PATHFINDER
A Cogema Resources Company

May 13, 1996

Joseph J. Holonich, Chief
Uranium Recovery Branch
Division of Waste Management,
Office of Nuclear Material Safety & Safeguards
U.S. Nuclear Regulatory Commission
Washington, D. C. 20555

Re: Docket No. 40-2259
License No. SUA-672

Dear Mr. Holonich:

Enclosed please find five sets of revised pages to Appendix H, Volume II, of the Lucky Mc Mine Tailings Reclamation Plan. These revisions were necessitated by the modifications to the soil cleanup plan as presented in Pathfinder's submittal to the NRC dated May 09, 1996. Please replace pages six and seven, and Standard Operating Procedure 03.020.01 with the enclosures.

Sincerely,

T. W. Hardgrove
Coordinator of Mine Environmental Affairs

cc: E. L. Nugent
R. W. Poyser
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4. Soil Cleanup Verification Survey and Sampling Plan

A final gamma-ray survey of the reclaimed area will be performed using the GPS-based equipment or conventional equipment as described above. For the GPS-based survey, a minimum of 7 data records in each 100-m^2 grid block will be used to obtain the average gamma count rate for the mill site and any other areas where localized hot spots could exist. For the windblown areas, a minimum of 5 data records have been shown to be sufficient. For conventional surveys, an integrated count over 60 seconds while walking the area will be used as the average count rate.

For all grid blocks that exceed a count rate (bare Ludlum 44-10 detector) of 55,000 cpm, the grid blocks will either be recleaned to below the action level or the grid blocks will be sampled using the five point soil sampling procedure. The sample will be analyzed to assure that the Ra-226 concentration complies with the 9.5 pCi/g limit.

The reclaimed area will then be divided into 500-ft by 500-ft grid blocks using the State Plane Coordinate System. The three 100-m^2 grid blocks within each 500-ft by 500-ft grid block that have the highest average gamma-ray count rates will be sampled using the five point composite method. This will result in a set of Ra-226 concentration data corresponding to the grid blocks having the highest gamma-ray count rates. This subset of biased Ra-226 concentration data should make up the data that approach, or in a few cases, perhaps exceed the cleanup criteria.

In order to demonstrate that the verification procedure identifies areas contaminated at the 9.5 pCi/g limit with a probability of 95 percent, a biased sampling strategy is proposed. The approach in this plan is to show that the mean of the subset of biased samples described above meets the limit, at the 95 percent confidence level. If this is demonstrated, then it is evident that the error rate for the set of all samples that could have been taken should be much less than the error rate for the subset.

The EPA recommended procedure for testing data for compliance with a guideline value at a desired level of confidence (NUREG/CR-5849, Equation 8-13) will be applied to this set of data. The test is to calculate the mean plus the standard error corresponding to the desired level of confidence and compare that value to the cleanup criterion of 9.5 pCi/g. In equation form,

$$\mu_a = \bar{X} + t_{1-\alpha,df}\frac{s}{\sqrt{n}}$$

where $t_{1-\alpha,df}$ is the "t" statistic for the 95% level for the degrees of freedom, df, taken from statistical tables, $\bar{X}$ is the arithmetic mean, s is the standard deviation, and n is the number of data points.

From the "student t" tables, the "t" statistic can be obtained corresponding to the degrees of freedom at the 95 percent confidence (one sided) level. Substituting the numbers in the above equation should result in a value of 9.5 pCi/g or less.

If any sample from a 100 m^2 grid block is found to exceed the 9.5 pCi/g limit, the grid block will be recleaned and a new gamma survey done. For any major grid block that failed the 9.5 pCi/g criterion, the 100 m^2 grid block with the fourth highest average gamma reading will be sampled and analyzed in a similar manner. This procedure will be followed until it is evident that there is a high probability that all portions of the grid block meets the cleanup criteria.

If the mean of the biased samples is less than the 9.5 pCi/g criterion but the data fails the statistical test, a procedure similar to that recommended in Section 8.6 of NUREG/CR-5849 will be followed. The number of biased samples will be increased beyond the initial three per major block to include the 100-m^2 grids with the next highest average gamma levels and the statistical test applied to this set of data. This progressive process may be done until the statistical test is met. In any case, all grid blocks that were sampled and measured to exceed the 9.5 pCi/g will be recleaned and resurveyed.

Based upon the calibration study, uranium is not a problem in the windblown tailings area. Th-230 typically is not a contamination concern relative to windblown tailings, particularly in a location such as the Lucky Mc windblown tailings area where significant spills of contaminated solution never occurred. The historical low volume air sampling data from the two environmental air monitoring stations proximate to the windblown area support the conclusion that Th-230 is not a windblown contamination problem. The Th-230 data for those stations has always been very low.

In the areas close to the mill site where cleanup is planned (such as immediately to the east of the mill site or immediately south of the No. 1 tailings ponds) there is likely to be contamination associated with historical ore storage in those areas. As a result radionuclides such as uranium and Th-230 will be in secular equilibrium with the Ra-226. Therefore, the cleanup program targeting Ra-226 will effectively decontaminate those areas for the other radionuclides. Selected confirmatory analyses will be accomplished to demonstrate this.

PATHFINDER MINES CORPORATION
LUCKY MC MILL SITE
RADIATION SAFETY AND ENVIRONMENTAL
STANDARD OPERATING PROCEDURE

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Title: Soil Cleanup Verification Survey and Sampling Plan

1. Purpose

This procedure provides guidance on how windblown tailings or contaminated soil will be removed and the area verified to meet the cleanup criteria.

2. Responsibilities

The site manager is responsible for assuring that this procedure is implemented. The survey team members and sampling technicians are responsible for following the procedures.

3. Procedure

3.1 Equipment

1. Global positioning system-based radiological survey components (Alternatively, conventional hand-held instrumentation such as the Ludlum Model 2221/44-10 or Ludlum Model 19 or equivalent for localized areas requiring a survey when the global positioning system-based equipment is not available)
2. Data processing/mapping hardware and software
3. Gamma-ray survey maps
4. Soil sampling locations from data sort
5. Post-hole digger or coring instrument
6. Shovel/trowel
7. 30 ml plastic bags or the equivalent
8. Balance
9. Rolling pin, ceramic grinder, or pulverizer
10. Trays
11. Drying oven
12. Two quart plastic bag or the equivalent and marking pins
13. Sample containers
14. Multichannel analyzer with NaI detector
15. 47 ft rope or string with marks at the middle and 7.9 feet from each end
16. Five gallon plastic pails

3.2 Soil Cleanup, Monitoring, and Sampling for Verification

3.2.1 Excavation Control Monitoring

Excavation control monitoring is done by a combination of two methods. The GPS-based radiological survey results in a plot of gamma count rates over large areas. Isocontour lines corresponding to action levels are used to delineate the excavation boundaries for scrapers or other large equipment to use while removing the contaminated material. The action level is determined from the correlation studies included in the Verification Plan, currently 55,000 cpm.

For small areas such as near utility lines, roads, and areas where contamination may be found at considerable depth, ground control technicians using shielded NaI detectors shall conduct radiological surveys and guide the excavation effort. This real-time monitoring information provides a high level of confidence that once the removal is complete, the area will meet the cleanup criteria. Correlation studies for the shielded detectors were performed at the same time as those for the unshielded detectors. The data were provided in the Verification Plan submitted to the NRC. With the Ludlum 2221/44-10 detector (shielded) placed at a height of eighteen inches above the surface, an action level of 14,000 cpm is used. Using the Ludlum Model 19 with three-sided shield (bottom exposed) in contact with the land surface, an action level of 29 uR/hr is used.

3.2.2 Radiological Survey

For the windblown area, a GPS-based gamma survey will be conducted to assure all areas are below 55,000 cpm using detectors as indicated in the "Soil Cleanup Verification Survey and Sampling Plan" which has been approved by the NRC.

3.2.3 Data Evaluation

The computer data sort activity will calculate the average gamma-ray count rate, the number of gamma data records, and the coordinates for each 100 m^2 grid block. Grid blocks with fewer than five (5) gamma data records will normally be resurveyed.

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For areas near the mill site or other areas where localized hot spots may be present, a minimum of seven (7) data records per grid block may be imposed. If resurveying is not practical, each grid block will be sampled using the standard 5 point sampling procedure.

The computer data sort will be used to identify the three 100 m^2 grid blocks within each 500-ft by 500-ft grid having the highest average gamma count rates. A five point composite sample will be prepared for each of those highest count 100 m^2 grid blocks by taking 6-inch deep surface samples. Each area exceeding the 9.5 pCi/g Ra-226 cleanup criterion will be further excavated and a new gamma survey done. If any sampled area requires additional decontamination, the fourth highest area within the grid block will be sampled and evaluated. This procedure will be followed until it is evident that the entire 500-ft grid block will meet the cleanup criterion of 9.5 pCi/g.

Since the presence of the boundary and other features will result in many grids being less than the full 500' by 500', these partial grid blocks will be treated the same as full grid blocks. Where the division into 100 m^2 grid blocks results in partial grid blocks, these small partial grid blocks will not be considered in the set of potential grids to be sampled.

A statistical test will be done to determine whether the mean concentration of the grid blocks is 9.5 pCi/g or less at the 95 per cent confidence level using formula 8-13 of NUREG/CR-5849. Since this represents the mean of a set of biased samples (selected from the three grids per major block that have the highest gamma exposure rates), the passing of this test provides assurance that the error rate is very low for the entire sample set made up of all the possible grids that could have been sampled.

If any sample exceeds the 9.5 pCi/g limit, the area will be recleaned and a new gamma survey done. For any grid block that failed the 9.5 pCi/g criterion, the 100 m^2 grid block with the fourth highest average gamma reading will also be sampled and analyzed in a similar manner. This procedure will be followed until it is evident that there is a high probability that all portions of the grid block meets the cleanup criteria.

If the mean of the samples is less than the 9.5 pCi/g criterion but the data fails the

statistical test, PMC will follow procedures similar to those recommended in Section 8.6 of NUREG/CR-5849. The number of samples will be increased to include the grids with the fourth highest average gamma levels, and the statistical test will be performed again. This progressive process will be followed until the statistical test is met. In any case, all grid blocks that were sampled and measured to exceed the 9.5 pCi/g will be recleaned and resurveyed.

3.2.4 Soil Sampling

The grid block to be sampled will have been marked by the land surveyor. Stakes will be set at the four corners with the state plane coordinates written on the northeast corner stake.

Obtain a rope or string that is 47 feet long. Fold the rope in half and mark the fold by spray paint. Mark the other two sampling points by measuring 7.9 feet from each end. Stretch the rope diagonally across the grid block. The center of the rope will be the geometrical center which will be a sampling point and the other two marked points on the rope will be two other sampling points. The fourth and fifth sampling points will be obtained by stretching the rope along the other diagonal. If the land surveyor has marked the center of each grid, then a 7.9 feet long rope may be used to mark the distance from each corner grid stake along the diagonal that the sample is to be taken.

A five point composite sample will be prepared for each sampled 100 m^2 grid block. At each of the sampling points, a post-hole digger or coring tool will be used to obtain a 6-inch sample. Collect an equal amount of sample from each of the five sample points. The material removed should be a vertical plug extending precisely to a depth of six inches. Transfer the five plugs to the five gallon pail, thoroughly mix, and then pour a composite sample into the plastic bag. Note that rocks (defined as 0.5 inches diameter or larger) should be discarded from the sample. Record the sample number on the plastic bag with a waterproof ink marker and seal the bag.

The sample number will be the same as the grid number with a V1 suffix, indicating that it is the first verification sample, etc. Record the coordinates of the NW corner grid stake along with the sample number and other information required on the soil

sampling data sheet. Fill a second bag with another verification sample of the composite as a backup and for possible confirmatory analysis at a future date. Label the second bag as described above.

Fill in the hole before proceeding to the next hole.

3.2.5 Sample Handling

1. All verification soil samples will be archived for possible splitting with regulatory agencies or other interested parties.

2. Soil samples will be shipped to the vendor laboratory for analysis of Ra-226 by gamma spectrometry. Randomly select five percent of the samples for splitting and additional confirmatory analysis by conventional wet chemistry for Ra-226. Blind label these split samples so the laboratory does not know which primary samples they match. Utilize the chain of custody form provided by the vendor laboratory.

3. Additional analyses may be required for natural uranium and/or Th-230. Any such additional analyses will be at the direction of the site manager.

4.0 References

Soil Cleanup Verification Survey and Sampling Plan for the Lucky Mc Mill Tailings Site, Environmental Restoration Group, Inc., December, 1995.