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MEMORANDUM

TO: Felix Miera, Program Manager, Uranium Licensing Section

FROM: Sam Simpson, Uranium Licensing Section

DATE: January 31, 1984

SUBJECT: Reclamation of the Johnny M. Mine Site

This memo addresses reclamation activities by Ranchers Exploration and Development Corporation, as relates to the EID licensed tailing backfill operations at the Johnny M. Mine project.

a. Background

Ranchers Exploration and Development Corp. applied to the EID for a radioactive material license (RML) on June 17, 1977. The purpose for which the RML was requested involved the use of uranium mill tailings, acquire from the Kerr McGee Corp. tailings impoundment area, to backfill evacuated stopes in Ranchers Johnny M. Mine at San Mateo, N.M. This innovation process is employed to prevent caving and to reduce the vulnerability of possible breaks in the integrity of the Dakota aquifer located above the mine. The operation consisted of transporting an estimated 8,000 tons of tailings per month from Kerr McGee to the Johnny M. Mine site with interim tailings storage being accomplished at both the north and south bore hole underground injection sites, which essentially consisted of approximate one acre site at each location. Sand or mill tailings were slurried with water to about 50% solids by weight and then pumped underground to the stopes or open areas for backfill.

The Radioactive Material License (NM-RED-MB-00) was issued by the EID on June 21, 1977, with an expiration date of February 28, 1978. Thirteen amendments to the original license have been granted by the EID for a variety of reasons. The license amendments beginning on February 28, 1978, have extended the expiration date because of operational and final reclamation delays experienced by Ranchers Exploration and Development Corp. A final termination report was

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submitted by Ranchers to the EID on August 23, 1983. EID staff and field personnel were involved in gamma surveys during each distinct phase of the reclamation and according to Ranchers (page 1, Gamma Surveys, Termination Report,) each phase of the reclamation plan was conducted with the prior knowledge and approval of the EID (Reference Attachment 1). With the high turnover rate of Radiation Protection Bureau personnel, at least five previous Environmental Scientists from the RPB managed this endeavor, from my position it is impossible to determine the complete accuracy of this statement. The last amendment to the license was issued on September 30, 1983, which extended the expiration date for 180 days, to expire on March 31, 1984. This extension was necessary for the EID to conduct a site verification inspection and evaluate data acquired from this inspection.

b. Reclamation Standards Provided to Ranchers

On June 22, 1982, the EID provided Ranchers with reclamation standards for the two small, approximately one acre each, tailing surface storage areas. Ranchers in their May 11, 1982 letter to EID explicitly states, "that any EID jurisdiction over cleanup or decontamination at the Johnny M. Mine relates only to two relatively small surface areas". At a conference conducted on May 7, 1982, at the Crown Building, the EID staff agreed that our jurisdiction indeed only pertained to the two licensed storage areas.

The reclamation standards provided by EID to Ranchers (EID June 22, 1982 letter) for satisfactory cleanup measures essentially followed the Federal 10 CFR 20 standards, commonly referred to as the 500 millirem rule. This equates to 57 microroentgens p/hr plus background (measured to be approximately 10 microroentgens p/hr). Therefore, gamma radioactivity levels, taken in the air at 1 meter, shall not exceed 67 microroentgens p/hr at the backfill storage areas. Provisions were established in this EID letter to enforce the ALARA principal by delineating 25 microroentgens per hour as a target level that the EID believed Ranchers could achieve in most cases with their suggested program of scraping, clean up, and cover.

Since all situations cannot be rigidly covered by the regulations, provisions in accordance with the NMRPR, Part 4-150B, were provided for Ranchers to request exemptions. The Division made a commitment to approve the exemptions requested only if it was demonstrated that Ranchers new proposals are not likely to cause any individual to receive a dose to the whole body in any period of one calendar year in excess of .5 rem (500 mrem above background).

c. Reclamation Activities

1. A July 19, 1982 EID memo, contains a status report on a site visit by EID staff personnel. At the time of this site visit,

(July 15, 1982) the south bore hole had been scraped and only has a few hot spots left. These spots would be covered and the area graded. The north bore hole required extensive scraping and covering, however, gamma readings were only slightly above the limits specified above.

2. On September 1, 1982, three members of the EID staff visited the Johnny M. Mine site and collected composite soil samples to assist in determination of background radiation levels at the project site. Radiochemical analysis of the soil samples was performed by Eberline Corp. as relates to Ra-226. The results at the north bore hole range from 45 ± 14 to 62 ± 19 pCi/g/dry and at the south bore hole 24 ± 7 to 68 ± 20 pCi/g/dry. These values are not representative of the region. In 1981, soil samples collected from background areas that included San Mateo, Crownpoint, and Marquez had Ra-226 mean values of 0.71, 0.65, and 0.64 pCi/g respectively.

Radon measurements taken at the site September 1-3, 1982, reflect after corrections, a probable annual average at the north bore hole of $.41 \pm .16$ pCi/l and the south bore hole of $.42 \pm .24$ pCi/l.

3. Ranchers termination report indicates that the initial clean up surveys (5/82) at the south bore hole indicate a mean gamma in air reading of 47 μ r/hr. The second clean up effort (6/16/82) elevated gamma readings to 60 μ r/hr p/hr, while the final clean up effort (8/17/82) "succeeded" only in raising gamma radioactivity to a level of 183 μ r/hr.

Reclamation activities at the north bore hole essentially proved fruitless. From the initial survey (5/82) of 158 μ r/hr the final survey revealed a reading of 153 μ r/hr.

4. The final EID site verification survey conducted on September 14, 1983, shown in Attachment 2, ascertained that the average gamma intensity readings, using a PRM-7 meter @ 1 meter in the air, were 228 μ r/hr ± 174 and 151 μ r/hr ± 60 at the north and south bore hole respectively.

d. Measurements

The EID survey team on September 14, 1983, took measurements of direct gamma-ray exposure rates one meter above the ground using an Eberline PRM-7 portable survey instrument. Measurements were made at the north and south bore hole former tailings storage areas and at adjacent borrow soil areas at varying intervals because of the nature of the site terrain. Measurements were made at approximate 50' intervals with results indicated in Attachment 2.

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The highest exposure rates off the north tailings storage pads were 1000 $\mu\text{r/hr}$ about 30' due east of the north storage pad eastern perimeter. The lowest exposure rate was 60 $\mu\text{r/hr}$ along the northeast quadrant. The south bore hole sand fill storage areas highest exposure measurement recorded was 400 $\mu\text{r/hr}$, approximately 50' east of the storage areas. Thirteen measurements at the north bore hole were taken with a mean of 228 ± 174 $\mu\text{r/hr}$. A total of 29 measurements taken at south bore hole sand fill storage area with a mean of 151 ± 60 $\mu\text{r/hr}$.

e. Problem

The acquisition of cover material from adjacent borrow material zones undoubtedly generated the elevated levels of radioactivity at the storage areas. Measurements as high as 1000 $\mu\text{r/hr}$ were observed along the face of the canyon in the vicinity of where the cover material was acquired. These elevated readings can be attributed to natural outcropping or possibly from some earlier deposited mine spoils. The "background" levels of Ra-226 content in the soil is quite elevated from natural background levels experienced in other locales in the region.

Spot gamma measurements taken outside the licensed zones reveal readings in the 300-400 $\mu\text{r/hr}$ range within a few feet of the tailings storage pads and in the main mine yard complex. Remember these zones are outside EID's regulatory function and represent a rather large land mass related to the small areas licensed by EID. To further complicate matters, surface water drainage patterns at the north bore hole flows down the canyon walls, these soils contain elevated levels of radioactivity, and over the former north tailing storage site.

Revegetation efforts in the licensed zones were in the most part unsuccessful. Species observed were those typical to disturbed habitats and included Bottle Brush Squirrel Tail, Beloedere Summer Cypress and Russian Thistle.

f. Summary

Ranchers position basically is one whereby their personnel with the knowledge and approval of EID attempted a good faith reclamation effort to adhere to standards provided by this agency. The final reclamation activity, after considerable expenditures of manpower and equipment resources, did not accomplish its goal. In fact virtually no progress was made at the north bore hole, a 158 $\mu\text{r/hr}$ to 153 $\mu\text{r/hr}$ reduction, and the south bore hole storage area was degraded by almost a factor of four (47 $\mu\text{r/hr}$ after scraping to 183 $\mu\text{r/hr}$ final clean-up). In my opinion the basic mistake was to acquire conveniently located

borrow material, which contained enhanced radioactivity attributed to outcropping along the canyon wall and possibly some earlier deposited mine spoils, and use this material as cover. In any case, both Ranchers and EID gamma surveys show the standard of 67 $\mu\text{r/hr}$ having been exceeded by a considerable margin at both sites as noted below:

1. North Bore Hole: Ranchers 153 $\mu\text{r/hr}$; EID 228 $\mu\text{r/hr}$.
2. South Bore Hole: Ranchers 183 $\mu\text{r/hr}$; EID 151 $\mu\text{r/hr}$.

g. Other Factors

1. A May 4, 1982, letter from Randy Hicks (Groundwater Section) to Mrs. Lee and Mr. Sonny Marquez, ranch owners, stipulated that the State was interested in monitoring ground water because of employment of mine stope backfilling with uranium mill tailings. Since substantial amounts of uranium mill tailings are deposited in the mined out portions of the underground mine, the State desired to study the effects of this practice on the water quality at the 1500 foot level.

My telephone discussion with Mr. Hicks (former EID employee) on December 27, 1983, revealed that his first attempt to take water samples was unsuccessful, lost three bailers and there was no evidence the aquifer had recharged. To his knowledge no further efforts were made to acquire water samples and ascertain the quality of the groundwater. Only the north bore hole is still open to the 1500' depth while the south bore hole has been cemented. There is a possibility that the north bore hole will be plugged, therefore this might be an ideal time to attempt resampling of groundwater.

2. The surface water flow drainage pattern, at the north bore hole, is down the south face of the canyon wall and flows over the former tailings storage pad. Elevated levels of radioactivity from outcroppings coupled with surface drainage will eventually erode away any subsequently replaced cover material and replace it with soils elevated in residual radioactivity.
3. The record does not reflect any detailed pre-operational surveys which is understandable since EID licensing activities for backfilling commenced quite a few years after the mining operation was started by Ranchers. In other words, the area was already disturbed and ascertaining background radiation levels at the mine complex would have been extremely difficult. Therefore, background levels of Ra-226 in the soil and gamma air surveys are not available. The EID personnel determined gamma background levels by taking air surveys in undisturbed areas outside the mining complex. A comprehensive preoperational survey of the site might have revealed highly elevated levels of radioactivity from the outcropping and therefore it is possible that the stan-

dards for clean-up were not realistically determined based on final termination inspection findings.

4. There is no coordinated approach for reclamation at a mine site unless it is located on Indian land. The basic dilemma is the piece-meal approach involving reclamation. In this instance, the EID has limited jurisdiction and has authority only to enforce compliance on an estimated two acres in a relative large mining complex involving hundreds of acres. The whole process is seriously flawed. There is an urgent need to have joint coordinated efforts across jurisdictional regulatory lines to enforce compliance with radioactive clean-up standards as it relates to the entire project environs. Anything less is a rather foolhardy approach. The inevitable result of current policies at best only guarantees at least postage stamp clean up of relatively elevated zones of radioactivity while allowing surrounding terrain to exist with elevated levels of residual radiation.

h. Recommendation

Unless some other State or Federal agency can enforce radiological cleanup to standards to meet the .5 rem guidelines throughout the mine complex, to insist on a reclamation effort to clean-up just a small plot of land does not appear warranted or justified. The economic resources devoted to such a project would virtually be wasted because within a few years windblown and water carried soils with elevated levels of radioactivity, will obscure any progress accomplished as related to new cover material spread over the licensed zones to reduce radioactivity levels.

The criteria for land decontamination have the objective of reducing residual gamma radiation levels which are as low as reasonably achievable (ALARA). However, topographic and economic consideration frequently preclude complete decontamination. Recommend under the circumstances that no further scraping or cover material be placed over the previous uranium tailings sand fill storage pads. The revegetation efforts in the reclaimed area were for the most part unsuccessful. Therefore, the former north and south tailings sand fill area should be disced and reseeded with an appropriate grass seed native to that region.

Once this revegetation measure is completed recommend termination of the Radioactive Material License.