

To: Ted Wolff and Al Topp

From: Richard Biubaugh

Date: October 4, 1977

Subject: UNITED NUCLEAR CORPORATION'S CHURCHROCK MILL TAILINGS SPILL.

On September 27, 1977, I was accompanying Dan Vigil, Regional Manager, and Bob Triviso, the recently hired Environmentalist in Gallup, on a surveillance tour of the Churchrock Mining Area. As we drove by the UNC millsite at approximately 1:00 pm we saw what appeared to be tailings east of and adjacent to the road (Hwy). The material had flowed both north and south of the trough containing the two 8" tailings lines which carry tailings from the mill to the tailings pond.

To the north of the tailings lines (see photographs 1 & 2), is a concrete trough approximately 14-16 feet wide and 25 feet deep which extends from two culverts beneath the road (see photo #6) thru an arc and a distance of approximately 25-30 feet. At the end of this concrete trough is drop of approximately 4 feet to an existing arroyo bed which through a distance of approximately 400 - 500 to the north fork of the Rio Puerco (see photos #1, #4, & #9). The width and depth of the arroyo varies considerable. The widest spot shown in photo #1 may be as wide as 50 or 60 feet and the narrowest point may be about 2 feet wide. The area adjacent to the stream flow is fairly large (see photo #9) with approximately four points of entry for the material, two contoured flows directly to the stream and two through culverts.

On the south side of the tailings lines (see photo #3) was a fenced line (restricted area fence) which had the material on both sides of it. The road to the tailings pond came thru the fence and ran adjacent to a retention facility which also contained a considerable amount of the material. The majority of the material obviously had flowed to this side of the tailings lines. My estimation of material on the north side compared to that on the south side would be in the range of 1:4 or 1:3.

There was also a dead cow in the material where the circled X is indicated in photo #3. It was fairly obvious that the animal had been hit by a vehicle as its head had almost been torn from the body. There was also a dead cow on the west shoulder of the road which had apparently been killed by a vehicle too. I later heard Todd Miller, the Environmental Coordinator and Acting RSO (Radiation Safety Officer), instruct someone to call the livestock Board for a Board Inspector. I feel fairly confident that the animals were killed by moving vehicles and that their death is unrelated to this incident. We stopped the car and got out to investigate. It was raining lightly. I took a small cubitainer sample (quart) of the material, and we then proceeded to the mill office to locate Mr. Todd Miller, the Environmental Coordinator. He was not immediately available, and the receptionist did not know where he was. We then drove to the mine sites of Kerr McGee and United Nuclear for the purpose of acquainting the new environmentalist of their locations and environmental issues. It was approximately 1:20 pm when we returned to the mill office and found Mr. Miller in.

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I confronted him with the facts. He said he wasn't sure whether it was tailings or not. I said I was fairly sure because it smelled like tailings. He then said he thought it was also, but had just spotted the situation himself about 12:30. I asked him what happened. He said he didn't know but would find out. He made a telephone call during which he laughed and made the comment that, "It was what we would call good timing" and that they had gotten caught.

He said that apparently what happened was that a CCD (Counter-Current decontation operator had failed to flush one of the tailings lines prior to leaving for the weekend and it plugged up with sands. When attempting to start up on the line. Monday evening, it found to be plugged, and early Tuesday morning (Graveyard shift) the CCD operator attempted to flush with high pressure water flow (make-up water from ion-exchange effluent), a coupling burst free on the west side of the road, allowing the material to flow out of an approximate 1enth opening. (It was explained that the pipes would move laterally within the loosened coupling, providing a flow space of approximately one inch. Mr. Miller estimated approximately one ton of tailings material was released, with the only liquid being the make-up water from the ion-exchange plant. After explaining this to us, he took us through the mill gate to the site. We examined the pipe which was intact with no leakage occurring. This was a little after two o'clock. We proceeded to the arroyo and followed it to the creek where slimes were observed entering the creek which was estimated to be flowing at the rate of 4000 gpm by Mr. Miller. It was still lightly raining. We returned to the office when I placed my call to Mr. Topp in the Santa Fe office. The situation was explained to Mr. Topp, Mr. Russ Rhoades, and Mr. Bruce Garber. I received instructions as to clean-up operations and so did Mr. Miller. It was also decided that samples were needed. I was instructed to take water samples from the stream at the boundary and a few miles downstream.

Mr. Vivil and Mr. Triviso returned to Gallup to obtain a camera, and I accompanied Mr. Miller to four sampling locations he was familiar with. It turned out to be practically impossible to collect a sample at the boundary due to a 60 foot deep arroyo. We collected two one gallon samples at the following locations:

- 1) the dirt road crossing at the creek north of the tailings area. (upstream sample)
- 2) the culvert beneath the temporary road from the mill to the tailings area, approximately 100 feet below the point where the arroyo empties to the stream.
- 3) the stream below the bridge at the Pinedale Road Crossing, and
- 4) the stream below the bridge on the paved road at the location used by USGS for their gauging station.

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After collecting the first two samples, we met with Mr. Gus Swonquist, Mill Manager, and notified him of the need to begin clean-up operations as soon as possible. He was very cooperative and went with us immediately to the spill area. He asked if the following actions would meet with our approval:

- 1) throw up a 4 foot beam across the arroyo where they could get the front end loader to without getting it stuck. (The area was extremely muddy because of the rain).
- 2) clean-up the area behind the temporary beam with the front end loader where possible and shovels in areas not accessible to the loader.
- 3) Clean-up the area below the beam with shovels as much as possible.

Photographs #1 and #2 were taken at approximately 4:40 pm and show the clean-up activity in progress at that time. The men were removing the slimes in the lower area with shovels in a "fire-line" manner since the footing was very poor.

Upon returning the following day, it was found that the clean-up activities had been proceeding full-speed. Photographs #4,5,6,7, & 8 depict the clean-up activities witnessed on 9-28-77. There were four areas of activity defined. The first is the large area from the road to the first berm located in front of the telephone poles shown in photo #4. The same area is shown in photos #6, 7, and 8. Photo #8 also shows the second area, which is a smaller area between the two berms. This was the area where clean-up was first attempted. The third area is partially shown in photo #9. This is the area from the second, smaller berm to the creek. This area was to be cleaned up when the posting improved somewhat. Mr. Miller indicated in a telephone call on 9-30-77. That this area would be completely cleaned up by noon 9-30-77. The fourth area, and lowest priority was the area south of the tailings lines shown in photo #5. The material in the retention facility would not be removed at this time. All the clean-up material was to be placed in the tailings pond. An attempt will be made to inventory the clean-up material. A gamma survey will also be conducted.

During my visit to the mill on 9-28-77, Mr. Miller had a slightly different version of the incident. It was as follows:

On Friday 9-23-77, there was a failure to properly flush the tailings line before shutdown. On Monday, it was discovered that the line was plugged, so the other line was used.

On Tuesday, at approximately 6:00 pm on graveyard shift, they took the line apart and flushed. Everything was back together by 12:30 pm shortly before Mr. Miller noticed it, and approximately 30 minutes before we saw it.

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I discussed the incident more fully with Mr. Miller by telephone Thursday (9-29-77 am). He gave me the following story:

On Monday, the swing shift (4:00 pm - 12:00 midnight) took the line apart; that is, they removed one or both of the sections indicated in photographs 2 and 3. They found the line "packed full of sands". They attempted to flush, but couldn't since there was insufficient water pressure. They did not replace the removed pipe section(s). According to Mr. Miller, a Mr. Richard Stout would have initiated the work order.

At this time (mid-night), there was only a little material in the launder. The graveyard shift attempted to flush the line, but couldn't since there was still no water pressure. The pipe sections were not replaced.

At approximately 6:00 am, the graveyard CCD operator who turned out to be a utility operator (fills in where needed), J. Tony, flushed the line from the CCD pumphouse which has a different water circuit with sufficient pressure.

It is still not clear at this time (Friday pm) what the actual flow rate and duration of the flushing activity were. Mr. Miller has been unable to contact this individual. This information should be contained in the Company's report to the Agency. The rate of flow was first estimated to be 20-30 gpm by T. Miller, then later estimated to be as high as 100 gpm.

At any rate, the flushing continued until a Mr. Jack James, tailings operator was the spill and notified the CCD operator to shut down the pump.

The day shift came on and appeared at the scene about 8:30 am (Mr. Miller arrives at work at 7:30 am). These individuals were Ron Girard, Kenneth Kirk, and Sandy Pasquole. They told Mr. Miller that when they arrived, there was not much material on the north side of the lines compared with that on the south side.

Their first action was to flush the launder for approximately 20 minutes. They flushed the tailings material towards the tailings pond with a high pressure water hose with a flow of approximately 100 gpm. They said most of this flushing activity was contained within the launder. They then reconnected the eastern most section of pipe. This took approximately 40 minutes. They then flushed the pipe with the high pressure water for about 20 minutes. There was some flow back and splash from this activity. Mr. Miller estimated approximately 1-2 gpm. If any solids flowed out, it probably would have been slimes as they are lighter than the sands. They then reconnected the next section of pipe (40 minutes) and flushed (20 min). They completed the final reconnection and reported to the foreman Mr. Wilson and the CCD operator who continued the flushing operation from the pumphouse. This activity was completed at approximately 12:00 noon.

The length of pipe from the CCD pumphouse to the spill location is approximately 200 feet. The inside diameter is 8 inches. If full, this section of pipe would contain approximately 2.25 tons of solids, 40% of which are slimes.

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containing approximately 500 gpm Ra-226. Assuming a 2 gpm flow during the flushing activity at the spill location and a 60 minute duration, approximately 120 gallons of liquid with some quantity of suspended slimes would be released to the area of the spill.

Again, it should be remembered that only 25-35% of the material released flowed to the arroyo and had access to the creek. The estimations here may be completely off base due to the uncertainties involved.

Mr. Miller has assured me that all areas that were accessible were cleaned up. This included 2-6 inches of top soil. He stated that the two areas under water (behind the berms) would be allowed to dry before completing the clean-up, hopefully within 2 weeks. Their report to the agency should include much of this information.

It should be stressed that the response and cooperation of the Company, once aware of the situation, was very good. However, there is some indication that this, or a similar situation may have occurred before without our being aware of it. This was implied in a remark by a foreman (Laison) on the clean-up operation who was heard to ask, when given instructions, "Do you want us to do it like the last time?"

The retention facility on the south side of the lines was constructed, prior to amending the license, with the function of an emergency spillway. I directed Mr. Miller to have Mr. Abbiss and Mr. Savignac to amend their license in regards to this item.

One additional point that should be stressed is that Mr. Miller, acting RSO was not aware of this situation, and was, therefore, unable to take any corrective action until we notified him that something was needed to stop the flow of material to the creek. The work order presumably a non-routine work order, was issued Monday evening, the accident occurred at 6:00 am, Mr. Miller was on duty at 7:30 am, and nothing was done until 3:30-4:00 pm.

When questioned, Mr. Miller stated that the flushing operations had occurred before. However, he stated that, to his knowledge, a release of tailings to the creek had never occurred before.

emm

(3)

$100 \text{ gpm} \times 60 \text{ min} = 6000 \text{ gal of slurry.}$
need specific gravity of slurry to get weight.

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II. EQUIPMENT

The intent is to at all times have the most modern, efficient equipment available from all three fields of supply, laundry, health physics, and waste handling; obsolete, worn out broken equipment will be replaced by equivalent equipment or better. The facility was chosen and the equipment was designed to at all times protect health and minimize danger to life and property.

A. Laundry

The equipment employed in the laundry includes, but is not necessarily limited to, the following:

1. One 100-lb Cooke Washette *not used*
2. One 200-lb washer-extractor type Washer Braun *used*
3. One 400-lb washer-extractor type Washer Braun
4. Five 100-lb 4242-type Cissell dryers *yes*
5. One button machine
6. Two shakeout tables
7. Six monitoring tables
8. One Bunn tying machine
9. One laboratory-type hood
10. Four absolute filters
11. Four prefilters

B. Health Physics

The health physics monitoring equipment utilized in the laundry includes, but is not necessarily limited to, the following:

1. One Eberline 3-500-A survey meter (beta, gamma) ✓
2. One Eberline PAC-ISA survey meter (alpha) ✓
3. ~~One~~ Eberline radiation monitor Model RM-14 (beta, gamma) ✓
4. ~~One~~ Eberline radiation monitor Model RM-15 (alpha) ✓
5. One air monitoring system (samples are counted on laboratory counting equipment)
6. One Bendix Micronair breathing-zone air sampler ✓
7. Counting equipment
 - a. One Eberline SAC-4 scintillation alpha counter ✓
 - b. One Eberline BC-4 beta-gamma counter ✓

Memo to: Ted Wolff and Al Tapp (Copy to Don)
From: Richard Blumhugh
Subject: United Nuclear Corp's. CHURCHROCK MILL
TAILINGS SPILL.

On September 27, 1977, I was accompanying Don Vigil, Regional Manager, and Bob Trivise, the recently hired Environmentalist in Gallup, on a surveillance tour of the Churchrock Mining Area. As we drove by the UNC millsite, ^{at approximately 1:00 pm} we saw what appeared to be ^{tailings} ^{east of and} adjacent to the road (Hwy —). The material had flowed both north and south of the trough containing the two 8" tailings lines which carry tailings from the mill to the tailings pond. To the north of tailings lines (see photographs 1 & 2) is a concrete trough approximately ¹⁴⁻¹⁶ feet wide and 2.5 feet deep which extends from two culverts beneath the road (see photo #6) to show an arc and a distance of approximately 30 feet. ~~At the end of this~~ At the end of this concrete trough is a drop of approximately 4 feet to an existing arroyo bed which meanders through a distance of approximately 400-500' to the north fork of the Rio Puerco (see photos #1, #4, & #9). The width and depth of the arroyo varies considerably. The widest spot shown in photo #1 may be as wide as 50 or 60 feet and the narrowest point may be ~~as~~ about 2 feet wide. The area adjacent to the stream flow is fairly large (see photo #9) with approximately four points of entry for the material, two contained flows ^{directly} to the ~~stream~~ ^{stream}, and two through culverts.

On the south side of the tailings lines (see photo #3) was a ~~fenced~~ ^{large} restricted area fence which had ~~the~~ the material on both sides of it. The road to the tailings pond came thru the fence and ran adjacent to a retention facility which

also contained a considerable amount of the material. The majority of the material obviously had flowed to this side of the tailings line. My estimation of material on the north side compared to that on the south side would be in the range of 1:4 or 1:3.

There was also a dead cow in the material where the circle X is indicated in photo #3. It was fairly obvious that the animal had been hit by a vehicle as its head had almost been torn from the body. There was also a dead cow on the west shoulder of the road which had apparently been killed by a vehicle, ~~etc.~~ I later heard Topo Miller, the Environmental Coordinator and Acting RSO (Radiation Safety Officer) instruct someone to call the Livestock Board for a Grand Board inquest. I feel fairly confident that the animals were killed by moving vehicles and that their death is unrelated to this incident.

We ~~stopped the~~ ^{It was raining lightly.} car and got out to investigate. I took a small cubitainer sample (quart) of the material, and we then proceeded to the mill office to locate Mr. Todd Miller, the Environmental Coordinator. He was not immediately available, and the receptionist ~~was~~ did not know where he was. We then drove to the mine sites of Ken McBe and United Nuclear ~~for~~ for the purpose of acquainting the new environmentalist of their locations and environmental issues. It was approximately 1:20 pm when we returned to the mill office and found Mr. Miller in.

I confronted him with the facts. He said he wasn't sure whether it was tailings or not. I said I was ~~fairly~~ ^{fairly} sure because ~~they~~ ^{it} smelled like tailings. He then said he thought it was also but had just spotted the situation himself about 12:30.

Mr. Topp, Mr. Russ Rhoades, and Mr. Gene Garber. I received instructions as to clean-up operations and so did Mr. Mettler. It was ^{also} decided that samples were needed. I was instructed to take water samples from the stream at the boundary and a few miles downstream.

Mr. Vigil and Mr. Trivisio returned to Gallup to obtain a camera, and I accompanied Mr. Mettler ~~to~~ to four sampling locations he was familiar with. It turned out to be practically impossible to collect a sample at the boundary due to a 60 foot ^{deep} arroyo. We collected two ~~of~~ one gallon samples at the following locations:

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- 2) the culvert beneath the temporary road from the mill to the tailings area, approximately 100 feet below the point where the arroyo empties to the stream.
- 3) the stream below the bridge at the Glendale Road crossing, and
- 4) the stream below the bridge on the paved road at the location used by USGS for their gauging station.

After collecting the first two samples, we met with Mr. Gus Swongquist, Mill Manager, and notified him of the need to begin clean-up operations as soon as possible. He was very cooperative and went with us immediately to the spill area.

He asked if the following actions would meet with our approval:

- 1) Throw up a 4 foot beam across the arroyo where they ^{could} get the front end loader to without getting it stuck. (The area was extremely muddy because of the rain.)

- 2) Clean-up the area behind the temporary beam with the front end loader where possible and shovels ~~and~~ in areas not accessible to the loader.
- 3) Clean-up the area below the beam with shovels as much as possible.

Photographs #1 and #2 were taken at approximately 4:40 pm and show the clean-up activity in progress at that time. The men were removing the slimes in the lower area with shovels in a "fire-line" manner since the footing was very poor.

Upon returning the following day, it was found that the clean-up activities had been proceeding full-speed. Photographs #4, 5, 6, 7, + 8 depict the clean-up activities witnessed on 9/28/77. There were four areas of activity defined. The first is the large area from the road to the first beam located in front of the ~~telephone~~^{telephone} poles shown in photo #4. The same area is shown in photos #6, 7 and 8. Photo #8 also shows the second area, which is a smaller area between the two beams. This was the area ~~first~~ where clean-up was first attempted. The third area is partially shown in photo #9. This is the area from the second, smaller beam to the creek. This area was to be cleaned up when the footing improved somewhat. Mr. Miller indicated in a telephone call on 9/30/77 that this area ~~was~~ would be completely cleaned-up by noon, 9/30/77. The fourth area, and lowest priority was the area south of the ~~tailings~~^{tailings} shown in photo #5. The material in the retention facility would not be removed at this time. All the clean-up material was to be placed in the tailings pond. An attempt will be made to inventory the clean-up material. A gamma survey will also be conducted.

During my visit to the mill on 9/28/77, Mr. Miller ~~advised me that~~ had a slightly different version of the incident. It was as follows:

On Friday 9/23/77, there was a failure to ~~be~~ properly flush the tailings line before shutdown. On Monday, it was discovered that the line was plugged, so the other line was used.

On Tuesday, at approximately 6:00 am on Graveyard shift, they took the line apart and flushed. Everything was back together by 12:30 pm shortly before Mr. Miller noticed it, and approximately 30 minutes before we saw it.

I discussed the incident more fully with Mr. Miller ~~by~~ telephone Thursday (9/29/77) a.m. He gave me the following story:

On Monday, the Sewing Shift (4:00 pm - 12:00 midnight) took the line apart; that is, they removed one or both of the sections indicated in photographs 2 and 3. They found the line "packed full of sand". They attempted to flush, but ^{couldn't} since there was insufficient water pressure, they did not replace the removed pipe section(s). According to Mr. Miller, a Mr. Richard Stout would have initiated the work order.

At this time (midnight), there was only a little material in the launder.

The Graveyard Shift attempted to ~~then~~ flush the line, but couldn't since there was still no water pressure. The pipe sections were not replaced.

At approximately 6:00 am, the graveyard C.C.O. operator who turned out to be a utility operator (fills in when needed), J. Tony, flushed the line from the C.C.O. pump house which has a different water circuit with sufficient pressure.

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It is still not clear at this time (Friday pm) what the actual flow rate and duration of the flushing activity were. Mr. Miller has been unable to contact this individual. This information should be contained in the Company's report to the Agency. The rate of flow was first estimated to be 20-30 gpm by T. Miller, then later estimated to be as high as 100 gpm.

At any rate, the flushing continued until a Mr. Jack Jones, tailings operator saw the spill and notified the CEO operator to shut down the pump.

The day shift came on and appeared at the scene about 8:30 am. (Mr. Miller arrives at work at 7:30 am.) These individuals were Ron Girard, Kenneth Kuit, and Sandy Pasquale. They told Mr. Miller that when they arrived, there was not much material on the north side of the line compared with that on the south side.

Their first action was to flush the launder for approximately 20 minutes. They flushed the tailings material towards the tailings pond with a high pressure water hose with a flow of approximately ~~100 gpm~~ 100 gpm. They said most of this flushing activity was contained within the launder. They then reconnected the eastern most section of pipe. This took approximately 40 minutes. They then flushed the pipe with the high pressure water for about 20 minutes. There was some flow back and splash from this activity. Mr. Miller estimated approximately 1-2 ~~gpm~~ ^{gpm}. If any solids ~~were~~ ^{were} flushed out, it ^{probably} would have been slimes as they are lighter than the sands. They then reconnected the next section of pipe (40 minutes) and flushed (20 min). They completed the final reconnection and reported to the

8.
foreman Mr. Wilson and the CCO operator who continued the flushing operation from the pump house. This activity was completed at approximately 12:00 noon.

The length of pipe from the CCO pump house to the spill location is approximately 200 feet. The inside diameter is 8 inches. If full, this section of pipe would contain approximately ~~225~~ 225 tons of solids, 40% of which are slimes containing approximately 500 ppm ka-226. Assuming a 2 gpm flow during the flushing activity ~~at~~ at the spill location and a 60 minute duration, approximately 120 gallons of liquid with some quantity of suspended slimes would be released to the area of the spill. ~~If only 25 gpm~~

~~material in the pipe flowed toward the creek,~~
Again, it should be remembered that only 25-35% of the material released flowed to the arroyo and had access to the creek. The estimations here may be completely off base due to the uncertainties involved.

Mr. Miller has assured me that all areas that were accessible were cleaned up. This included 2-6 inches of topsoil. He stated that the two areas under water (behind the beams) would be allowed to dry before completing the clean-up, hopefully within 2 weeks. Their report to the Agency should include much of this information.

It should be stressed that the response and cooperation of the company, once aware of the situation, was very good. However, there is some indication that this, or a similar situation may have occurred before without our ~~being~~ being aware of it. This was implied in a remark by a foreman ^(Lawson) on the clean-up operation who was heard to say, when ~~given~~ given instructions, "Do you want us to do it like the last time?"

9.
The retention facility on the south side of the line was constructed, prior to ~~the~~ amending the license, with the function of an emergency spillway. I directed Mr. Miller to show Mr. Abbin and Mr. Sanguino to amend their license in regards to this item.

One ^{additional} point that should be stressed is that Mr. Miller, Acting RSO, was not aware of this situation, and was, therefore, unable to take any corrective action until we notified him that something was needed to stop the flow of material to the creek. The work order, presumably a non-routine work order, was issued Monday evening, the accident occurred at 6:00 am, Mr. Miller was on duty at 7:30 am, and nothing was done until 3:30-4:00 pm.

When questioned, Mr. Miller stated that ^{the} flushing operations had occurred before. However, he stated that, to his knowledge, a release of tailings to the creek had never occurred before.

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When questioned, Mr. Miller stated that ^{the} flushing operations had occurred before. However, he stated that, to his knowledge, a release of tailings to the creek had never occurred before.

CHURCH ROCK URANIUM MILL EFFLUENT

MAY 3, 1977 TO JUNE 30, 1977

	<u>Liquid Effluents</u>	<u>Annual Population Dose Rate Estimate</u>
U-natural	0.0 μ Ci/ml	0.0 man-rem/yr.
Th-230	0.0	0.0
Ra-226	0.0	0.0

	<u>Gaseous and Particulate Effluent</u>	<u>Annual Population Dose Rate Estimate</u>
U-natural	1.5×10^{-13} μ Ci/ml	3.2 man-rem/yr.
Th-230	1.4×10^{-14}	7.1
Ra-226	1.4×10^{-14}	1.1
Rn-222	1.6×10^{-15}	<u>7.1×10^{-4}</u>
TOTAL:		11.4