILE ALONG STARTER DAM CENTERLINE
(LOOKING DOWNSTREAM)
SCALE: 1"=50'

FIGURE 1



BEDROCK CONTOURS IN BREACHED AREA

SCALE: 1" = 50'

FIGURE 2

UNITED NUCLEAR CORPORATION
CHURCH ROCK TAILINGS IMPOUNDMENT DAM

Evaluation of the Integrity of the Remaining Starter Dam and Present Divider Dike

by

JACOBS ENGINEERING GROUP INC.

and

WAHLER ASSOCIATES

August 29, 1979

INTRODUCTION

Based on available data, breaching of the United Nuclear Corporation Church Rock Dam is believed to have been due to cracking with subsequent internal erosion. The cracking, in our opinion, was caused by differential settlement. Because differential settlement cannot be precluded in the future, the dam should be modified in the manner discussed for satisfactory performance.

INTEGRITY OF REMAINING STARTER DAM FOR IMPOUNDMENT PURPOSES AT PRESENT HEIGHT

Prior to the construction of the starter dam, a small dam existed across the arroyo at about Station 26+00 (SHB stationing). This dam is reported to have been constructed by the CCC in the 1930's. Since its construction, the arroyo has silted in and water was ponded behind the dam until construction of the starter commenced. Thus, the foundation materials north of Station 26+00 were wetter than those south of Station 26+00 prior to construction of the starter dam. Saturation or near saturation of the upper foundation materials north of Station 26+00 and particularly north of Station 34+00 is evidenced by moisture contents of samples from borings made after the breach occurred.

Based on information available, remedial design defending against any existing and future cracking should be undertaken on this southern portion of the dam before it can be relied upon to safely perform its function. The remedial design must also apply to any raises of the embankment. Cracks are known to have occurred in the dam in areas other than where the breach occurred (vicinity of Stations 45+50 to 47+50 and Stations 51+50 to 53+50 -- SHB stationing). Large settlements (up to 3 feet) have been measured in a 14-month period. This portion of the dam is over 1/2 mile long. Hidden and incipient cracks cannot be reliably located, consequently selective location and treatment of cracks cannot be recommended.

INTEGRITY OF REMAINING STARTER DAM - continued

The consolidation process is probably not complete. The logs of post failure drill holes along the dam crest through the embankment and beyond to depths of 55 feet into the foundation soils reveal that the shallow alluvium, 10-15 ft, is not saturated except in a few limited reaches. Therefore, more settlement upon saturation should be anticipated. The foundation soils are deep, stratified, and cross-bedded. Their horizontal and vertical positions could therefore result in differential consolidation, aggravating any incipient cracks or creating new ones in the embankment.

Because existing cracks cannot, with reliability, be selectively located and dependably treated, a remedial design defending against existing and future cracks would have to be made over this length of the dam before the dam could be considered safe for use at its present height.

A suggested protective remedy would include a pervious, coarse grained, and filtered drain on the downstream face of the existing dam leading to outfall strip drains.

The coarse grained element of this drain should be highly pervious and able to adjust to large deformations without rupture. Permeability coefficients should be in the order of 3,000 feet per day in order to conduct concentrated large flows from cracks occurring anywhere along the entire embankment length. Gravel, crushed rock, or cinders would have these properties if properly graded.

Strip drains should be placed directly on the fine-to-medium sand layer already in place over the enlarged foundation area downstream. This will require removing the soil that now covers the tailings sand in the strip drain areas. To intercept any concentrated flow occurring in cracks in the shallow foundation, a continuous toe drain should be placed in a trench excavated into the alluvium along the toe of the existing dam. This drain would be contiguous with the sloping and horizontal drains described above.

INTEGRITY OF REMAINING STARTER DAM - continued

The drain zones should be everywhere enveloped by filter. Drain blanket compatibility with the grading of the available cycloned sand can be obtained by using well graded sand and gravel ranging from 1/8 - 3/4 inch sizes.

With precise construction methods, the coarse drain elements might be about 3 or 4 feet thick. A 3 x 25 ft strip drain of the gradation suggested would have a capacity of more than the amount of seepage that could be expected to occur through a tailings sand beach and a crack.

The drain elements should be weighted with a ballast section of sandy, silty, clayey soils. The suggested section to control flow through cracks and internal erosion is shown on Figure 1.

From a review of available project soils strength data and stability analyses performed by SHB, the existing section appears to meet commonly acceptable factors of safety against slope failure. The suggested section could have an even higher factor of safety against slope failure.

Area North of Station 26+00 and the Divider Dike

The area north of the divider dike is considerably different than that south of the divider dike. As discussed previously, foundation materials were wetter when the starter dam was constructed, no cracking has been observed in the area, surveys indicate minimal settlements, and post failure borings indicate that most of the foundation materials are near saturation. However, this does not mean that cracking in this reach has never occurred or might not occur in the future, particularly if the embankment is raised. Any cracking in this reach that may have occurred or might occur in the future would be expected to be less severe than those that occurred south of Station 26+00 and a failure in this reach is much less likely under normal operating conditions. The continuous internal and horizontal strip drains as suggested for the southern part of the dam should also be provided in this reach of the dam before the present water level is raised significantly.

EVALUATION OF DIVIDER DIKE

Divider dikes to contain tailings in the central and northern portions of the tailings impoundment have been constructed. A cross section of the divider dike is shown on Figure 2.

For the height of dike shown it is not anticipated that piping would be a problem. However, considerable seepage could occur and some provision for returning seepage water to the impoundment area above the divider dike may be required.

Stability analyses using the strength values shown in Table 1 indicate that the dike has a factor of safety of 1.7 against sliding. Because of the wide crest on this low dike, one would not anticipate its being breached by a slope failure under static conditions. An upstream sand beach under the low operating heads should prevent failure due to cracking and internal erosion.

TABLE 1

DIVIDER DIKE STRENGTH PARAMETERS

	Strength Parameters	
Material	Angle of Internal Friction-$\emptyset'$ (Degrees)	Cohesion Intercept-c' (psf)
Sandy, silty, clay fill	10	200
Tailings	30	0

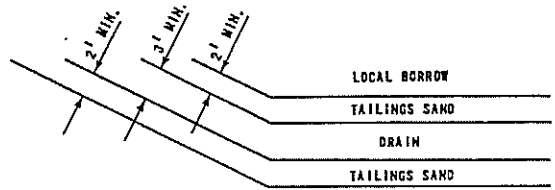
The saturated sands upon which the dike is founded could liquefy if a large earthquake occurred nearby. Liquification of these materials could also occur if excavation of these materials extended significantly below the line of saturation. However, because the tailings impoundment is located in an area of low seismic activity and because the divider dike would be utilized for a short period of time, the possibility of this type of failure is considered extremely remote.

OTHER INTEGRITY CONSIDERATIONS

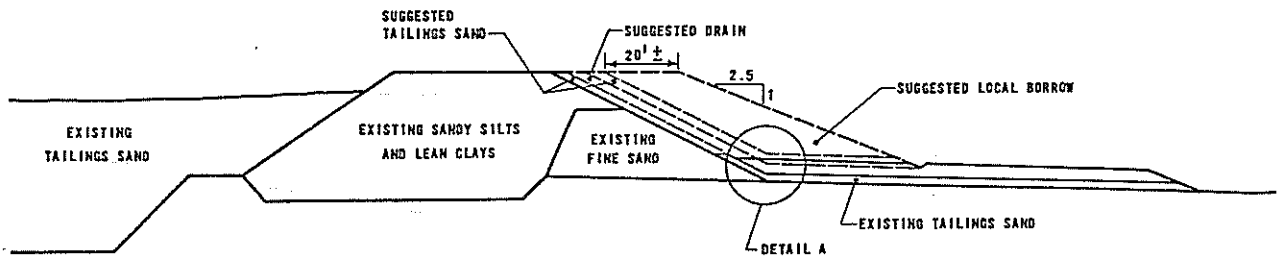
The alignment of the arroyo cannot be permitted to be closer to the toe of the embankment than the present drawings indicate. An additional recommendation is to periodically survey the alignment of the arroyo west of the dam as a protection against any movement of the arroyo toward the toe of the embankment.

A program to monitor the settlement and other performance characteristics of the dam should be started now and continued over the active life of the tailings system.

A beach should be maintained in front of the embankment to feed tailings into any cracks that might form and to restrict the flow of liquid into these cracks. It is recommended that a beach be developed that extends to the vertical projection of the toe of the dam, and be maintained in this position until the monitoring program develops sufficient data for rational modification.

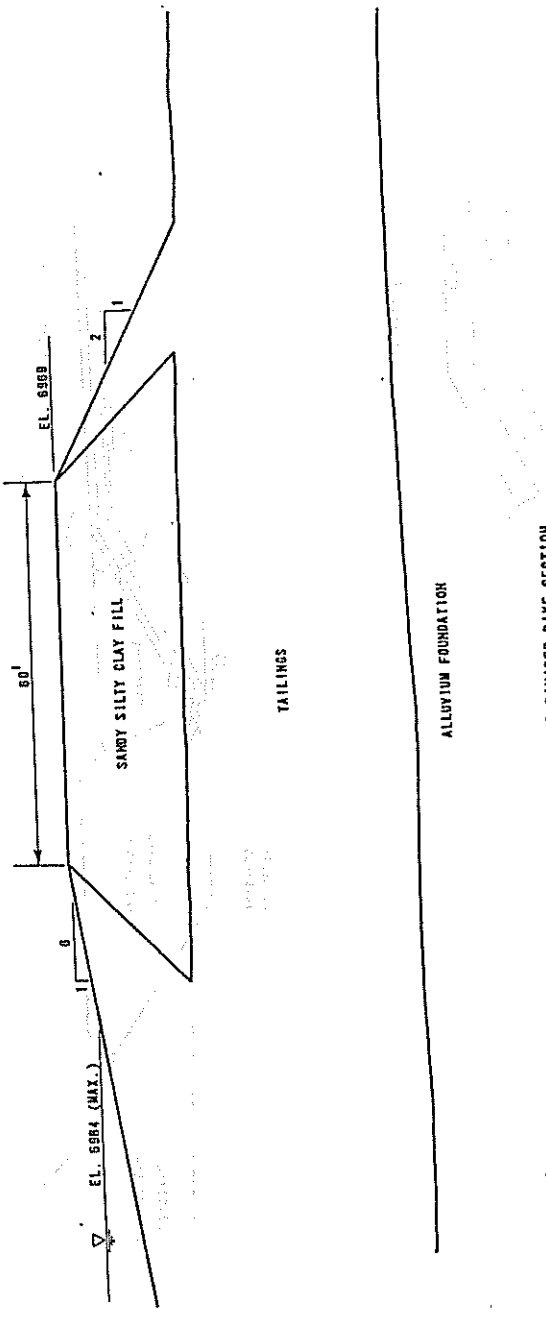


DETAIL A



SUGGESTED REMEDIAL STARTER DAM SECTION

FIGURE 1



TYPICAL DIVIDER DIKE SECTION

FIGURE 2

TESTIMONY OF

WILLIAM J. DIRCKS, DIRECTOR

OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS

U.S. NUCLEAR REGULATORY COMMISSION

BEFORE THE

SUBCOMMITTEE ON ENERGY AND THE ENVIRONMENT,

OF THE COMMITTEE ON INTERIOR AND INSULAR AFFAIRS

OCTOBER 22, 1979

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.

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 entending 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.

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

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.

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

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

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.

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

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

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.

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. Nothwithstanding 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 haved 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.

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

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.

NUCLEAR REGULATORY COMMISSION

10 CFR Parts 40, 150

Uranium Mill Tailings Licensing

AGENCY: Nuclear Regulatory Commission.

ACTION: Final Regulations with request for comments.

SUMMARY: The Nuclear Regulatory Commission (NRC) is amending its regulations to conform to the requirements of the Uranium Mill Tailings Radiation Control Act of 1978 and to the standards set forth in the draft Generic Environmental Impact Statement Uranium Milling. The bulk of these regulations are being published in proposed form. (See proposed rules published elsewhere in this part of the Federal Register.) The Commission finds it necessary, however, to issue as immediately effective a temporary general license to authorize the possession and storage of mill tailings or wastes to prevent existing milling operations in both Agreement and non-Agreement States from being in technical violation of the Atomic Energy Act of 1954, as amended by the Uranium Mill Tailings Radiation Control Act of 1978. The immediately effective regulations relating to the general license, such as amendments to the definition of "byproduct material," and to the coverage of tailings in Agreement States, serve two functions. They reflect the NRC's legal interpretation of the new Act necessitating the general license and clarify the application of the general license. Accordingly, these regulations must also be made immediately effective.

DATES: Effective date: August 24, 1979.

Comments on or before October 24, 1979.

ADDRESSES: Written comments should be submitted to the Secretary of the Commission, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, Attention: Docketing and Service Branch. Copies of comments on these amendments may be examined in the Commission's Public Document Room at 1717 H Street, NW., Washington, D.C.

FOR FURTHER INFORMATION CONTACT: Don F. Harmon, Office of Standards Development, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555 (phone 301/433-5910) or Hubert J. Miller, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555 (phone 301/427-4103).

SUPPLEMENTARY INFORMATION: These immediately effective regulations are closely related to the proposed rules implementing the Uranium Mill Tailings Radiation Control Act of 1978 and the draft Generic Environmental Impact Statement on Uranium Milling. Thus, the two sets of amendments should be read together. (See proposed rules published elsewhere) in this part of the Federal Register.

On May 17, 1979, the Commission met to determine the issue of the timing of the effectiveness of certain requirements of the Uranium Mill Tailings Radiation Control Act of 1978. At this meeting it was determined that the NRC has immediate licensing authority over mill tailings, now defined as section 11e(2) byproduct material in the Atomic Energy Act of 1954, as amended; that the new requirements for agreement state regulation of tailings and milling operations will not take effect until three years after the date of enactment of the mill tailings legislation; and that during that three-year interim, the legislation requires that NRC assume concurrent jurisdiction over tailings in both Agreement and non-Agreement States. The Commission also determined that the definition of section 11e(2) byproduct material includes the above-ground wastes from in situ extraction operations.

New § 40.28 is added to 10 CFR Part 40 to establish a temporary general license to authorize the possession and storage of mill tailings or wastes. The general license will prevent existing milling operations with valid licenses from being in technical violation of the Atomic Energy Act of 1954, as amended by the Uranium Mill Tailings Radiation Control Act of 1978. The Commission believes this general license is consistent with the Congressional intent to implement the mill tailings legislation in a manner designed to minimize unnecessary disruption. As provided in section 40.20 of 10 CFR Part 40, a general license is effective without filing of an application or the issuance of licensing documents to particular persons. This general license is applicable only to persons who possess appropriate specific licenses issued by the Commission or Agreement States to authorize uranium milling activities. The authority to possess, use, or own tailings under the general license shall expire upon the expiration or renewal of the underlying NRC or Agreement State specific milling license.

The Commission notes that all of its existing active milling licenses have been reviewed or are being reviewed under the provisions of the National Environmental Policy Act (NEPA). All NRC licenses presently contain, or will contain, requirements for tailings reclamation, mill and site cleanup, and surety arrangements to cover these costs. For the most part, present requirements and conditions are substantially the same as the requirements set forth in the proposed amendments concerning uranium milling, and most milling operations in non-Agreement States have already committed to specific plans for decommissioning and tailings disposal meeting the new requirements. NRC uranium milling licenses that have been granted under the NEPA process during the period over which the NRC's generic environmental impact statement or uranium milling was being developed were issued with the express condition that approved waste generating processes and mill tailings management practices were subject to revision in accordance with the conclusions of the final generic environmental impact statement and any related rulemaking. In the process of reevaluating approved mill operator plans upon expiration or renewal to meet the new regulatory requirements, the NRC staff plans to incorporate into applicable specific licenses the authority to possess and store byproduct material covered by this general license.

Under the provisions of this general license, Agreement State licensees will not be required to obtain a specific NRC license until such time as the licensee's Agreement State specific license expires or is renewed. The Commission notes in this regard that there presently exist Agreement State regulations and requirements governing the control of tailings in Agreement States that appear adequate to protect the public health and safety during the interim period until such licenses expire or are renewed. At such time as each Agreement State license expires or is renewed, it will be necessary at least until November 1, 1981, for the Agreement State licensee to apply for and obtain a specific NRC license covering the possession of byproduct material. The Commission intends to review each application under the NEPA process and impose any necessary requirements as may be necessary to protect the public health and safety. Given that tailings piles in Agreement States covered by this general license have been in existence for several years, the Commission does not believe that the relatively small incremental increase to such piles during the interim time until licenses expire or are renewed will foreclose available alternatives for

reducing or avoiding adverse environmental and other effects or result in irreversible or irretrievable commitments of sources. The Commission has concluded that the issuance of the general license is not a major Federal action significantly affecting the quality of the human environment and as such does not require an environmental impact statement. The Commission further notes in this regard that the authority to possess, own, or receive title to tailings now defined as byproduct material under this general license is subject to NRC remedial orders as necessary to protect the public health and safety and to correct any situations in which events might require more immediate Commission attention to insure proper control of tailings.

Section 40.4 of 10 CFR Part 40 is amended to include a new definition of "byproduct material." This amendment, which includes uranium and thorium mill tailings as byproduct material licensable by the Commission, is required by the recently enacted Uranium Mill Tailings Radiation Control Act. Discrete above-ground wastes from in situ or solution extraction are covered by this definition, although the underground ore bodies depleted by the extraction process are not covered. The Commission considered amending 10 CFR Part 30, "Rules of General Applicability to Licensing of Byproduct Material," to specify licensing requirements concerning tailings, but has concluded that it is more appropriate to amend 10 CFR Part 40. The legislative record of the mill tailings legislation makes it clear that the expanded definition of byproduct material covers only mill tailings or wastes, which are exclusively associated with 10 CFR Part 40 licensing matters.

The amendments to 10 CFR Part 150 are to conform to Part 40's new definition of byproduct material and to Part 40's coverage of such byproduct material in Agreement States for the three years following enactment of the Uranium Mill Tailings Radiation Control Act of 1978. This is in accordance with the statute's provisions requiring NRC licensing of tailings in Agreement States for the three-year interim. Pursuant to the mill tailings legislation, however, Agreement States may exercise concurrent jurisdiction over tailings and wastes for the three-year interim.

The Commission finds that because the regulations supporting the general license must be effective immediately so as to prevent existing milling operations from being in technical violation of the Atomic Energy Act, good cause exists pursuant to 5 U.S.C. 553 to waive the 30-day comment period, as impracticable and contrary to the public interest, and make the amendments to 10 CFR 40.1, 40.2a, 40.3, 40.4, 40.26, 150.3, and 150.15 immediately effective. The Commission notes in this regard that informal written comments on this matter were solicited and received from industry, environmental groups, and several states. (These comments may be found in the Commission's public document room in a memorandum dated May 9, 1979, from the Executive Legal Director to the Commission entitled "Staff Response to the Commission Request for Further Information Regarding SECY-79-88 'Timing of Certain Requirements of the Uranium Mill Tailings Radiation Control Act of 1978'.") Comments on these amendments are invited, however, and the new regulations remain subject to further modification in response to such comments.

(Secs. 11.e(2), 81, 83, 84, 161b, 174, Pub. L. No. 83-703, 68 Stat. 948 et seq. (42 U.S.C. 2014e.(2), 2111, 2113, 2114, 2201b, 2021)).

Dated at Washington, D.C. this 22nd day of August 1979.

For the Nuclear Regulatory Commission.

Samuel J. Chilk,

Secretary of the Commission.

Regulatory Changes

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974, as amended, the Uranium Mill Tailings Radiation Control Act of 1978, and sections 552 and 553 of Title 5 of the United States Code, the following amendments to Title 10, Chapters 40 and 150, Code of Federal Regulations are published as a document subject to codification.

1. § 40.1 of 10 CFR 40 is amended by revising paragraphs (a) and (b) as follows:

§ 40.1 Purpose.

(a) The regulations in this part establish procedures and criteria for the issuance of licenses to receive title to, receive, possess, use, transfer, deliver, or import into or export from the United States source and byproduct materials, as defined in this Part, and establish and provide for the terms and conditions upon which the Commission will issue such licenses. The regulations in this Part do not establish procedures and criteria for the issuance of licenses for material covered under Title I of the Uranium Mill Tailings Radiation Control Act of 1978 (92 Stat. 3021).

(b) The regulations contained in this part are issued pursuant to the Atomic Energy Act of 1954, as amended (68 Stat. 919), Title II of the Energy Reorganization Act of 1974 (88 Stat. 1242), and Title II of the Uranium Mill Tailings Radiation Control Act of 1978 (42 U.S.C. 7901).

2. § 40.2a of 10 CFR 40 is added to read as follows:

§ 40.2a Temporary coverage in Agreement States.

Until November 8, 1981, the regulations in this Part shall govern the Commission's licensing of byproduct material as defined in this Part in Agreement States.

3. § 40.3 of 10 CFR 40 is revised to read as follows:

§ 40.3 License requirements.

No person subject to the regulations in this Part shall receive title to, own, receive, possess, use, transfer, deliver, or import into or export from the United States byproduct material as defined in this Part or any source material after removal from its place of deposit in nature, except as authorized in a specific or general license issued by the Commission pursuant to the regulations in this Part.

4. § 40.4 of 10 CFR 40 is amended by revising paragraphs 40.4(a-1), 40.4(e), and 40.4(l) and adding new paragraphs 40.4(b-1) and 40.4(p).

§ 40.4 Definitions.

* * * * *

(a-1) "Byproduct Material" means the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content, including discrete surface wastes resulting from uranium solution extraction processes. Underground ore bodies depleted by such solution extraction operations do not constitute "byproduct material" within this definition.

* * * * *

(b-1) "Department of Energy" means the United States Department of Energy or its duly authorized representative.

* * * * *

(e) "Persons" means (1) any individual, corporation, partnership, firm, association, trust, estate, public or private institution, group, Government agency other than the Commission or the Department of Energy except that the Department of Energy shall be considered a person within the meaning of the regulations in this Part to the extent that its facilities and activities are subject to the licensing and related regulatory authority of the Commission pursuant to section 202 of the Energy Reorganization Act of 1974 (88 Stat.

1244)[1] and the Uranium Mill Tailings Radiation Control Act of 1978 (92 Stat. 21), any State or any political subdivision of, or any political entity within a State, any foreign government or nation or any subdivision of any such government or nation, or other entity; and (2) any legal successor, representative, agent or agency of the foregoing.

* * * * *

(i) With the exception of "byproduct material" as defined in Section 11e. of the Act, other terms defined in Section 11 of the Act shall have the same meaning when used in the regulation in this Part.

* * * * *

(p) "Uranium Milling" means any activity that results in the production of byproduct material as defined i this Part.

5. § 40.26 of 10 CFR 40 is added to read as follows:

§ 40.26 General license for possession and storage of byproduct material as defined in this Part.

(a) A general license is hereby issued to receive title to, own, or possess byproduct material as defined in this Part without regard to form or quantity.

(b) The general license in paragraph (a) of this section applies only:

(1) In the case of licensees of the Commission, where activities that result in the production of byproduct material are authorized under a specific license issued by the Commission pursuant to this Part, to byproduct material possessed or stored at an authorized disposal containment area or transported incident to such authorized activity; Provided, that authority to receive title to, own, or possess byproduct material under this general license shall terminate when the specific license for source material expires, is renewed, or is amended to include a specific license for byproduct material as defined in this Part; or

(2) In Agreement States until November 8, 1981, where activities that result in the production of byproduct material are authorized under a specific license issued by the Agreement State on or before May 17, 1979, to byproduct material possessed, or stored at an authorized disposal containment area or transported incident to such authorized activities; Provided, that authority to receive title to, own, or possess byproduct material under such general license shall terminate when such Agreement State license expires or is renewed, whichever first occurs.

(c) The general license in paragraph (a) of this section is subject to:

(1) The provisions of Parts 19, 20, 21, and §§ 40.1, 40.2, 40.2a, 40.3, 40.4, 40.5, 40.6, 40.41, 40.46, 40.61, 40.62, 40.63, 40.65, 40.71, and 40.81 of Part 40 of this Chapter; and

(2) The documentation of daily inspections of tailings or waste retention systems and the immediate notification of the appropriate NRC regional office as indicated in Appendix D of 10 CFR Part 20, or the Director, Office of Inspection and Enforcement, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, of any failure in a tailings or waste retention system which results in a release of tailings or waste into unrestricted areas, and/or of any unusual conditions (conditions not contemplated in the design of the retention system) which if not corrected could lead to failure of the system and result in a release of tailings or waste into unrestricted areas; and any additional requirements the Commission may by order deem necessary.

6. § 150.3 of 10 CFR 150 is amended by revising § 150.3(c) to read as follows:

§ 150.3 Definitions.

* * * * *

(c) "Byproduct material" means (1) any radioactive material (except special nuclear material) yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear material; or (2) the tailings or wastes produced by the extraction.

7. § 150.15 of 10 CFR 150 is amended by adding a new paragraph (a)(7), to read as follows:

§ 150.15 Persons not exempt.

(a) * * *

(7) Until November 8, 1981, the receipt of title to, ownership of, receipt of, possession of, use of, transfer of, delivery of, import or export of the byproduct material as defined in § 150.3(c)(2) of this Part; Provided, however, that during this period any State may exercise any authority under State law respecting such material in the same manner, and to the same extent, as permitted before enactment of the Uranium Mill Tailings Radiation Control Act of 1978. In case of conflict between Federal and State requirements regarding a license, the Federal license requirements shall prevail unless the State requirements are more stringent than the Federal requirements.

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[1] The Department of Energy facilities and activities identified in section 202 are:

(1) Demonstration Liquid Metal Fast Breeder reactors when operated as part of the power generation facilities of an electric utility system, or when operated in any other manner for the purpose of demonstrating the suitability for commercial application of such a reactor.

(2) Other demonstration nuclear reactors, except those in existence on January 19, 1975, when operated as part of the power generation facilities of an electric utility system, or when operated in any other manner for the purpose of demonstrating the suitability for commercial application of such a reactor.

(3) Facilities used primarily for the receipt and storage of high-level radioactive wastes resulting from licensed activities.

(4) Retrievable Surface Storage Facilities and other facilities authorized for the express purpose of subsequent long-term storage of high-level radioactive waste generated by the Department of Energy, which are not used for, or are part of, research and development activities.

NUCLEAR REGULATORY COMMISSION

[10 CFR Parts 30, 40, 70, 150, and 170]

Criteria Relating to Uranium Mill Tailings and Constructions of Major Plants

AGENCY: U.S. Nuclear Regulatory Commission.

ACTION: Proposed rules.

SUMMARY: The proposed amendments to 10 CFR Parts 40 and 150 would incorporate licensing requirements for uranium and thorium mills and their tailings and wastes into the Commission's regulations. The proposed amdnedments to Parts 40 and 150 are derived from a draft generic environmental impact statement on uranium milling and the requirements contained in the Uranium Mill Tailings Radiation Control Act of 1978. The proposed amendments to Parts 30 and 70 would require a final environmental assessment be completed by the NRC prior to construction of other types of major plants. The proposed amendments to 10 CFR 170 set forth the fees to be charged in conjunction with licenses authorizing the possession of tailings. These proposed regulation changes and the draft generic environmental impact statement referred to above will be the subjects of public hearings to be held in October at locations in western milling regions. The general purpose of these hearings will be to receive comments on these proposed regulation changes and the draft generic environmental impact statement. More specific information concerning these hearings will be made available in a forthcoming Federal Register notice.

Closely related to these proposed regulations are immediately effective regulations pertaining to a general license authorizing possession of tailings by existing milling operations with valid specific licenses for milling. Although the immediately effective regulations are formally published elsewhere in this part of the Federal Register, they are shown here for purposes of clarity and continuity.

DATE: Comment period expires October 24, 1979.

ADDRESSES: Written comments should be submitted to the Secretary of the Commission, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, Attention: Docketing and Service Branch. Copies of comments on the proposed amendment may be examined in the Commission's Public Document Room at 1717 H Street, N.W., Washington, D.C.

FOR FURTHER INFORMATION CONTACT: Don F. Harmon, Office of Standards Development, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555 (phone 301/443-5910) or Hubert J. Miller, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555 (phone 301/427-4103).

SUPPLEMENTARY INFORMATION: The Nuclear Regulatory Commission is amending its regulations to conform to the requirements of the Uranium Mill Tailings Radiation Control Act of 1978 and to the standards set forth in the draft generic environmental impact statement on uranium milling. The bulk of these regulations are published here in proposed form. The Commission finds it necessary, however, to issue as immediately effective a temporary general license to authorize the possession and storage of mill tailings or wastes to prevent existing milling operations in both Agreement and non-Agreement States from being in technical violation of the Atomic Energy Act of 1954, as amended by the Uranium Mill Tailings Radiation Control Act of 1978. Although the immediately effective regulations are formally published elsewhere in this part of the Federal Register, they are shown here for the purposes of clarity and continuity. In a notice published in the Federal Register on June 3, 1976, the U.S. Nuclear Regulatory Commission announced its intention to prepare a generic environmental impact statement (GEIS) on uranium milling. The Commission was acting partly in response to a petition for rulemaking filed with the Commission by the Natural Resources Defense Council, Inc. The Commission has evaluated the environmental impacts of uranium milling and has published a draft GEIS (NUREG-0511) on this subject (See Notice of Availability, April 26, 1979, 44 FR 24963).

The GEIS concludes that there is a need for certain definitive rule changes to the Commissions's regulations to establish specific uranium mill licensing requirements, particularly with regard to the tailings or wastes generated during the milling process. The rule change proposed herein to 10 CFR 40 will incorporate into the Commission's regulations the additional needed requirements derived from the draft GEIS. These proposed additional requirements and potential alternatives are discussed in detail in the draft GEIS along with their supporting bases. It is not possible to provide here a complete summary of all the complex issues, alternatives, and supporting technical bases addressed in the draft GEIS. In formulating proposals for dealing with uranium milling problems to assure public health and safety and environment protection, the NRC staff has developed a full range of perspectives and facts. It has analyzed the problems from short- and long-term points of view. It has evaluated potential health risks to individuals living in the immediate vicinity of mills, to individuals living in mining and milling regions, to mill workers, and to large populations which can be exposed to radon. Potential impacts on land use, air quality, water quality, water use, biota and soils, and potential socieconomic effects of milling operations have been assessed. Alternatives for tailings disposal which have been examined range from the past practice of doing virtually nothing to isolate tailings, to utilizing potential advanced treatment methods such as incorporation of tailings in a solid matrix, such as cement or asphalt. The major institutional questions considered by the NRC in developing needed rule changes include: the need for land use controls and site monitoring at tailings disposal sites; methods of providing financial surety so that tailings disposal and site decommissioning are accomplished by the milling operator; and the need for and methods of funding any long-term surveillance which may be necessary at tailings disposal sites. For additional information concerning these issues, the draft GEIS should be reviewed. (It is suggested that readers of the GEIS start with the Summary; the chief bases for these proposed regulations are presented there. In preparing the Summary, the staff made a special effort to refer to specific sections of the text which are pertinent to each issue discussed. This has been done to make it easy for readers to find and consider all of the information that has been developed, so that they can draw their own conclusions about the issues addressed.) The major conclusions reached in the draft GEIS relative to needed rule changes, stated here in broad terms, are:

1. Tailings areas should be located at remote sites to reduce potential population exposures to the maximum extent reasonably achievable.

2. Tailing areas should be located at sites where disruption and dispersion by natural forces are eliminated or reduced to the maximum extent reasonably achievable.

3. The "prime option" for tailings disposal is placement below grade.

4. If tailings are located above ground, stringent siting and design criteria should be adhered to.

5. Sufficient cover should be placed over tailings to reduce radon exhalation

to a calculated value of less than 2pCi/m²sec above natural background levels.

6. Steps should be taken to reduce seepage of materials into groundwater to the maximum extent reasonably achievable.

7. Final disposition of tailings should be such that ongoing active maintenance is not necessary to preserve isolation.

8. Milling operations should be conducted so that all airborne effluent releases are reduced to as low as is reasonably achievable. Yellowcake drying and packaging operations should cease when effluent control devices are inoperative or not working at their reasonably expected best performance levels.

9. Financial surety arrangements should be established to ensure that sufficient funds are available to cover the costs of decontamination and decommissioning the mill and site and for the reclamation of tailings areas.

10. Sites on which tailings are stored should be controlled through ownership and custody by a government agency unless, in special cases as might occur in deep mine disposal, this is determined unnecessary.

11. Funds should be provided by each mill operator to cover the costs of long-term site surveillance.

12. Construction of a uranium mill or tailings disposal area should not commence until the NRC has completed its final environmental impact statement required by the National Environmental Policy Act (NEPA).

The rule changes proposed herein would also incorporate into the Commission's regulation 10 CFR 40 and 150 the requirements established by the Uranium Mill Tailings Radiation Control Act of 1978 (92 Stat. 3201). This legislation, among other things, establishes a program to regulate mill tailings during uranium or thorium ore processing at active mill operations and after termination of such operations in order to stabilize and control such tailings in a safe and environmentally sound manner and to minimize or eliminate radiation health hazards to the public. In the Commission's view, the legislation also requires that the NRC exercise concurrent jurisdiction over tailings in Agreement States until November 8, 1981. The UMTRCA, among other things, specifies:

1. A revised definition of "byproduct material" to include tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content;

2. Ownership and custody requirements for byproduct material;

3. Provisions for bonds, sureties, or other financial arrangements covering the decontamination, decommissioning, and reclamation of sites, structures, and equipment used in conjunction with byproduct material;

4. Provisions for Agreement State authority under Section 274 of the Atomic Energy Act; and

5. Provisions for NRC grants to States to aid in the development of State regulatory programs.

The UMTRCA further establishes certain responsibilities and authorities whereby the Environmental Protection Agency (EPA) must develop standards of general application for the protection of the public health, safety, and the environment from radiological and nonradiological hazards associated with the processing and with the possession, transfer, and disposal of byproduct material. Such generally applicable standards for nonradiological hazards must provide for the protection of human health and the environment consistent with the standards required under subtitle C of the Solid Waste Disposal Act, as amended. The Commission and any State permitted to exercise authority under § 274b.(2) of the Atomic Energy Act must apply these standards of general application in licensing actions involving byproduct material. In this regard, the Commission notes that the EPA has published (43 FR 58946), for comments, proposed regulations to implement the requirements of the Solid Waste Disposal Act, as amended. The Commission believes that the requirements in the amendments proposed herein, along with applicable requirements in other parts of the Commission's regulations, will be at least comparable to presently published requirements applicable to the possession, transfer, and disposal of similar material regulated by the EPA under the Solid Waste Disposal Act, as amended. Since final regulations have not been adopted by EPA to implement the mandates of the Solid Waste Disposal Act, additional amendments to the Commission's regulations may be required. The Commission intends to follow the progress of the EPA rulemaking action to implement regulations under the Solid Waste Disposal Act. Any final regulations pertaining to byproduct material adopted by the Commission will be comparable, to the maximum extent practicable, to requirements applicable to the possession, transfer, and disposal of similar hazardous material regulation by EPA under the Solid Waste Disposal Act, as amended. To ensure comparability, concurrence of final regulations will be obtained from the Administrator of EPA as required by the UMTRCA. In addition, the Administrator of EPA will be specifically requested to provide comments and recommendations concerning this matter.

The significant features of the amendments to 10 CFR 40 are:

1. Section 40.4 of Part 40 is being amended (effective immediately) to include the definition of "byproduct material." This amendment, to include uranium and thorium mill tailings as byproduct material as a licensable material in the Commission's regulations, is requird by the recently enacted UMTRCA. Discrete above ground wastes from in-situ or solution extraction are covered by this definition, although the underground ore bodies depleted by the extraction process are not covered. While the Commission has considered amending its regulation 10 CFR 30, "Rules of General Applicability to Licensing of Byproduct Material," to specify licensing requirements relative to tailings, the Commission considers it more appropriate to amend 10 CFR 40 since the legislative record of the UMTRCA makes clear that the expanded definition of byproduct material covers only mill tailings or wastes which are exclusively associated with 10 CFR 40 licensing matters.

2. A new § 40.26 is being added (effective immediately) to 10 CFR 40 to establish a temporary general license to authorize the possession and storage of mill tailings or wastes to keep existing milling operations in both Agreement and non-Agreement States from being in technical violation of the Atomic Energy Act of 1954, as amended by UMTRCA. The Commission believes this general license is consistent with the Congressional intent to implement the UMTRCA in a manner designed to minimize unnecessary disruption. As provided in § 40.20 of 10 CFR 40, a general license is effective without the filing of an application or the issuance of licensing documents to particular persons. This general license is applicable only to persons who possess appropriate specific licenses issued by the Commission or Agreement States which authorize uranium milling activities. The authority to possess, use, or own tailings under the general license shall expire concurrently with the expiration or renewal of each NRC or Agreement State specific milling license.

The Commission notes that all of its existing active milling licenses have been reviewed or are being reviewed under the provisions of the National Environmental Policy Act (NEPA). All

NRC licenses presently contain, or will contain, requirements for tailings reclamation, mill and site cleanup, and surety arrangements to cover these costs. For the most part, present requirements and conditions are substantially the same as the requirements being proposed herein, and most milling operators involved in non-Agreement States have already committed themselves to specific plans for decommissioning and tailings disposal meeting these requirements. NRC uranium milling licenses that have been granted under the NEPA process during the period over which the NRC's generic environmental impact statement on uranium milling was being developed were issued with the express condition that approved waste generating processes and mill tailings management practices were subject to revision in accordance with the conclusions of the final generic environmental impact statement and any related rulemaking. In the process of reevaluating approved mill operator plans upon expiration or renewal to meet the requirements of the rule change proposed herein, the NRC staff plans to incorporate into applicable specific licenses the authority to possess and store byproduct material covered by this general license.

Under the provisions of this general license, Agreement State licensees will not be required to obtain a specific NRC license until such time as the licensee's Agreement State specific license expires or is renewed. The Commission notes in this regard that there presently exist Agreement State regulations and requirements governing the control of tailings in Agreement States which appear adequate to protect the public health and safety during the interim period until such licenses expire or are renewed. At such time as each Agreement State license expires or is renewed, it will be necessary at least until November 1, 1981, for the Agreement State licensee to apply for and obtain a specific NRC license covering the possession of byproduct material. The Commission intends to review each application under the NEPA process and impose any necessary requirements as may be necessary to protect the public health and safety. Given that the tailings piles in Agreement States covered by this general license have been in existence for several years, the Commission does not believe that the incremental increase to such piles during the interim time until licenses expire or are renewed will foreclose available alternatives for reducing or avoiding adverse environmental and other effects or result in irreversible or irretrievable commitments of resources. Thus, the Commission has concluded that an environmental impact statement to support this interim general license is not required. The Commission further notes in this regard that the authority to possess, own, or receive title to tailings now defined as byproduct material under this general license is subject to NRC remedial orders as necessary to protect the public health and safety and to correct any situations where events might require more immediate Commission attention to insure proper control of tailings.

3. Section 40.31 of Part 40 is being amended by revising § 40.31(a) to cover applications for byproduct material and by adding a new paragraph (g) to require applicants for mill licenses to propose specifications relating to the operation of mill sand disposition of tailings or wastes so as to achieve certain requirements and objectives set forth in a new Apendix A to 10 CFR 40. These requirements and objectives are discussed in detail in the following Item #4.

Since these requirements and objectives deal primarily with presently operating and future milling activities, they do not apply to the remedial action program authorized in Title I of the UMTRCA.

4. A new Appendix A entitled, "Criteria Relating to the Operation of Uranium Mills and Disposition of Tailings or Wastes (i.e., byproduct material as defined in Section 11e.(2) of the Atomic Energy Act] Produced by the Extraction or Concentration of Source Material From Ores," is being added to 10 CFR 40. This appendix is divided into four major categories: technical criteria; financial criteria; site and byproduct material ownership; and long-term site surveillance. The technical criteria deal primarily with specifications for siting tailing areas, options for storing tailings below and above ground, seepage controls, minimum cover requirements for tailings at the end of milling operations, preoperational site monitoring requirements, and effluent controls during milling operations. These criteria were basically dervied from the GEIS discussed above. The guiding principles in the development of these criteria were that: tailings should be isolated from people and the environment in such a manner to reduce potential exposures to as low as is reasonably achievable; the site where tailings are stored should be returned to conditions reasonably near those of the surrounding evironment; and final disposition of tailings should be such that active maintenance is not necessary to preserve isolation. The bases for these criteria are set forth in detail in the GEIS. The Commission believes that under these criteria tailings can be disposed of at reasonable costs and in such a manner that conditions at disposal sites will be reasonably near those of surrounding environs. Thus, the need for ongoing active care and maintenance programs to redress degradation of the tailings isolation by natural weathering and erosion forces can be essentially eliminated. In that the proposed technical criteria for mill siting and tailings disposal areas preclude location of tailings or milling operations in an area that could be disrupted by natural events such as flooding, these criteria will assure that the requirements of Executive Order 11988 of May 23, 1977, concerning flood plain management are met. Therefore, as well as assuring tailings isolation, floodplains will be protected.

The ownership, surety, and long-term funding criteria delineated in the new Appendix were derived from the GEIS. They are also requirements established under the UMTRCA. The Commission believes that compliance with these criteria will ensure that milling operators, who are responsible for the generation of tailings, will bear the costs of tailing reclamation and long-term site surveillance and that government ownership of tailings and disposal sites will ensure adequate long-term control of the tailings.

With regard to long-term site surveillance, the UMTRCA requires the final disposition of tailings or wastes at milling sites to be such that the need for long-term maintenance and monitoring of such sites after license termination shall be minimized, and to the maximum extent practicable, eliminated. These requirements are delineated in the long-term surveillance criterion set forth in the new Appendix. In order to confirm the integrity of a stabilized tailings system, the Commission proposes to require annual site inspections by site owners (e.g., an appropriate government agency). Depending on the specific conditions of a particular site, as determined during the period following site reclamation and before termination of a mill operator's license, a determination may be made that more frequent inspections or more comprehensive monitoring are required. More specific guidance on long-term surveillance may be issued in the future after more experience has been gained relative to this issue. Results of such inspections would be submitted to the

Commission within 60 days following each inspection.

The criteria in the new Appendix A would become effective following completion of the rulemaking action contemplated herein by the Commission, except that criterion 11 would not become effective until November 8, 1981, under the provisions of the UMTRCA.

5. Paragraphs (b) of § 40.14 and (e) of § 40.32 of 10 CFR 40 are being amended to require the Director of the Commission's Office of Nuclear Material Safety and Safeguards or his designee to make a positive finding on an applicant's proposed plans as meeting the requirements and objectives in Appendix A prior to commencement of construction of a mill which produces byproduct material. This finding would be that made in the final environmental impact statement (or other environmental assessment) prepared pursuant to Part 51 of this chapter. These proposed amendments will delete paragraph (b) of § 40.14 so as to preclude exemptions from the requirements of §§ 40.31(f) and 40.32(e) of Part 40 and amend paragraph (e) of § 40.32 so as to require the denial of applications for licenses where construction is started before the appropriate environmental appraisals are completed and documented. The Commission notes in this regard that milling results in the production of large quantities of byproduct material as tailings per year. When construction of a mill commences, nearly irrevocable commitments are made regarding tailings disposal. Given that each mill tailings pile constitutes a low-level waste burial site containing long-lived radioactive materials, the Commission believes that prudence requires that specific methods of tailings disposal, mill decontamination, site reclamation, surety arrangements, and arrangements to allow for transfer of site and tailings ownership be worked out and approved before a license is granted.

The Commission also notes that similar irrevocable and/or irretrievable commitments are involved in the commencement of construction of plants and facilities in which source materials are possessed and used for the production of uranium hexafluoride and commercial waste disposal by land burial. Accordingly, the requirements of the revised paragraphs (b) of § 40.14 and (e) of § 40.32 would apply to these plants and facilities.

The proposed amendments to 10 CFR 30 and 70 also relate to commencement of construction of other types of plants and facilities in which byproduct and special nuclear materials are used and possessed. The Commission also believes commencement of construction of these plants and facilities may also result in irreversible and irretrievable commitments of resources. Therefore, the Commission believes that it is also desirable and necessary that a final environmental impact statement or assessment be completed and documented before authorizing commencement of construction. Thus, 10 CFR 30.11(b), 10 CFR 30.33(a)(5), 10 CFR 70.14(b) and 10 CFR 70.23(a)(7) are being amended to conform to the foregoing amendments to 10 CFR 40.

The amendments to 10 CFR Part 150 that are to conform to Part 40's new definition of byproduct material and to Part 40's coverage of such byproduct material in Agreement States for the three years following enactment of UNTRCA are immediately effective. These amendments are in accordance with UMTRCA's provisions requiring NRC licensing of tailings in Agreement States for the three year interim. Pursuant to UMTRCA, however, Agreement States may exercise concurrent jurisdiction over tailings and wastes for the three-year interim.

A new proposed § 150.15a is added to enumerate certain authorities reserved in the Commission under UMTRCA. Paragraph (a) is drawn directly from sections 204(f) and 202(a) of UMTRCA. Paragraph (b) is extracted from § 83 of the Atomic Energy Act of 1954, as added by § 202(a) of UMTRCA. The language of UMTRCA and its legislative history indicate that the NRC is to make the determinations under and establish requirements pursuant to § 83, which minimum Federal standards and determinations must, under § 204(e) of the UMTRCA, be met by the Agreement States. New proposed § 150.31 and 150.32 outline requirements in the UMTRCA for Agreement State regulation of tailings or activities that produce such tailings or wastes. The new requirements, which become effective after November 8, 1981, are taken directly from § 274o of the Atomic Energy Act, as added by § 204(e) of the UMTRCA.

The proposed amendments to 10 CFR 170 establish fees for licensing and inspection actions involving only the management of mill tailings and associated wastes. The proposed fees are based on NRC staff experience involving the review of the environmental and public health aspects of uranium milling and related activities.

Proposed regulatory changes

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974, as amended, the Uranium Mill Tailings Radiation Control Act of 1978, and section 553 of title 5 of the United States Code, notice is hereby given that the Commission proposes to amend 10 CFR 30, 40, 70, 150, and 170 as indicated below.

The amendments to §§ 40.1, 40.2a, 40.3, 40.4, 40.26, 150.3, and 150.15, adopted as final rules in a document printed elsewhere in this part, are included below for purposes of clarity and continuity. They are identified in the amendatory language as being effective immediately.

1. Section 40.1 of 10 CFR 40 is amended (effective immediately) by revising paragraphs (a) and (b) as follows:

§ 40.1 Purpose.

(a) The regulations in this part establish procedures and criteria for the issuance of licenses to receive title to, receive, possess, use, transfer, deliver, or import into or export from the United States source and byproduct materials, as defined in this Part, and establish and provide for the terms and conditions upon which the Commission will issue such licenses. The regulations in this Part do not establish procedures and criteria for the issuance of licenses for materials covered under Title I of the Uranium Mill Tailings Radiation Control Act of 1978 (92 Stat. 3021).

(b) The regulations contained in this part are issued pursuant to the Atomic Energy Act of 1954, as amended (68 Stat. 919), Title II of the Energy Reorganization Act of 1974 (88 Stat. 1242), and Title II of the Uranium Mill Tailings Radiation Control Act of 1978 (42 U.S.C. 7901).

2. § 40.2a of 10 CFR 40 is added (effective immediately) to read as follows:

§ 40.2a Temporary coverage in Agreement States.

Until November 8, 1981, the regulations in this Part shall govern the Commission's licensing of byproduct material as defined in this Part in Agreement States.

3. § 40.2b of 10 CFR 40 is proposed to be read as follows:

§ 40.2b Coverage of inactive tailings sites.

(a) Prior to the completion of the remedial action, the Commission will not require a license pursuant to this Part for possession of byproduct material as defined in this Part that is located at a site where milling operations are no longer active, if such site is or is likely to be designated a processing site covered by the remedial action program of title I of the Uranium Mill Tailings Radiation Control Act of 1978. The Commission will exert its

regulatory role in remedial actions exclusively through concurrence and consultation in the execution of the remedial action pursuant to title I of the Uranium Mill Tailings Radiation Control Act of 1978.

(b) The Commission will require a license pursuant to this Part for byproduct material as defined in this Part that is located at a site where milling operations are not longer active, if such site is not and will not be covered by the remedial action program of title I of the Uranium Mill Tailings Radiation Control Act of 1978; provided, however, that the criteria in Appendix A of this Part will be applied to the maximum extent practicable, with consideration given to the unique circumstances of such inactive sites.

4. § 40.3 of 10 CFR 40 is revised (effective immediately) to read as follows:

§ 40.3 License requirements.

No person subject to the regulations in this Part shall receive title to, own, receive, possess, use, transfer, deliver, or import into or export from the United States byproduct material as defined in this Part or any source material after removal from its place of deposit in nature, except as authorized in a specific or general license issued by the Commission pursuant to the regulations in this Part.

5. § 40.4 of 10 CFR 40 is revised (effective immediately) by amending paragraphs 40.4(a–1), 40.4(e), and 40.4(t) and adding new paragraphs 40.4(b–1) and 40.4(p).

§ 40.4 Definitions.

* * * * *

(a–1) "Byproduct Material" means the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content, including discrete surface wastes resulting from uranium solution extraction processes. Underground ore bodies depleted by such solution extraction operations do not constitute "byproduct material" within this definition.

* * * * *

(b–1) "Department of Energy" means the United States Department of Energy or its duly authorized representative.

* * * * *

(e) "Person" means (1) any individual, corporation, partnership, firm, association, trust, estate, public or private institution, group, Government agency other than the Commission or the Department of Energy except that the Department of Energy shall be considered a person within the meaning of the regulations in this Part to the extent that its facilities and activities are subject to the licensing and related regulatory authority of the Commission pursuant to section 202 of the Energy Reorganization Act of 1974 (88 Stat. 1244) * and the Uranium Mill Tailings Radiation Control Act of 1978 (92 Stat. 21), any State or any political subdivision of, or any political entity within a State, any foreign government or nation or any political subdivision of any such government or nation, or other entity; and (2) any legal successor, representative, agent or agency of the foregoing.

* * * * *

(t) With the exception of "byproduct material" as defined in Section 11e. of the Act, other terms defined in Section 11 of the Act shall have the same meaning when used in the regulation in this Part.

* * * * *

(p) "Uranium Milling" means any activity that results in the production of byproduct material as defined in this Part.

6. Section 40.11 of 10 CFR 40 is proposed to be amended by changing the word "Adminstration" to read "Department of Energy" and by adding the words "or the Uranium Mill Tailings Radiation Control Act of 1978" following the words "Energy Reorganization Act of 1974."

7. Section 40.13 of 10 CFR 40 is proposed to be amended by adding the following sentence at the end of Paragraph (a): "The exemption contained in this paragraph does not include byproduct material as defined in this Part."

8. Section 40.14 of 10 CFR 40 is proposed to be amended by deleting paragraph 40.14(b).

* The Department of Energy facilities and activities identified in section 202 are:

(1) Demonstration Liquid Metal Fast Breeder reactors when operated as part of the power generation facilities of an electric utility system, or when operated in any other manner for the purpose of demonstrating the suitability for commercial application of such a reactor.

(2) Other demonstration nuclear reactors, except those in existence on January 19, 1975, when operated as part of the power generation facilities of an electric utility system, or when operated in any other manner for the purpose of demonstrating the suitability for commercial application of such a reactor.

(3) Facilities used primarily for the receipt and storage of high-level radioactive wastes resulting from licensed activities.

(4) Retrievable Surface Storage Facilities and other facilities authorized for the express purpose of subsequent long-term storage of high level radioactive waste generated by the Department of Energy, which are not used for, or are part of, research and development activities.

9. Section 40.26 of 10 CFR 40 is added (effective immediately) to read as follows:

§ 40.26 General license for possession and storage of byproduct material as defined in this Part.

(a) A general license is hereby issued to receive title to, own, or possess byproduct material as defined in this Part without regard to form or quantity.

(b) The general license in paragraph (a) of this section applies only:

(1) In the case of licensees of the Commission, where activities that result in the production of byproduct material are authorized under a specific license issued by the Commission pursuant to this Part, to byproduct material possessed or stored at an authorized disposal containment area or transported incident to such authorized activity: Provided, that authority to receive title to, own, or possess byproduct material under this general license shall terminate when the specific license for source material expires, is renewed, or is amended to include a specific license for byproduct material as defined in this Part; or

(2) In Agreement States until November 8, 1981, where activities that result in the production of byproduct material are authorized under a specific license issued by the Agreement State on or before May 17, 1979, to byproduct material possessed, or stored at an authorized disposal containment area or transported incident to such authorized activities: Provided, that authority to receive title to, own, or possess byproduct material under such general license shall terminate when such Agreement State license expires or is renewed, whichever first occurs.

(c) The general license in paragraph (a) of this section is subject to:

(1) The provisions of Parts 19, 20, 21, and sections 40.1, 40.2, 40.2a, 40.3, 40.4, 40.5, 40.6, 40.41, 40.46, 40.61, 40.62, 40.63, 40.65, 40.71, and 40.81 of Part 40 of this Chapter; and

(2) The documentation of daily inspections of tailings or waste retention systems and the immediate notification of the appropriate NRC regional office as indicated in Appendix D of 10 CFR Part 20, or the Director, Office of Inspection and Enforcement, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, of any failure in a tailings or waste retention system which results in a release of tailings or waste into unrestricted areas, and/or of any unusual conditions (conditions not contemplated in the design of the retention system) which if not corrected could lead to failure of the system and result in a release of tailings or waste

into unrestricted areas; and any additional requirements the Commission may by order deem necessary.

10. Section 40.31 of 10 CFR 40 is proposed to be amended by revising § 40.31(a) and adding a new § 40.31(g) as follows:

§ 40.31 Applications for specific licenses.

(a)(1) Applications for a specific license for source material or for byproduct material produced in conjunction with the uranium milling activity for which a source material license is sought from the Commission should be filed in quadruplicate on Form NRC-2 "Application for Source Material License," with the Director of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555. Applications may be filed in person at the Commission's Offices at 1717 H Street, NW., Washington, D.C., or 7920 Norfolk Avenue, Bethesda, Md. Information contained in previous applications, statements, or reports filed with the Commission may be incorporated by reference, provided such references are clear and specific.

(2) Applications for specific licenses for byproduct material as defined in this Part not sought in conjunction with a source material license from the Commission for uranium milling shall be filed with the Director of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555. Such applications include, until November 8, 1981, applications for specific licenses from the Commission for such byproduct material generated by uranium milling under an Agreement State license issued or renewed after May 17, 1979.

* * * * *

(g) An application for a license to receive title to, own, receive, possess, and use source material for uranium milling or byproduct material, as defined in this Part, shall contain proposed specifications relating to milling operations and the disposition of the byproduct material to achieve the requirements and objectives set forth in Appendix A of this Part.

11. Section 40.32 of 10 CFR 40 is proposed to be amended by revising § 40.32(e) as follows:

§ 40.32 General requirements for issuance of specific licenses.

* * * * *

(e) In the case of an application for a license to possess and use source and byproduct material for uranium milling, production of uranium hexafluoride, commercial waste disposal by land burial or for the conduct of any other activity which the Commission determines will significantly affect the quality of the environment, the Director of Nuclear Material Safety and Safeguards or his designee, before commencement of construction of the plant or facility in which the activity will be conducted, on the basis of information filed and evaluations made pursuant to Part 51 of this chapter, has concluded, after weighing the environmental, economic, technical and other benefits against environmental costs and considering available alternatives, that the action called for is the issuance of the proposed license, with any appropriate conditions to protect environmental values. Commencement of construction prior to such a conclusion shall be grounds for denial of a license to possess and use source and byproduct material in such plant or facility.

12. Appendix A is proposed to be added to Part 40 to read as follows:

Appendix A to Part 40

Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes (i.e., byproduct material as defined in Section 11e.(2) of the Atomic Energy Act) Produced by the Extraction or Concentration of Source Material From Ores.

Introduction. Every applicant for a license to possess and use source material in conjunction with uranium or thorium milling is required by the provisions of § 40.31(g) to include in a license application proposed specifications relating to milling operations and the disposition of tailings or waste resulting from such milling activities. This appendix establishes technical, financial, ownership, and long-term site surveillance requirements relating to the siting, operation, decontamination, decommissioning, and reclamation of mills and tailings or waste systems and sites at which such mills and systems are located.

I. Technical Criteria

Criterion 1—Tailings or waste disposal areas shall be located at remote sites so as to reduce potential population exposures and the likelihood of human intrusions to the maximum extent reasonably achievable. To avoid proliferation of small waste disposal sites, byproduct material from in-situ extraction operations, such as residues from solution evaporation or contaminated control processes, and wastes from small remote above ground extraction operations shall preferably be disposed of at existing large mill tailings disposal sites; consideration will be given to the nature of the wastes, such as their volume and specific activity, and to costs and environmental impacts of transporting the wastes to a large disposal site.

Criterion 2—Tailings or waste disposal areas shall be located at sites where disruption and dispersion by natural forces are eliminated or reduced to the maximum extent reasonably achievable. In the selection of mill sites, primary emphasis shall be given to isolation of tailings or wastes, a matter having long-term impacts, as opposed to consideration only of short-term convenience or benefits, such as minimization of transportation or land acquisition costs. These criteria, which preclude location of tailings or mill site in an area which could be disrupted by natural events, such as flooding, assure that the requirements of Executive Order 11988 concerning floodplain management are met.

Criterion 3—The "prime option" for disposal of tailings is placement below grade, either in mines or specially excavated pits. The evaluation of alternative sites and disposal methods performed by mill operators in support of their proposed tailings disposal program (provided in applicant environmental reports) shall reflect this. In some instances, below-grade disposal may not be the most environmentally sound approach, such as might be the case if a high quality groundwater formation is relatively close to the surface or not very well isolated by overlying soils and rock. Also, geologic and topographic conditions might make full, below-grade burial impracticable; for example, bedrock may be sufficiently near surface that blasting would be required to excavate a disposal pit at excessive cost, and more suitable alternate sites are not available. In these cases, it must be demonstrated that an above-grade disposal program will provide reasonably equivalent isolation of the tailings from natural erosional forces.

Criterion 4—If tailings or wastes are disposed of above ground, the following siting and design criteria shall be adhered to:

(a) Upstream rainfall catchment areas must be utilized to decrease the size of the maximum possible flood which could erode or wash out sections of the tailings disposal area.

(b) Topographic features shall provide good wind protection.

(c) Embankment slopes shall be relatively flat after final stabilization to minimize erosion potential and to provide conservative factors of safety assuring long-term stability. The broad objective should be to contour final slopes to grades which are as close as

possible to those which would be provided if tailings were disposed of below grade; this would, for example, lead to slopes of about 10 horizontal to 1 vertical (10h:1v) or less steep. In general, slopes should not be steeper than about 5h:1v. Where steeper slopes are proposed, reasons why a slope less steep than 5h:1v would be impracticable should be provided, and compensating factors and conditions which make such slopes acceptable should be identified.

(d) A full, self-sustaining vegetative cover shall be established or riprap employed to retard wind and water erosion. Special concern shall be given to slopes of embankments.

(e) The impoundment shall not be located near a potentially active fault that could cause a maximum credible earthquake larger than that which the impoundment could reasonably be expected to withstand.

(f) The impoundment, where feasible, should be designed to incorporate features which will promote deposition. For example, design features which promote deposition of sediment suspended in any runoff which flows into the impoundment area might be utilized; the objective of such a design feature would be to enhance the thickness of cover over time.

Criterion 5—Steps shall be taken to reduce seepage of toxic materials into groundwater to the maximum extent reasonably achievable. This could be accomplished by lining the bottom of tailings areas and reducing the inventory of liquid in the impoundment by such means as dewatering tailings and/or recycling water from tailings impoundments to the mill. Furthermore, steps shall be taken during stockpiling of ore to minimize penetration of radionuclides into underlying soils; suitable methods include lining and/or compaction of ore storage areas. Also, tailings treatment, such as neutralization to promote immobilization of toxic substances shall be considered. The specific method, or combination of methods, to be used must be worked out on a site-specific basis. While the primary method of protecting groundwater shall be isolation of tailings and tailings solutions, disposal involving contact with groundwater will be considered provided supporting tests and analysis are presented demonstrating that the proposed disposal and treatment methods will preserve quality of groundwater.

Criterion 6—Sufficient earth cover, but not less than three meters, shall be placed over tailings or wastes at the end of milling operations to result in a *calculated* reduction in surface exhalation of radon from the tailings or wastes to less than two picocuries per square meter per second above natural background levels. Direct gamma exposure from the tailings or wastes should be reduced to background levels. Plastic or other synthetic caps should not be used to reduce radon exhalation from the tailings or wastes. Cover material must not include mine waste or rock that contain elevated levels of radium; soils used for cover must be essentially the same, as far as radioactivity is concerned; as that or surrounding soils.

Criterion 7—At least one full year prior to any major site construction, a preoperational monitoring program should be conducted to provide complete baseline data on a milling site and its environs prior to development. Throughout the construction and operation phase of the mill, an operational monitoring program should be conducted to demonstrate compliance with applicable standards and regulations; to evaluate performance of control systems and procedures; to evaluate environmental impacts of operation; and to detect potential long-term effects.

Criterion 8—Milling operations shall be conducted so that all airborne effluent releases are reduced to as low as is reasonably achievable below the limits in 10 CFR Part 20. The primary means of accomplishing this should be by means of emission controls. Institutional controls, such as extending the site boundary and exclusion area, may be employed to ensure that offsite exposure limits are met, but only after efforts have been taken to control emissions at the source to the maximum extent reasonably achievable. Notwithstanding the existence of individual dose standards, strict control of emissions is necessary to assure that population exposures are reduced to the maximum extent reasonably achievable and to avoid site contamination. The greatest potential sources of offsite radiation exposure (aside from radon exposure) are dusting from dry surfaces or the tailings disposal area not covered by tailings solution and emissions from yellowcake drying and packaging operations. Yellowcake drying and packaging operations should cease when effluent control devices are inoperative or not working at their reasonably expected best performance levels. To control dusting from tailings, that portion not covered by standing liquids should be wetted or chemically stabilized to prevent or minimize blowing and dusting to the maximum extent reasonably achievable. This requirement may be relaxed if tailings are effectively sheltered from wind, such as may be the case where they are disposed of below grade and the tailings surface is not exposed to wind. Consideration should be given in planning tailings disposal programs to methods which would allow phased covering and reclamation of tailings impoundments since this will help in controlling particulate and radon emissions during operation. To control dusting from diffuse sources, such as tailings and ore pads where automatic controls do not apply, operators should develop written operating procedures specifying the methods of control which will be utilized.

Criterion 8(A)—Daily inspections of tailings or waste retention systems shall be conducted and documented. The appropriate NRC regional office as indicated in Appendix D of 10 CFR Part 20, or the Director, Office of Inspection and Enforcement, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, shall be immediately notified of any failure in a tailings or waste retention system which results in a release of tailings or waste into unrestricted areas, and/or of any unusual conditions (conditions not contemplated in the design of the retention system) which if not corrected could lead to failure of the system and result in a release of tailings or waste into unrestricted areas.

II. Financial Criteria

Criterion 9—Financial surety arrangements shall be established by each mill operator to assure that sufficient funds will be available to carry out the decontamination and decommissioning of the mill and site and for the reclamation of any tailings or waste disposal areas. The amount of funds to be ensured by such surety arrangements shall be based on cost estimates in an approved plan for (1) decontamination and decommissioning of mill buildings and the milling site to levels which would allow unrestricted use of these areas upon decommissioning, and (2) the reclamation of tailings and/or waste disposal areas in accordance with technical criteria delineated in Section I of this Appendix. The licensee shall submit this plan in conjunction with an environmental report that addresses the expected environmental impacts of the milling operation, decommissioning and tailings reclamation, and evaluates alternatives for mitigating these impacts. The surety shall cover the payment of the charge for long-term surveillance required by Criterion 10. In establishing specific surety arrangements, the licensee's cost estimates shall take into

account total capital costs that would be incurred if an independent contractor were hired to perform the decommissioning and reclamation work. In order to avoid unnecessary duplication and expense, the Commission will accept financial sureties that have been consolidated with financial or surety arrangements established to meet requirements of other Federal or State agencies and/or local governing bodies for such decommissioning, decontamination, reclamation, and long-term site surveillance. The licensee's surety mechanism will be reviewed from time to time by the Commission (generally at the time of license renewal) to assure sufficient funds for completion of the reclamation plan if the work had to be performed by the regulatory authority. The amount of surety liability should change in accordance with the predicted cost of future reclamation. Factors affecting reclamation cost estimates include: inflation; increases in the amount of disturbed land; and decommissioning and reclamation that has been performed. This will yield a surety that is at least sufficient at all times to cover the costs of decommissioning and reclamation of the areas that are expected to be disturbed before the next license renewal. The term of the surety mechanism must be open ended. Liability under the surety mechanism shall remain in effect until the reclamation program has been completed and approved. Financial surety arrangements generally acceptable to the Commission are:

(a) Surety bonds;
(b) Cash deposits;
(c) Certificates of deposit;
(d) Deposits of government securities;
(e) Letters or lines of credit; and
(f) Combinations of the above or such other types of arrangements as may be approved by the Commission.

Criterion 10—A charge of $250,000 to cover the costs of long-term surveillance shall be paid by each mill operator to the general treasury of the United States or to an appropriate State agency prior to the termination of a uranium or thorium mill license. If site surveillance requirements at a particular site are determined, on the basis of a site-specific evaluation, to be significantly greater than those specified in Criterion 12, variance in funding requirements may be specified by the Commission. The total charge to cover the costs of long-term surveillance shall be such that, with an assumed 1 percent annual real interest rate, the collected funds will yield interest in an amount sufficient to cover the annual costs of site surveillance. The charge will be adjusted annually to recognize inflation. The inflation rate to be used is that indicated by the change in the Consumer Price Index published by the U.S. Department of Labor, Bureau of Labor Statistics.

III. Site and Byproduct Material Ownership

Criterion 11—

A. These criteria relating to ownership of tailings and their disposal sites become effective on November 8, 1981, and apply to all licenses terminated, issued, or renewed after that date.

B. Any uranium or thorium milling license or tailings license shall contain such terms and conditions as the Commission determines necessary to assure that, prior to termination of the license, the licensee will comply with ownership requirements of this criterion for sites used for tailings disposal.

C. Title to the byproduct material licensed under this Part and land, including any interests therein (other than land owned by the United States or by a State) which is used for the disposal of any such byproduct material, shall be transferred to the United States or the State in which such land is located, at the option of such State. For licenses issued before November 8, 1981, the NRC will review an applicant's plans to effect arrangements to allow for transfer of site and tailings ownership prior to issuance of a license.

D. If the Commission determines that use of the surface or subsurface estates, or both, of the land transferred to the United States or to a State will not endanger the public health, safety, welfare, or environment, the Commission will permit the use of the surface or subsurface estates, or both, of such land in a manner consistent with the provisions provided in these criteria. If the Commission permits such use of such land, it will provide the person who transferred such land with the right of first refusal with respect to such use of such land.

E. In the case of any uranium or thorium milling license in effect on November 8, 1981, the Commission may require, before the termination of such license, transfer of land and interests therein (including tailings) to the United States or a State in which such land is located at the option of such State as may be necessary to protect the public health, welfare, and the environment from any effects associated with byproduct material defined in this Part. In exercising this requirement, the Commission will take into consideration the status of the ownership of such land and interests therein (including tailings) and the ability of the licensee to transfer title and custody thereof to the United States or a State. For licenses issued before November 8, 1981, the NRC will review an applicant's plans to effect arrangements to allow for transfer of site and tailings ownership prior to issuance of a license. Subsequent renewals shall not disqualify licensees otherwise eligible for such consideration under this criterion.

F. Material and land transferred to the United States or a State in accordance with this Criterion shall be transferred without cost to the United States or a State other than administrative and legal costs incurred in carrying out such transfer.

G. The provisions of this Part respecting transfer of title and custody to land and tailings and wastes shall not apply in the case of lands held in trust by the United States for any Indian tribe or lands owned by such Indian tribe subject to a restriction against alienation imposed by the United States. In the case of such lands which are used for the disposal of byproduct material, as defined in this Part, the licensee shall enter into arrangements with the Commission as may be appropriate to assure the long-term surveillance of such lands by the United States.

IV. Long-Term Site Surveillance

Criterion 12—The final disposition of tailings or wastes at milling sites should be such that the need for ongoing active maintenance is not necessary to preserve isolation. As a minimum, annual site inspections shall be conducted by site owners where tailings, or wastes are stored to confirm the integrity of the stabilized tailings or waste systems and to determine the need, if any, for maintenance and/or monitoring. Results of the inspection shall be reported to the Commission within 60 days following each inspection. The Commission may require more frequent site inspections if, on the basis of a site-specific evaluation, such a need appears necessary due to the features of a particular tailings or waste disposal system.

13. Section 70.14 of 10 CFR 70 is proposed to be amended by deleting paragraph 70.14(b).

14. Section 70.23 of 10 CFR 70 is proposed to be amended by revising paragraph (a)(7) to read as follows:

§ 70.23 Requirements for the approval of applications.

(a) * * *

(7) Where the proposed activity is processing and fuel fabrication, scrap recovery, conversion of uranium hexafluoride, commercial waste disposal by land burial, or any other

activity which the Commission determines will significantly affect the quality of the environment, the Director of Nuclear Material Safety and Safeguards or his designee, before commencement of construction of the plant or facility in which the activity will be conducted, on the basis of information filed and evaluations made pursuant to Part 51 of this chapter, has concluded, after weighing the environmental, economic, technical, and other benefits against environmental costs and considering available alternatives, that the action called for is the issuance of the proposed license, with any appropriate conditions to protect enviromental values. Commencement of construction prior to such conclusions shall be grounds for denial to posses and use special nuclear material in such plant or facility.

* * * * *

15. Section 30.11 of 10 CFR 30 is proposed to be amended by deleting paragraph 30.11(b).

16. Section 30.33 of 10 CFR 30 is proposed to be amended by revising paragraph (a)(5) to read as follows:

§ 30.33 General requirements for issuance of specific licenses.

(a) * * *

(5) In the case of an application for a license to receive and possess byproduct material for commercial waste disposal by land burial or for the conduct of any other activity which the Commission determines will significantly affect the quality of the environment, the Director of Nuclear Material Safety and Safeguards or his designee, before commencement of construction of the plant or facility in which the activity will be conducted, on the basis of information filed and evaluations made pursuant to Part 51 of this chapter, has concluded, after weighing the environmental, economic, technical, and other benefits against environmental costs and considering available alternatives, that the action called for is the issuance of the proposed license, with any appropriate conditions to protect environmental values. Commencement of construction prior to such conclusion shall be grounds for denial of a license to receive and possess byproduct material in such plans or facility.

17. Section 150.3 of 10 CFR 150 is amended (effective immediately) by revising paragraph 150.3(c) to read as follows:

§ 150.3. Definitions.

* * * * *

(c) "Byproduct material" means (1) any radioactive material (except special nuclear material) yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear material; or (2) the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content, including discrete surface wastes resulting from solution extraction processes. Underground ore bodies depleted by such solution extraction operations do not constitute "byproduct material" within this definition.

18. Section 150.15 of 10 CFR 150 is amended (effective immediately) by adding a new paragraph (a)(7), to read as follows:

§ 150.15 Persons not exempt.

(a) * * *

(7) Until November 8, 1981, the receipt of title to, ownership of, receipt of, possession of, use of, transfer of, delivery of, import or export of the byproduct material as defined in § 150.3(c)(2) of this Part; Provided, however, that during this period any State may exercise any authority under State law respecting such material in the same manner, and to the same extent, as permitted before enactment of the Uranium Mill Tailings Radiation Control Act of 1978. In case of conflict between Federal and State requirements regarding a license, the Federal license requirements shall prevail unless the State requirements are more stringent than the Federal requirements.

19. 10 CFR 150 is proposed to be amended by adding a new § 150.15a to read as follows:

§ 150.15a Continued Commission authority pertaining to byproduct material.

(a) Prior to the termination of any Agreement State license for byproduct material as defined in § 150.3(c)(2) of this Part, or for any activity that results in the production of such material, the Commission shall have made a determination that all applicable standards and requirements pertaining to such material have been met.

(b) After November 8, 1981, the Commission reserves the authority to establish minimum standards regarding reclamation, long term surveillance (i.e., continued site observation, monitoring and, in some cases where necessary, maintenance), and ownership of byproduct material as defined in § 150.3(c)(2) of this Part and of land used as a disposal site for such material. Such reserved authority includes:

(1) Authority to establish such terms and conditions as the Commission determines necessary to assure that, prior to termination of any license for byproduct material as defined in § 150.3(c)(2) of this Part, or for any activity that results in the production of such material, the licensee shall comply with decontamination, decommissioning, and reclamation standards prescribed by the Commission; and with ownership requirements for such materials and its disposal site as the Commission may establish;

(2) The authority to require that prior to termination of any license for byproduct material as defined in § 150.3(c)(2) of this Part or for any activity that results in the production of such material, that title to such byproduct material and its disposal site be transferred to the United States or the State in which such material and land is located, at the option of the State (provided such option is exercised prior to termination of the license);

(3) The authority to permit use of the surface or subsurface estates, or both, of the land transferred to the United States or a State pursuant to paragraph (b)(2) of this section in a manner consistent with the provisions of the Uranium Mill Tailings Radiation Control Act of 1978, provided that the Commission determines that such use would not endanger the public health, safety, welfare, or the environment;

(4) The authority to require, in the case of a license for any activity that produces such byproduct material (which license was in effect on November 8, 1981) transfer of land and material pursuant to paragraph (b)(2), of this section, taking into consideration the status of such material and land and interests therein, and the ability of the licensee to transfer title and custody thereof to the United States or a State;

(5) The authority to require the Secretary of the Department of Energy, other Federal agency, or State, whichever has custody of such property and materials, to undertake such monitoring, maintenance and emergency measures as are necessary to protect the public health and safety and other actions as the Commission deems necessary to comply with the standards promulgated pursuant to the Uranium Mill Tailing Radiation Control Act of 1978; and

(6) The authority to enter into arrangements as may be appropriate to assure Federal long term surveillance (i.e., continued site observation of such disposal sites on land held in trust by the United States for any Indian tribe or land owned by an Indian tribe and subject to a restriction against alienation imposed by the United States.

20. 10 CFR 150 is proposed to be amended by adding a new § 150.31 to read as follows:

§ 150.31 Requirements for Agreement State regulation of byproduct material.

After November 8, 1981, in the licensing and regulation of byproduct material, as defined in § 150.3(c)(2) of this Part, or of any activity which results in the production of such byproduct material, an Agreement State shall require—

(a) Compliance with requirements established by the Commission pertaining to ownership of such byproduct material and disposal sites for such material; and

(b) Compliance with standards which shall be adopted by the Agreement State for the protection of the public health, safety, and the environment from hazards associated with such material which are equivalent, to the extent practicable, or more stringent than, standards adopted and enforced by the Commission for the same purpose, including requirements and standards promulgated by the Commission and the Administrator of the Environment Protection Agency pursuant to the Uranium Mill Tailing Radiation Control Act of 1978; and

(c) Procedures which—

(1) In the case of licenses under State law include—

(i) An opportunity, after public notice, for written comments and a public hearing, with a transcript,

(ii) An opportunity for cross examination, and

(iii) A written determination which is based upon findings included in such determination and upon the evidence presented during the public comment period and which is subject to judicial review;

(2) In the case of rulemaking, provide an opportunity for public participation through written comments or a public hearing and provide for judicial review of the rule;

(3) Require for each license which has a significant impact on the human environment a written analysis (which shall be available to the public before the commencement of any such proceedings) of the impact of such license, including any activities conducted pursuant thereto, on the environment. Such analysis shall include—

(i) An assessment of the radiological and nonradiological impacts to the public health of the activities to be conducted pursuant to such license;

(ii) An assessment of any impact on any waterway and groundwater resulting from such activities;

(iii) Consideration of alternatives, including alternative sites and engineering methods, to the activities to be conducted pursuant to such license; and

(iv) Consideration of the long term impacts, including decommissioning, decontamination, and reclamation impacts associated with activities to be conducted pursuant to such license, including the management of any byproduct material, as defined in § 150.3(c)(2) of this Part; and

(4) Prohibit any major construction activity with respect to such material prior to complying with the provisions of paragraph (c)(3) of this section.

(d) No Agreement State shall be required under paragraph (c) to conduct proceedings concerning any license or regulation which would duplicate proceedings conducted by the Commission.

21. 10 CFR 150 is proposed to be amended to add § 150.32 to read as follows:

§ 150.32 Funds for reclamation or maintenance of byproduct material.

(a) The total amount of funds an Agreement State collects, pursuant to a license for byproduct material as defined in § 150.3(c)(2) of this Part or for any activity that results in the production of such material, for reclamation or long term maintenance and monitoring of such material, shall, after November 8, 1981, be transferred to the United States if title and custody of such material and its disposal site is transferred to the United States upon termination of such license. Such funds include, but are not limited to, sums collected for long term surveillance (i.e., continued site observation, monitoring and, in some cases where necessary, maintenance). Such funds do not, however, include monies held as surety where no default has occurred and the reclamation or other bonded activity has been performed.

(b) If an Agreement State requires such payments for reclamation or long term surveillance (i.e., continued site observation, monitoring and, in some cases where necessary, maintenance), they payments must, after November 8, 1981, be sufficient to ensure compliance with those standards established by the Commission pertaining to bonds, sureties, and financial arrangements to ensure adequate reclamation and long term management of such byproduct material and its disposal site.

22. § 170.2 of 10 CFR 170 is proposed to be revised to read as follows:

§ 170.2 Scope.

Except for persons who apply for or hold the permits, licenses, or approvals exempted in § 170.11, the regulations in this part apply to a person who is an applicant for, or holder of, a specific byproduct material license issued pursuant to Part 40 of this chapter, a specific special nuclear material license issued pursuant to Part 70 of this chapter, a specific approval of spent fuel casks and shipping containers issued pursuant to Part 71 of this chapter, a specific request for approval of sealed sources and devices containing byproduct material, source material, or special nuclear material, or a production or utilization facility construction permit and operating license issued pursuant to Part 50 of this chapter, to routine safety and safeguards inspections of a licensed person, to a person who applies for approval of a reference standardized design of a nuclear steam supply system or balance of plant, for review of a facility site prior to the submission of an application for a construction permit, for review of a standardized spent fuel facility design, and for a special project review which the Commission completes or makes whether or not in conjunction with a license application on file or which may be filed.

23. § 170.3 of 10 CFR 170 is proposed to be amended by revising paragraphs 170.3 (a) and (c) to read as follows:

§ 170.3 Definitions.

As used in this part:

(a) "Byproduct material" means (1) any radioactive material (except special nuclear material) yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear material; or (2) the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content, including discrete surface wastes resulting from uranium solution extraction processes. Underground ore bodies depleted by such solution extraction operations do not constitute "byproduct material" within this definition.

* * * * *

(c) "Materials license" means a byproduct material license issued pursuant to Part 30 of this chapter, or a source or byproduct material license issued pursuant to Part 40 of this chapter, or a special nuclear material license issued pursuant to Part 70 of this chapter.

* * * * *

24. § 170.31 of 10 CFR 170 is proposed to be amended by adding a new category 4.D to read as follows:

§ 170.31 Schedule of fees for materials licenses and other regulatory services.

* * * * *

4.D (1) Licenses specifically authorizing the receipt, possession, use, or ownership of tailings or wastes (i.e., byproduct material) produced in conjunction with heap-leaching operations.

Application	13,000
New License*	83,800
Renewal*	93,800
Amendment*	
Major*	20,800
Minor*	3,500
Administrative	150

(2) Licenses specifically authorizing the receipt, possession, use, or ownership of tailings or wastes (i.e., byproduct material) produced in conjunction with milling operations.

Production scale activity:	
Application	7,000
New License*	12,500
Research and development scale activity:	
Application	2,000
New License*	14,800
Renewal*	*13,500
Amendment*	
Major*	*4,200
Minor*	*760
Administrative	*150

(3) Licenses specifically authorizing the receipt, possession, use, or ownership of tailings or wastes (i.e., byproduct material) produced in conjunction with in situ leaching operations.

Production scale activity:	
Application	2,500
New License*	16,900
Research and development scale activity:	
Application	850
New License*	5,000
Renewal*	*14,800
Amendment*	
Major*	*1,400
Minor	*250
Administrative	*150

* * * * *

25. § 170.32 of 10 CFR 170 is proposed to be amended by adding a new category 4.D to read as follows:

§ 170.32 Schedule of fees for health and safety, and safeguards inspections for materials licenses.

* * * * *

4.D. Licenses specifically authorizing the receipt, possession, use, or ownership of tailings or wastes (i.e., byproduct material) produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content.

Health and Safety	1,500 One Per Year.

* * * * *

The Commission finds that because the regulations supporting the general license must be effective immediately so as to prevent existing milling operations from being in technical violation of the Atomic Energy Act, good cause exists pursuant to 5 U.S.C. 553 to waive the 30-day comment period, as impracticable and contrary to the public interest, and make the amendments to 10 CFR 40.1, 40.2a, 40.3, 40.4, 40.26, 150.3, and 150.15 immediately effective. The Commission notes in this regard that informal written comments on this matter were solicited and received from industry, environmental groups, and several States (these comments may be found in the Commission's public document room in a memorandum dated May 9, 1979, from the Executive Legal Director to the Commission entitled "Staff Response to the Commission Request for Further Information Regarding SECY-79-88 'Timing of Certain Requirements of the Uranium Mill Tailings Radiation Control Act of 1978' "). Comments on these amendments are invited, however, and the new regulations remain subject to further modifications in response to such comments.

(Secs. 11e.(2), 81, 83, 84, 161b, 161x, 274; Pub. L. No. 83-703, 68 Stat. 948 et seq. (42 U.S.C. 2014e.(2), 2111, 2113, 2114, 2201b, 2201x, 2021))

Dated at Washington, D.C. this 22nd day of August 1979.

For the Nuclear Regulatory Commission.

Samuel J. Chilk,

Secretary of the Commission.

[FR Doc. 79-26516 Filed 8-23-79; 8:45 am]

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NEW MEXICO'S RESPONSE TO CHAIRMAN MORRIS UDALL'S SEPTEMBER 19, 1979 LETTER TO GOVERNOR BRUCE KING

BY

CUBIA L. CLAYTON

NEW MEXICO ENVIRONMENTAL IMPROVEMENT DIVISION

I APPRECIATE THE OPPORTUNITY TO APPEAR BEFORE THE COMMITTEE TODAY TO DISCUSS THE TAILINGS DAM FAILURE AT CHURCH ROCK, NEW MEXICO WHICH OCCURRED ON JULY 16, 1979. FIVE OF THE ISSUES RAISED BY THE COMMITTEE HAVE BEEN ADDRESSED BY INDIVIDUALS WITH THE NEW MEXICO STATE ENGINEER OFFICE AND MR. FRED ALLEN IS HERE TO PRESENT THOSE FINDINGS TO THE COMMITTEE. I WILL ADDRESS THOSE ISSUES NOT TREATED BY MR. ALLEN. MY STATEMENT IS INTENDED TO PROVIDE A GENERAL OVERVIEW. I WILL, OF COURSE, RESPOND TO ANY FURTHER QUESTIONS THE COMMITTEE MIGHT HAVE.

THE FACTS BRIEFLY ARE AS FOLLOWS:

ABOUT 6:45 ON THE MORNING OF JULY 16, AN EMPLOYEE OF UNITED NUCLEAR CORPORATION OBSERVED A BREAK IN THE TAILINGS DAM LOCATED AT CHURCH ROCK, NEW MEXICO. THE MILL WAS SHUT DOWN BY 7:00 A.M. THAT MORNING AND APPROPRIATE AUTHORITIES INCLUDING THE NEW MEXICO ENVIRONMENTAL IMPROVEMENT DIVISION (EID) WERE NOTIFIED. THE FLOW WAS STOPPED BY 7:50 A.M. WITH A TEMPORARY DIKE. IT APPEARS THAT THE RELEASE CONSISTED OF APPROXIMATELY 1100 TONS OF TAILINGS (SANDS) AND 95 MILLION GALLONS OF TAILINGS SOLUTION. THE FLOW WHICH WAS CONFINED TO PIPELINE CANYON AND THE RIO PUERCO EXTENDED TO THE NEW MEXICO-ARIZONA STATE LINE AND BEYOND TO THE AREA OF SANDERS, ARIZONA.

EID FIELD PERSONNEL WERE ON THE UNC SITE BY 9:00 A.M. TO INSURE THE MILL WAS SHUT DOWN, THE BREACH PLUGGED EFFECTIVELY, AND EARLY DAMAGE ASSESSMENT AND

SAMPLE COLLECTION WERE INSTITUTED. SHORTLY AFTER NOON, A TEAM FROM EID AND THE STATE ENGINEER OFFICE WERE ON SITE FOR PRELIMINARY DAM FAILURE ANALYSIS AND TO COORDINATE SAMPLE COLLECTION FOR ENVIRONMENTAL DAMAGE ANALYSIS. A FORMAL MILL SHUTDOWN ORDER WAS ISSUED BY EID TO COMPANY OFFICIALS BY 4:00 P.M. ALTHOUGH IT SHOULD BE NOTED THAT UNC HAD VOLUNTARILY SHUT DOWN AS NOTED EARLIER.

THE STOP ORDER WAS FOLLOWED ON JULY 18 BY AN EID CLEANUP ORDER AND AN ADDITIONAL STOP ORDER FROM THE STATE ENGINEER OFFICE. ON AUGUST 13, 1979 UNC WAS ISSUED CLEANUP INSTRUCTIONS GIVING CLEANUP CRITERIA AND CONSIDERABLE ADDITIONAL CLEANUP REQUIREMENTS BY EID. AN ADMINISTRATIVE ORDER WAS ISSUED BY THE ENVIRONMENTAL PROTECTION AGENCY ON AUGUST 9, 1979 AND A STOP ORDER BY THE NUCLEAR REGULATORY COMMISSION ON OCTOBER 13, 1979.

EXTENSIVE MONITORING AND SAMPLE COLLECTION EFFORTS BY BOTH UNC AND EID WERE BEGUN ON JULY 16, THE DAY OF THE BREACH, IN AN EFFORT TO QUANTIFY THE EXTENT OF THE SPILL, AND TO PROVIDE INFORMATION NECESSARY FOR CLEANUP. THOSE EFFORTS ARE CONTINUING TO THIS DAY AND WILL CONTINUE INTO THE FUTURE. THERE WAS SOME DIFFICULTY IN OBTAINING SPEEDY LABORATORY ANALYSIS, AND ON SEPTEMBER 22, 1979 THE NUCLEAR REGULATORY COMMISSION ARRANGED FOR A FIELD LABORATORY TO BE PLACED ON SITE. THE LABORATORY HAS BEEN ANALYZING APPROXIMATELY SEVENTY SAMPLES PER DAY SINCE ITS ARRIVAL AND HAS BEEN OF GREAT VALUE IN LOCATING AREAS IN NEED OF CLEANUP. AS OF OCTOBER 12, UNITED NUCLEAR CORPORATION HAS REMOVED APPROXIMATELY 3,150 TONS OF MATERIAL FROM THE ARROYO AND DEPOSITED IT TO THE TAILINGS AREA. THOSE EFFORTS WILL CONTINUE UNTIL TOTAL CLEANUP HAS BEEN ACCOMPLISHED. TO PLACE THE AMOUNT OF TIME AND EFFORT EXPENDED TO DATE IN SOME PERSPECTIVE IT MIGHT BE NOTED THAT OUR WATER POLLUTION CONTROL SECTION HAS HAD FIVE GEOHYDROLOGISTS INVOLVED FOR A TOTAL OF MORE THAN 300 MAN-DAYS.

OUR RADIATION PROTECTION SECTION HAS HAD FIVE SPECIALISTS AND TWO TECHNICIANS INVOLVED FOR A TOTAL OF MORE THAN 350 MAN-DAYS, AND SEVEN OTHER FIELD PERSONNEL HAVE BEEN INVOLVED FOR MORE THAN 50 MAN-DAYS. THIS DOES NOT INCLUDE THE EFFORT FROM OUR STATE LABORATORY SYSTEM OR THE EFFORT REQUIRED BY THE NEW MEXICO STATE ENGINEER OFFICE.

THE RESULT OF MONITORING EFFORTS TO DATE MAY BEST BE SUMMARIZED AS FOLLOWS. ON THE DAY OF THE SPILL, WE OBSERVED AN IMMEDIATE AND DRAMATIC RESPONSE IN SURFACE WATER. TRACE ELEMENTS AND RADIONUCLIDES WERE PRESENT IN EXTREMELY HIGH CONCENTRATIONS. AS WOULD BE EXPECTED, THERE WAS NOT A COMPARABLE RESPONSE IN GROUND WATER. AT PRESENT, THE SURFACE WATER APPEARS TO HAVE UNDERGONE SIGNIFICANT RECOVERY, BUT IS NOT YET BACK TO PRE-SPILL QUALITY. THERE HAS BEEN A GRADUAL INCREASE IN SOME CONTAMINANT LEVELS IN GROUND WATER AS DETECTED AT THE NEAREST OBSERVATION WELL. NOTHING WE HAVE FOUND TO DATE INDICATES ANY HAZARD TO HUMAN HEALTH, HOWEVER, WE FEEL THAT CONTINUED LONG-TERM MONITORING IS ESSENTIAL.

THERE HAVE BEEN MANY STATE AND FEDERAL AGENCIES INVOLVED SINCE THE DAM FAILURE OCCURRED. IN ADDITION TO THE NEW MEXICO ENVIRONMENTAL IMPROVEMENT DIVISION AND THE NEW MEXICO STATE ENGINEER OFFICE WHICH HAVE PRIMARY JURISDICTION, THERE HAS ALSO BEEN INVOLVEMENT BY THE NUCLEAR REGULATORY COMMISSION, THE ENVIRONMENTAL PROTECTION AGENCY, THE U.S. CORPS OF ENGINEERS, THE INDIAN HEALTH SERVICE, THE BUREAU OF INDIAN AFFAIRS AND THE CENTER FOR COMMUNICABLE DISEASE CONTROL. ALL AGENCIES INVOLVED HAVE MADE CONTRIBUTIONS OF ONE KIND OR ANOTHER.

THE AGREEMENT STATES PROGRAM HAS NOT BEEN WITHOUT PROBLEMS. THERE ARE CERTAINLY EXAMPLES WHERE FAILURES HAVE OCCURRED IN AGREEMENT STATES INCLUDING,

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UNFORTUNATELY, THE MOST RECENT EXAMPLE IN NEW MEXICO. IT SHOULD BE POINTED OUT, HOWEVER, THAT THERE HAVE ALSO BEEN FAILURES WHERE THE FEDERAL GOVERNMENT HAS HAD EXCLUSIVE JURISDICTION. THE ART OF TAILINGS MANAGEMENT IS DEVELOPING SO RAPIDLY AND IS AS YET SO FAR FROM PROVIDING THE DEFINITIVE ANSWER THAT ANY REGULATORY AUTHORITY HAS HAD AND WILL CONTINUE TO EXPERIENCE PROBLEMS.

UNDER SECTION 274 OF THE ATOMIC ENERGY ACT, THE U.S. NUCLEAR REGULATORY COMMISSION HAS THE RESPONSIBILITY FOR EVALUATING STATE PROGRAMS AND TERMINATING THE STATE'S JURISDICTION IF IT IS NOT ADEQUATE TO PROTECT PUBLIC HEALTH AND SAFETY. AT THIS TIME THERE IS NO BASIS FOR SUCH DETERMINATION IN NEW MEXICO.

THERE ARE SEVERAL ADVANTAGES TO MAINTAINING THE AGREEMENT STATES PROGRAM. THE FIRST IS THAT FROM THE FEDERAL GOVERNMENT'S POINT OF VIEW, IT IS COST-EFFECTIVE IN THAT EXCEPT FOR TECHNICAL ASSISTANCE, IT IS AN ENTIRELY STATE-FUNDED PROGRAM. THERE IS ALSO AMPLE EVIDENCE THAT THE STATE IS IN A MUCH BETTER POSITION TO RESPOND QUICKLY IN EMERGENCY SITUATIONS. AT LEAST IN NEW MEXICO, BECAUSE OF OUR AGENCY'S OTHER ENVIRONMENTAL PROTECTION MANDATES AND STAFFING, THERE IS OPPORTUNITY FOR A MORE COMPREHENSIVE REVIEW OF LICENSE APPLICATIONS THAN IS GENERALLY POSSIBLE AT THE FEDERAL LEVEL.

FINALLY, THERE IS THE QUESTION OF THE IMPLICATIONS OUR AGENCY HAS DRAWN FROM THIS INCIDENT FOR FUTURE MILL TAILINGS LICENSING. THE FIRST AND MOST OBVIOUS IS THAT WE NEED TO SUBSTANTIALLY INCREASE OUR INSPECTION ACTIVITIES OVER URANIUM MILLS DURING THE OPERATION, POST-OPERATION AND RECLAMATION PHASES. THE EID MUST CAREFULLY CONSIDER ANY PROPOSED NEW TAILINGS SITE IN RELATION TO THE SURROUNDING DRAINAGE AND GROUND WATER SOURCES, AND WE MUST CONSIDER ALTERNATIVE SCHEMES INCLUDING THOSE WHICH WOULD ELIMINATE THE NEED FOR ANY RETENTION DAMS.

ADDENDUM TO NEW MEXICO'S RESPONSE TO CHAIRMAN MORRIS UDALL'S SEPTEMBER 19, 1979 LETTER TO GOVERNOR BRUCE KING

By

J. L. Whiteman, D. T. Lopez and F. R. Allen
New Mexico State Engineer Office

The September 19, 1979 letter from Chairman Morris K. Udall to Governor King requests testimony on eight issues. Five of these issues, numbered as in Chairman Udall's letter, are quoted below and followed by our discussion.

1. An assessment of the probable causes of the accident and of their relationship to other tailings containment structures licensed or under construction in New Mexico.

Two consulting engineering firms retained by United Nuclear Corporation, Sergent, Hauskins and Beckwith and Jacobs Engineering Group Inc. and Wahler Associates, prepared reports on evaluation of the probable cause of failure. The State Engineer concurs with their conclusions which are cited below.

The Sergent, Hauskins & Beckwith report concludes:

> "As documented in the following sections of this report, it is concluded that the breach was caused by the following sequence of events.
>
> A. Transverse cracking of the embankment occurred at the area of the breach due to differential settlements.
>
> B. The tailings pond surface rose above the protective beach sands fronting the dam in this particular area, and free liquids came in direct communication with the crack(s).
>
> C. Flow of liquids through the crack (or system of cracks) created erosion, widening the cracks to the point of total breach."

The Jacobs Engineering Group, Inc. and Wahler Associates report concludes:

> "Based on factual and photographic evidence made available, personal interviews, and on-site observations of post-failure conditions, the failure is probably due to cracking with subsequent internal erosion. This cracking resulted from differential settlement which resulted from different rates of consolidation of the heterogeneous foundation. The cracking may not have extended to the downstream slope and the failure of the extreme downstream portion may have been due to other common causes of failure where a high hydraulic gradient exists."

Although each dam is unique because of site conditions and design, there are two general categories of uranium tailings dams in New Mexico. One category is dams constructed in their entirety with a compacted earthen embankment. There are two dams in this category, one of which is the Church Rock dam and the other is under construction but not yet approved for operation. The second category is dams started with a small compacted earthen embankment and constructed in stages using the discharged tailings sands as embankment material. There are four dams in the second category which are under construction and in operation.

3. A detailed description of United Nuclear Corporation's response to the accident and to requests of the State.

On July 18, 1979 the State Engineer issued an order to United Nuclear Corporation requiring an investigation of the cause of the failure. The order also provides that no repair or replacement of the dam shall be undertaken until plans and specifications have been prepared and the plans and specifications have been approved by the State Engineer.

Upon learning that the Corporation was excavating tailings sands in the reservoir

adjacent to the dam and was continuing to construct the dam, the State Engineer issued a second order to United Nuclear Corporation on August 8, 1979 requiring that excavation of the tailings sands within 150 feet of the upstream crest of the dam be terminated and that no further construction of the dam be carried on without the written approval of the State Engineer. The Corporation has complied with this order. On September 5, 1979 United Nuclear Corporation furnished the State Engineer and others with the consulting engineer's reports on evaluation of the cause of the failure. On September 28, 1979 United Nuclear Corporation furnished the State Engineer preliminary plans and specifications and proposals for the resumption of milling operations, except for necessary materials and stability analyses which had not yet been completed by the Corporation's engineers. The Corporation has indicated that they would soon complete the analyses so that plans and specifications, including the analyses, and proposals for resumption of operation could be formally submitted for the State Engineer's consideration. On October 3, 1979 United Nuclear Corporation requested State Engineer approval of discharge into the existing central pond cell and newly constructed below grade borrow pit. On October 5, 1979 the State Engineer approved the request on the conditions, among others, that all discharge be under the supervision of a New Mexico registered engineer, that the elevations of liquid levels be limited as specified and that sand beaches with a dimension of at least 150 feet be constructed and maintained.

6. A comparison of the tailings impoundment structure design approved for licensing by the State with the tailings impoundment structure as it existed at the time of the accident. (Were aspects of the approved structure design not implemented which might have helped prevent the July dam failure?)

The approved plans and specifications require a sandy drain zone on the downstream portion of the dam. This drain zone was not constructed to full height

in the southern half of the dam and was entirely omitted in the northern half. At the breached section near the southern end of the dam about one-third of the height of the drain zone was omitted. It is the consensus of the engineers involved in the review and evaluation of the failure that had the drain zone been constructed according to approved plans and had the tailings beach been in place as recommended by the Corporation's engineers, it is likely that failure would not have occurred.

7. A summary of any implications you might draw for future New Mexico mill tailings licensing.

The State Engineer has concluded that all dams being constructed by the use of tailings, or otherwise, to impound mill discharges must be considered dams under construction which must be under the supervision of a registered professional engineer. On September 13, 1979 the State Engineer issued orders to the owners of uranium tailings dams, over which he has jurisdiction, requiring the submission of qualifications of professional engineers who will supervise the continuing construction of the tailings dams. Further, a status report certifying safety of the dam will be required before any impoundment may be initiated.

8. A description of any activities planned or under way in the State to assess other existing tailings structures for possible similar problems.

On July 20, 1979 Governor King requested assistance from the Albuquerque District Corps of Engineers in determining whether other uranium tailings dams in New Mexico are safe. The Corps under the National Dam Safety Program has undertaken and recently completed an initial inspection of these dams. The State Engineer will review the Corps' final inspection reports and make such independent review as appropriate to ascertain the safety of the structures. The owners of tailings dams under State Engineer jurisdiction will be required to correct any deficiencies found.

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1580
ALBUQUERQUE, NEW MEXICO 87103

SWAED

9 October 1979

Honorable Bruce King
Governor of New Mexico
State Capitol Building
Santa Fe, NM 87501

Dear Governor King:

I have completed my review of the additional information made available by United Nuclear Corporation consultants since my 3 August 1979 letter to you regarding the cause of failure of its Church Rock tailings dam. Inclosed are my comments that relate to the assessment of failure and additionally, to some particular precautions that should be taken in the rebuilding of the dam section that failed and the raising of the dam to its ultimate height.

Based upon available information as to design, construction and operation, and the conditions observed at the site following the breach, I find, as did the consultants, that the principle cause of failure was differential settlement of the foundation with the resultant formation of cracks by which fluid penetrated the embankment. The change in characteristics of the embankment material when subjected to the highly acidic fluids may have influenced the rate of failure substantially. Defensive design techniques are now available which will permit competent rebuilding of the breached structure and construction of the planned increase in height.

Sincerely,

Leroy A. Klein LTC CE
for BERNARD J. ROTH
Colonel, CE
District Engineer

1 Incl
As stated

Copy furnished: (w incl)
State Engineer Office
Bataan Memorial Bldg.
State Capitol
Santa Fe, NM 87503
Mr. Tom Baca; N.M. EID
Mr. James P. Knight; NRC

ATTACHMENT 1

Review Comments and Recommendations
To Geotechnical Investigational Reports -
Church Rock Tailings Dam

Sergent, Hauskins & Beckwith - Vol. 2 - History

Information contained in Vol. 2 of Sergent, Hauskins & Beckwith report indicated that the starter dam consists of a zoned embankment which includes an upstream, relatively impervous clayey zone and a granular, more pervious downstream zone. It was also stated that, "The design was based on a zone of tailings being continuously maintained against the upstream face of the embankment to act as a buttress fill." However, the approved design and construction drawings do not indicate that a continuous zone of tailings was to be provided against the upstream face of the embankment. When cracking of the starter dam was first observed in December 1977, Vol. 2 of Sergent, Hauskins & Beckwith states, "It was recommended by Sergent, Hauskins & Beckwith and Kaiser Engineers at that time that the cracks be monitored for a period of time to determine if any movement was taking place. It was also recommended that a sand beach be developed in these areas as soon as possible and that a settlement monitoring program be started." Vol. 2 of the report further states, "As previously stated, the cycloning operation never operated continuously over a long period of time due to various operational problems. While cycloning was not taking place, spigoting to continue the sand beach was being accomplished. However, since the sand beaches were not being formed during the periods of cycloning, the pond elevation began to rise over the previously formed beach in such a way that shallow depths of tailings liquid began to front the dam in isolated areas. The area of the breach was one of those areas." Based on the above information, it appears that a design aspect, a zone of tailings being continuously maintained against the upstream face of the embankment, was not met.

Based on the information presented in Vol. 2 of Sergent, Hauskins & Beckwith report regarding the approved design and construction drawings, the post-failure cross sections of the breached area presented in Vol. 3 of Sergent, Hauskins & Beckwith report, and visual inspection of the breach by Corps of Engineers personnel on 18 July 1979, the starter dam was not built in accordance with the approved drawings, as evidenced by the construction of the downstream "selected sandy fill" zone.

It is also questionable as to whether project operation procedures were in accordance with the design, construction and operation requirements for maintaining a minimum freeboard of 5 feet at all times and a continuous zone of tailings or sand beach against the upstream face of the embankment.

Sergent, Hauskins & Beckwith - Vol. 2 - History

It is our understanding from previous conversations with the State Engineer Office personnel that the embankment cracking which occurred in December 1977, the bentonite grouting of these cracks in February 1978, and embankment cracking which occurred in October 1978 were not formally reported to the State Engineer Office and that this information was not made available until after the failure of the Church Rock Tailings Dam. Since this information was of utmost significance and paramount in the evaluation of the safety of the structure at the time when cracking was first observed, not only the owner of the structure, but also the State Engineer Office should have been contacted and informed of these conditions.

In the report to Kaiser Engineers from Sergent, Hauskins & Beckwith, dated 16 January 1976 and entitled, "Report of Additional Geotechnical Studies Church Rock Uranium Mill Tailings Dam", which is presented in Appendix A, Vol. 2 of Sergent, Hauskins & Beckwith report, seepage analyses for the proposed future embankment are discussed and presented. The above report of 16 January 1976 stated, "Seepage analysis was based on a preliminary evaluation by Kaiser Engineers that slimes will produce a barrier of very low permeability and, thus, there will be very little underseepage. If such a barrier is not created, substantial seepage through the embankment foundation materials would occur. It is recommended that this factor be carefully evaluated in final design." However, the construction specifications and drawings do not make any specific provisions as to the depth, grading requirements, and extent of borrow pit excavation. In fact, the report submitted by Jacobs Engineering Group, Inc. and Wahler Associates dated 22 August 1979 and entitled, "United Nuclear Corporation Church Rock Tailings Impoundment Dam, Evaluation of Probable Cause of July 16, 1979 Failure" discusses the rate and pattern of saturation of the deeper foundation alluvial deposits. The report states, "The rate and pattern of saturation were probably influenced by the direct exposure of the heterogeneous alluvial strata to reservoir fluid at the deep (30±feet) excavation face created by borrowing in extremely close proximity along the southerly portion of the dam alignment." In addition, Vol. 2 of Sergent, Hauskins & Beckwith report states, "Borrow materials for the upstream selected clayey fill zone were obtained largely from borrow pits within the pond area ... the largest pit developed within the pond area was located between approximate stations 40+00 to 55+00, about 20 feet upstream from the toe of the starter dam. This borrow pit excavation ranged from about 20 to 30 feet deep with side slopes of about 1:1." In view of this information, substantial seepage through the embankment foundation materials did occur and this condition of underseepage was not carefully evaluated and implemented in the final design as evidenced by the lack of control of the borrow pit excavation along the southerly portion of the dam alignment.

In addition, seepage analyses for the embankment and foundation materials of the starter dam were not discussed or presented in the reports submitted by the consultants.

In the report from Sergent, Hauskins & Beckwith to Kaiser Engineers, dated 16 January 1976 which is presented in Vol. 2 of Sergent, Hauskins & Beckwith report and entitled, "Report of Additional Geotechnical Studies Church Rock Uranium Mill Tailings Dam", potential cracking of the embankment was discussed and excerpts of the report are as follow.

> "As discussed in our earlier report, large settlements of embankment will occur in the areas of deep alluvium with consequent large differential settlements in transition zones between areas with rock foundations and foundations of deep alluvium. For this reason, it is recommended that the clay zone be compacted at about 2 percent above the optimum moisture content or more to produce as flexible an embankment as possible."

> "Because of cracking considerations, it is also important that a clean cohesionless granular zone be provided in the downstream portion of the dam which is not susceptible to cracking. This is important to prevent piping through any transverse cracking in the clay zone. For this reason, it is recommended that the drain be extended up the face of the starter dike as shown in Sketch No. 2. This is important because the silty sands may be slightly cohesive and, thus, susceptible to cracking.... It is recommended that all zones of the embankment be compacted to a minimum of 95 percent of maximum density as determined in accordance with ASTM D698. As stated above, special moisture control is recommended for the clay zone.... Careful moisture control of the clay zone will be extremely important due to the cracking considerations."

Based on previous conversations with the State Engineer Officer personnel, the above report of 16 January 1976 was not made available to the State Engineer Office prior to the approval of the design and construction documents.

It is important to note that differential settlement and subsequent cracking of the embankment were expected in the design stages of the embankment in that downstream filter zones were required to prevent piping through any transverse cracking in the clay zone. In view of these considerations, downstream filter zones consisting of inclined drains and drainage blankets should have been designed and provided for the starter dam as well as the final or future embankment.

Sergent, Hauskins & Beckwith - Vol. 2 - History

It is important to note that the compaction and moisture for the embankment materials recommended by Sergent, Hauskins & Beckwith were not incorporated into the construction specifications.

The construction specifications for the starter dam as presented in Appendix A, Vol. 2 of Sergent, Hauskins & Beckwith report states in paragraph 5.4 Construction of Embankments and Arroyo Fill that the embankment materials shall be "compacted to 90 percent of ASTM D1557 maximum density for cohesive soils" and that "the materials shall be placed at appropriate moisture contents for compaction." The above specifications further state in paragraph 5.8.1 Laboratory Control, "The moisture-density relation will be determined by the Soils Engineer in accordance with ASTM D1557."

The compaction test specified in ASTM D1557 is a modified compaction test using a 10-pound rammer and an 18-inch drop. Whereas, the standard compaction test, as specified in ASTM D698, requires the use of a 5.5-pound rammer and a 12-inch drop. The significance of the above different test methods is that the modified compaction test (ASTM D1557) requires a greater compactive effort than the standard compaction test (ASTM D698), which in turn results in higher maximum densities and lower optimum water contents.

In order to provide for one aspect of defensive design against potential cracking of the clay zone (Zone 1) materials, the moisture content of the compacted clay zone should have been specified as being within the limits of optimum moisture content and 2 percent wet of optimum moisture content as determined by the standard compaction test specified in ASTM D698.

The resurvey of 18-20 November 1976 as presented in Appendix B, Vol. 2 of Sergent, Hauskins & Beckwith report, was apparently the "As-Built" or initial survey performed after construction of the starter dam. The Starter Dam resurvey of 18-20 November 1976, indicates both vertical and horizontal "As-Built" variations from design limits. In particular, from Station 51+00 to Station 57+00 (Kaiser Stationing), the vertical measurements indicate approximately 1 foot to approximately 3 feet difference from grade design; the horizontal measurements indicates approximately 2 feet to approximately 26 feet of overbuild in the downstream direction. The cross sections presented in Appendix B indicate that the "As-Built" conditions are substantially different from the "Design Limits (neat line)" or typical section requirements in the reach extending from Station 51+00 to Station 57+00 (Kaiser Stationing). This appears to indicate a lack of quality control during construction.

Sergent, Hauskins & Beckwith - Vol. 2 - History

The gradation specifications for the proposed future embankment Zone 3 Filter materials, as presented in Appendix C, Vol. 2 of Sergent, Hauskins & Beckwith report, appears to meet filter criteria and compatible with the Zone 1 fill material gradation specifications with the exception of the percent passing the No. 200 sieve requirement. The percent passing the No. 200 sieve should not be greater than 5 percent. The gradation requirements for the Zone 3 filter material does not meet filter criteria for Zone 2 fill materials. Design of an inclined drain, adjacent to the downstream slope of the starter dam and consisting of a multiple-stage filter and a downstream drainage blanket, would be required for safe operation of the structure. These filter materials should consist of clean, well-graded sands and designed according to filter criteria as discussed in the text, Seepage, Drainage, and Flow Nets by Harry R. Cedergren.

In addition, the Zone 2 fill material gradation requirements as presented in Appendix C, Vol. 2 of Sergent, Hauskins & Beckwith report are too coarse to act as a filter zone for the starter dam Zone 1 fill materials if differential settlement and cracking of the starter dam were expected. Had the "selected sandy fill" zone (Zone 2) for the starter dam been constructed in accordance with the approved design and construction drawings and if the Zone 2 fill materials consisted of clean, well-graded fine to medium-grained sands resembling those specified for the Zone 3 filter materials, it is possible that the failure would not have occurred.

It is also important to note that the gradation specification for Zones 1, 2, and 3 fill materials which are presented in Appendix C, Vol. 2 of Sergent, Hauskins & Beckwith report are not specified in the approved construction specifications.

Sergent, Hauskins & Beckwith - Vol. 4 - Existing Dam Stability

The Flow Net constructed for the cross dikes as presented in Figure 11, Appendix C, Vol. 4 of Sergent, Hauskins & Beckwith report is not entirely correct, based on flow net construction principles as discussed by Harry R. Cedergren in his text, Seepage, Drainage, and Flow Nets. A flow net was constructed by Corps of Engineers personnel using the cross section presented in Figure 11 of the above report. Flow net and seepage analyses of the cross dike section were made using a stratification ratio of 4 horizontal to 1 vertical for the tailings sand foundation materials. The horizontal permeability of 1,300 ft/yr for the tailings sand was used to calculate the quantity of seepage flow through the tailings sand foundation materials. The analysis indicated that the uplift pressures at the downstream toe of the tailings slope are not great enough to cause sand boils and piping through the foundation tailings sand. The estimated quantity of seepage flow through the foundation tailings sand is approximately 2,400 cubic feet per year per foot of cross dike.

Sergent, Hauskins & Beckwith - Vol. 4 - Existing Dam Stability

Potential for liquefaction of the cross dike foundation tailings sands were not discussed in Vol. 4 of Sergent, Hauskins & Beckwith report. However, in the report by Jacobs Engineering Group, Inc. and Wahler Associates, liquefaction potential for the cross dikes was discussed. The report states, "The saturated sands upon which the dike is founded could liquefy if a large earthquake occurred nearby. Liquefaction of these materials could also occur if excavation of these materials extended significantly below the line of saturation."

The report by Jacobs Engineering Group, Inc. and Wahler Associates states, "because the tailings impoundment is located in an area of low seismic activity and because the divider dike would be utilized for a short period of time, the possibility of this type of failure is considered extremely remote." However, based on Corps of Engineers criteria, the Church Rock Mine Tailings Dam is located in seismic zone 2, corresponding to moderate damage and a seismic coefficient of 0.05. In addition, based on conversations with the State Engineer Office, United Nuclear Corporation, and Sergent, Hauskins & Beckwith personnel, the cross dikes would be used for approximately 8 months during the interim of remedial design and repair of the starter dam, and design and construction of the proposed future embankment.

The Corps of Engineers does not know if blasting methods are used to excavate the uranium ore at the project site and the proximity of such blasts to the dam. If blasting is performed for mining operations, then blasting vibrations may possibly occur at the dam site. In this case, liquefaction of the cross dike foundation tailings sands could also occur.

Therefore, based on the above, since the foundation tailings sands would be saturated, seismic vibrations at or near the project area could cause liquefaction of these foundation materials and subsequent failure of the cross dikes. Field and laboratory testing of the foundation tailings sands for the cross dikes should be performed to adequately determine factors of safety against and/or probability of liquefaction occurrence. In addition, seismic instruments should be installed to monitor seismic activity or vibrations at the damsite.

Jacobs Engineerings Group, Inc. & Wahler Associates - Evaluation of Probable Cause of Failure and Sergent, Hauskins & Beckwith Vol. 3 - Breach Investigation

The slope stability analysis presented in Vol. 3 of Sergent, Hauskins & Beckwith report for the starter dam was made for the assumed seepage condition at the time of failure and also earthquake loading for the assumed seepage condition at the time of failure. The method used for slope stability analysis was the Spencer-Wright method which is a

circular arc analysis. Slope stability analyses were not performed for the starter dam for "End of Construction" and "Maximum Storage Pool with Steady Seepage" conditions and "Earthquake Conditions" as described in U.S. Nuclear Regulatory Commission Regulatory Guide 3.11. Since the subsurface investigations indicate that the foundation soils consist of alternating layers of sandy clays and clayey and silty sands, some having low shear strengths as indicated by triaxial shear tests, the need for Wedge Slope Stability Analyses is warranted. However, Wedge Analyses were not performed for any type of loading condition for the starter dam nor for the proposed future embankment.

Wedge Slope Stability Analyses for the starter dam were performed by Corps of Engineer personnel. The section analyzed for the starter dam was that which was presented for the breached area and shown on Figure 4, Appendix C, Vol. 3 of Sergent, Hauskins & Beckwith report. The shear strengths and unit weights of the embankment materials used in the analyses were the same as those used in the stability analyses presented in the report. However, a shear strength of $\emptyset = 10^{o}$ and C = 500 PSF, as indicated by triaxial shear tests, was used for a zone of foundation clay located from approximately EL 6900 to EL 6920, as indicated by the subsurface investigations. The "End of Construction" and "Maximum Storage Pool with Steady Seepage" conditions were analyzed using the Wedge Method and the minimum factors of safety were 1.09 and 1.53, respectively for the starter dam. The minimum factors of safety as required in Nuclear Regulatory Commission Regulatory Guide 3.11 for "End of Construction" and "Maximum Storage Pool with Steady Seepage" conditions are 1.3 and 1.5, respectively. The above stability analyses for the starter dam indicate that additional stability analyses are warranted and should be performed for the remedial design of the starter dam and the proposed future embankment. Extent and effect of embankment cracking should be considered in the above recommended stability analyses.

It was reported by the consultants in the meeting on 5 September 1979, that the pH of the tailings liquid is 1.2. The pinhole dispersion tests which were performed indicate that the embankment materials were dispersive when the pH of the liquid is below 2. Vol. 3 of Sergent, Hauskins & Beckwith report states, "Pinhole tests of the embankment soils indicated that they were nondispersive when tested with distilled water. Tests with the acidic tailings fluid, however, (pH of about 1.0) indicated severe erosion." It is not known how far a transverse crack or a system of transverse, horizontal, and/or longitudinal cracks may have extended downstream through the embankment within the breached area. However, it has been established that the tailings liquid, which has a pH of 1.2, was in direct contact with the upstream slope of the embankment, at the location where failure occurred, prior to the breach. The pinhole test

procedures and data are not described in the reports submitted by the consultants and should be presented. Additional tests, such as Percent Sodium vs. Total Dissolved Salts, and large slot filter studies using representative samples of the existing embankment and foundation materials, proposed borrow materials for construction of the future embankment, and the tailings liquid should be performed to adequately provide defensive design measures against the dispersive nature of these materials. A thorough discussion of these and other tests for dispersive soils are presented in the following recent publications: 1) "Piping in Earth Dams Constructed of Dispersive Clay: Literature Review and Design of Laboratory Tests" by Edward B. Perry, Soils and Pavements Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss., November 1975. 2) "Dispersive Soil Problem at Los Esteros Dam" by T. N. McDaniel and R. S. Decker, ASCE Geotechnical Journal, September 1979. In the above publication by Edward B. Perry, the author states, "Piping in an earth dam is the progressive internal erosion of the soil by the flow of water along preferred seepage paths such as cracks or sandy lenses transversing the width of the dam.... Dispersive clays are a particular type of soil in which the clay fraction erodes in the presence of water by a process of deflocculation.... If the water is flowing, as in a crack in an earth dam, the detached clay particles are carried away and piping occurs." Vol. 3 of Sergent, Hauskins & Beckwith report states, "Thus, it does not appear that the acidic nature of the tailings fluids contributed directly to the cause of failure. However, if the free tailings fluid flowed rapidly through an open crack to the downstream face of the embankment, the acidic nature of the fluid may have accelerated the rate of erosion." The report by Jacobs Engineering Group, Inc. and Wahler Associates states, "Pinhole dispersion tests indicate that the materials are not dispersive when the pH of the raffinate was above 2 and the materials were dispersive when the pH is below 2 (normal pond liquid). Since such a small portion of the dam or foundation in areas near the breach are saturated this reaction is not believed to be the cause of failure. However, dispersion could have accelerated the loosening of material along sides of a crack and contributed to extension of the crack and internal erosion." The significance of the pinhole tests is that the conditions at the time of failure and properties of the embankment materials and the tailings liquid indicate that the materials were definitely susceptible to dispersion. If a crack or a system of cracks existed within the embankment, caused by differential settlement of the foundation materials, and at the location where the tailings liquid had ponded against the embankment, then it is quite conceivable that dispersion of the embankment and/or foundation materials may have occurred through a crack or a system of cracks and eventually resulted in the failure of the dam.

Jacobs Engineerings Group, Inc. & Wahler Associates - Evaluation of Probable Cause of Failure and Sergent, Hauskins & Beckwith Vol. 3 - Breach Investigation

The report by Jacobs Engineering Group, Inc. and Wahler Associates states, "The consolidation process is probably not complete. The logs of post-failure drill holes along the dam crest through the embankment and beyond to depths of 55 feet into the foundation soils reveal that the shallow alluvium, 10-15 feet, is not saturated except in a few limited reaches. Therefore, more settlement upon saturation should be anticipated." Consolidation tests of embankment foundation materials as presented in Appendix B, Vol. 4 of Sergent, Hauskins & Beckwith report and discussed in the report by Jacobs Engineering Group Inc. and Wahler Associates indicate that additional settlements of the embankment foundation materials should be expected upon saturation of these materials and increased loading due to construction of the future embankment. Due to the heterogeneous characteristic and stratification of the foundation materials, potential cracking of the embankment resulting in possible differential consolidation of the foundation materials cannot be excluded.

Therefore, remedial design of the entire starter dam is required to protect the structure against any existing and future cracking. The remedial design should be carefully reviewed, prior to approval, for compliance with current Nuclear Regulatory Commission and State of New Mexico design requirements and assurance of a safe structure. The suggested protective remedy as described in the report by Jacobs Engineering Group, Inc. and Wahler Associates could be considered as a defensive design measure against embankment cracking provided that adequate filter and transition materials are provided for the downstream inclined drain and downstream drainage blanket. These filter and transition materials should be designed in accordance with the filter criteria as discussed in the text, Seepage, Drainage, and Flow Nets by Harry R. Cedergren. In addition the proposed filter materials should be used in the recommended filter tests for the large slot dispersive tests as discussed hereinbefore.

A collector system should be provided downstream of the proposed future embankment to intercept any foundation and/or embankment seepage. Provisions should also be made to pump the collected seepage back into the reservoir.

No discussion has been made by the consultants regarding the required foundation preparation and treatment of the sandstone bedrock abutments for construction of the proposed future embankment. In addition, no discussion has been made of possible seepage under and/or through the embankment materials and through fractures in the sandstone bedrock. In conjunction with this possible seepage, no discussion has been made regarding the defensive design measures which would be required and provided in

these abutment areas to adequately protect the structure against a piping failure. In conjunction with the sandstone bedrock abutment, the cementing constituents in the sandstone should be investigated, tested, and analyzed to determine the existence and effect of possible chemical reactions between the cementing agents in the sandstone and the highly acidic tailings liquid.

Conclusions

The Corps of Engineers concurs with the consultants' conclusions that the Church Rock Mine Tailings Dam failure was probably caused by flow of the tailings liquids through a transverse crack or system of cracks in the embankment which resulted from differential settlements of the foundation materials upon stauration.

However, review of the consultants' reports also indicate that other aspects regarding the design, construction, and operation of the starter dam contributed greatly to the ultimate fauilure of the Church Rock Mine Tailings Dam and are discussed in the above comments.

Additional investigations, field and laboratory tests, and analyses will be required for the remedial design of the remaining starter dam, repair of the breached embankment, and design of the proposed future embankment. These investigations, tests, and analyses are also discussed above.

In addition, any additional or future design and construction documents submitted by United Nuclear Corporation and their consultants regarding the remaining starter dam, breached area of the starter dam, and proposed future embankment should be carefully reviewed prior to approval to insure that an adequate and safe design of the structure is obtained. Adequate contractor quality control and Government quality assurance should be provided during repair of the breached area of the starter dam and construction of the future embankment to insure that the requirements set forth in the construction specifications and drawings are met.

58-567 O - 80 -- 15

STATEMENT OF
ADLENE HARRISON
ADMINISTRATOR REGION 6
U.S. ENVIRONMENTAL PROTECTION AGENCY
BEFORE THE
SUBCOMMITTEE ON ENERGY AND ENVIRONMENT OF THE
COMMITTEE ON INTERIOR AND INSULAR AFFAIRS
HOUSE OF REPRESENTATIVES
OCTOBER 22, 1979

I HAVE BEEN ASKED TO DISCUSS THE ENVIRONMENTAL PROTECTION AGENCY'S RESPONSE TO THE RECENT URANIUM TAILINGS SPILL NEAR CHURCHROCK, NEW MEXICO.

SINCE MAY OF 1977, UNITED NUCLEAR CORPORATION (UNC) HAS OPERATED A URANIUM MILL NEAR CHURCHROCK, NEW MEXICO. UNC'S CHURCHROCK MILL HAS A TAILINGS POND WHICH RECEIVES AND CONTAINS WASTE MATERIALS FROM THE MILLING PROCESS. ON JULY 16, 1979, THE TAILINGS POND DAM FAILED. THIS RESULTED IN A DISCHARGE OF APPROXIMATELY 93 MILLION GALLONS OF CONTAMINATED WASTEWATER INTO A TRIBUTARY OF THE RIO PUERCO AND SUBSEQUENTLY INTO THE RIO PUERCO ITSELF. EPA HAS DETERMINED THAT THE FLOW ATTRIBUTABLE TO THE SPILL CONTINUED DOWN THE RIVER, THROUGH GALLUP, NEW MEXICO, AND ULTIMATELY TERMINATED AT A POINT NEAR THE COMMUNITY OF SANDERS, ARIZONA. WITHIN THAT AREA, THE SPILL RAISED THE LEVEL OF THE RIVER FOR A SHORT PERIOD OF TIME AND LEFT SOME RESIDUAL PONDS AND DEPOSITS IN THE RIVER CHANNEL AND ON THE BANKS.

AN INCIDENT OF THIS NATURE AND MAGNITUDE IS OF SPECIAL CONCERN TO EPA. FROM THE OUTSET, OUR PRINCIPAL INTEREST HAS BEEN IN IDENTIFYING AND REDUCING ANY THREAT WHICH THE SPILL POSES TO HUMAN HEALTH. IN THAT REGARD, WE HAVE BEEN

ESPECIALLY CONCERNED WITH THE POSSIBLE CONTAMINATION OF PUBLIC DRINKING WATER SUPPLIES, THE ENVIRONMENTAL THREAT TO SURFACE WATER AND GROUNDWATER QUALITY, AND THE IMPACTS ON LIVESTOCK INSOFAR AS THEY AFFECT HUMANS. ON AUGUST 15, 1979, EPA REQUESTED THE INDIAN HEALTH SERVICE TO TAKE SAMPLES FROM WELLS IN THE AREA. THESE SAMPLES WERE TAKEN ABOUT FIVE WEEKS AGO AND WE EXPECT RESULTS IN THE NEAR FUTURE. I MIGHT NOTE THAT THESE WELLS ARE NOT "PUBLIC WATER SYSTEMS" WITHIN THE MEANING OF THE SAFE DRINKING WATER ACT. IN ADDITION, WE HAVE TAKEN STEPS TO IDENTIFY OTHER LONG-TERM HAZARDS, TO REDUCE THE EXPOSURE OF PERSONS TO THE CONTAMINATED MATERIALS, AND TO SEE THAT CLEAN-UP IS CARRIED OUT IN A TIMELY AND EFFECTIVE MANNER. I WILL DETAIL OUR ACTIONS LATER.

BEFORE DISCUSSING EPA'S IMMEDIATE RESPONSE TO THE SPILL, I WOULD LIKE TO BRIEFLY OUTLINE THE OVERALL REGULATORY FRAMEWORK. THE UNC CHURCHROCK MILL IS LICENSED BY THE STATE OF NEW MEXICO PURSUANT TO AN AGREEMENT BETWEEN THE STATE AND THE U.S. NUCLEAR REGULATORY COMMISSION (NRC). THE NEW MEXICO ENVIRONMENTAL IMPROVEMENT DIVISION, IN ITS CAPACITY AS THE PRIMARY REGULATORY AUTHORITY OVER THE MILL, HAS ACTED AS THE LEAD AGENCY IN THE INVESTIGATION AND HAS SUPERVISED THE ABATEMENT AND CLEANUP EFFORTS. A NUMBER OF FEDERAL AGENCIES, INCLUDING EPA, THE INDIAN HEALTH SERVICE, AND THE NRC, HAVE CONTRIBUTED VALUABLE SAMPLING, ANALYTICAL AND TECHNICAL ASSISTANCE TO THE EFFORT. THE ENVIRONMENTAL PROTECTION AGENCY HAS ACTED UNDER AUTHORITY OF THE CLEAN

WATER ACT, WHICH REGULATES DISCHARGES OF POLLUTANTS INTO WATERS OF THE UNITED STATES. HOWEVER, IN THIS CASE, UNC'S TAILINGS POND (LIKE MOST TAILINGS PONDS) DID NOT HAVE A DISCHARGE. CONSEQUENTLY, IT DID NOT REQUIRE A FEDERAL DISCHARGE PERMIT. IN ADDITION, EPA HAS PARTICIPATED IN A GROUNDWATER MONITORING PROGRAM UNDER THE SAFE DRINKING WATER ACT, WHICH IS DESIGNED TO PROTECT PUBLIC DRINKING WATER SUPPLIES.

NOW I WOULD LIKE TO DESCRIBE EPA'S SPECIFIC RESPONSE TO THE UNC SPILL AND FOLLOW THAT DISCUSSION WITH THE AGENCY'S PRELIMINARY CONCLUSIONS REGARDING THE IMPACTS OF THE SPILL. EPA'S RESPONSE WAS IMMEDIATE AND POSITIVE. THIS RESPONSE INVOLVED THE COORDINATED EFFORTS OF FOUR EPA UNITS: EPA, REGION 6 IN DALLAS; EPA, REGION 9 IN SAN FRANCISCO; THE OFFICE OF RADIATION PROGRAMS IN WASHINGTON; AND THE ENVIRONMENTAL MONITORING AND SUPPORT LABORATORY IN LAS VEGAS, NEVADA. ON JULY 16, 1979, THE DAY OF THE SPILL, THE STATE OF NEW MEXICO REQUESTED EPA TO OBTAIN AERIAL PHOTOGRAPHS OF THE SPILL AREA. EPA FLEW THE MISSION THAT DAY AND HAS SINCE CONDUCTED TWO FOLLOW-UP MISSIONS. ON THE DAY AFTER THE SPILL, EPA CONTACTED THE STATE TO ASCERTAIN WHETHER THE SPILL PRESENTED ANY IMMEDIATE THREAT TO DRINKING WATER SUPPLIES IN THE AREA, ESPECIALLY AT GALLUP, NEW MEXICO. THE STATE ASSURES US THAT THERE WAS NO IMMINENT HAZARD BUT AGREED TO TAKE A CLOSER LOOK. EPA IMMEDIATELY DISPATCHED AN EMERGENCY RESPONSE CONTRACTOR TO THE SPILL AREA.

THE CONTRACTOR MET WITH REPRESENTATIVES OF THE COMPANY AND THE STATE, DISCUSSED THE STATUS OF THE SPILL, AND INSPECTED AND PHOTOGRAPHED THE SPILL AREA. ON JULY 19, 1979, EPA CONDUCTED A STREAM SURVEY FROM THE SPILL SITE TO CHAMBERS, ARIZONA. WE OBSERVED NO DISCERNIBLE FLOW AT CHAMBERS -- AN INDICATION THAT THE SPILL DID NOT REACH THAT POINT.

ON JULY 20, 1979, EPA TOOK WATER AND SEDIMENT SAMPLES AT FOUR LOCATION: (1) UPSTREAM FROM THE TAILINGS POND BUT DOWNSTREAM FROM THE UNC AND KERR-MCGEE MINE DISCHARGES; (2) AT THE TAILINGS POND ITSELF; (3) FROM SEDIMENT DEPOSITED IMMEDIATELY DOWNSTREAM FROM THE BREACH; AND (4) AT A POINT DOWNSTREAM FROM THE IMMEDIATE FLOODPLAIN. THESE SAMPLES WERE DISPATCHED TO TWO DIFFERENT LABORATORIES FOR HEAVY METALS AND RADIOLOGICAL ANALYSES. ON AUGUST 1, 1979, EPA CONDUCTED A FOLLOW-UP SURVEY TO LOCATE SUITABLE GROUNDWATER AND SOIL SAMPLING POINTS. ON AUGUST 29, 1979, WE TOOK FOLLOW-UP SAMPLES AT THE FOUR PREVIOUS LOCATIONS PLUS FOUR ADDITIONAL DOWNSTREAM SITES. IN ADDITION, EPA HAS COOPERATED WITH THE STATES OF NEW MEXICO AND ARIZONA, THE INDIAN HEALTH SERVICE, AND THE NRC TO ESTABLISH CONTINUING MONITORING PROGRAMS FOR THE RIO PUERCO AND ADJACENT SHALLOW GROUNDWATER SOURCES AND TO ASSESS THE IMPACTS OF THE SPILL ON THE HEALTH OF HUMAN BEINGS AND LIVESTOCK.

HOWEVER, EPA'S RESPONSE HAS NOT BEEN LIMITED TO THE SCIENTIFC MEASURES MENTIONED ABOVE. FIRST OF ALL, EPA HAS ACTIVELY SUPPORTED A SERIES OF ORDERS ISSUED BY THE STATE OF NEW MEXICO DIRECTING UNC TO CEASE ALL DISCHARGES INTO THE TAILINGS POND AND ORDERING THE COMPANY TO INSTITUTE A THOROUGH CLEAN-UP PROGRAM WITH RESPECT TO RADIOACTIVE AND CHEMICAL CONTAMINANTS. IN THAT REGARD, EPA HAS PROVIDED THE STATE WITH TECHNICAL ASSISTANCE, INCLUDING INTERIM GUIDELINES FOR CLEAN-UP AND ANALYTICAL SUPPORT.

SECONDLY, ON AUGUST 9, 1979, EPA ISSUED ITS OWN ADMINISTRATIVE ORDER UNDER THE CLEAN WATER ACT CHARGING UNC WITH AN UNAUTHORIZED DISCHARGE IN VIOLATION OF THE ACT. EPA'S ORDER DIRECTED THE COMPANY TO FILE A DETAILED REPORT WITHIN 30 DAYS ON THE CAUSE OF THE BREACH, IMPACTS OF THE SPILL, REMEDIAL MEASURES TO PREVENT FUTURE DISCHARGES, CLEAN-UP MEASURES AND OTHER APPROPRIATE INFORMATION. ON SEPTEMBER 10, 1979, EPA RECEIVED UNC'S REPORT. ON OCTOBER 19, 1979, THE AGENCY AMENDED ITS ADMINISTRATIVE ORDER TO EXTEND UNC'S CLEAN-UP PROGRAM INTO ARIZONA AND TO REQUIRE MONITORING IN ASSOCIATION WITH THE CLEAN-UP.

THIRD, ON SEPTEMBER 14, 1979, I CONVENED A MEETING OF AFFECTED FEDERAL AND STATE AGENCIES TO REVIEW ALL FINDINGS AND TO COORDINATE FUTURE ACTIVITIES. AT THAT TIME, WE ESTABLISHED AN INFORMATION CLEARINGHOUSE AND REFINED OUR MONITORING PLANS, ESPECIALLY WITH RESPECT TO A COMPREHENSIVE WELL SAMPLING PROGRAM TO BE COORDINATED BY THE INDIAN HEALTH SERVICE.

FINALLY, ON THAT SAME DAY, I MET WITH CHAIRMAN PETER MACDONALD OF THE NAVAJO NATION TO DISCUSS THE SPILL AND TO BRIEF HIM ON OUR EFFORTS TO DEAL WITH IT. THIS MEETING WAS CALLED BECAUSE OF THE CHAIRMAN'S CONCERNS ABOUT THE POTENTIAL IMPACTS OF THE SPILL ON THE HEALTH OF CITIZENS OF THE NAVAJO NATION. AS A RESULT OF THE MEETING, EPA AND THE NAVAJO NATION ISSUED A JOINT STATEMENT ON THE STATUS OF THE UNC SPILL AND ESTABLISHED A TEMPORARY WORKING GROUP TO DETERMINE NAVAJO NEEDS IN THE AREA OF ENVIRONMENTAL PROTECTION, WITH SPECIAL EMPHASIS ON RADIATION AND THE UNC SPILL.

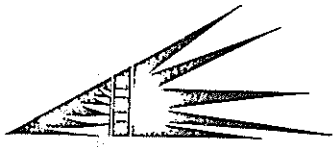
AS YOU CAN SEE, THE ENVIRONMENTAL PROTECTION AGENCY HAS DEVOTED A GREAT DEAL OF EFFORT TO THE UNC INVESTIGATION. WE WILL CONTINUE TO DO SO AS WE ASSESS LONG-TERM EFFECTS AND CONSIDER ALL TECHNICAL AND LEGAL REMEDIES. OUR WORK TO DATE FORMS THE BASIS FOR THE FOLLOWING CONCLUSIONS:

1. WE HAVE NO EVIDENCE THAT THE SPILL HAS ADVERSELY AFFECTED ANY PUBLIC DRINKING WATER SUPPLIES COVERED BY THE SAFE DRINKING WATER ACT. HOWEVER, SHALLOW GROUNDWATER SOURCES IN THE IMMEDIATE VICINITY OF THE RIO PUERCO MAY HAVE BEEN AFFECTED BY THE SPILL. CONSEQUENTLY, THE INDIAN HEALTH SERVICE HAS (WITH EPA'S ASSISTANCE) INITIATED A LONG-TERM MONITORING PROGRAM TO DETERMINE EFFECTS, IF ANY, AND TO OBTAIN DATA TO FORM THE BASIS FOR APPROPRIATE ACTION.
2. RADIATION, PH, AND HEAVY METALS READINGS IN WATER FROM THE RIO PUERCO HAVE RETURNED TO BACKGROUND LEVELS.
3. THE PRESENCE OF SALT DEPOSITS IN THE RIO PUERCO BASIN APPARENTLY DERIVED FROM THE UNC SPILL HAS BEEN THE SOURCE OF SOME CONCERN. HOWEVER, UNC'S CLEAN-UP OF THE DEPOSITS IS PROGRESSING AND, AT THIS TIME, WE DO NOT BELIEVE THAT THE SALTS PRESENT A HAZARD.

FOR THE BENEFIT OF THE SUBCOMMITTEE, I HAVE PROVIDED YOU WITH A LIST OF DOCUMENTS AND DATA PERTAINING TO THE UNC SPILL. IF YOU WISH TO REVIEW ANY OF THESE DOCUMENTS, PLEASE CONTACT ME AND WE WILL MAKE APPROPRIATE ARRANGEMENTS.

-8-

IN CONCLUSION, LET ME ASSURE YOU THAT EPA IS TAKING EVERY STEP NECESSARY TO PROTECT THE PUBLIC HEALTH AND ENVIRONMENT IN THE IMPACTED AREA.



SOUTHWEST RESEARCH AND INFORMATION CENTER

TESTIMONY BEFORE THE HOUSE OF REPRESENTATIVES
COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,
SUBCOMMITTEE ON ENERGY AND THE ENVIRONMENT

HEARINGS ON THE CAUSES AND IMPLICATIONS OF
UNITED NUCLEAR-CHURCHROCK TAILINGS DAM FAILURE

Prepared by Wm. Paul Robinson

October 22, 1979

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Members of the subcommittee, thank you for an opportunity to testify before you today. My name is Paul Robinson. I have been an Environmental Analyst at Southwest Research and Information Center, a non-profit organization, for three and one-half years, focusing on mining and water issues. I also teach Environmental Impact Analysis at the University of New Mexico and have, except for thesis, completed a Masters in Environmental Design at the University of New Mexico. I would like to summarize the several causes for the Churchrock spill, and some of its implications for uranium mills and their licensing in New Mexico and the western United States.

CAUSES OF THE SPILL:

The Churchrock dam failed for a combination of design, construction, and operational faults. First, I will summarize various flaws in the design and construction of the dam. The foundation material at the site is not of one type; it was not homogeneous. It has been well-established that bedrock lies below the south end of the dam and alluvial sands and gravels underlie the northern section of the dam. The breach occurred where the bedrock dipped down below the alluvium. Siting is out-dated for good tailings management plans. The waste should be overlying one homogeneous, impervious, structural element to assure stability and eliminate seepage.

The uncertainty with respect to the stability of such a non-homogeneous, underlying system is noted in United Nuclear Evaluation of Probable Cause of Failure Report by Jacobs Engineering and Wahler Associates, August 22, 1979. They say: "During preconstruction geotechnical investigations in 1976, the difficult site characteristics and unfavorable soil properties were recognized." Nevertheless, the company went ahead and constructed this tailings dam at the present site. The second Jacobs and Wahler report, Evaluation of the Integrity of the Remaining Starter Dam, states:

> "Prior to construction of the starter dam, a small dam existed across the arroyo at about station 26+00. This dam was reported to have been constructed by the CCC in the 1930s. Since its construction, the arroyo has silted in and water was piled behind the dam until construction of the starter commenced. Thus, the foundation materials north of station 26+00 were wetter than those south of station 26+00 prior to construction of the starter dam. Saturation and near saturation of the upper foundation materials north of station 26 and particularly north of station 34+00 is evidenced by moisture contents of samples of soil from borings made after the breach occurred."

This indicates that the dam was built on differential foundation rock, not homogeneous materials, and on alluvial material saturated by stock impoundment just described. Both of these design constraints were ignored by the State of New Mexico in its evaluation of the company's siting proposals and indicate long-term instabilities in the dam.

In addition, the Jacobs-Wahler report indicates that there was differential settling not only in the material underlying the dam, but also in the materials composing the dam. The cause of the latter settling was failure to compact the selected dam materials to design density and moisture content.

Kaiser Engineers in a 1976 "UNC Churchrock Tailings Dam Design Report" based on Sargent, Haskins, and Beckwith Soil and Engineering Data, recommended that the starter dam, which is the dam that broke, be used only for a year and one-half before being raised (and also contain the piezometers, alignment monument and five foot freeboard not used). The starter dam at the time of the spill had been used and overloaded 50% beyond its design capacity. It was used for about 25 months rather than 18 months.

In discussing the causes of the accident, we have to understand the differences between what was actually approved in the licensing process and what was actually done by United Nuclear in building and operating its tailings pond.

The UNC Churchrock license application was received in July, 1975; the license was issued on May 3, 1977; the mill operated until the spill occurred. New Mexico does not prepare an environmental assessment, an environmental impact statement, or any form of a summary evaluation document for these licensing actions. The details/specifications of the licensed facility are found in the initial application from the company and the letters exchanged between the company and the state licensing agents. The commitments in those letters are the license condition the company made before it could be licensed; these examples are part of the licensing action. Procedures formulated in those letters include:

--In a February 1977 letter UNC said it would inspect the tailings dam once a day for freeboard adequacy, signs of leaks or breaks, tailings pipe rupture, and diversion ditch obstruction.

--In February 1977, UNC committed itself to inspecting its tailings dam daily and the tailings pipeline once every eight hour shift. UNC also committed itself to semiannual reports on the piezometer-seepage monitor-measurements in the tailings dam. Piezometers are wells built into dams to monitor internal seepage.

--In a March 1977 letter, UNC committed itself to monitoring tailings dam stability. UNC stated piezometers-seepage monitors would be installed in the downstream face of the starter dam and in the tailings dam when raised.

The piezometers were not built into the starter dam, so seepage in the dam was not monitored. No daily or semiannual operational monitoring reports have surfaced in the investigation of the Churchrock spill. According to the 1976 Kaiser Engineers Report, the freeboard at the dam was supposed to be maintained at five feet. Freeboard is the space between the top of the dam and the top of the tailings material. At the time of the dam failure, the freeboard was less than two feet-about 20 inches. The dam had been overloaded to dangerously close to the top of the dam and had no internal seepage control devices.

Aerial photos from March 1978 and May 1979 show that UNC operated the tailings pond so that the liquids were up against the face of the dam rather

than a beach of tailings against the dam. This is a key point because once the cracks occurred, the liquids flowed in and eroded further cracks rather than solids flowing in and sealing the cracks. Creation and maintenance of a tailings sand beach to separate the highly acidic tailings liquids from the material in the dam is a basic operational procedure well-known in the tailings management field. No evidence has come out to show UNC ever maintained the sand beach which should be on the tailings pile.

United Nuclear had had cracks in its dam within six months of its initial operation of the facility. Aerial photos from December 1977 and May 1979 submitted to the New Mexico Environmental Improvement Division(EID) after the spill documented these cracks in two sections of the dam. It was well known by the company that the dam was cracking after the first year of operation. The state licensing agencies--EID or the New Mexico State Engineer's Office--were not notified; NRC was not notified; no one knew about the cracks except the company until the dam broke. UNC had filled the cracks with bentonite-a clay which swells to seal cracks; but that is only a band-aid remedy; it didn't identify or fix the causes of the cracks--only filled them in.

Each of this set of steps which United Nuclear failed to take might have itself prevented the catastrophic spill which occurred. Seepage monitors would have provided information as to seepage and structural discharge inside of the dam, but no information was available. The freeboard at the dam showed the overloading of the starter dam and the lack of safety measures. The regular monitoring inspection could have caught the multiple cracks in the dam, but there is no indication that it was done. The combination of these operational failures left the company unaware of the problems within the dam.

THE CHURCHROCK TAILINGS PILE COMPARED TO OTHERS IN NEW MEXICO:

In comparison with other tailings dams in New Mexico, UNC-Churchrock was the most recently built and the most carefully engineered tailings dam in the state. The other active tailings dams are at the Anaconda, Kerr-McGee, United Nuclear-Homestake Partners (UNHP), and Sohio uranium mills. These five active piles in New Mexico represent about half of the United States uranium production. Of these tailings impoundments, only Sohio and UNC are engineered structures. The Anaconda, Kerr-McGee, and UNHP tailings piles are all old style tailings where the radioactive waste is just piled above ground surrounded by a dam of tailings with no structural containment or seepage controls. The seepage below these dams and the releases from these facilities is well-documented by the 1975 EPA, Water Quality Study of the Grants Mineral Belt and summarized in Groundwater, v.14 n5, September/October 1976.

The Churchrock dam was supposed to have been the best, but other piles are disasters waiting to happen. Though massive seepage has occurred, these facilities are still being added to. The United Nuclear, Homestake, Kerr-McGee, Anaconda facilities were up for re-licensing in 1976. The licenses have not been renewed and the companies are still in operation. As a matter of fact, New Mexico has never renewed a single uranium mill license in its history of its Agreement States status dating back to May, 1974.

CLEAN-UP:

The clean up started very slowly; and as a result, most of the contaminated material has been too badly disseminated to recollect. Within two weeks of the spill, there were several rain storms which further distributed the material and made clean up more difficult. Right after this spill occurred, United Nuclear put some of its workers on the clean-up. Six to ten workers had 55 gallon drums and shovels. On August 13, a month after the spill, New Mexico Environmental Improvement Division sent a letter order to United Nuclear saying that the clean up was inadequate due to the small number of people participating. UNC accelerated its clean-up to 30 to 40 people but by mid-August contamination had been widely distributed into groundwater and down-stream beyond its critical 75 mile reach. The Rio Puerco, the stream which carried the spill, has a perennial flow from two uranium mines which discharge water into the stream upstream from the Churchrock mill: the flow is about 10 feet wide and the streambed is 50-100 feet wide. The damp streambed could not support the heavy equipment needed to scrape the streambed; thus the bucket-shovel clean-up has been used. As a result of the wet streambed and bucket-shovel operation, only about 0.3% of the total volume of the material spilled has been removed from the Rio Puerco. This does not include any of the volume of contaminated material beyond just the spill volume.

United Nuclear was requested to evaluate diverting that flow so that the streambed could be dried up for heavy equipment removal of the contaminated material. The company responded by arguing that an impact statement would be required, and diversion would be too expensive. They estimated it would cost five million dollars. United Nuclear did not have to prepare an impact statement for the mill itself, and this emergency clean up would not have required an impact statement because it would have been a state order and there is no state impact statement requirement. The five million dollar cost the company quoted for the diversion cost included 3.6 million dollar cost for an all-weather road. Since we are talking about a temporary diversion until the spill is cleaned up, a permanent pipeline or a permanent road are not required.

CONTAMINATION:

According to Environmental Improvement Division data, contamination has become broad at the two foot depth level. (The company is only cleaning up in the first six to twelve inches in its bucket-shovel clean-up.) Indications of increased levels of sulfate at 30 feet depth may signal much deeper contamination. Those 30 foot readings come from Environmental Improvement Division monitoring wells and are the only samples from that deep taken within 100 yards of the stream.

Another area of concern with respect to the clean-up is the company's use of uranium as a chemical indicator of contamination in their assessment of stagnant pools in the downstream reaches of the spill. Of all the materials in the ore, only uranium is removed at the Churchrock mill; that is its job. Thus, uranium would be one of the worst indicators of contamination from the spill. Since the company used uranium, they should not have expected to find any high level contamination in those stagnant pools; and indeed for that reason, they did not clean up those pools at that time. The state of New Mexico took three weeks to indicate to the company that they had used the wrong indicator in their stagnant pool investigation.

RE-OPENING THE MILL:

So far the company has requested to go back into operation using its existing dam. This dam has cracked and failed due to poor design, construction, and operation in the past. The facility has dikes which separate the dam into three main cells; these dikes are built on tailings and are not engineered structures or below grade. The company wants to rely on this already broken dam and these dikes built on tailings to contain its radioactive material even though it has proven itself incapable of operating an impoundment safely or in the way that it had been licensed. UNC has been amassing considerable political support in the State of New Mexico to get back into operation as quickly as possible. The company is losing $100,000 to $200,000 per day in yellowcake production.

The New Mexico State Engineer plays a major role in the reopening of the mill, as the state's dam engineer. Recently, the New Mexico State Engineer appears to have given UNC approval to use the existing site(an unlined borrow pit) for solids and one of the unbreached cells in the impoundment for liquids for about two months worth of additional tailings discharge. The State Engineer's mandate relates to water quantity and impoundment of surface water and does not consider the long-term management reclamation and seepage issues so key to uranium tailings management. Since solids are planned for the pit, not behind the "dam," the State Engineer has no reason to disapprove the temporary permit because only dams, not pits, are within the State Engineer's jurisdiction. But the seepage from that pit and the eventual reclamation of the site are the key parameters from a tailings standpoint. The State Engineer was the EID's engineering expert who approved the failed Churchrock dam, had not known about the cracking in the dam, and had not checked the installation for compliance with the approved design.

I recommend the company not be allowed to operate with above grade tailings disposal. The tailings should go below grade in engineered pits or a combination of pits and mine backfill. In that way, there cannot be a catastrophic failure of the tailings facility as occurs with above grade management such as dams.

It is interesting to note that in the Jacobs-Wahler report, UNC continues to advocate above grade disposal with reinforcement of the broken dam. There is no evaluation of below grade options. The assumption that UNC has to go back to the same dam is incorrect, and has not been compared to a full range of available alternatives. On the other hand, Jacobs-Wahler do provide a fairly full list of alternative failure mechanisms.

Jacobs-Wahler are the consultants used by Gulf Mineral Resources Corporation at its Mount Taylor mill. They had originally designed an above grade dam, part of which was on severely fractured bedrock, for the tailings site, and have recently begun to re-design a fully below grade tailings facility for the Gulf operation. Such re-design is appropriate, if not mandatory, for the Churchrock facility.

COORDINATION BETWEEN ARIZONA AND NEW MEXICO:

Though the UNC mill was licensed in New Mexico, this spill flowed at least 30 miles into Arizona and the stream's sediment transport processes will

carry the contaminated material through Arizona toward the Colorado River, There will be limited dilution because we have an ephemeral stream system with rare perennial flows and contaminants will not be spread except in the linear down-stream direction. The spill contained about 40 curies total alpha radiation and about 0.4 curies or 4×10^6 maximum allowable body burdens of Radium-226. Liquids from the spill were seen at Sanders, Arizona. A UNC manager indicates that much of the volume of the spill was lost in a canyon 5-6 miles east of Sanders. Since less than 1% of the volume of the release has been collected, much of the toxic trace and radioactive elements continue downstream and into groundwater. Eventually all of this material will flow through Arizona since it is downgradient.

Compared to the involvement of the various New Mexico and Federal agencies, Arizona's has been almost non-existent in the investigation of this spill. The Arizona Health Services samples from the time of the spill were mishandled and improperly collected. Only on 25 September did the Arizona Bureau of Water Quality Control grant New Mexico permission to sample Arizona waters. As yet no water quality samples from Arizona waters in the first two months since the spill have appeared and none are expected. The signs which have been posted as warnings against use of the water in the Rio Puerco end at the New Mexico State line. Arizona had no direct input into the UNC mill licensing process; and has not, I don't believe, adequately protected the public health and safety of Arizona people since the spill.

ADEQUACY OF REGULATORY RELATIONSHIPS:

It is important to understand that both Arizona and New Mexico are NRC Agreement States; neither of them collect license fees to pay for the regulation of radioactive materials. The State line has been an impenetrable barrier to information on this spill and to cooperation on tailings management in the southwest. EPA has jurisdiction over the Rio Puerco under NPDES permits issued to United Nuclear Churchrock mine above the mill and the Gallup Sewage Treatment Plant below the mill. The spill went interstate along the Rio Puerco. A month after the spill, EPA issued an order telling United Nuclear that they were in violation of the Clean Water Act for discharging without a permit. They have not enforced a fine on the company even though, by regulation, they are required to levy fines for discharges of pollutants without an NPDES permit. EPA has only asked for initial documentation and has not protected people whose waters have been contaminated by this unregulated discharge. Arizona is in EPA Region IX and New Mexico is in EPA Region VI, another cause for disjointed agency action. The EPA Regions are not coordinating actions though both have contacted New Mexico EID briefly. Despite the two current NPDES permits on the Rio Puerco, EPA's Region VI Administrator has had the record of an NPDES permit adjudicatory hearing on her desk for a year without any action.

The relationship between New Mexico and NRC with respect to radiation protection requires very lengthy discussion which I will try to summarize briefly. New Mexico, which became an Agreement State in May, 1974, has issued two new mill licenses, but has failed to renew any of the four current mill licenses which the State took over after the 1974 Agreement. These facilities are operating under 1971 licenses though renewal applications were presented on time in January 1976. Three and one-half years later, these license renewal applications are still in a preliminary evaluation stage. New Mexico does not

prepare an environmental analysis or any summary document of its uranium mill licensing action, has no public participation provisions in its licensing procedures, and does not receive enough copies of documents to distribute to interested parties. Even so, New Mexico EID has been considering a suit against the NRC for taking concurrent jurisdiction during the implementation period of the Mill Tailings Act. Such concurrent jurisdiction is appropriate and desperately needed for orderly growth of the industry and for health and safety reasons. Though New Mexico's licensing staff has good people, the staff is much too small for their enormous task. In a mining state like New Mexico, the state legislature is not likely to adequately fund the regulator of the fastest growing industry in the state.

It is appropriate to keep the licensing decision in New Mexico for access by local people, but a major NRC technical support role is required. We feel that there needs to be firm detailed commitments from the NRC as to exactly what kinds of technical assistance will be provided on a multi-year basis so that we are not just talking about "technical assistance" generally, without knowing what is actually coming. New Mexico needs to know in detail, both monetarily and with respect to human resources, how much can be expected from NRC and when. Such a detailed technical assistance agreement should be the basis for authorizing an Agreement State's operation and should be subject to formal annual compliance reviews by the agencies involved and the public. There has not been a detailed compatibility review on the New Mexico and NRC Agreement. Such a review should be conducted for New Mexico, and the other Agreement States before they are allowed to operate as NRC Agreement States after November 8, 1981, the date of implementation of the Atomic Energy Act.

ENFORCEMENT:

As a final recommendation, the Regulations have no weight without an actual, coherent enforcement program. In this instance NRC has no method to enforce the requirements of an agreement with the Agreement State, such as New Mexico, or with the individual licensees within the States. In addition, the State has no mechanism to enforce compliance with its licensing actions. New Mexico lacks the enforcement capability of the construction phase during routine operation and in response to catastrophic events. An "as built review" must be implemented to ensure that the design approved in the license is actually built. On-going operational control, via routine and surprise inspections and regular operational reports from licensees need to be instituted so licensing agents can have a firm grip on what is being operated and how. This enforcement framework must include mandatory penalties as a mechanism to ensure enforcement of the law within a regulatory system which has been more responsive to lobbying and short-term political concerns, rather than long-term health and safety. The NRC must improve its system so that actual enforcement of the law can be accomplished and must require an effective enforcement program before authorizing continued agreement state licensing.

That concludes my prepared comments. If you have any questions or comments, please contact me at the address on the cover sheet.

Thank you.