

MAR 11 1977

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Ref: SA/ER

MEMORANDUM FOR: G. Wayne Kerr, Assistant Director
for State Agreements Program
Office of State Programs

SUBJECT: ASSESSMENT OF THE PUBLIC HEALTH IMPACT OF THE FAILED
MILL TAILINGS DAM -- UNITED NUCLEAR - HOMESTAKE
PARTNERS MILL, GRANTS, NEW MEXICO

Attached is the report of the visit to the subject site and an
assessment of the impact on the public health resulting from the
dam failure.

Ernest P. Resner
State Agreements Program
Office of State Programs

Enclosure:
As stated

cc: R. G. Ryan w/attachment

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ASSESSMENT OF PUBLIC HEALTH IMPACT
OF THE FAILED
MILL TAILINGS DAM--UNITED NUCLEAR HOMESPAKE
PARTNERS MILL, GRANTS, NEW MEXICO

Summary

As part of the Office of State Programs continuing oversight of uranium mill operations and mill tailings piles in the agreement States, a representative of the Office of State Programs visited the United Nuclear--Homestake Partners Mill site in Grants, New Mexico and the offices of the New Mexico Environmental Improvement Agency during the period February 1-2, 1977 to assess the public health impact resulting from a tailings pond failure and to coordinate the visit of NRC representatives from the Office of Standards Development and Nuclear Reactor Regulation. The representatives of the Office of Standards Development and Nuclear Reactor Regulation visited the site to review the causative factors which led to the failing of the dam and the engineering details of the repair effort. The names and affiliations of the NRC representatives are attached as Appendix A.

Based on the onsite inspection of the involved areas, discussions with company and consultant personnel, State representatives, and the review of documented information, it is concluded that there has been no adverse impact on the public health and safety as a result of the dam failure. Comments on a technical quality of the reconstruction effort of the dam will be made by the representatives of SD and NRR. It appears that the State has taken timely and effective action to protect the public health and safety and to require appropriate corrective action by the licensee.

The failure occurred at approximately 5:00 a.m. on February 5, 1977 and resulted from a combination of mechanical failure, operator error, and inadequate management of the water levels in the tailings pond. The failed dam encompasses an area of 64 acres with walls built of tailing sands approximately 70 feet high at the point of the failure. The dam break occurred in the south wall of the west pond. The dam was originally constructed in 1957 and consisted of a 10 feet high earthen berm. Over a 19-year operating period, it has been raised to a height of 70 to 80 feet with tailings sands. At the time of the dam failure, the tailings pond contained approximately 10 million tons of slimes and solid materials and approximately 2 - 8 million gallons of water. Exact estimates of the water levels were not possible due to icing of the pond surface.

The spill released approximately 50,000 tons of slimes and solids and approximately 2 - 8 million gallons of water over approximately a 60 acre area. Because of extremely cold weather, the solids and slimes did not move rapidly and the company was able to construct an emergency berm to

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contain the spill of all released solids, slimes and liquids on the company property. There were no offsite releases of radioactive materials. Attached as Appendix B is a map showing the extent of the release.

At the time of the visit, clean-up and repair operations were well underway and approximately 20% of the contaminated ground had been scraped up to a depth of 6 to 12 inches and transported to the site of an old and dry tailings pile on the company property. Attached as Appendix C is a map showing the areas adjacent to the dam break. These areas are identified as areas A, B, C, and D. Area A was the area covered by liquids, area B was the area covered by slimes, area C was covered by sands and slimes, area D was also covered with sand and slimes. The cleanup operations had scraped area A clean to a depth of six to twelve inches. The deepest penetration of liquids into the soil had been determined to be twelve inches. The material removed from area A was being placed on the old tailings pile. The company estimates that areas A, B, and C will be cleaned up by June 1, 1977. Company officials were reluctant to set a date for completion of the cleanup of area D. It is our understanding that the State will require the company to complete the cleanup of area D on a timely bases.

The company has retained the International Engineering Company of San Francisco to assist in the cleanup and for the reconstruction of the dam. This company has constructed a temporary coffer dam and is repairing the main dam at the present. The estimated cost of the cleanup and repair is expected to be in the order of \$1,000,000. Mill operations, under strict operating provisions by the State, have been restarted and tailings are now being pumped to the west side of the tailings pond. The west side is separated by a dike from the main pond area.

The State has had personnel in almost constant attendance during the clean-up and repair operations and to monitor the current mill operations. On-site and offsite well water sampling is in progress and an offsite air sampling program is being implemented. To date, there has been no indication of an adverse impact on the public health and safety. Potable water has, for a considerable time, been trucked in to residents in the area, not because of radiological problems, but because of high mineral content, in particular, selenium in shallow groundwaters.

A groundwater protection plan agreement between the New Mexico Environmental Improvement Agency (NMEIA) and the United Nuclear--Homestake Partners was executed on August 18, 1976. This agreement obligates the company to construct a line of collection and recharge wells south and west of the tailings pond. The purpose of the system is to achieve, through flushing and dilution, a reduction in the selenium levels and other undesirable constituents arising from seepage from the pond into shallow groundwaters.

It should be noted that a State representative met the NRC representatives prior to departure for the site and reviewed the area maps taken by the

U.S. EPA at the request of the State. Following this preliminary review, the group departed for the mill site. At the mill site, senior company management and supervisory personnel and the Chief Engineer of the consultant firm briefed the NRC representatives as to how the incident occurred, the actions taken by company and consultant personnel, the current progress on repair and cleanup, and the engineering details of the reconstruction work on the dam. This was followed by a visit to the area of the break and direct observation of the failed portion of the dam and surrounding area. Upon return to the mill site, a question and answer period was held. Company officials as well as the engineering consultant were noted to be cooperative and willing to provide answers to questions asked by the NRC representatives. A visit to the Sohio Mill, recently licensed by the State, was also made. The housekeeping and cleanliness at the Sohio Mill was immensely superior to the United Nuclear--Homestake Partners Mill.

Background

The operation was originally licensed in the name of the Homestake--Sapin Partners on March 21, 1957 and subsequently amended to extend the term of the license for one-year periods on 11/18/57, 12/01/58, and 03/02/59. The file contains a letter dated 06/29/61 from the Acting Director of Regulation to Homestake--Sapin Partners stating that routine urinalyses for uranium are not necessary and were no longer being required. The letter stated that air sampling was now being required to be conducted on a routine basis during mill operations. A letter dated 01/09/62 regarding renewal of the license requested additional supporting information from the company including the following:

"Where retention systems such as levies, dikes, ponds, etc., are used to prevent the release of liquid or solid waste containing radioactive material to offsite areas, describe and submit an analysis of the retention capabilities and integrity of the system, conditions which might lead to accidental releases, the environmental effect of such a release, and an outline of the inspection and maintenance program designed to prevent such an accidental occurrence."

The licensee replied on 07/31/62 and responded only sketchily to the questions asked. The license was amended on 07/05/63 to extend the expiration date to 06/30/66 and again on 09/06/66 to extend the expiration date to 08/31/67. It was amended on 12/09/68 to change the name to the current name of United Nuclear--Homestake Partners. On August 18, 1968, a letter was sent to the company pointing out that the original application had been filed over 10 years ago and that a complete new application will be required prior to renewal. The renewal was issued on 02/08/71 for a five-year term. New Mexico became an Agreement State on 04/03/74 with an effective date of 05/01/74. The company's current application for renewal of their license was rejected by the State as being inadequate and the company

has been given until May 1977 to prepare and submit an adequate application. It also our understanding that the State may require the company to cease the use of tailings ponds constructed of sands and to require the construction of a new retention system composed, at a minimum, of compacted earth.

An onsite radiation safety analysis conducted in July of 1963 by a license reviewer stated, in regard to the tailings pond, that:

"Both solid and liquid wastes are totally contained at the site except for liquids which may be lost through seepage. Since the land around the site is virtually flat, the tailings retention system was initially constructed by erecting an earthen dam approximately 10 feet high and enclosing a rectangular area 2,200 feet by 1,500 feet (approximately 76 acres). Tailing slurry is pumped to perimeter of the system where a sand-slime liquid separation is made by use of truck mounted cyclones. The coarse sands are discharged onto the earthen dam thus gradually increasing its height while the fines fractions (slimes) and the liquids flow towards the center of the retention system for containment and recycling of the water. Due to heavy evaporation and the recycling, the total quantity of stored liquids in the retention system is small (approximately 2,000,000 gallons).

In support of his application for a license renewal, the licensee has submitted a detailed description and analysis of the retention capability and structural integrity of the system. This description included drawings of the layout, heights, top widths, side slopes, and so forth. This information has been evaluated by the engineering staff of the Fuel Processing Branch and appears satisfactory.

In order to evaluate the possible environmental effects of seepage, the licensee has built a series of four wells topographically and geologically below the retention system and monitors them on a periodic basis for radium-226, thorium-230, and natural uranium. The well nearest the retention system is sampled quarterly and the others are sampled on a semi-annual basis. This program appears satisfactory."

The company's compliance history over the years has been less than satisfactory. It should be noted an initial inspection, conducted in 1959 noted health and safety deficiencies. These deficiencies continued on and off up until the time the license was transferred to the State. Clear inspections were noted in 1964, 1965, and 1969 by the AEC. The inspection conducted in 1971 again noted noncompliance including some health and safety items. A clear inspection was conducted in 1973 (the last one by AEC). The last inspection conducted by the State was made in August 1976 and again indicated a number of noncompliance items.

Incident Details

The incident occurred sometime between 4:00 and 5:00 a.m. on Saturday, February 5, 1977. It appears that when the third shift came on duty on February 4, 1977, the shift foreman and a tailings pond operator were warned by the previous shift personnel that the slimes being pumped from the north cyclone truck were in danger of running over the bank, and in fact, some had already done so. The north cyclone truck was located on the north end of the east side of the tailings pond. The tailings pond operator then went to the top of the dam to shovel sand up on the dam to hold back the slimes. At 1:00 a.m., the cyclone truck was moved forward a short distance. Reportedly, the shift foreman and the tailings pond operator were maintaining close observation on the pond levels. At 4:30 a.m., the tailings pond operator reported to the foreman that operations should be shifted to the south side cyclone truck. The foreman then sent the operator to check the south truck to see if fresh water was being discharged, inasmuch as fresh water is used to pump the discharge line free of solids when a tailings discharge line has been shut down for any period of time. It should also be noted that clean water is pumped continuously through the lines to prevent freezing in the winter months. At this point in time, shift personnel noted some trouble with a pump in the south discharge line pumping station due to a sand lock. It took approximately 40 minutes to free the pump. A subsequent examination of the pump revealed there was a one-inch by three-inch hole in the common side of the two compartment pump thus allowing slurry from the north side pump to enter the south side discharge compartment. According to the shift foreman, he checked to see that the obstruction had been cleared. The operator was then sent to the south side cyclone truck to see if everything was working properly. On her way, she noticed that a section of the dam appeared to be wet and reportedly, she returned immediately to the pump house to tell the foreman. By this time, slurry had been started through the south pump and discharge system. The operator and the foreman then drove to the south side of the dam and found a large flow of tailings flowing down the bank of the dam and crossing the company's road around the pond. The operator then went to the south cyclone truck and found that the discharge hose was pulsating, but that no slurry was reaching the cyclone. While this was happening, the foreman called the General Operations Foreman (GOF). The review of the telephone log showed that the call was made at 6:00 a.m. It was later learned that the Dresser coupling on the hose had separated thus allowing the high pressure discharge from the hose to cut into the dam.

According to the GOF, he instructed the Shift Foreman (SF) to shut the mill down. He then called the Assistant Metallurgical Superintendent (AMS), the Operations Foreman (OF) and the Labor Foreman (LF). The LF then called in members of the labor crew. The GOF arrived at the site at approximately 6:20 a.m. and drove to the tailings dam to assess the damage. Finally realizing that a major incident was occurring, he returned to the mill and

ordered heavy equipment such as front end loaders to start constructing an emergency berm to contain the slimes, sands and water on company property. The equipment arrived at the site at approximately 7:00 a.m. and started building the earthen dam south of the old inactive tailings pile. A map of this area is attached as Appendix B. The GOF then returned to the dam break and found slurry still discharging out of the end of the pipe where the Dresser coupling had separated. He then returned to the mill and instituted an emergency shutdown. It appears that the tailings pumps were actually shutdown at approximately 7:30 a.m. The plant General Manager (PGM) was notified of the incident at approximately 7:10 a.m. by the AMS. The AMS informed the PGM that a break in the dam had occurred about 5:00 a.m., that water and slimes were flowing out of the embayment, and that he was constructing emergency dikes to contain the spill on company property. The PGM arrived at the plant around 7:25 a.m., went directly to the site of the break, and noted that the breach in the dam was now approximately 200 feet across the top and formed a V cut almost to ground level. He ordered up more heavy equipment such as dozers and loaders to push up a big pile of sands to try to cut off the flow through the break.

State and Company Actions

The State maintains a field office in the Grants area currently staffed by two professionals. One person is assigned full-time to mill operations and the other assigns 50% of his time to mill operations and 50% of his time to environmental considerations in the Grants area. Additionally, two additional professionals have been devoting essentially full-time to the incident. Significant input of professional time was also provided by the Radiation Control Section Program Manager and the Chief of the Occupational Health and Radiation Protection Division.

The State first became aware of the incident upon receipt of a call from the company attorney on February 5, 1977. The resident inspector became aware of the incident on the morning of February 7, 1977. He immediately verified the occurrence of the incident with his supervision in Santa Fe. He then went directly to the mill site arriving at approximately 9:00 a.m. He took eight photographs and reviewed with the PGM the probable causes of the incident and the courses of action to be taken by the licensee to correct the situation. He then contacted his supervision and gave them an oral report.

According to the State inspector, he considered the break in the dam structure to be substantial. He was able to see the V-shaped breach from a distance of approximately 2 miles away while still enroute to the site. He estimated that the height of the dam at this point to be about 70 feet with the width of the breach to be approximately 250 feet across extending approximately 300 to 350 feet through the dike to the pond area. At that time, it appeared that the flow out of the pond was in the order of 50 to

75 gallons per minute. An area up to 60 acres appeared to have been inundated. Company officials at that time estimated a loss of material (liquid and solid) from the pond to be about 150,000 tons. This figure supposedly included approximately 5 to 8 million gallons of water. The flow of liquid continued until February 17, 1977 although at a much lower rate.

The inspector's onsite appraisal of the situation indicated that all of the liquid effluent had been contained on the company property by the newly constructed berm (four feet high). The greatest amount of water was noted standing between the old tailings pile and the active pile and along the toe of the dam and the general area of the decant ditch. There was one area where the liquid (not slimes) reached to a point about 30 feet from the property line.

The inspector noted emergency repair operations underway and environmental samples being collected by company personnel. State personnel from the Water Quality Section of NMELA recommended that samples be obtained from the wells of the first row of residents in the nearest housing area. Analyses were to be made for SO_4 , Na, Se, Mo, Ra^{226} , and Ra^{228} . These samples were collected on February 8, 1977. Results will be forwarded to the Office of State Programs. Prior to the spill, Ra^{226} levels in well waters had average 30 pCi/l and 400 pCi/l in unrestricted and restricted areas, respectively.

On February 8, 1977, the Chief of the Design and Construction Section of the State's Engineers Office surveyed the dam site. His opinion was that the dam had not failed but had been washed out from the top and that the west section of the pond was still stable and useable. The State inspector met with the PGM and with the Metallurgical Superintendent (MS) and asked:

1. How long will it take to repair the breach so as to completely stop the loss of pond material.
2. How long would it take to be totally repaired?
3. How long would it take to complete the cleanup operation?
4. How much top soil will be removed and where will it be placed?
5. How much material actually left the confines of the pond?
6. What are the plans for operating again?
7. Will the company perform a tailings dam stability analysis?

At this meeting, the State inspector furnished the company officials with a copy of NRC Regulatory Guide 3.11, "Design Stability of Embankment Retention Systems for Uranium Mills.

On February 11, 1977 following a meeting with NMEIA officials and company representatives, an Order was issued which required:

1. The company shall cease discharge of slurry into the east portion of the tailings pile until further approval by this Agency.
2. Intentional drainage of radioactive liquids from the eroded dike areas shall be into the west pond as soon as possible or into some other confined area.
3. The company shall submit to the Agency by February 22, 1977, an outline of its plan and time scales for early recovery of the liquid slimes and sand spilled. This operation must be accomplished as soon as practicable.
4. The company shall submit to the Agency by March 1, 1977, an outline of its plans and times scales for repair of the Tailings Dam break. A stability analysis of the structure, when completed, shall be submitted within 90 days.
5. The company shall submit to the Agency by April 10, 1977, a report of the cleanup operations conducted by it, including a sampling program for surrounding wells under the company's control and plans for any additional and appropriate cleanup or monitoring.
6. The company shall submit to the Agency, as part of its license renewal application, emergency control measures in case of a similar break on each side of the tailings pile.
7. The company may discharge tailing into the west end of the tailings pond pursuant to the conditions submitted by the company attached hereto.
8. If any spillage or other indication of structural weakness of the west pond are observed or if the provisions of the attachment are not met, the company will cease discharge pursuant to normal, non-emergency, procedures to the west end of the tailings pond upon the Agency's request. Upon cease of discharge pursuant to this paragraph, the Agency and the company shall meet in attempt to resolve the difficulties which resulted in the Agency's request to cease discharge. The company shall not be required to cease discharge for a period of more than 10 days pursuant to this paragraph.
9. If the information submitted by the company is found inadequate by the Agency, the parties shall meet as quickly as possible to attempt to resolve any dispute and any required information shall be submitted within a reasonable time.

The conditions referred to in the order resulted from the recommendations of the State Engineer's Office and were as follows:

1. Maintain a free board of at least five feet at all times, free board being the vertical distance between the water surface and the embankment crest.
2. Maintain a beach of at least 50 feet at all times between the water surface and the embankment crest.
3. Maintain the water level at the tailings pond west cell within plus or minus 0.5 foot of that now existing.

It was the opinion of the State Engineer's Office that the condition of the west cell was adequate for the storage of tailings subject to the above restrictions.

The State inspector visited the site on February 11, 1977 and noted that there appeared to be an error or a misrepresentation regarding the water levels on the west pond. The inspector immediately contacted his supervisor. His supervisor immediately came to the site and verified that the company had not adhered to the half-foot water level restriction. At a subsequent meeting, the above criteria was modified inasmuch as the half-foot level restriction did not permit enough water for an decanting and recycling of the water system. The Order of February 11, 1977 was then modified to incorporate the new operating criteria.

In response to the NMEIA Order of February 11, 1977 and amended on 2/17/77, the company submitted a cleanup and repair schedule, confirmed a 24-hour surveillance of the pond crest and tailing discharge line was being initiated and that additional personnel had been assigned to do this, changed the Dresser couplings to Naylor quik-lock couplings on the discharge hoses, instructed the plant personnel to immediately initiate an emergency plan shutdown at any time serious erosion of the dikes occurred or water levels are noted to be excessive in the ponds. It also stated that new instructions were being prepared for plant personnel, alarm systems were being installed on the pumps of discharge lines.

The repair schedule to be followed by the International Engineering Company of San Francisco was noted to be as follows:

1. Eliminate all flow of water into the washout gulley by pumping from the pond behind a temporary coffer dam.
2. Install a permanent concrete plug at the upstream end of the steel pipe in the bottom of the gulley.

3. Construct work dikes out from the toe and perpendicular to the crest of the main damable sides of the gulley.
4. Remove all slimes and soft or loose soil from the foundation at the down stream toe of the gulley.
5. Place a stabilizing layer of clean rock-fill in the foundation--the depth of the rock-fill layer to be dependent upon the consistency of the foundation and the depth of the excavation. The rock-fill to be placed in lifts with maximum thickness no greater than two feet.
6. A gravel drain to be placed on top of the rock-fill stabilizing layer. The material should be placed in lifts with thicknesses no greater than 15 inches. The drain thickness to be at least 3 feet.
7. Material from a suitable borrow area to be placed on top of the gravel drain. The material to be free draining, if possible, and placed in 12 inch layers and compacted.
8. As the stabilizing toe berm and buttress fill is being constructed at the down stream end of the washout, foundation cleanup work in the gulley is to be extended upstream toward the axis of the main retaining dike. This work will require the removal of portions of the temporary coffer dam.
9. For the final "closure" between the temporary coffer dam and the buttress fill it may be necessary to use dump rock-fill.
10. All material in the buttress fill and the washout plug will be placed in layers no greater than 12 inches and will be compacted by a bulldozer.
11. The extent of the overlap of the buttress fill on each side of the washout to be determined at a later date by the engineer.

The proposed repair schedule was noted to be as follows:

1. By two days--eliminate flow into the gulley.
2. By three days--the concrete plug to be installed in the lower pipe.
3. By eight days--rock-fill to be placed in the toe.
4. By ten days--the gravel drain to be implaced.

5. By thirteen days--the buttress fill is to be in place and construction of the rock-fill closure complete.
6. By seventeen days--the buttress overlap to be completed.

At the time of the NRC visit, item four was in progress.

Additional actions of the State were to request assistance in obtaining aerial photos of the area. Copies of these photos, which were taken by the USEPA, are being obtained for OSP files.

Additionally, the State has sent letters to all mill operators in the State informing them of the incident and requesting, as appropriate, for specific mill operations, the following information:

1. An analyses of the potential hazards to the public health and safety and property damage associated with a break in the dam in which liquid, slimes and associated eroded sands that are impounded by the dam are released.
2. A description of existing and planned measures and systems which would prevent the released materials from leaving your property.
3. A description of existing and planned measures and systems which will prevent failure of the dam by washout due to a break in the slurry line.
4. A description of the cleanup and reclamation of the area affected by such a failure.

It was noted that licensees were required to reply within 30 days. It was also noted that the State is obtaining reports at weekly intervals from the licensee regarding the water levels in the west pond area including information on the extent of the beach area. An example of the weekly report is attached as Appendix C.

Environmental Aspects

The housing areas adjacent to the mill appear, for the most part, to be composed of trailers and/or weather beaten shacks and houses. The area is without a central water supply system or central sewerage system. Wells on the property of the residents in the area tap the relatively shallow aquifer in the Chinle Formation. These aquifers have been contaminated with undesirable minerals and chemical radicals presumably from the mill operation. The selenium content in this aquifer has been the most significant factor in not using well water for potable purposes. The mill operators truck in potable water for the area residents.

The areas adjacent to the mill site appear to be devoid of vegetable gardens or truck farms. Vegetation in the areas appears to consist predominately of sage brush. During the tour through the area meat and milk producing animals were not seen.

The mill, over the years, has a history of poor housekeeping. Seepage from the pond area has been allowed to dry although the mill operators claim that the seepage is collected and pumped back into the pond area.

Any insult to the environment resulting from the tailings spill would be difficult to differentiate from the environmental insult that has resulted from 19 years of mill operations.

Mill Licensing In New Mexico

Prior to acceptance of a formal application for authorization to operate a uranium mill, the staffs of the applicant and the Agency meet to ensure that all necessary information will be included in the application. The applicant is provided with information describing the licensing procedure, various regulatory guides, and other material that indicates acceptable design and operating procedures.

The application must include data relevant to employee and public health and safety and environmental impact. State and Federal Agencies are invited by letter to review and comment on the application. The review is coordinated with State personnel in the Air Quality, Water Quality, and Solid Waste Divisions.

Notice is published in various newspapers in the State which invites comments from the public.

Currently, the status of uranium mill operations in New Mexico in that in the 3 years since New Mexico became an NRC agreement state one new mill (SOHIO) has been licensed, three operating mills and the one IX plant are presently in the license renewal process, and another new mill application (United Nuclear Churchrock) is undergoing final evaluation. An application for a new IX plant has been received recently. Mill applications from at least five companies (Phillips, Gulf, Ranchers, Exxon, and Conoco) are expected within the next two years. About 12 requests for mill license application information packages have been received from various engineering and consulting firms which indicates additional license activity in the near future in New Mexico.

At present, the NMEIA has included the following license condition on the newly licensed SOHIO mill operation:

"Approved waste generating processes and mill tailings management practices may be subject to revision in accordance with the conclusions of the final generic environmental impact statement presently

being prepared by the U.S. Nuclear Regulatory Commission (refer to the Federal Register, 41 FR 22430, June 3, 1976) and any related rule making."

This same license condition will be included in any future licenses issued by the NMEIA. Since the other uranium mill companies (now operating or expected to operate in the near future) have applied for either a license renewal or a new license, all uranium mill operations in the State will be subject to the above condition in the near future.

New Mexico is also concerned with the structural integrity of tailings dams. The NRC presently requires applicants to provide extensive analysis to demonstrate that proposed tailings dams meets certain structural criteria. It is the intent of the NMEIA radiation licensing section to also adopt this practice. Since the NMEIA does not at present have the necessary expertise in the area of structural dynamics to evaluate such an analysis it is exploring the possibility of either (1) retaining a consultant (2) obtaining assistance from the State Engineer Office or (3) obtaining assistance from NRC.

A New Mexico mill inspection consists of a tour of the facility (including the tailings area), independently measuring radioactivity at various locations within the mill and at its boundary, checking the company's radiation monitoring and effluent control equipment, a thorough examination of the company's employee radiation dose records and effluent monitoring data (including independent radiological computations as a check on the company's radiological dose calculations), and a conference with the company's management. The inspection is followed up by a letter to management listing items of noncompliance to which the company must respond within a specified period of time describing its corrective actions. The corrective action program is evaluated by the NMEIA staff and communication continues between the NMEIA staff and the company until the noncompliance items are corrected. If the company refuses corrective action or does not carry out the corrective action program in a timely manner, the case is brought before the Environmental Improvement Board for enforcement proceedings.

The actual inspection of a mill requires several days with several NMEIA staff members participating in the inspection. The preparation for an inspection and the resulting follow-up activities generally requires several weeks of staff time with the possibility of more time required if problems are encountered.

It should be pointed out that each mill conducts periodic radiological surveys at various locations within and at the facility's boundary for the purposes of assessing employee radiation dose and verifying that effluents to the environment are less than maximum permissible concentrations in air and water as specified in the NMEIA Radiation Protection Regulations.

Records of these surveys are examined by the NMEIA staff during inspections and the accuracy of the surveys checked by making independent samples.

MRC Assistance

The Office of State Programs has, with the assistance of the FPF, provided two weeks of on-the-job training for one NMEIA staff member, one week of training in uranium mill licensing and inspection for two additional NMEIA members, and technical assistance on the review of applications for licenses for uranium mill licenses.

Additionally, the OSP has, with the assistance of IE made arrangements for technical support in the analyses of onsite and offsite environmental samples at the United Nuclear Homestake Partners mill following the recent failure of the tailings pond dam.

Ernest Resner
Senior Agreement State Specialist
State Agreements Program
Office of State Programs

Appendix A

List of Attendees

NMEIA:

A. Topp
T. Buhl

UN-HP:

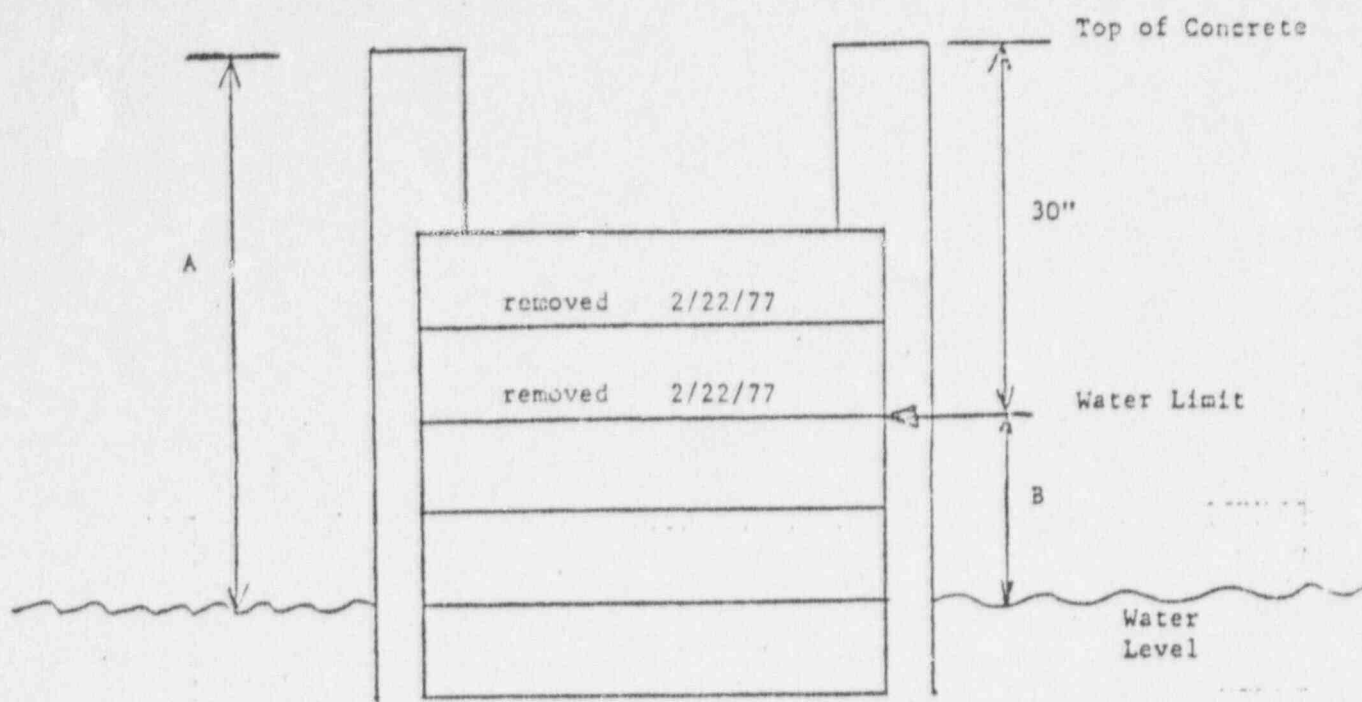
P. M. Price, Plant General Manager
E. Kennedy, Environmental Coordinator
R. Madsen, Mechanical Engineer
J. Jones, Mill Metallurgical Supt.
Dr. E. S. Smith, Int. Engineering Corp.

NRC:

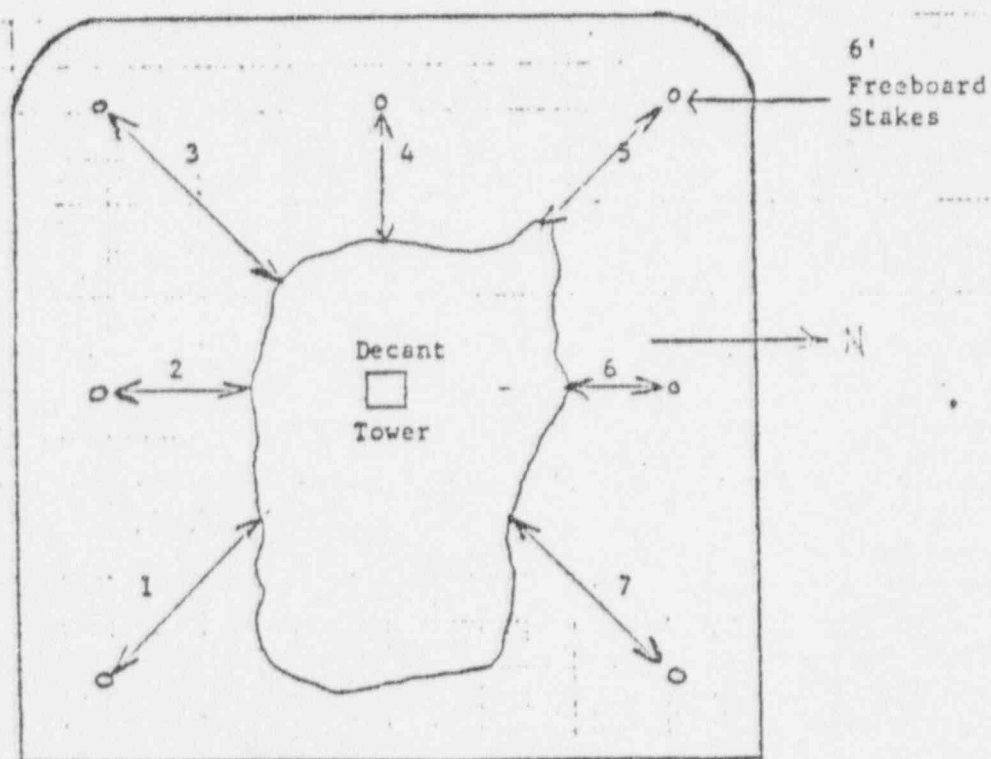
L. Beratan - SD
J. Chen - SD
L. Heller - DSE
T. Johnson - DSE
J. Kane - DSE
E. Resner - OSP

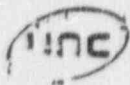
DECANT TOWER

Date 2/25/77



WEST POND BEACH AREAS





Division of United Nuclear Corporation
A UNC RESOURCES Company

P.O. Box 3951
Albuquerque, New Mexico 87190

4801 Indian School Road, N.E.
Albuquerque, New Mexico 87110
Telephone 505 263 4421

November 7, 1979

Mr. Cubia Clayton
Bureau Chief
NM ENVIRONMENTAL IMPROVEMENT DIVISION
P. O. Box 968
Santa Fe, NM 87503

Subject: NECR TAILINGS IMPOUNDMENT

Dear Mr. Clayton:

To ensure compliance with NMEID letters dated October 23 and October 31, 1979, and the NRC Order dated October 26, 1979, the following documents are forwarded for the week of operation October 27th through November 3rd, 1979.

1. Sergeant, Hauskins & Beckwith weekly report to the New Mexico State Engineer.
2. Aerial photograph of the tailings impoundment area taken October 27, 1979.
3. Summary sheet of the freeboard levels in the northern and southern cells and the borrow pit area.
4. Analysis of water samples from two monitoring wells.
5. Daily inspection sheets for starter dam, north and south cross dikes.

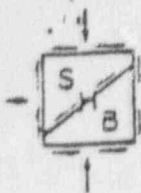
The detailed water budget for the pit is not included in this report as your letter of October 31st was not received until November 2nd.

Cleanup operations in the arroyo and the Rio Puerco are continuing.

Sincerely,

A handwritten signature in ink, appearing to read "H. J. Abbiss".

H. J. Abbiss, P.E.
Vice President
Environmental and Safety Services



SERGENT, HAUSKINS & BECKWITH

CONSULTING SOIL AND FOUNDATION ENGINEERS

APPLIED SOIL MECHANICS • ENGINEERING GEOLOGY • MATERIALS ENGINEERING

B. DWAIN SERGENT, P.E.
DALE V. BECKWITH, P.E.

JOHN S. HAUSKINS, P.E.
ROBERT D. BOOTH, P.E.

GEORGE H. BECKWITH, P.E.
BENNY E. MCILLAN, P.E.
BUD WOODWARD

November 6, 1979

State of New Mexico
Natural Resources Department
Water Resources Division
Bataan Memorial Building
Santa Fe, New Mexico 87503

SHB Job No. E79-1096

Attention: Mr. S. E. Reynolds
State Engineer

Re: Church Rock Tailings Dam
Church Rock, New Mexico

Gentlemen:

Transmitted herewith are (1) liquid surface elevations of the north, central and southern cells as well as the borrow pit, (2) readings on the piezometers installed in the northern and southern cross dikes, (3) horizontal and vertical measurements on the survey monuments installed in the northern and southern cross dikes and the starter dam, and (4) readings on the Hall Hydrostatic Pressure Cell Piezometers (HPC-7's) installed on the downstream side of the existing starter dam. These data are for the week ending November 3, 1979.

REPLY TO: 2821 GIRARD BLVD., N.E. ALBUQUERQUE, NEW MEXICO 87107

PHOENIX
(602) 272-8848

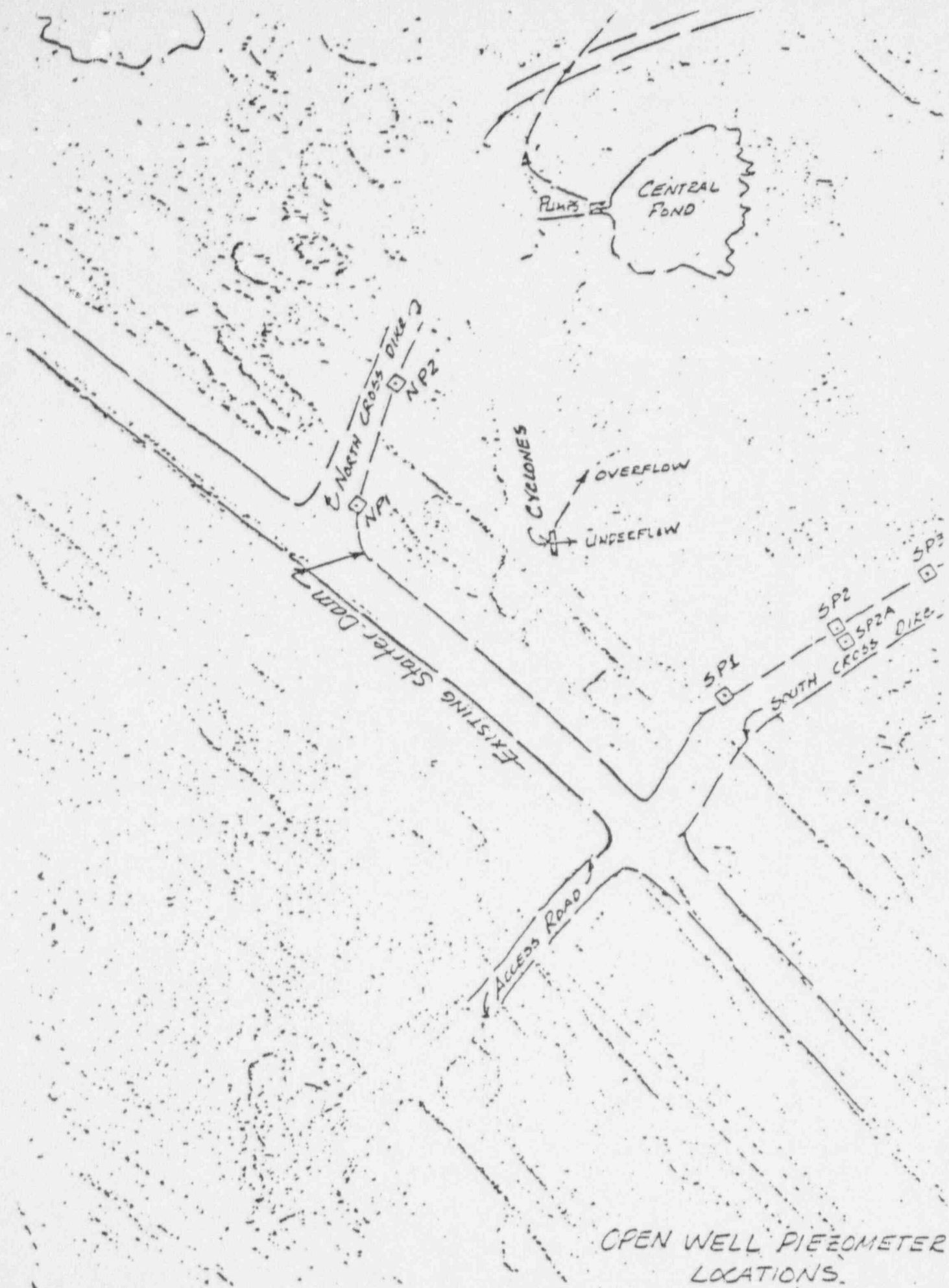
TUCSON
(602) 884-9333

ALBUQUERQUE
(505) 345-8608

EL PASO
(915) 581-8188

POND LIQUID SURFACE ELEVATIONS

<u>DATE</u>	<u>NORTH POND</u>	<u>CENTRAL POND</u>	<u>SOUTHERN POND</u>	<u>BORROW PIT</u>
09/06/79	6956.4	6954.4	6953.4	---
09/13/79	---	---	6953.1	---
09/20/79	6955.8	6954.0	6952.7	---
09/24/79	6955.6	6954.0	6952.7	---
10/01/79	6955.3	6953.7	6952.5	---
10/08/79	---	---	6952.2	---
10/11/79	6955.0	6954.6	6952.2	---
10/17/79	6954.6	6953.4	6951.9	---
10/21/79	6954.6	6953.1	6951.8	---
10/23/79	6954.6	6953.9	6951.3	---
10/24/79	6954.6	6953.5	6951.5	---
10/25/79	6954.7	6953.4	6951.4	---
10/26/79	6954.7	6953.8	6951.7	---
10/27/79	6954.6	6955.0	6951.6	---
10/28/79	6954.6	6954.0	6951.6	---
10/29/79	6954.6	6954.3	6951.6	---
10/30/79	6954.5	6954.4	6951.7	6939.2
10/31/79	6954.5	6954.8	6951.6	6939.6
11/01/79	6954.5	6954.7	6951.6	6939.9
11/02/79	6954.5	6955.2	6951.6	6940.5
11/03/79	6954.4	6955.5	6951.5	6940.7



OPEN WELL PIEZOMETER READINGS

PIEZOMETER READINGS*

<u>DATE</u>	<u>SP-1</u>	<u>SP-2</u>	<u>SP-2A</u>	<u>SP-3</u>	<u>NP-1</u>	<u>NP-2</u>
07/18/79	12'0"	--	17'0"	10'0"	10'0"	10'0"
10/09/79	11'8"	--	9'9"	**	14'3"	**
10/12/79	11'8"	--	9'9"	12'2"	14'3"	11'8"
10/20/79	11'8"	--	9'9"	12'2"	14'3"	11'8"
10/22/79	10'3"	--	10'3"	10'0"	15'0"	13'6"
10/26/79	11'8"	--	9'9"	9'4"	9'9"	12'9"
10/29/79	12'5"	9'9"	10'7"	9'9"	13'5"	20'4"
11/02/79	12'5"	10'2"	11'2"	9'6"	13'5"	20'4"

* Depth to liquid from ground surface

** Destroyed - reinstalled 10/12/79



SERGENT, HAUSKINS & BECKWITH

CONSULTING ENGINEERS
PHOENIX, ALBUQUERQUE & SANTA FE

Scanlon & associates, inc.
engineers and planners

79064

November 6, 1979

United Nuclear Corporation
Real Estate and Facilities Division
4801 Indian School Road
Albuquerque, New Mexico 87108

ATTN: Robert G. Patterson

Gentlemen:

Enclosed herein are the most recent results of the monitoring survey for the tailings dam at United Nuclear Corporation's Church Rock Mill site. This data contains results from monitoring run number 5. The tabulated data provides slope distance and vertical measurements to 29 monitoring stations placed on the existing tailings dam and cross dikes. Distances are taken from five primary control monuments in the dam vicinity. Section A of this report contains a tabulation of slope distances measured by field survey, Section B contains a tabulation of relative distance change from the base reference at run number 2, and Section C contains a tabulation of elevation data.

Elevations contained herein are based on spirit level measurements from known bench marks. Accuracy of elevations is plus or minus three hundredths (± 0.03) of a foot. Distances shown herein are taken from electronic distance meter measurements. Run numbers 1 and 3 have distance accuracies of plus or minus four hundredths (± 0.04) of a foot. All other runs have distance accuracies of plus or minus three hundredths (± 0.03) of a foot.

The monitoring survey is set up to allow for periodic remeasurement of distance and elevation data. A remeasurement cycle can be completed in approximately three (3) days. We believe that the monitoring survey will be sufficient to measure any movement of the dam.

Sincerely,

SCANLON & ASSOCIATES, INC.



Clifford E. Anderson
New Mexico P.E. & L.S. #6472

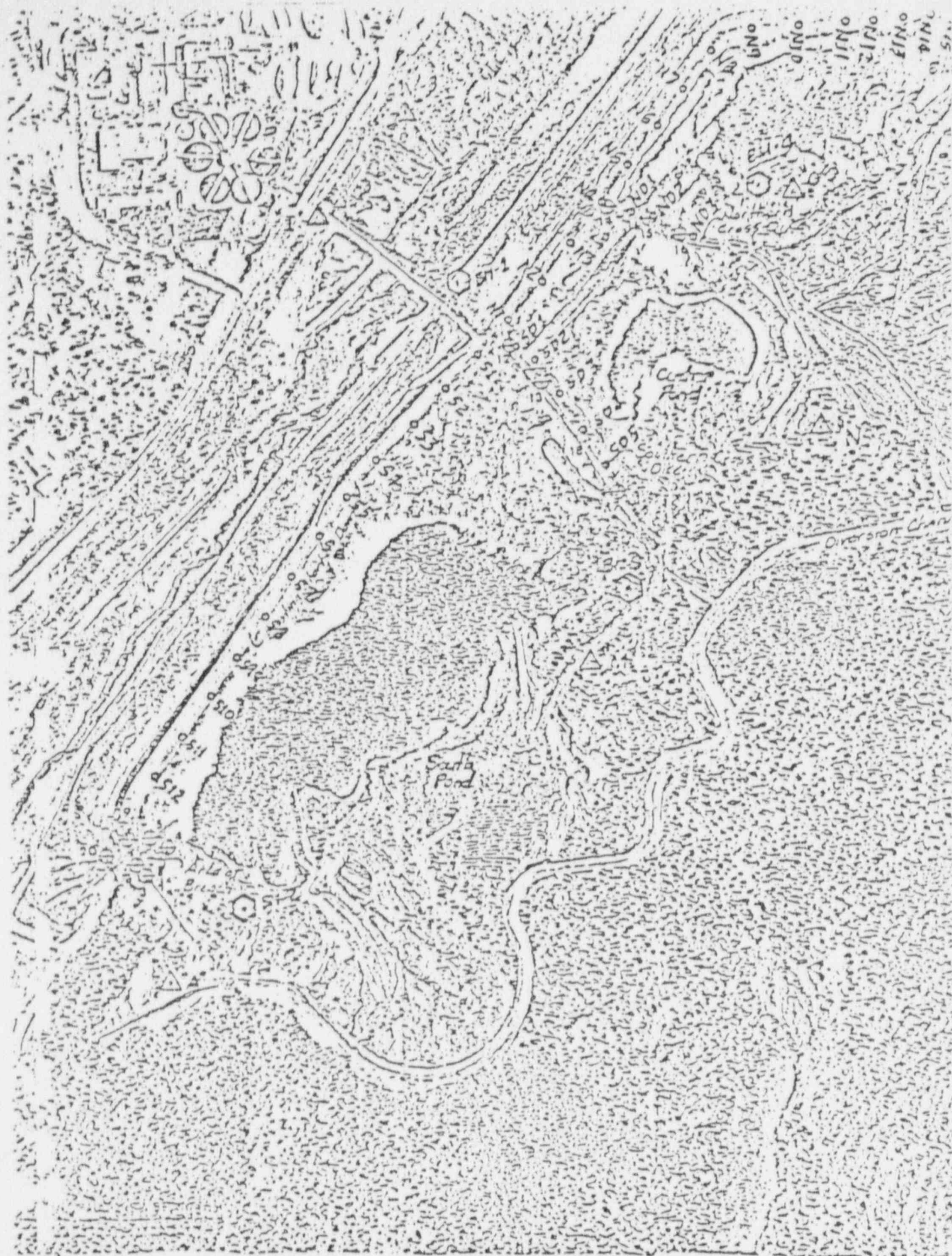
cc: Sergeant, Hauskins & Beckwith
U.N.C. Church Rock Mill

PLEASE REPLY TO:

- ☐ SANTA FE, NEW MEXICO 87502
- ☒ ALBUQUERQUE, NEW MEXICO 87110
- ☐ ARTISIA, NEW MEXICO 88210

PO BOX 4577, 1002 OSAGE AVENUE
ROOSEVELT, PENNSYLVANIA 16070
SIOUX FALLS, S.D. 57105

TELEPHONE: (505) 983-3323
TELEPHONE: (505) 255-8941
TELEPHONE: (505) 748-1010



- △ Control Stations
- Bench Marks
- Monitor Station

UNC TAILINGS DAM
CHURCH ROCK

Scale:
1 in = 1 mi

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SECTION A

Slope Distances

* NO MEASUREMENT

* NO MEASUREMENT

* NO MEASUREMENT

JOB NO. 75-005

[illegible]

* NO MEASUREMENT

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SECTION B

Relative Distance Change

LOCATION CHURCH
JOB NO. 79024

* * PLUS INDICATES DISTANCE AWAY FROM INSTRUMENT LOCATION. MINUS INDICATES DISTANCE TOWARD INSTRUMENT LOCATION.

LOCATION CHURCH
JOB NO. 72024

* * PLUS INDICATES DISTANCE AWAY FROM INSTRUMENT LOCATION. MINUS INDICATES DISTANCE TOWA INSTRUMENT LOCATION.

LOCATION 5-40
JOB NO. 74034

* * PLUS INDICATES DISTANCE AWAY FROM INSTRUMENT LOCATION. MINUS INDICATES DISTANCE TOWARD INSTRUMENT LOCATION.

LOCATION GROUP
JOB NO. 75034

* * PLUS INDICATES DISTANCE AWAY FROM INSTRUMENT LOCATION. MINUS INDICATES DISTANCE TOWA INSTRUMENT LOCATION.

LOCATION CH-CH
JCB NO 79134

* * PLUS INDICATES DISTANCE AWAY FROM INSTRUMENT LOCATION. MINUS INDICATES DISTANCE TOWARD INSTRUMENT LOCATION.

SECTION C

Elevations

RUN NO.	1	2	3	4	5	6
DATE	8-17-79	9-17-79	10-20-79	10-27-79	11-1-79	
WATER ID NUMBER	ELEVATION					
N1	6968.967	6968.973	6968.943	6968.950	6968.947	
N2	69.260	69.266	69.230	69.240	69.230	
N3	68.830	68.837	68.806	68.817	68.803	
N4	67.960	67.964	*	67.940	67.930	
N5	69.360	69.373	*	69.357	69.350	
N6	69.370	69.380	*	69.359	69.347	
N7	69.287	69.900	*	69.883	69.876	
N8	68.990	69.000	*	68.980	68.977	
N9	70.427	70.433	*	70.403	70.406	
N10	69.047	69.060	*	69.023	69.026	
N11	68.057	68.070	*	68.036	68.046	
N12	67.630	67.637	*	67.603	67.610	
N13	68.103	68.117	*	68.086	68.087	
N14	68.580	68.580	*	68.539	68.550	
N15	68.090	68.103	*	68.073	68.080	
N16	68.910	68.927	*	68.896	68.907	
ND1	68.217	68.201	68.146	68.160	68.146	
ND2	68.413	68.401	68.336	68.350	68.356	
ND3	72.886	72.911	72.860	72.873	72.880	
SD1	68.580	68.563	68.493	68.500	68.490	
SD2	69.960	69.926	69.866	69.870	69.867	
SD3	69.160	69.116	68.976	68.986	68.980	
SD4	67.913	67.823	67.693	67.709	67.693	
SD5	6968.723	6968.710	6968.636	68.650	68.647	
S8	6964.980	64.955	*	64.940	64.940	
S9	6964.610	64.561	*	64.516	64.514	
S10	6963.690	63.668	*	63.656	63.650	
S11	6964.090	64.048	*	64.026	64.030	
S12	6964.417	64.348	*	64.303	64.304	
NORTH POND	*	*	6954.6	6954.66	6954.47	
CENTER POND	*	*	6953.1	6953.71	6954.86	
SOUTH POND	*	*	6951.8	6951.81	6951.65	

* NO MEASUREMENT

LOCATION OF HALL HYDROSTATIC PRESSURE CELLS (HPC-7)

Piezometer Number

Location

PS-1	Not Yet Installed
PS-2	Not Yet Installed
PS-3	25' L of CL Sta. 13+00
PS-4	100' L of CL Sta. 13+00
PS-5	100' L of CL Sta. 19+00
PS-6	25' L of CL Sta. 19+00
PS-7	25' L of CL Sta. 24+50
PS-8	25' L of CL Sta. 30+50
PS-9	25' L of CL Sta. 39+00
PS-10	100' L of CL Sta. 45+00
PS-11	25' L of CL Sta. 45+00
PS-12	25' L of CL Sta. 50+00
PS-13	100' L of CL Sta. 56+60
PS-14	100' L of CL Sta. 56+60



SERGENT, HAUSKINS & BECK

ENGINEERS, ARCHITECTS, AND SURVEYORS
SAN FRANCISCO, CALIFORNIA

Console # 15

PIEZOMETRIC READINGS

TAILINGS DAM EMBANKMENT

Date: 7-18-77

Observer: A. J. Hickey

Piezometer Numbers	PS-1	PS-2	PS-3	PS-4	PS-5	PS-6	PS-7	PS-8	PS-9	PS-10	PS-11	PS-12	PS-13	PS-14
Serial Number	2251	2253	2247	2250	2254	2260	2261	2264	2268	2269	2270	2271	2279	2300
Gauge Reading			3	55	37	22	11	12	16	18	16	18	22	22
Indicated Pressure (PSI)			15	3.3	2.2	1.9	0.7	0.7	1.0	1.1	1.0	1.1	1.3	1.3
ΔP (PSI)			2.0	2.9	1.9	1.6	0.4	0.7	0.8	1.0	0.9	1.0	1.2	1.0
Actual Pressure (PSI)			0	0.4	0.3	0.3	0.3	0	0.2	0.1	0.1	0.1	0.1	0.3
Pressure Cell Elevation (FT)			6927.5	6923.5	6923.6	6923.6	6929.0	6935.4	6947.6	6959.6	6962.6	6957.0	6962.0	6965.0
Piezometric Pressure (FT)			0	0.9	0.7	0.7	0.7	0	0.5	0.2	0.2	0.2	0.2	0.7
Piezometric Elevation (FT)			6927.5	6923.4	6924.3	6929.3	6929.7	6935.9	6948.1	6955.8	6962.8	6957.2	6962.2	6965.7

Indicated Pressure = Gauge Reading x 0.06

Piezometric Pressure = Actual Pressure x 2.307

ΔP - Taken from Calibration Graph

REMARKS: _____

PIEZOMETRIC READINGS

Date: 10-3-77

TAILINGS DAM EMBANKMENT

Observer: R. A. [Signature]

Insole # 76

piezometer number	PS-1	PS-2	PS-3	PS-4	PS-5	PS-6	PS-7	PS-8	PS-9	PS-10	PS-11	PS-12	PS-13	PS-14
trial number	2251	2253	2247	2250	2254	2250	2261	2264	2268	2269	2270	2271	2279	2300
auge reading			32	48	86	33	10	13	14	19	17	20	20	20
indicated pressure (PSI)			1.9	2.9	2.2	2.0	0.6	0.8	0.8	1.1	1.0	1.2	1.2	1.2
P PSI			1.9	2.9	1.9	1.6	0.9	0.7	0.7	1.0	0.9	1.0	1.1	1.0
actual pressure (PSI)			0	0	0.3	0.4	0	0.1	0.1	0.1	0.1	0.2	0.1	0.2
pressure cell elevation (FT)			6927.5	6922.5	6920.6	6920.6	6928.0	6935.4	6947.6	6955.6	6962.6	6957.0	6962.0	6960.0
piezometric pressure (FT)			0	0	0.7	0.9	0	0.2	0.2	0.2	0.2	0.5	0.2	0.5
piezometric elevation (FT)			6927.5	6922.5	6924.3	6929.5	6928.0	6935.6	6947.8	6955.8	6962.8	6957.5	6962.2	6965.5

indicated Pressure = Gauge Reading x 0.06

piezometric Pressure = Actual Pressure x 2.307

P - Taken from Calibration Graph

REMARKS:

PIEZOMETRIC READINGS

TAILINGS DAM EMBANKMENT

Date: 10-22-77

Observer: [Signature]

Console # 17

Piezometer Number	PS-1	PS-2	PS-3	PS-4	PS-5	PS-6	PS-7	PS-8	PS-9	PS-10	PS-11	PS-12	PS-13	PS-14
Serial Number	2251	2253	2247	2250	2254	2260	2261	2264	2268	2270	2271	2271	2277	2300
Gauge Reading			27	56	35	32	11	13	16	18	17	20	20	20
Indicated Pressure (PSI)			1.6	3.4	2.1	1.9	0.7	0.8	1.0	1.1	1.0	1.2	1.2	1.2
Δ P (PSI)			2.1	2.9	0.9	1.6	0.4	0.7	0.8	1.0	0.9	1.0	1.1	1.0
Actual Pressure (PSI)			0	0.5	0.2	0.3	0.3	0.1	0.2	0.1	0.1	0.2	0.1	0.2
Pressure Cell Elevation (FT)			6927.5	6922.5	6923.6	6920.6	6929.0	6935.4	6947.6	6953.6	6962.6	6957.0	6962.0	6965.5
Piezometric Pressure (FT)			0	1.2	0.5	0.7	0.7	0.2	0.5	0.2	0.2	0.5	0.2	0.5
Piezometric Elevation (FT)			6927.5	6923.7	6924.1	6929.3	6929.7	6935.6	6942.1	6953.8	6962.5	6957.5	6962.2	6965.5

Indicated Pressure = Gauge Reading x 0.06

Piezometric Pressure = Actual Pressure x 2.307

Δ P - Taken from Calibration Graph

REMARKS:

753

PIEZOMETRIC READINGS

TAILINGS ON MEASUREMENT

Date: 11-1-79

Observer: James O. Winters

piezometer numbers	PS-1	PS-2	PS-3	PS-4	PS-5	PS-6	PS-7	PS-8	PS-9	PS-10	PS-11	PS-12	PS-13	PS-14
serial number	2251	2253	2247	2250	2254	2260	2261	2264	2268	2269	2270	2271	2279	2300
auge reading			26	56	33	30	10	12	15	19	16	19	20	20
ndicated ressure (PSI)			1.6	3.4	2.0	1.8	0.6	0.7	0.9	1.1	1.0	1.1	1.2	1.2
SP PSI			2.1	2.9	1.9	1.8	0.4	0.7	0.7	1.0	0.9	1.0	1.1	1.0
ctual ressure (PSI)			0	0.5	0.1	0	0.2	0	0.2	0.1	0.1	0.1	0.1	0.2
ressure Cell levation (FT)			6927.5	6922.5	6923.6	6929.6	6929.0	6935.4	6947.6	6959.6	6962.6	6959.0	6962.0	6965.0
iezoetric ressure (FT)			0	1.2	0.2	0	0.5	0	0.5	0.2	0.2	0.2	0.2	0.5
iezoetric levation (FT)			6927.5	6923.7	6923.8	6929.6	6929.0	6935.4	6948.1	6959.8	6962.8	6957.2	6962.2	6965.5

$$\text{Indicated Pressure} = \text{Gauge Reading} \times 0.06$$
$$\text{Piezometric Pressure} = \text{Actual Pressure} \times 2.307$$

2P - Taken from Calibration Graph

REMARKS:

		WELL SUMMARY						
		SOUTH		CENTRAL		PIT	NORTH	
		1	2	3	4	5	6	7
1979 Oct 26	H I F T							
	1							
	2							
27	3	52.8	51.5	<59.0	54.0	40.0	52.7	52.7
	1	51.8	51.5	<59.0	54.8	<40.0	54.7	54.7
	2	52.7	52.6	* <50.0	49.9	40.7	54.6	54.6
28	3	51.8	51.6	58.0	55.0	40.6	54.6	54.7
	1	51.8	51.6	* <58.0	54.3	40.6	54.6	54.7
	2	51.7	51.6	<50.0	54.0	40.5	54.6	54.6
29	3	51.7	51.5	<50.0	54.0	<40.5	54.6	54.7
	1	51.7	51.5	<50.0	54.7	40.5	54.6	54.7
	2	51.6	51.6	<59.0	54.3	<40.5	54.5	54.5
30	3	51.6	51.3	<59.0	54.7	40.5	54.6	54.6
	1	51.7	51.3	<59.0	54.7	40.6	54.6	54.5
	2	51.6	51.6	<59.0	* 40.5	<40.5	55.6	55.6
31	3	51.6	51.3	<59.0	55.0	<40.5	54.4	54.6
	1	51.7	51.3	<59.0	55.2	<40.5	54.4	54.5
	2	* 50.6	50.6	<58.0	55.0	<40.5	54.5	54.5
Nov 1	3	51.6	51.3	<58.0	54.8	<40.5	54.5	54.5
	1	51.5	51.3	<58.0	* 55.9	<40.5	54.5	54.5
	2	51.6	51.6	<58.0	54.8	<40.5	54.5	54.5
2	3	51.6	51.6	<58.0	54.6	<40.5	54.5	54.5
	1	51.6	51.6	<58.0	55.3	<40.5	54.4	54.5
	2	51.5	51.5	<58.0	55.5	<40.6	54.3	54.5
3	3	51.5	51.5	<58.0	55.0	39.5	54.3	54.4
	1	51.5	52.4	<58.0	55.8	40.7	54.3	54.4
	2	51.6	51.2	<58.0	55.5	40.7	54.3	54.4
	3	51.6	NR	<58.0	56.0	40.7	54.3	54.4

1. The variance in some of the readings^(*) on the same shift is due to inexperience on the operator's part to read the gauges. This situation has now been rectified.
2. For correct elevations add 6900 ft. to the readings.
3. Station #4 liquid level will rise and fall as liquids are pumped to borrow pit station #5. Therefore station #5 will show a gradual rise.

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)		
Cadmium (mg/l)		
Chloride (mg/l)	95.8	81.9
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
Selenium (mg/l)		4.03
Silver (mg/l)		
Sodium (mg/l)		
Sulfate (mg/l)	6293.1	7090.4
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)		

22: 322 30-11 (22-11)
11-11 11-11 11-11 11-11

Signature

Journal of Interpersonal Violence 26(10)br/>© The Author(s) 2011
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Assign a value to each "yes" reply: _____

General Comments:

started singing to the tune
of the new one.

cc: Bob Smith (S+L)
v.11 File 2.2.1

Creeks as described					
1. Springs		2. Creeks		3. Settlements	
YES	NO	YES	NO	YES	NO
	✓		✓		✓
	✓		✓		✓
	✓		✓		✓

Description and qualifying statement to each "Yes" mark:

General Comments: 10:45 A.M. Tailings line coupling failed in trench leading to central pond. Tailings liquid flowed towards central pond. Liquid was confined to trench. Material never reached dam crest. The tailings operator immediately noticed the failure and shut down the line. Repair and clean-up is in progress. The trench will be lined with plastic to simplify clean-up of any future spill. This will permit wash down of any potential spill. Additionally, a fusion welding machine is being rented. This will permit joining line sections without clamps. A fusion welding machine will be purchased in the near future so that one is always on the property.

INC

Division of United Nuclear Corporation
AUNE RESOURCES COMPANY

Charger Box Operations
PO Drawer 92

Carlsbad, New Mexico 87501
Telephone 505 722 5551

Memorandum

DATE: 18 OCT 74 CC: Bob Booth (SHAB)
TO: D. D. Turberville, J. Abbiss, T. M. Kilroy Mill File 2.02.10.
FROM: G. A. Swanquist
SUBJECT: Daily Inspection - Starter Dam, North & South Cross Dikes

Inspection Conducted by: G. A. Swanquist
Time: From 11⁰⁰ A.M./P.M. TO 12⁰⁰ A.M./P.M.

Check as applicable

1. Starter Dam
2. North Cross Dike
3. South Cross Dike

1. Seepage		2. Cracks		3. Settlement	
YES	NO	YES	NO	YES	NO
	✓		✓		✓
	✓		✓		✓
	✓		✓		✓

Description and qualifying statement to each "Yes" mark: _____

General Comments: PH in order

UNC Mining and Milling
NECR Tailings Impoundment
Weekly Report
November 4-10, 1979

UNC MINING AND MILLING



Division of United Nuclear Corporation
A UNC RESOURCES Company

P.O. Box 3951
Albuquerque, New Mexico 87190

4801 Indian School Road, N.E.
Albuquerque, New Mexico 87110
Telephone 505/265-4421

November 14, 1979

Mr. Cubia Clayton
Bureau Chief
NM ENVIRONMENTAL IMPROVEMENT DIVISION
P. O. Box 968
Santa Fe, NM 87503

Subject: NECR TAILINGS IMPOUNDMENT

Dear Mr. Clayton:

To ensure compliance with NMEID letter dated October 23, 1979 and October 31, 1979, and the NRC Order dated October 26, 1979, the following documents are forwarded for the week of operations November 4th through November 10th, 1979.

1. Sergeant, Hauskins & Beckwith weekly report to the New Mexico State Engineer.
2. Summary sheet of the freeboard levels in the northern and southern cells and the borrow pit area.
3. Analysis of water samples from monitoring wells 201 and 202.
4. Daily inspection sheets for starter dam, north and south cross dikes.
5. Evaporation and precipitation record.
6. Response to your letter to Mr. D. D. Turberville dated October 31, 1979.

Cleanup operations in the arroyo and the Rio Puerco are continuing. Should you find it necessary to discuss item 6 at greater length, UNC Mining and Milling personnel will be pleased to meet with you at your convenience.

Sincerely,

H. J. Abbiss, P.E.
Vice President
Environmental and Safety Services

Copy: Mr. Ross Scarano, NRC
Dr. John Nelson



SERGEANT, HAUSKINS & BECKWITH

CONSULTING SOIL AND FOUNDATION ENGINEERS

APPLIED SOIL MECHANICS • ENGINEERING GEOLOGY • MATERIALS ENGINEERING

S. OWAINES SERGEANT, P.E.
DALE V. SEDENKOP, P.E.

JOHN S. HAUSKINS, P.E.
ROBERT D. BOOTH, P.E.

GEORGE H. BECKWITH, P.E.
BENNY E. McMILLAN, P.E.
BUD WOODWARD

November 14, 1979

State of New Mexico
Natural Resources Department
Water Resources Division
Bataan Memorial Building
Santa Fe, New Mexico 87503

SHB Job No. E79-1096

Attention: Mr. S. E. Reynolds
State Engineer

Re: Church Rock Tailings Dam
Church Rock, New Mexico


Gentlemen:

Transmitted herewith are (1) liquid surface elevations of the north, central and southern cells as well as the borrow pit, (2) readings on the piezometers installed in the northern and southern cross dikes, (3) horizontal and vertical measurements on the survey monuments installed in the northern and southern cross dikes and the starter dam, and (4) readings on the Hall Hydrostatic Pressure Cell Piezometers (HPC-7's) installed on the downstream side of the existing starter dam. These data are for the week ending November 10, 1979.

Should any questions arise concerning the attached data, please do not hesitate to call.

Respectfully submitted,
Sergeant, Hauskins & Beckwith, Engineers

By


Robert D. Booth,



Copies: Addressee (1)
United Nuclear Corporation (10)

REPLY TO: 2821 GIRARD BLVD., N.E., ALBUQUERQUE, NEW MEXICO 87107

PHOENIX
(602) 272-6848

ALBUQUERQUE
(505) 345-8606

EL PASO
(915) 591-8188

TUCSON
(602) 884-9333

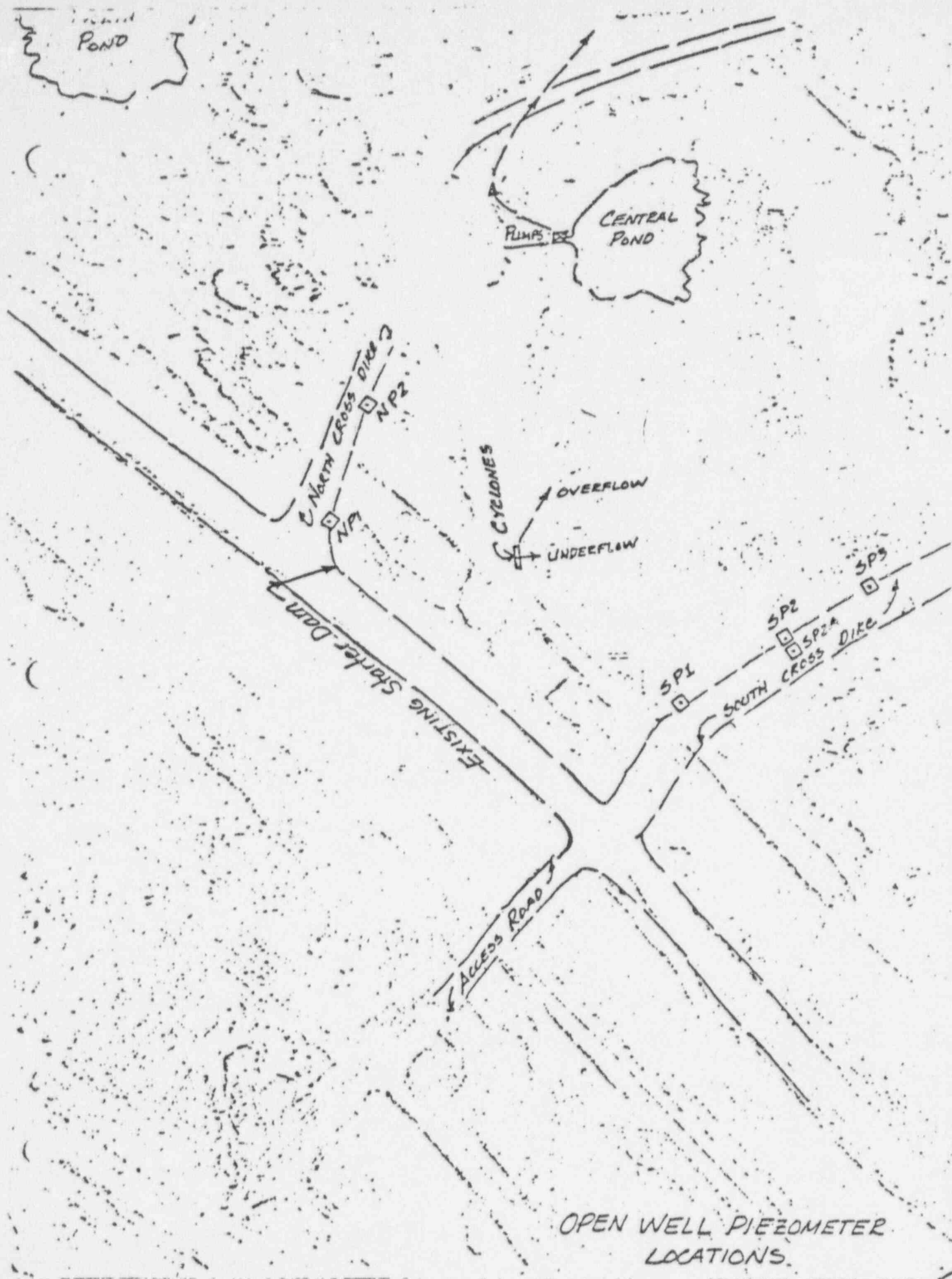
POND LIQUID SURFACE ELEVATIONS

<u>DATE</u>	<u>NORTH POND</u>	<u>CENTRAL POND</u>	<u>SOUTHERN POND</u>	<u>BORROW PIT</u>
09/06/79	6956.4	6954.4	6953.4	---
09/13/79	---	---	6953.1	---
09/20/79	6955.8	6954.0	6952.7	---
09/24/79	6955.6	6954.0	6952.7	---
10/01/79	6955.3	6953.7	6952.5	---
10/08/79	---	---	6952.2	---
10/11/79	6955.0	6954.6	6952.2	---
10/17/79	6954.6	6953.4	6951.9	---
10/21/79	6954.6	6953.1	6951.8	---
10/23/79	6954.6	6953.9	6951.3	---
10/24/79	6954.6	6953.5	6951.5	---
10/25/79	6954.7	6953.4	6951.4	---
10/26/79	6954.7	6953.8	6951.7	---
10/27/79	6954.6	6955.0	6951.6	---
10/28/79	6954.6	6954.0	6951.6	---
10/29/79	6954.6	6954.3	6951.6	---
10/30/79	6954.5	6954.4	6951.7	6939.2
10/31/79	6954.5	6954.8	6951.6	6939.6
11/01/79	6954.5	6954.7	6951.6	6939.9
11/02/79	6954.5	6955.2	6951.6	6940.5
11/03/79	6954.4	6955.5	6951.5	6940.7
11/04/79	6954.4	6955.6	6951.5	6941.9
11/05/79	6954.4	6955.9	6951.6	6942.6
11/06/79	6954.3	6956.8	6951.5	6942.1
11/07/79	6954.3	6956.1	6951.5	6942.5
11/08/79	6954.5	6956.3	6951.6	6943.3
11/09/79	6954.4	6956.3	6951.6	6943.6
11/10/79	6954.5	6956.3	6951.6	6943.6



SERGEANT, HAUSKINS & BECKWITH

CONSULTING CIVIL AND POLYMERIZATION ENGINEERS
PHOENIX • ALBUQUERQUE • SANTA FE



OPEN WELL PIEZOMETER READINGS
PIEZOMETER READINGS

<u>DATE</u>	<u>SP-1</u>	<u>SP-2</u>	<u>SP-2A</u>	<u>SP-3</u>	<u>NP-1</u>	<u>NP-2</u>
*11/05/79	12'5"	10'2"	11'2"	9'6"	13'5"	20'4"
**11/06/79	12'5"	10'2"	11'2"	9'6"	13'5"	20'4"
**11/07/79	6956.0	6956.7	6956.5	6957.0	6951.8	6947.8
**11/08/79	6956.0	6956.7	6956.5	6957.0	6951.8	6947.8
**11/09/79	6956.0	6956.7	6956.5	6957.0	6951.8	6947.8
**11/10/79	6956.0	6956.7	6956.5	6957.0	6951.8	6947.8

* Depth of liquid from ground surface
** Elevation of liquid surface



SERGEANT, HAUSKING & BECKWITH

CONSULTING OIL AND PETROLEUM ENGINEERS
P.O. BOX 100, ALBUQUERQUE, N.M. 87103

Scanlon & associates, inc.
engineers and planners

79064

November 13, 1979

United Nuclear Corporation
Real Estate and Facilities Division
4801 Indian School Road
Albuquerque, New Mexico 87108

ATTN: Robert G. Patterson

Gentlemen:

Enclosed herein are the most recent results of the monitoring survey for the tailings dam at United Nuclear Corporation's Church Rock Mill site. This data contains results from monitoring run number 6. The tabulated data provides slope distance and vertical measurements to 29 monitoring stations placed on the existing tailings dam and cross dikes. Distances are taken from five primary control monuments in the dam vicinity. Section A of this report contains a tabulation of slope distances measured by field survey, Section B contains a tabulation of relative distance change from the base reference at run number 2, and Section C contains a tabulation of elevation data.

Elevations contained herein are based on spirit level measurements from known bench marks. Accuracy of elevations is plus or minus three hundredths (± 0.03) of a foot. Distances shown herein are taken from electronic distance meter measurements. Run numbers 1 and 3 have distance accuracies of plus or minus four hundredths (± 0.04) of a foot. All other runs have distance accuracies of plus or minus three hundredths (± 0.03) of a foot.

The monitoring survey is set up to allow for periodic remeasurement of distance and elevation data. A remeasurement cycle can be completed in approximately three (3) days. We believe that the monitoring survey will be sufficient to measure any movement of the dam.

Sincerely,

SCANLON & ASSOCIATES, INC.

Clifford E. Anderson
Clifford E. Anderson
New Mexico P.E. & L.S. #6472

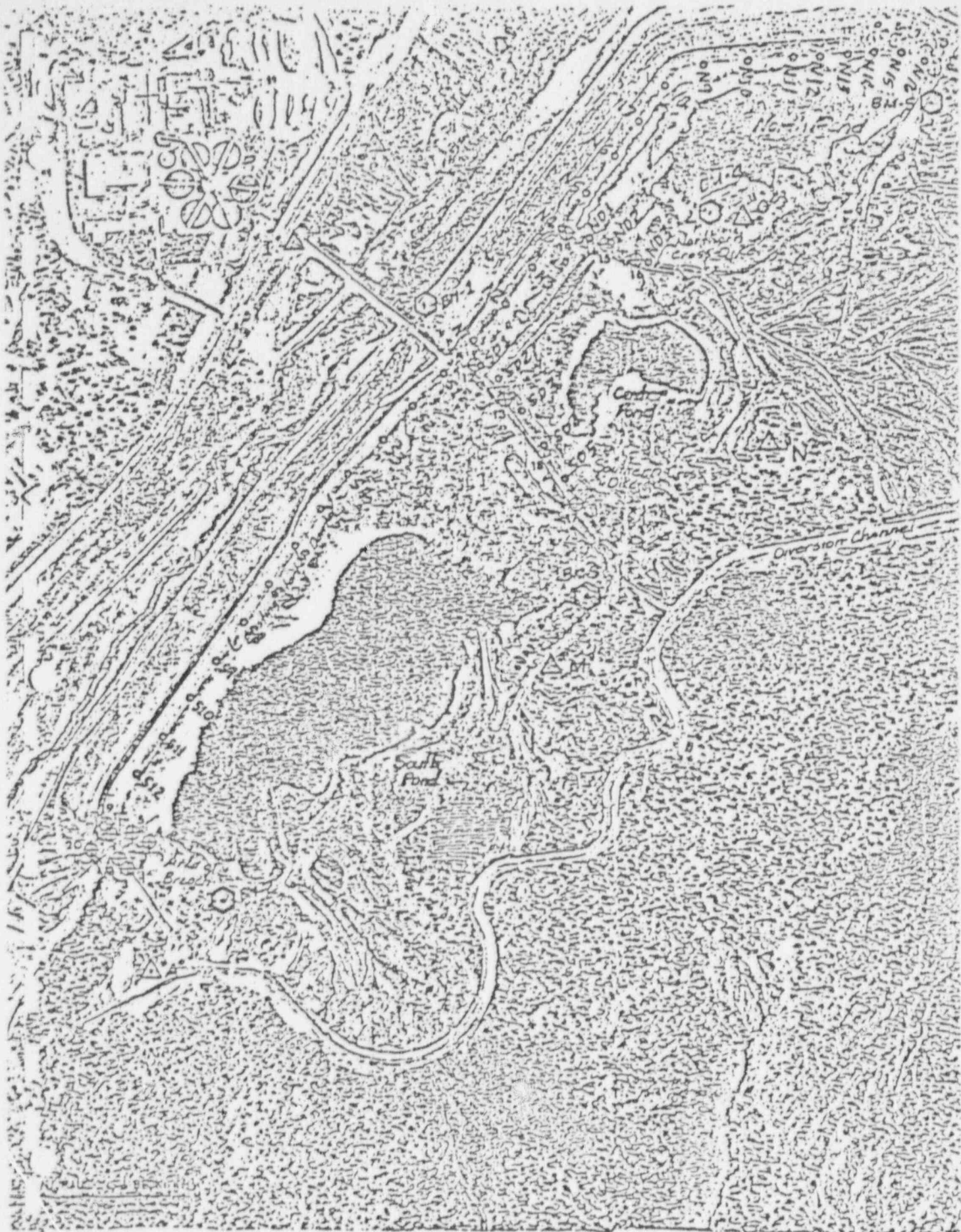
cc: Sergeant, Hauskins & Beckwith
U.N.C. Church Rock Mill

PLEASE REPLY TO:

- ☐ SANTA FE, NEW MEXICO 87502
- ☒ ALBUQUERQUE, NEW MEXICO 87110
- ☐ ARTESIA, NEW MEXICO 88210

P.O. BOX 4577, 1302 OSAGE AVENUE
8008 PENNSYLVANIA CIRCLE NE
810 WEST TEXAS

TELEPHONE: (505) 983-3323
TELEPHONE: (505) 265-6941
TELEPHONE: (505) 748-1010



- △ Control Stations
- Bench Marks

UNC TAILINGS DAM.
CHURCH ROCK

Scale: 1" = 100'

SECTION A

Slope Distances

[illegible]

* NO MEASUREMENT?

CLIENT U.N.C. MILLING
PROJECT TAILINGS DAM
LOCATION CHURCH ROCK, NW
JOB NO. 79064

[illegible]

* NO MEASUREMENT

CLIENT U.N.C. MILLING
PROJECT TAILINGS DAM
LOCATION CHURCH ROCK, NM
JOB NO. 79064

שתנ

Church Rock Operations
PO Drawer 22

General Leon Merino 8737
Telephone 525 722-4651

Memorandum

DATE:

4 Nov 79

cc: Bob Booth (SH&B)
Mill File 2.02.10

TO:

D. D. Turberville, J. Abbiss, T. M. Kilroy

FROM:

G. A. Swanquist

SUBJECT:

Daily Inspection - Starter Dam, North & South Cross T. res

Inspection Conducted by:

L. J. H. H. H. H.

Time: From 11⁰⁰ A.M. / P.M. / TO 12⁰⁰ A.M. / P.M.

Check as applicable

1. Starter Dam
2. North Cross Dike
3. South Cross Dike

Check as applicable					
1. Seepage		2. Cracks		3. Settlement	
YES	NO	YES	NO	YES	NO
	✓		✓		✓
	✓		✓		✓
	✓		✓		✓

Description and qualifying statement to each "Yes" mark:

General Comments:

General Comments: Solids building up near tailings transfer pump - modifying inlet to cope with slimes build up

UNC MINING AND MILLING



Division of United Nuclear Corporation
AUNC RESOURCES Company,

Chemical Process Operations
PO Drawer 00

Gallop, New Mexico 87301
Telephone 505 722-6651

Memorandum

DATE: November 5, 1979 CC: Bob Booth (SH&B)
TO: D. D. Turberville, J. Abbiss, T. M. Kilroy Mill File 2,02.10
FROM: G. A. Swanquist
SUBJECT: Daily Inspection - Starter Dam, North & South Cross Dikes
Inspection Conducted by: C. E. Oliver
Time: From 12:13 ~~Afternoon~~/P.M. TO 12:33 ~~Afternoon~~/P.M.

Check as applicable

1. Starter Dam
2. North Cross Dike
3. South Cross Dike

1. Seepage		2. Cracks		3. Settlement	
YES	NO	YES	NO	YES	NO
	✓		✓		✓
	✓		✓		✓
	✓		✓		✓

Description and qualifying statement to each "Yes" mark: _____

General Comments: _____

UNIC MINING AND MILLING

UNIC RESOURCES LTD.

Plant Operations
PO Box 100

Box 100, New Mexico 87201
Telephone 505 727-5511

MEMORANDUM

DATE: 6 Nov 79 CC: Bob Booth (SH&B)
TO: D. D. Turberville, J. Abbiss, T. M. Kilroy Mill File 2:02.10
FROM: G. A. Swanquist
SUBJECT: Daily Inspection - Starter Dam, North & South Cross Dikes

Inspection Conducted by: G. A. Swanquist

Time: From 2:00 A.M./P.M. TO 4:30 A.M./P.M.

Check as applicable

1. Starter Dam
2. North Cross Dike
3. South Cross Dike

1. Seepage		2. Cracks		3. Settlement	
YES	NO	YES	NO	YES	NO
	✓		✓		✓
	✓		✓		✓
	✓		✓		✓

Description and qualifying statement to each "Yes" mark: _____

General Comments:

Started to deposit clay material over North West face of borrow pit rock outcrops to seal rock face and prevent possible seepage

(בהנ)

SECRET
12-1-55

சென்னை : 19-08-2016

$$f_{\text{eff}} = \frac{\rho}{\rho_0} \left(\frac{v}{v_0} \right)^2 \left(\frac{A}{A_0} \right) \left(\frac{L}{L_0} \right)$$

7 Nov 79

CC: Bob Booth (SMAE)
Mill File 2:02.10

D. D. T. ~~Deville~~, J. Abbiss, T. M. Kilroy

5. SUBJECT: Daily Inspection - Starter Dam, North & South Cross Dikes

Inspection Conducted by:

Time: From 9³⁰ am A.M./P.M. TO 1⁰⁰ pm A.M./P.M.

Check as applicable

Check as applicable					
1. Seepage		2. Cracks		3. Settlement	
YES	NO	YES	NO	YES	NO
	✓		✓		✓
	✓		✓		✓
	✓		✓		✓

Description and qualifying statement to each "Yes" mark:

UNC MINING AND MILLING

INC

UNC RESOURCES CORP.

2000 Main Street
P.O. Box 100

Call 505-727-8737
Telex 505-727-8737

MEMORANDUM

DATE: 2 Nov 79 CC: Bob Booth (SHAB)
TO: D. D. Turberville, J. Abbiss, T. M. Kilroy Mill File 2:02.10
FROM: G. A. Swanquist
SUBJECT: Daily Inspection - Starter Dam, North & South Cross Dikes

Inspection Conducted by: G. A. Swanquist

Time: From 4:00 A.M./P.M. TO 5:00 A.M./P.M.

Check as applicable

1. Starter Dam
2. North Cross Dike
3. South Cross Dike

1. Seepage		2. Cracks		3. Settlement	
YES	NO	YES	NO	YES	NO
	✓		✓		✓
	✓		✓		✓
	✓		✓		✓

Description and qualifying statement to each "Yes" mark:

General Comments: About 1/2" rain last 24 hrs on
at 11:00 - extremely maddy - instructed
surveillance men not to go to south end of
dam - too slick and dangerous.

Depositing sand with machinery on
North side of central dike to extend beach.

Having orderly shut down - 15
Shut down grinding @ 6pm

UNC TRAINING AND MILLING

UNC RESOURCES CENTER, Charge Postmaster, General Mail Box 21, B-201, Telephone 504-755-4441

MEMORANDUM

DATE: 7 Nov 79 TO: Bob Booth (SH&B)
D. D. Turberville, J. Abbiss, T. M. Kilroy Mill File 2:02.10
FROM: G. A. Swanquist
SUBJECT: Daily Inspection - Starter Dam, North & South Cross Dikes

Inspection Conducted by: G. A. Swanquist
Time: From 2⁰⁰ A.M./P.M. TO 3⁰⁰ A.M./P.M.

Check as applicable

1. Starter Dam
2. North Cross Dike
3. South Cross Dike

1. Seepage		2. Cracks		3. Settlement	
YES	NO	YES	NO	YES	NO
	✓		✓		✓
	✓		✓		✓
	✓		✓		✓

Description and qualifying statement to each "Yes" mark: _____

General Comments: Rent Newlin, and shell construction
equipment extending beach on North side of
central cross dike
Agency team to Nam Tailings site inspection
by Dept State Engineer, Dan Lopez accompanied
by J. Abbiss, Bob Booth, Chuck Wolff and G. Swanquist
Area still muddy--

UNIC RESOURCES

[illegible]

10 Nov 79

cc: Bob Borch (SHE)
Mill File 2.02.10

100

D. 2. Fairbairn, J. Adams, T. N. Kelly

77311

G. A. Szwedist

Subject: Daily Inspection - Starter Dam, North & South Cross Dikes

Inspection Conducted by: J. J. 11-21-11

Time: From 1³⁰
20 A.M./P.M. TO 4³⁰
20 A.M./P.M.

Check, as applicable

1. Starter Dam
2. North Cross Dike
3. South Cross Dike

Check as applicable					
1. Sacrifice		2. Cracks		3. Settlement	
YES	NO	YES	NO	YES	NO
	✓		✓		✓
	✓		✓		✓
	✓		✓		✓

Description and qualifying statement to each "Yes" mark:

General Comments:

General Comments: Work to extend sand beach progressing at - steel beach by tomorrow noon

EVAPORATION AND PRECIPITATION RECORD

DATE	1 READING BEGINNING	2 READING ADDED	3 READING ENDING	4 INDICATED EVAPORATION	5 PRECIP- itation	6 TRUE EVAPOR	7 NUMBER OF DAYS	8 EVAPOR PER DA
10-26	3.936							
11-5		2.989						
11-12			4.505	2.326	.745	3.074	16	.192

ALL READINGS IN INCHES

Method of Calculation:

#4 Indicated evaporation- $1 + 2 - 3 = 4$

#6 True evaporation- $4 + 5 = 6$

UNC MINING AND MILLING



Division of United Nuclear Corporation
A UNC RESOURCES Company

Church Rock Operations
P.O. Drawer QQ

Gallup, New Mexico 87301
Telephone 505/722-6651

Memorandum

DATE: November 12, 1979

CC: T. M. Kilroy

TO: H. J. Abbiss ✓

FROM: G. A. Swanquist

SUBJECT: New Mexico Environmental Improvement Division letter dated October 31, 1979, signed by Mr. Cuba Clayton: five numbered items on Page 2.

Compliance with the items listed on Page 2 of this letter will be difficult. Each item will require some form of instrumentation. The accuracy of this instrumentation is a critical consideration. At best, under ideal conditions, we may approach $\pm 5\%$ aggregate system accuracy. This $\pm 5\%$ discrepancy in measurement could be misinterpreted as representing seepage in the borrow pit. Recognizing this, the design and implementation of any instrumentation used to meet these measurement requirements must be critically evaluated.

In response to the individual items listed on Page 2 of the letter:

1. The measurement of the water discharged to the pit will have to be done with a recording flowrater installed near the discharge of the transfer pump.
2. In order to measure the quantity of solids discharged, a nuclear gauge density meter should be installed so that the solids quantity can be calculated.

3. The volume of water in storage can be calculated by planimeter measurements; however, the accuracy is approximate.
4. Precipitation measurements have been taken for the past several months. Records are now being kept on a weekly basis. It will be most difficult, perhaps impossible, to have an accurate measurement of the total volume of fluid added to the pit. The outline of the run-off area is inexact. If we assume no infiltration or evaporation in this run-off area, this compounds the inaccuracy of measurement.
5. Evaporation measurements are being taken; however, thermal differences between the ponds and the references, add potential inaccuracies to these measurements.

Finally, to calculate volumes on 0.10 ft. increments, assumes a greater accuracy than we have within our present surveying capabilities. It will be virtually impossible to achieve this degree of accuracy mainly due to the irregularities of the terrain.

I believe that the $\pm 5\%$ figure of accuracy stated previously is extremely optimistic for this aggregate system. We need a good discussion with our consultants relating to what we can do and what we cannot do. Bob Booth and perhaps, Earl B. Hall in the instrumentation area will be of assistance in this task. Gail Billings could have some input in this matter as well.

It will be extremely difficult to arrive at a materials balance with an accountable balance that could not be misinterpreted as seepage. To compound our problems, the proposed system of sprinkling for enhancement of evaporation must also be considered. With the long leadtimes of instrumentation availability, 6 to 8 weeks minimum, installation, and a break-in period, we may approach the end of this interim operating period. Additionally, the costs for such an instrumentation system will not be insignificant. These could easily exceed \$10,000.00. I believe it imperative that all these issues be discussed.

ACID &
CORROSION
IN PIPES

4/24/68

CLIENT U.N.C. MILLING
PROJECT TAILINGS DAM
LOCATION CHURCH ROCK, NM
JOB NO. 79064

[illegible]

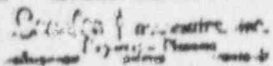
* NO MEASUREMENT

[illegible]

* NO MEASUREMENT

SECTION B

Relative Distance Change

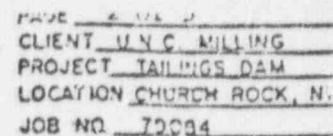


MONITOR STATION RELATIVE CHANGE
INSTRUMENT STATION "A"

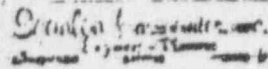
PAGE 1 of 5
CLIENT U N C MILLING
PROJECT TAYNINGS DAM
LOCATION CHURCH ROCK, NM
JOB NO. 79084

[illegible]

PLUS INDICATES DISTANCE AWAY FROM INSTRUMENT LOCATION MINUS INDICATES DISTANCE TOWARD INSTRUMENT LOCATION



** PLUS INDICATES DISTANCE AWAY FROM INSTRUMENT LOCATION. MINUS INDICATES DISTANCE TOWARD INSTRUMENT LOCATION.



MONITOR STATION RELATIVE CHANGE
INSTRUMENT STATION "N"

PAGE 3 OF 3
CLIENT U N C MILLING
PROJECT TAILINGS DAM
LOCATION CHURCH ROCK, NM
JOB NO. 75084

* * PLUS INDICATES DISTANCE AWAY FROM INSTRUMENT LOCATION. MINUS INDICATES DISTANCE TOWARD INSTRUMENT LOCATION.

8008 PENNSYLVANIA CIRCLE, NW
ALBUQUERQUE, NM 87110

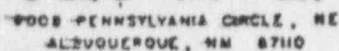
MONITOR STATION RELATIVE CHANGE
INSTRUMENT STATION "O"

PAGE 4 of 5
CLIENT U.N.C. MILLING
PROJECT WILDS DAM
LOCATION CHURCH ROCK, NM
JOB NO. 72064

[illegible]

* NO MEASUREMENT TAKEN

* * PLUS INDICATES DISTANCE AWAY FROM INSTRUMENT LOCATION. MINUS INDICATES DISTANCE TOWARD INSTRUMENT LOCATION.



MONITOR STATION RELATIVE CHANGE
INSTRUMENT STATION "P"

PAGE 5 of 5
 CLIENT U.N.C. MILLING
 PROJECT TAILINGS DAM
 LOCATION CHURCH ROCK, NM
 JOB NO. 79294

* NO MEASUREMENT TAKEN

* * PLUS INDICATES DISTANCE AWAY FROM INSTRUMENT LOCATION. MINUS INDICATES DISTANCE TOWARD INSTRUMENT LOCATION.

SECTION C

Elevations

8008 PENNSYLVANIA CIRCLE, NE
ALBUQUERQUE, NM 87110

MONITOR STATION ELEVATIONS

CLIENT U.N.C. MILLING
PROJECT TAILINGS DAM
LOCATION CHURCH ROCK, NM
JOB NO. 79064

RUN NO.	1	2	3	4	5	6	7
DATE	8-17-79	9-17-79	10-20-79	10-27-79	11-1-79	11-5-79	
MONITOR I.D. NUMBER	ELEVATION						
N1	6968.967	6968.973	6968.943	6968.950	6968.947	6968.943	
N2	69.260	69.266	69.230	69.240	69.230	6969.227	
N3	68.830	68.837	68.806	68.817	68.803	6968.800	
N4	67.960	67.964	*	67.940	67.930	6967.930	
N5	69.360	69.373	*	69.357	69.350	6969.350	
N6	69.370	69.380	*	69.359	69.347	6969.350	
N7	69.887	69.900	*	69.883	69.876	6969.877	
N8	68.990	69.000	*	68.980	68.977	6968.973	
N9	70.427	70.433	*	70.403	70.406	6970.403	
N10	69.047	69.060	*	69.023	69.026	6969.020	
N11	68.057	68.070	*	68.036	68.046	6968.047	
N12	67.630	67.637	*	67.603	67.610	6967.607	
N13	68.103	68.117	*	68.086	68.087	6968.083	
N14	68.580	68.580	*	68.539	68.550	6968.543	
N15	68.090	68.103	*	68.073	68.080	6968.080	
N16	68.910	68.927	*	68.896	68.907	6968.903	
ND1	68.217	68.201	68.146	68.160	68.146	6968.143	
ND2	68.413	68.401	68.336	68.350	68.356	6968.340	
ND3	72.886	72.911	72.860	72.873	72.880	6972.870	
SD1	68.580	68.563	68.493	68.500	68.490	6968.483	
SD2	69.960	69.926	69.866	69.870	69.867	6969.863	
SD3	69.160	69.116	68.976	68.986	68.980	6968.980	
SD4	67.913	67.823	67.693	67.709	67.693	6967.700	
SD5	6968.723	6968.710	6968.636	68.650	68.647	6968.650	
S8	6964.980	64.955	*	64.940	64.940	6964.940	
S9	6964.610	64.561	*	64.516	64.514	6964.510	
S10	6963.690	63.668	*	63.656	63.660	6963.660	
S11	6964.090	64.048	*	64.026	64.030	6964.033	
S12	6964.417	64.348	*	64.303	64.304	6964.293	
NORTH POND	*	*	6954.6	6954.66	6954.47	6954.33	
INDICATOR BOARD #1 NORTH POND			*	*	*	6954.37	
CENTER POND		*	6953.1	6953.71	6954.86	6955.80	
INDICATOR BOARD #1 CENTER POND			*	*	*	6955.9	
SOUTH POND		*	6951.8	6951.81	6951.65	6951.53	
INDICATOR BOARD #1 SOUTH POND				*		6951.1	
BORROW PIT	*	*	*	*	*	6942.12	
INDICATOR BOARD #1 - BORROW PIT				*	*	6942.15	

* NO MEASUREMENT

LOCATION OF HALL HYDROSTATIC PRESSURE CELLS (HPC-7)

Piezometer Number

Location

PS-1	Not Yet Installed
PS-2	Not Yet Installed
PS-3	25' L of CL Sta. 13+00
PS-4	100' L of CL Sta. 13+00
PS-5	100' L of CL Sta. 19+00
PS-6	25' L of CL Sta. 19+00
PS-7	25' L of CL Sta. 24+50
PS-8	25' L of CL Sta. 30+50
PS-9	25' L of CL Sta. 39+00
PS-10	100' L of CL Sta. 45+00
PS-11	25' L of CL Sta. 45+00
PS-12	25' L of CL Sta. 50+00
PS-13	100' L of CL Sta. 56+60
PS-14	100' L of CL Sta. 56+60



SERGEANT, HAUSKINS & BECKWITH

CONSULTING CIVIL AND FOUNDATION ENGINEERS
PHOENIX • ALBUQUERQUE • SANTA FE

Gus

PIEZOMETRIC READINGS

Date: 11-9-78

Console # 78

TAILINGS DAM EMBANKMENT

Observer: R.D. Widen - D. Ardustrae

Piezometer Indicators	PS-1	PS-2	PS-3	PS-4	PS-5	PS-6	PS-7	PS-8	PS-9	PS-10	PS-11	PS-12	PS-13	PS-14
Serial Number	2251	2253	2247	2250	2254	2260	2261	2264	2268	2269	2270	2271	2279	2300
Gauge Reading			22	48	28	26	7	12	13	15	14	17	14	17
Indicated Pressure (PSI)			1.3	2.9	1.7	1.6	0.4	0.7	0.8	0.9	0.8	1.0	0.8	1.0
Actual Pressure (PSI)			2.1	2.9	1.9	1.6	0.4	0.6	0.8	0.9	0.9	1.0	1.1	0.9
Pressure Cell Elevation (FT)			0	0	0	0	0	0.1	0	0	0	0	0	0.1
Piezometric Pressure (FT)			5927.5	6922.5	6923.6	6928.6	6929.0	6935.4	6947.6	6959.6	6962.6	6957.0	6962.0	6965.0
Piezometric Elevation (FT)			6927.5	6922.5	6923.6	6928.6	6929.0	6935.6	6947.6	6959.6	6962.6	6957.0	6962.0	6965.2

Indicated Pressure = Gauge Reading x 0.06

Piezometric Pressure = Actual Pressure x 2.307

IP - Taken from Calibration Graph

REMARKS:

TEMP 5°C

FREE BOARD PAUSE RECORD

CHILT SUMMARY

15X
DET 26

11-11

SOUTH		CENTRAL		PIT	NORTH	
1	2	3	4	5	6	7

JURVE.
MAN

57

28

29

30

31

1101 1

2

3

4

5

1. 6.

1

2

3

1

2

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1

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1

2

3

1

2

3

52.2 52.5 <59.0 54.0 40.0 55.7 55.7

51.8 51.5 <59.0 54.8 <40.0 54.7 54.7

52.7 52.6 <50.0 49.9 40.7 54.6 54.6

51.8 51.6 58.0 55.0 40.6 54.6 54.7

51.8 51.6 <58.0 54.3 40.6 54.6 54.7

51.7 51.6 <50.0 54.0 40.5 54.6 54.6

51.7 51.5 <50.0 54.0 <40.5 54.6 54.7

51.7 51.5 <50.0 54.7 <40.5 54.6 54.7

51.6 51.6 <59.0 54.3 <40.5 54.5 54.5

51.6 51.3 <59.0 54.7 40.5 54.6 54.6

51.7 51.3 <59.0 54.7 40.6 54.6 54.5

51.6 51.6 <59.0 40.5 <40.5 55.6 55.6

51.6 51.3 <59.0 55.0 <40.5 54.4 54.6

51.7 51.3 <59.0 55.2 <40.5 54.4 54.5

50.6 50.6 <58.0 55.0 <40.5 54.5 54.5

51.6 51.3 <58.0 54.8 <40.5 54.5 54.5

51.5 51.3 <58.0 55.9 <40.5 54.5 54.5

51.6 51.6 <58.0 54.8 <40.5 54.5 54.5

51.6 51.6 <58.0 54.6 <40.5 54.5 54.5

51.6 51.6 <58.0 55.3 <40.5 54.4 54.5

51.5 51.5 <58.0 55.5 <40.6 54.3 54.5

51.5 51.5 <58.0 55.0 39.5 54.3 54.4

51.5 52.4 <58.0 55.8 40.7 54.3 54.4

51.6 51.2 <58.0 55.5 40.7 54.3 54.4

51.6 NR <58.0 56.0 40.7 54.3 54.4

51.5 51.2 <58.0 55.4 41.9 54.3 54.4

51.4 51.2 <58.0 55.6 41.0 54.3 54.4

51.4 51.2 <58.0 55.4 41.2 54.3 54.4

51.4 51.2 <58.0 55.3 41.4 54.3 54.4

51.4 51.2 <58.0 55.1 41.6 <54.3 54.4

51.4 51.1 <58.0 56.0 41.8 54.3 54.4

51.4 51.4 <58.0 55.7 42.0 54.3 54.4

51.4 51.4 <55.0 56.0 42.2 54.3 54.6

51.4 51.1 <58.0 56.0 42.4 54.3 54.6

Borgu

Rome

Loval

Borgu

Rome

Loval

Borgu

Rome

Loval

Borgu

McLe

Loval

Borgu

Borgu

Loval

Borgu

McLe

Loval

Rome

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Rome

Loval

Borgu

Rome

Note - The first two digits of all elevations
are in the same ft

FREE BOLOD GAGE RECORDED DAILY SUMMARY

(1979 DOR	TIME	SOUTH		CENTRAL		PIT	NORTH		Survey Man
		1	2	3	4	5	6	7	
Nov 7	1	51.4	51.1	58.0	56.0	42.6	54.5	54.4	Lowato
	2	51.4	51.2	58.0	56.0	42.6	54.2	54.3	Boogwa
	3	51.4	51.2	58.0	56.4	42.7	54.2	54.3	Rome
8	1	51.5	51.3	58.0	56.4	43.0	54.2	54.4	Lowato
	2	51.6	51.2	58.0	56.2	43.4	54.4	54.6	Boogwa
	3	51.5	51.2	58.0	56.4	43.5	54.4	54.5	McLell
9	1	51.5	51.3	58.0	56.3	43.6	54.4	54.6	Lowato
	2	51.6	51.3	NR	56.3	43.6	54.4	54.5	Boogwa
	3	51.5	51.2	NR	56.4	43.6	54.3	54.3	McCl.
10	1	51.5	51.2	NR	56.4	43.6	54.4	54.5	I. Too
	2	51.5	51.2	NR	56.4	43.5	54.4	54.5	Rome
	3	51.5	51.2	NR	56.4	43.2	54.4	54.5	Jon.

Station No. 3 Gage down
to extend sand beach.

MONITOR WELL ANALYSIS REPORT

Sample Identification/	Sampling Date	Well-201 (11-9-79)	Well-202 (11-9-79)
Chloride (mg/l)		80.9	70
Conductivity (umhos/cm)		3800 @ 20°C	4550 @ 19°C
Salinity (parts/thousand)		2	3
pH 25°C		4.23	4.17
Sulfate (mg/l)		5974.5	6256.3
Total Dissolved Solids (mg/l)		9218	10928