LANDMARK RECLAMATION

January 20, 1988

Mr. Harry J. Pettengill
U. S. Nuclear Regulatory Commission
Region IV
Uranium Recovery Field Office
Box 25325
Denver, Colorado 80225

Dear Mr. Pettengill:

Landmark Reclamation (Landmark), acting as a subcontractor to Nuclear Assurance Corporation (NAC), is proposing to receive tailings material from cleanup of a radium processing site in the state of New Jersey and to process and dispose of this material in the White Mesa Mill tailings impoundment. This proposal is being undertaken with the concurrence of the partners of the White Mesa Mill; Umetco Minerals Corporation and our parent company, Energy Fuels Nuclear, Inc. You will shortly be receiving authorization from Umetco Minerals to deal directly with Landmark on licensing activities for this project.

The activities at the New Jersey clean up site and transport of the material to the White Mesa Mill site will be the responsibility of NAC. Landmark will assume responsibility at the White Mesa Mill, receive the material, conduct verification of shipping manifests and inventory of material, and arrange for processing and final disposal of the tailings material.

This letter is a formal request for amendment to the White Mesa mill Source Material License (# SUA 1358) to receive, process and permanently dispose of this material.

This material is coming from several sites in the state of New Jersey which were dump sites in the early 1900's from the milling of carnotite ore from Paradox Valley, Montrose County, Colorado. This ore was processed for radium extraction at a plant in the New Jersey area in the early 1900's and radium processing ended in 1926.

Attached for your review are several items of information received from the state of New Jersey, through NAC, which give basic background information on the history of the tailings material, the cleanup and sampling programs, and a characterization of the radiological aspects of this material. Any additional information on this tailings material which becomes available will be forwarded to your attention.

[redacted]

Activities planned at the White Mesa Mill site will involve the receipt of tailings material contained in 55 gallon drums and metal storage boxes shipped to the White Mesa site according to Department of Transportation and U. S. Nuclear Regulatory Commission regulations and guidelines. The material is contained in 9,525 55-gallon drums and 51 B-12 metal storage boxes containing approximately 4000 lbs each. The total amount of material is approximately 3,912 tons.

An initial verification will be made to ensure that all containers have arrived intact with no shipping damage and that all containers received correspond to shipping manifests from NAC at the New Jersey site. Activities will then involve the removal of tailings material from the storage containers (55 gallon drums in metal storage boxes) and placement of this material on the ore storage pad at the White Mesa Mill for processing, once the mill resumes operation in mid-1988. All existing license conditions for employee and environmental health and safety will be followed with the appropriate documentation for all activities involving the handling of this material.

Because of the relatively low radiological activity of this material, the impact of final disposal in the White Mesa Mill tailings system will cause no additional radiological considerations for the maintenance and ultimate reclamation of the tailings disposal cells. Depending on the specific time period in which this material is processed through the White Mesa Mill, it would be our intention to discharge this material into the central part of Cell 2 or the eastern edge of Cell 3. Documentation will be provided to the NRC as to discharge points for tailings slurry at the time the material is processed through the mill. The material will, in fact, end up as a homogeneous mixture with the other uranium-bearing ores being processed at that time and will not end up in the tailings cells as an isolated pocket of specific material.

The only revision to the operating procedure for the White Mesa Mill will be for verification of receipt of the material at the White Mesa Mill and the removal of material from the shipping containers prior to being fed to the mill process. These revisions to the operating procedures will result in no additional employee exposure or environmental impact to the White Mesa Mill area.

Enclosed is a check for $150.00 to cover the cost of initiating this license amendment request.

Timing for approval of this request is very critical as we must have authorization to receive the material at the time of bid submittal to the State of New Jersey. Bids are to be submitted by February 11, 1988, and I would appreciate an initial indication from your office if there is any problem in meeting this deadline.

If you have any questions or require additional information, please feel free to contact me.

Very truly yours,

Harold R. Roberts
General Manager

HRR:smm

Enclosures

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GEOLOGIC ANALYSIS OF AND SOURCE OF THE RADIUM CONTAMINATION AT THE MONTCLAIR, WEST ORANGE, AND GLEN RIDGE RADIUM CONTAMINATED SITES

FINAL REPORT

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JUNE 19, 1986

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INTRODUCTION

A study was undertaken at the request of a Mr. Wayne D. Greenstone, attorney at law, to conduct a geological investigation of certain sites in Montclair, West Orange, and Glen Ridge, New Jersey. These three sites have been identified in U.S. Environmental Protection Agency reports (references 1-4) as radium contaminated areas, with high levels of radon gas and gamma radiation. The sites are all located in residential areas where many homes are situated. The sites were once dump sites in the early part of the 1900's. Construction of homes on these sites began in the late 1920's. The sites were fully developed as residential neighborhoods by the early 1940's (reference 3). All three sites are within 1½ mile radius from the site of the former U.S. Radium Corporation's processing plant in Orange, NPJ. Carnotite ore from Paradox Valley, Montrose County, Colorado was processed for radium extraction at this plant in the early 1900's (references 5-8). Radium processing at the Orange plant ended in 1926 (references 5-8).

The nature of the geological investigation was to examine and analyze the materials underlying the three sites in order to: 1) determine the composition of these materials and 2) determine the geologic nature and origin of these materials.

PROCEDURE

The geological investigation involved the following procedures:

1. Field inspection of the sites for their topographic and geologic setting.

2. Field sampling which included:

   a. obtaining geologic samples of the excavation on Virginia Street and Nishuane Avenue, Montclair, where contaminated material is being removed by a NJDEP project.

   b. obtaining augerhole geologic samples at the Montclair West Orange, and Glen Ridge sites.

3. Stereoscopic microscopic examination of the geologic samples.

4. Scanning electron microscope (SEM) and X-ray analysis of selected samples.

5. Radioisotope analysis by gamma spectrometry of selected samples.

6. Comparison of the geologic samples taken at Montclair, West Orange, and Glen Ridge with the ore tailings at the site of the former U.S. Radium Corporation's Radium processing plant at Orange, New Jersey.

GEOLOGIC SETTING

The Montclair, Glen Ridge, and West Orange sites are located in the Newark Basin, a geologic structure that formed 200 to 180 million years ago. The bedrock of the area is the Brunswick Formation, a reddish brown mudstone, sandstone and siltstone. The Brunswick Formation in Montclair and West Orange is covered by a thin cover of ground moraine that was deposited as the Wisconsin Ice Sheet melted from New Jersey around 10,000 years ago. This material, which was derived from the Brunswick Formation as it was overidden and scoured by the ice sheet, was encountered in the U.S. Environment Protection Agency's study (reference 3). At Glen Ridge stratified drift overlies the Brunswick Formation (reference 3).

Topographic maps dating from 1908 to 1937 with a 20 foot contour interval show a gentle slooping area at each of the site locations. Prior to alteration by various human activities small streams ran through the area. They are now channelized and the sites have been altered by various developments such as housing and recreational facilities. In the early 1900's, prior to these developments, the embankments of these streams and gulleys were used for dumping of refuse and fill so that the original profile was altered. As an example, at the Montclair site a small gulley used to parallel Virginia Street between Nishuane Avenue and Harrison Street. The gulley was subsequently completely filled in. The fill can be observed in the N.J. Department of Environmental Protection's excavation pit at Virginia and Nishuane. The fill was also encountered in boreholes taken in the U.S. EPA study (reference 1) and in the augerholes of this study. In a similar way fill underlies the Glen Ridge and West Orange sites.

FIELD SAMPLING

Taking of geologic samples (Figures 1-3) was guided by the maps in the U.S. EPA reports (references 1-4) showing the areas at the sites where high gamma radiation reading were observed. Location M1 at the Montclair site is the excavation pit at the corner of Virginia Street and Nishuane Avenue. The augerhole sites at Montclair, West Orange, and Glen Ridge were positioned where ground level gamma radiation showed high levels on a hand held counter. Gross counts per minute (CPM) were taken on each sample as it was retrieved during the operation. Samples were placed in sample bags for later laboratory study. The penetration of sampling was guided by the borehole reports in the U.S. EPA reports (references 1 and 2). The objective was to sample intervals with the highest gamma radiation readings.

STEREOSCOPIC MICROSCOPE EXAMINATION

Each sample was examined under a stereoscopic light microscope. The lithology of each sample was described (Appendix A). The results of this study supplemented by observations taken at the sample site indicate that the fill overlying the natural materials consist of several intervals. Most prominent is ash and slag, often mixed with bottles and other material such as ceramic brick and other refuse. The majority of bottles recovered once contained food products such as catsup, mustard, milk, cream and soda. Some chemical glassware was also recovered. Other intervals contained rock fragments such as might come from excavations of local bedrock (Brunswick Formation). The most interesting intervals for purposes of this study were the light gray to white sand intervals. The characteristic sand of these intervals was also found to be mixed in varying degrees with ash and other fill. The highest gamma radiation readings are associated with this sand (herein referred to as the "White Sands").

THE WHITE SANDS

The White Sands consist of fine to medium grained sand. The sand grains are rounded in the medium-size range. The fine-size sand consists of both rounded and angular grains. The angular grains appear to be broken fragments from larger grains. The rounded grains exhibit a frosted surface which is due to micron-size pitting of the surface. The frosted surface can also be seen on some surfaces of the smaller angular grains. Other surfaces of these angular grains are smooth, clear, and transparent, an indication that they are broken surfaces.

Also associated with the White Sands is a white matrix which is composed of very fine silt and clay material. This matrix often partially coats the frosted surfaces of the grains. The White Sands therefore have a unique physical signature which allows their ready recognition at all of the sample localities even when the sands are mixed with ash and other material.

MINING OF THE CARNOTITE ORES OF COLORADO

Deposits of carnotite were first discovered in 1899 in the western part of Montrose County, Colorado (reference 9). The yellow mineral in these deposits which was found to contain uranium, vanadium, and radium was given the name carnotite. Carnotite ores were mined for their radium content from 1911 to 1923. Mining practically ceased in 1923 when Belgian Congo pitchblende ore began to supply radium (references 8, 9).

Carnotite ore that was shipped to Orange, New Jersey came from mines situated in Long Park, Paradox Valley in the western part of Montrose County, Colorado (reference 7). These mines, operated by the U.S. Radium Corporation (originally called the Radium Luminous Materials Corporation) from 1916 to 1923, were collectively called the Doctor Camp. Various mine shafts were named Long Park, Yellow Bird, Hart Camp, Wild Steer, Cripple Creek, and Honeymoon. Approximately 19,300 tons of ore were produced from 1916 to 1923 (Table I). Ore was shipped from Placerville, Colorado to Orange, New Jersey for milling and processing (references 6-8).

GEOLOGY OF THE CARNOTITE ORES OF COLORADO

The carnotite ores in Montrose County, Colorado, which were mined by the U.S. Radium Corporation, occur in the Morrison Formation (reference 9). The Morrison Formation was deposited during Late Jurassic time about 150 million years ago (Ma). The Morrison Formation consists of green and red shales which, in Montrose County, are interlayered with gray and white sandstones. These sediments are of continental origin and formed in stream and floodplain environments.

Carnotite mineralization occurs in massive lenses of sandstone which are up to 60 feet thick (reference 9). Crossbedding is prominent in the sandstone lenses. The crossbedding indicates that the sandstone lenses were deposited along meandering streams as sand dunes, channel sands, and sand bars.

RELATIONSHIP BETWEEN THE WHITE SANDS AND CARNOTITE ORE

The White Sands were first identified at the site of the former radium processing plant of the U.S. Radium Corporation in Orange, New Jersey (reference 10). At the Orange site small bits of carnotite are found mixed with this sand. The sands were identified as tailings of carnotite ore which was processed at the former radium processing plant (reference 10). These sands came from the mines operated by the U.S. Radium Corporation in Montrose County, Colorado (reference 7).

The rounded grains and frosted surfaces of the grains of the White Sands were produced in the environment in which they were deposited some 150 Ma. Rounding of the sand grains is caused by the impact of grains with one another as they are blown by wind and transported by rivers. The nearly perfect rounding of these grains and the frosted surfaces indicate that the grains had a complex geologic history before they were deposited. The term mature is sometimes used in such cases to indicate an aging effect on sand grains. In contrast, sand grains that do not have a complex geologic history have sharp angular surfaces. The White Sands, therefore, have a unique signature which readily identifies them and allows their separation from other sand deposits.

The White Sands sampled at the Montclair, West Orange, and Glen Ridge sites were directly compared with the sands from the Orange site. They all have the same genesis and origin. They came from the sandstone carnotite ore deposits of the Morrison Formation in Montrose County, Colorado. Furthermore, they are tailings of processed carnotite ore from which the carnotite was leached.

RADIOACTIVITY SOURCE IN THE WHITE SANDS

The highest levels of gamma radiation were found to be associated with the White Sands that were sampled at the Montclair, West Orange, and Glen Ridge sites. At the Montclair and Glen Ridge sites carnotite was identified and, it obviously is the source of some of the radiation. However, in other cases of high radiation carnotite was not found. Radionuclide analysis of the White Sands show that they have activities of radium - 226 and thorium - 230 much higher than uranium activities (reference 3). This indicates that the concentrations of radium and thorium have been enhanced or that uranium has been depleted.

Microscopic analysis of 60 and 100 mesh and pan sieve fractions of White Sand samples at all three sites revealed, yellow-orange to pale orange to white crystalline grains. These grains were identified by X-ray analysis as barium sulphate (Appendix A). Uranium was not detected by X-ray analysis in the barium sulphate. Approximately 100 grains of barium sulphate were visually isolated from a sample of White Sand (location H1) for gamma radiation testing. Tests showed that this small amount had gamma radiation activities two times background level. Subsequently, a technique of separating barium sulphate by heavy liquid (bromoform) was used to rapidly concentrate this substance. Gamma radiation activities were always above background levels in the concentrated barium sulphate samples. In the absence of detectable levels of uranium, this indicates that the barium sulphate is enriched in radium - 226 and thorium - 230 radionuclides. The barium sulphate concentrates were subjected to a gamma spectrometry analysis for identification of the radium-226 radioisotope. Radium-226 was confirmed. The barium sulphate in the White Sands is, in fact, barium-radium sulphate.

This analysis shows that radium contamination at the Montclair, West Orange, and Glen Ridge sites is due, at least in part, to barium-radium sulphate. It is clear that the barium-radium sulphate is the result of a man-made process which separates radium from uranium. The association of the uranium-vanadium-radium mineral carnotite with the barium-radium sulphate establishes that the barium-radium sulphate is derived from processed carnotite, ie. carnotite ore.

It is known that the radium production process used by the U.S. Radium Corporation at the Orange plant was an acid leach process (references 6 and 11). Carnotite ore after crushing, was placed in acid-proof brick tanks, and treated with hydrochloric acid to dissolve the carnotite. The solution was then treated with sulphuric acid to precipitate barium as sulphate. Radium precipitated with barium as barium-radium sulphate. The resulting liquor which contained uranium and vanadium in solution and Barium-radium sulphate in suspension was decanted through an opening in the side of the tank level with the top of the sand tails. In order to maintain the sulphates in solution the sand-liquor mixture had to be stirred. Barium-radium sulphate has a specific gravity of 4.5 so that it would settle in the tank rapidly if the mixture was not stirred. The bulk of sand remaining in the tank was washed with water, stirred, and decanted again. The sand tails were then conveyed to a dump. The separated barium-radium sulphate was then treated through a series of chemical procedures to produce the final product, radium bromide.

Samples of the sand tails were checked for activity in an electroscopic laboratory before dumping. Small amounts of activity in the sand tails were allowed in the dumping (reference 11). Since the procedure of stirring and decanting the suspended barium-radium sulphate did not give a complete separation of this precipitate and because the entire sand tails in the tank were not checked for activity, it is most probable that varying quantities of radium-barium sulphate accompanied the sand tails to the dump. The acid leach process, also, did not completely dissolve the carnotite mineral because small amounts are present in tailings on the site of the U.S. Radium Corporation's radium processing plant in Orange, New Jersey (reference 9) and at the Montclair and Glen Ridge sites.

RELATIONSHIP OF THE WHITE SANDS TO SAMPLE TYPES AT THE MONTCLAIR, WEST ORANGE, AND GLEN RIDGE SITES

Four general types of samples have been reported from the Montclair, West Orange, and Glen Ridge sites: organic soil, non-natural fill material, non-native soil, and native soil (reference 3). The presence of this general type of material is also confirmed in this study. The highest levels of radionuclide activity and gamma radiation are found in the non-natural fill material and the non-native soils (reference 3). Native material which includes the Brunswick Formation and glacial drift and moraine does not give abnormal levels of activity and radiation.

The non-native fill material consists of ash, cinders, slag, bottles of various types, porcelain, brickware, metal, and other debris mixed in varying amounts with sand, silt, and clay. The non-native soil consists of the White Sands, yellowish sand, and multicolored silts and clays. Microscopic analysis shows that all the non-native material can be placed in a spectrum according to the volume of sand in the sample. The White Sands and associated other sands stand at one end of the spectrum with decreasing amounts toward the other end of the spectrum. There is an association between greater levels of radioactivity and greater amounts of sand.

As discussed previously, the White Sands have a unique signature which allows ready identification. The rounded frosted grains can be easily identified by microscope analysis. The White Sands represent pure concentrations of these grains. Yellowish sands contain small amounts of carnotite mixed with the White Sand. Sandy fill is White Sand mixed in varying proportions with non-native material. Ash is seldom free of some White Sand. The organic soil covering the contaminated sites also contains varying amounts of White Sand.

CONCLUSIONS

The results of this geological study of the Montclair and West Orange sites are the following:

1. The White Sands at these sites are the processed sand tails from the acid leach process used at the U.S. Radium Corporation's radium processing plant located in Orange, New Jersey.

2. The White Sands are residual sands from processed carnotite sandstone ore mixed by the U.S. Radium Corporation from the Morrison Formation in Montrose County, Colorado between 1916 and 1923.

The presence of the White Sands at the Montclair, West Orange, and Glen Ridge sites establishes a direct link between the processing and mining operations of the U.S. Radium Corporation at Orange, New Jersey and Montrose County, Colorado, respectively.

4. The gamma radiation and radionuclide activity at the Montclair, West Orange, and Glen Ridge sites is due to radioactive materials incorporated in the sand tails transported from the U.S. Radium Corporation's radium processing plant in Orange, New Jersey.

5. The source of the gamma radiation and radionuclide activity at the Montclair, West Orange, and Glen Ridge sites is **barium-radium sulphate** and **carnotite** that were incorporated in the sand tails transported from the U.S. Radium Corporation's radium processing plant in Orange, New Jersey.

6. The barium-radium sulphate was produced by the acid leach process applied to carnotite sandstone ores at the U.S. Radium Corporation's radium processing plant in Orange, New Jersey.

7. Levels of gamma radiation and radionuclide activity at the Montclair, West Orange and Glen Ridge sites is related to the concentration of barium-radium sulphate and carnotite and the degree of mixing of the carrying host (White Sands) with other non-native materials.

8. The Montclair, West Orange, and Glen Ridge sites were used as dump sites by the U.S. Radium Corporation for disposing of processed carnotite sandstone ores during its operation of their Orange, New Jersey facility between 1916 and 1926. This conclusion is based on the fact that this was the only facility in New Jersey which concentrated radium during 1916 to 1926 (reference 8). Radium production in the U.S. ceased after 1926.

REFERENCES

Reports Used in Investigation

1. Results of the Source Characterization Program Montclair Low Level Radiation Site Montclair, New Jersey. Prepared for Environmental Services Division, U.S. Environmental Protection Agency, by NUS Corporation, Superfund Division, July 12, 1984.

2. Results of the Source Characterization Program Glen Ridge Low Level Radiation Site Glen Ridge, New Jersey. Prepared for Environmental Services Division, U.S. Environmental Protection Agency, by NUS Corporation, Superfund Division, July 12, 1984.

3. Remedial Investigation Study for the Montclair/West Orange and Glen Ridge, New Jersey Radium Sites, Volumes I & II. U.S. EPA Contract No. 68-01-6939, Camp Dresser & McKee Inc., Prime Contractor, 1985.

4. Remedial Investigation/Feasibility Study for Montclair/Glen Ridge/West Orange Radium Sites. U.S. Environmental Protection Agency, Camp Dresser & McKee Inc., November 13, 1985, Nishuane School.

5. Investigation of a Former Radium Processing Site. New Jersey State Department of Environmental Protection, Division of Environmental Quality, Bureau of Radiation Protection.

6. Allen, et al., v. United States Radium Corporation - defendant USR certified answers to plaintiffs' interrogatories, January 9, 1986, File 5527-21. Greenstone, Greenstone & Greifinger, 744 Broad Street, Newark, New Jersey.

7. Reports to State of Colorado, Bureau of Mines. Various reports on uranium mines operated by U.S. Radium Corporation in Montrose County, Colorado - dated 1916 to 1923.

8. Mineral Resources of the United States, Part I - Metals. U.S. Geological Survey, Government Printing Office, Washington, 1916 to 1927 reports.

9. Vanadium deposits of Colorado and Utah. R.P. Fischer, U.S. Geological Survey Bulletin 936-P, 1942.

10. Geologic Report on Augerhole Program on Property of T & E Industries Inc. R.K. Olsson, July 31, 1981.

11. Radium Production in America - I by H.D. d'Aguiar in Chemical and Metallurgical Engineering, vol. 25, 1921, p. 825-828.

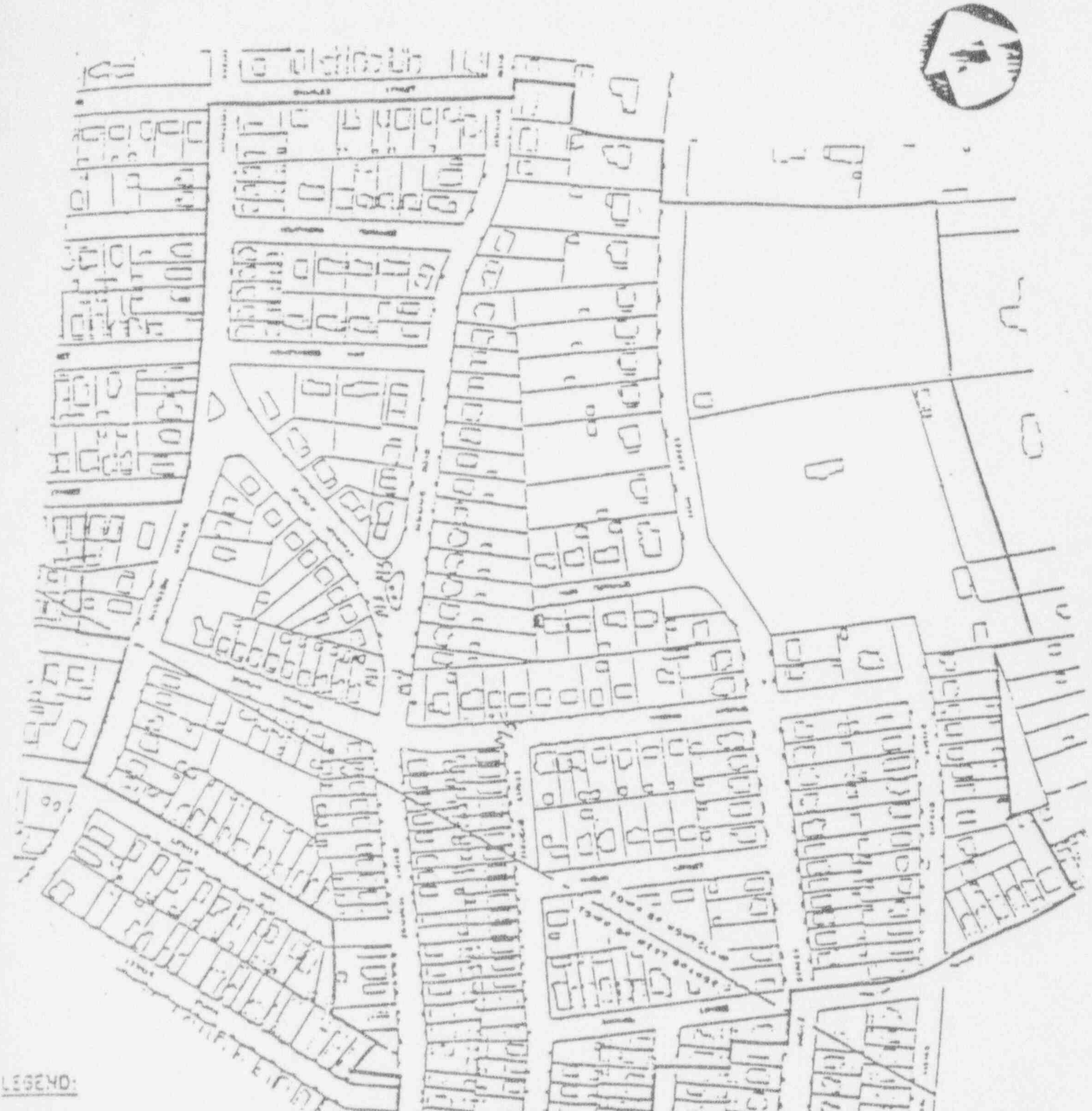
TABLE I

Production statistics of U.S. Radium Corporation's Doctor Camp, Long Park, Montrose County, Colorado from 1916 to 1923.

Year	Ore Produced (tons)	Days Operated	Average # Men Underground	Surface	Uranium Oxide %	Oxide %
1915-16	600*	80	6	2	n.a.	n.a.
1916-17	3500	365	20	5	0.9	1.7
1917-18	3500*	365	28	16	n.a.	n.a.
1918 t	3400	275	25	6	2.0	4.0
1919	1600	180	15	4	2.3	4.3
1920 t	3500*	363	35	15	n.a.	n.a.
1920 t	500*	64	6	1	n.a.	n.a.
1921	1540	365	19.4	11.6	2.5	2.0
1922	930	304	12	7	2.4	3.5
1923	229	107	6.2	2.5	3.0	4.2

* estimated
t separate mine or mines report

source - reference 7

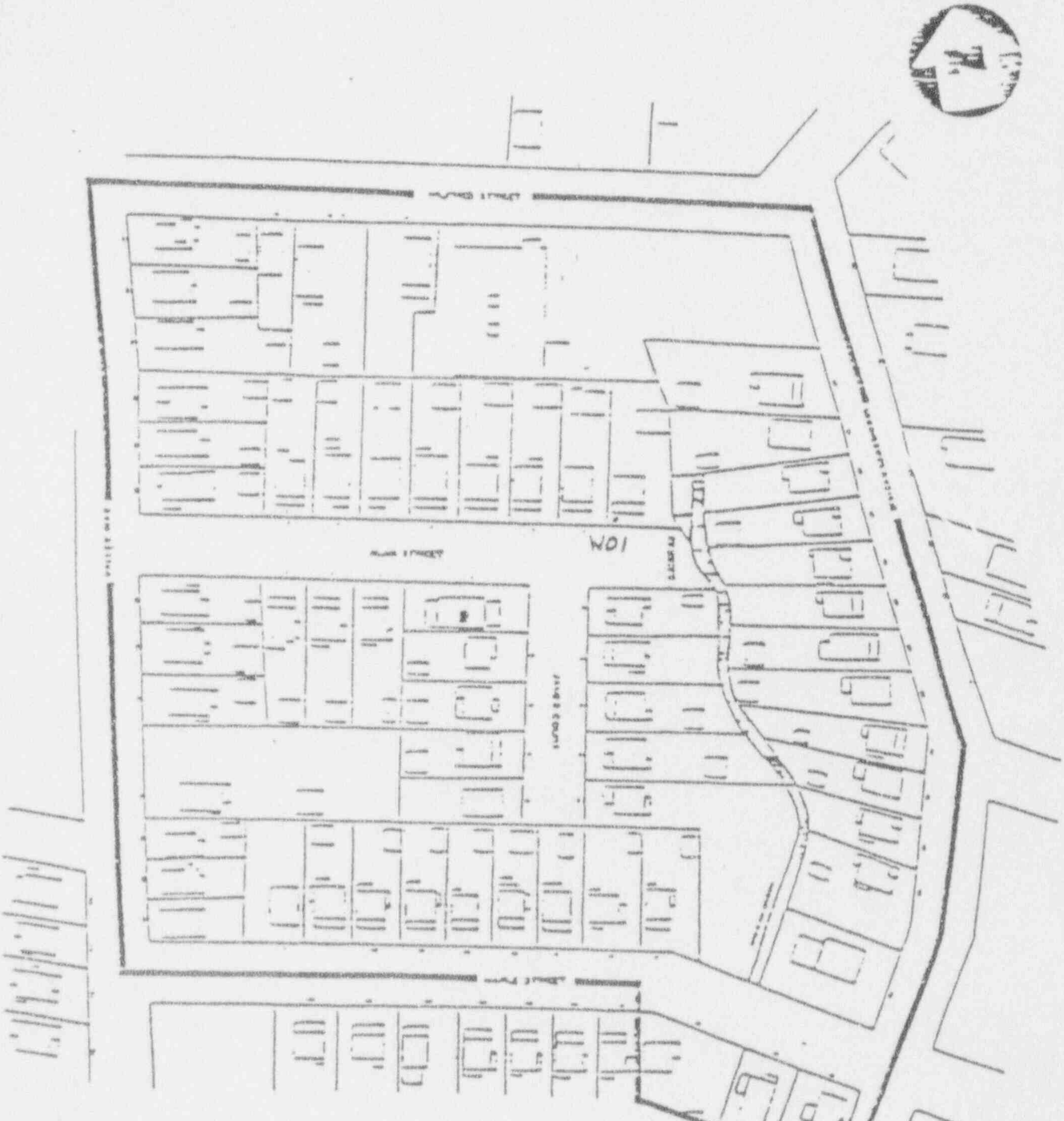


LEGEND:

STUDY AREA PERIMETER

SCALE: N.T.S.

SOURCE: MUS CORPORATION



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STUDY AREA PERIMETER

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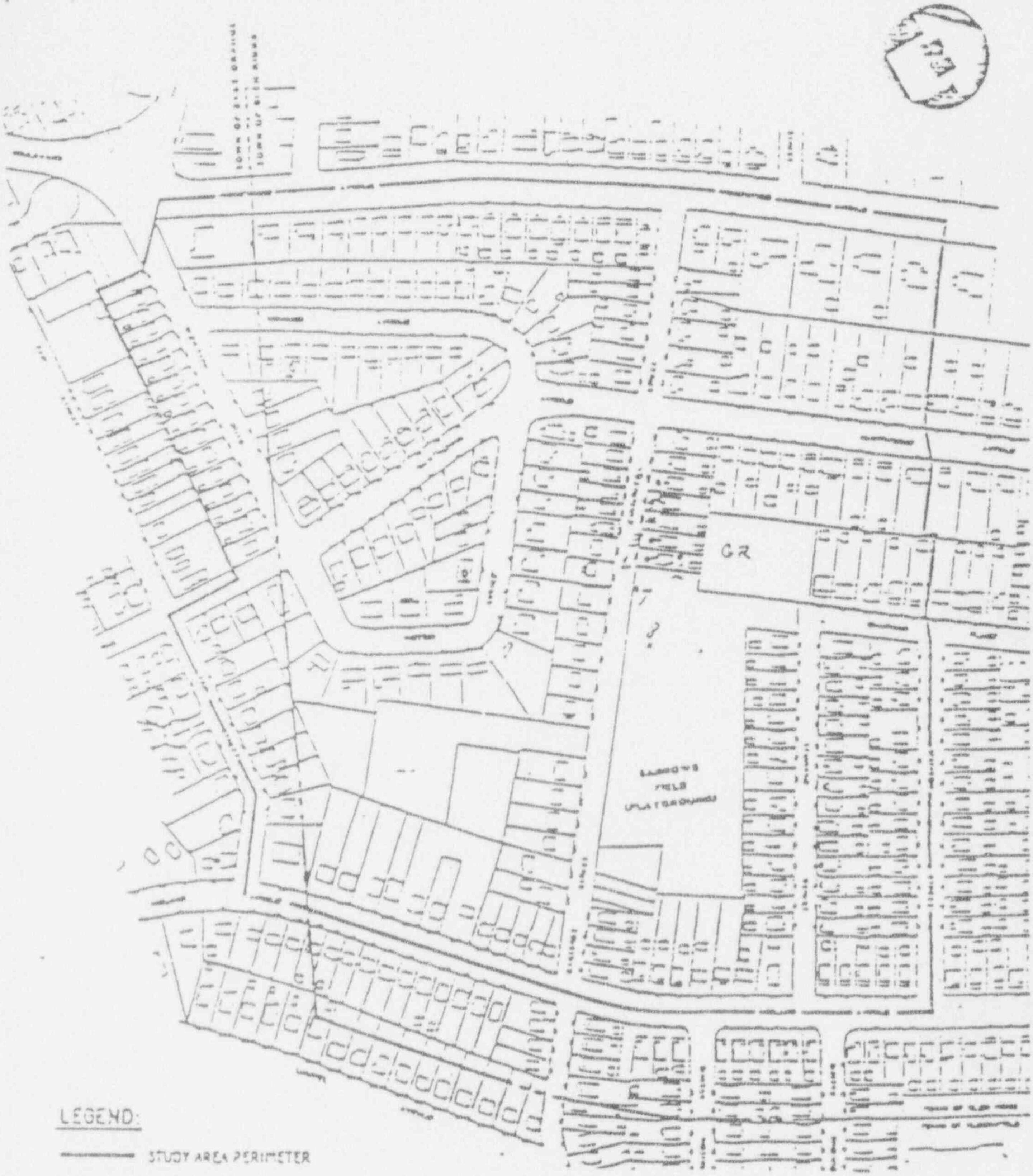
SOURCE: NUS CORPORATION

FIG. 3 - LOCATION OF BOREHOLES, GLEN RIDGE SITE



SCALE: N.T.S.

SOURCE: NUS CORPORATION

APPENDIX A

ANALYSIS OF AUGERHOLE SAMPLES

Montclair Site

Location M1

SAMPLE #	INCHES	GROSS COUNTS PER MINUTE	LITHOLOGY
1	0 - 3	400	Mixture of fine sand and silt with abundant black coal-like chips, dark brown in color, also brown medium sand, white amorphous flakes, lumps of light grey silty ash. Some fragments of coal.
2	3 - 6	350-400	Brown to yellowish brown fine to medium sand with abundant chips of coal-like material, broken glass, lumps of white ash.
3	6 - 9	408	Brown fine to medium sand and silt, lumps of ash and slag-like material. Abundant coal-like chips. Small amounts of bright orange clayey matrix*.
4	9 - 12	356	Brown fine-medium sand and silt with abundant black coal-like chips. White ash chips. Pieces of dark grey slag, a few large quartz grains.
5	12 - 15	414	Dark brown to reddish yellow brown fine to medium sand, chip of white ash, some large quartz grains. Abundant black coal-like chips. Broken glass.
6	15 - 18	392	Brown fine-medium sand with chips of white ash and black coal-like chips. Some large quartz grains, also a little silt. Lump of coal. A little orange-yellow clayey matrix*.
7	18 - 21	10,000	Light gray to white fine-medium sand with white ash and black coal-like chips. Some large quartz grains.
8	21 - 24	10,000	Light gray to white fine-medium sand and white ash with streaks of reddish yellowish orange material. Chips of black coal-like material. Lump of coal. Some bright orangish yellow clayey matrix*.

M1 - Montclair Site

SAMPLE #	INCHES	GROSS COUNTS PER MINUTE	LITHOLOGY
9	24 - 27	307	White ash and brown fine-medium sand and silt with black coal-like chips. Bits of glassy slag and orange yellow clayey matrix*. Coal, glass. Lump of glassy slag.
10	27 - 20	321	Brown medium to fine sand with scattered large quartz grains. Some black coal-like chips. Slag with orangish yellow matrix*. White ash. Brown siltstone cobble.
11	30 - 33	282	Brown fine to medium sand and silt with some large quartz grains. Bits of charcoal, coal white chips* and yellow matrix*. Black and orange brown slag. Grey clayey-silty matrix, white ash. Fragment of slag crust.
12	33 - 36	235	Grey clayey-silty matrix, black slag chips, charcoal. Brown fine-medium sand, white chips. Piece of ceramic dish. Coal. Yellowish-brown slag.
13	36 - 39	473	Brown fine-medium sand with black slag-like chips, white chips. Charcoal, broken glass. Pieces of reddish-brown siltstone. White ash. Some large quartz grains. Small bits of yellowish clayey matrix*.
14	39 - 42	300	Brown fine-medium sand with black slag-like chips, white chips*. Light Grey clayey-silty matrix*. Some large quartz grains.
15	42 - 45	950	Light Grey clayey-silty matrix. Brown to brown fine-medium sand and silt with black slag-like chips*. Coal. White ash. Bits of bright yellow and orange matrix.
16	45 - 48	400	Light Grey to pale yellow clayey matrix* with gypsum crystals. Black slag-like chips, charcoal, white chips. Brown silty sand. Fibers. Orange brown slag. Coal.

M1 - Montclair Site

SAMPLE #	INCHES	GROSS COUNTS PER MINUTE	LITHOLOGY
17	48 - 51	287	Light Grey clayey matrix with black slag-like chips. Coal. Oyster shell.
18	51 - 54	300	Brown fine-medium sand with black slag-like chips. Lump of coal, Broken bottle glass. Pale yellowish white crust-like chips*. Broken pottery tile.
19	54 - 57	300	White ash with brown slag material and black slag-like chips. Coal.
20	57 - 60	360	Like above.
21	60 - 63	300	White ash mixed with sand. Pieces of coal and charcoal. Also black slag-like chips. Some large quartz grains. Some yellow matrix*.
22	63 - 66	298	White ash mixed with sand, coal, charcoal, black slag-like chips. Some orange-yellow matrix*.
23	66 - 69	336	Like above.
24	69 - 72	750	Greyish brown mixture of ash, sand, and black slag-like chips. Coal, glass chips.
25	72 - 75	750 - 900	Like above. Some orange-yellow-brown matrix*.
26	75 - 78	450	Mixture of ash, slag, coal, and sand, battery. Blue glass.
27	78 - 81	286	Mixture of ash, slag, sand, charcoal. Some orange yellow matrix*. Pieces of wood, metal and heavy bottle glass. Old ceramic stopper with metal clamp. Top reads Gold Seal Bottling Works, West Orange, N.J. Bottom reads Pat's Khutter, Feb. 1, 1893.
28	77 below house	296	Reddish brown sandy silt.

Montclair Site

Location M2

SAMPLE #	INCHES	GROSS COUNTS PER MINUTE	LITHOLOGY
1	0 - 4"	105	Dark brown fine-medium sand with black slag chips, white ash chips.
2	4 - 10	124	Brown fine-medium sand with black slag chips, white ash chips, bottle.
3	10 - 13	130	Mixture of fine-medium sand and ash, broken glass.
4	13 - 18	150	Brown fine-medium sand, black slag chips, glass, white ash chips.
5	18 - 19½	230	like above
6	19½ - 21	215	no sample
7	21 - 24	200	Brown silty, fine-medium sand with black slag chips, white ash chips, some white sand.
8	24 - 26	240-290	Reddish brown fine-medium sand, black slag chips, white ash chips, also light gray sand.
9	26 - 27½		Like above but mixed with ash

GROUND LEVEL CPM AT AUGERHOLE 250 CPM

Montclair Site

Location M3

SAMPLE #	INCHES	GROSS COUNTS PER MINUTE	LITHOLOGY
1	0 - 4	275	Brown fine-medium sand, black slag chips, white ash chips, white sand.
2	4 - 6	240	Like above with white sand
3	6 - 11½	240-280	Light gray to white fine-medium sand, black slag chips.
4	11½ - 13	180	Brown fine-medium sand mixed with ash.

GROUND LEVEL CPM AT AUGERHOLE 550 CPM

Montclair Site

Location M4

SAMPLE #	INCHES	GROSS COUNTS PER MINUTE	LITHOLOGY
1	0 - 5½	200	Black fine-medium sand, black slag chips, white ash, coal.
2	5½ - 7½	300	Dark gray fine-medium sand, black slag chips, coal, white ash, some coarse quartz grains.
3	7½ - 8½	500	Gray fine-medium sand, black slag, chips, white ash, glassy slag, charcoal, yellow clayey matrix.
4	8½ - [illegible]½	90[illegible]	Light gray to ~~white fine-medium sand~~, black slag chips and white ash, carnotite.
5	12 - 13½	675	Light gray fine-medium sand, black slag chips, white ash, broken brick material, glassy slag.
6	13½ - 14	575	Like above, abundant ash, pieces of reddish brown sandstone.
7	14 - 17	4[illegible]	Like above.
8	17 - 18	450	No sample.
9	18 - 19	350	Mixture of ash with fine-medium sand.
10	19 - 21	400	Like above.
11	21 - 23	325	Like above.
12	23 - 23½	240	No sample.
13	23½ - 26½	230	Mixture of ash with fine-medium sand.

GROUND LEVEL CPM AT AUGERHOLE 2300 CPM

Montclair Site

Location M5

SAMPLE #	INCHES	GROSS COUNTS PER MINUTE	LITHOLOGY
1	0 - 4	200	Brown fine-medium grained sand, black slag chips.
2	4 - 8	280	Dark brown fine-medium sand with black slag chips.
3	8 - 12	1050	Light gray fine-medium sand, minor amounts of black slag chips.
4	12 - 14	1250	Light gray to white fine-medium sand, minor amounts of black slag chips.
5	14 - 17	1550	Like above.
6	17 - 18	1350	Like above.
7	18 - 19	950	Brown fine-medium sand with black slag chips.
8	19 - 22½	750	Reddish brown silty fine sand with white ash chips and black slag chips.
9	22½ - 24	330	Like above.
10	24 - 28	180	Reddish brown medium sand with black slag chips.
11	28 - 29	125	Reddish brown silty fine sand, piece of reddish-brown siltstone (Brunswick Formation).

GROUND LEVEL CPM AT AUGERHOLE 2700

West Orange Site

WO-1

SAMPLE #	INCHES	GROSS COUNTS PER MINUTE	LITHOLOGY
1	0 - 4	1150	Brown silty sand and clay, white slag and ash chips and black slag chips.
2	4 - 7½	1100	Brown silty, fine-medium sand mixed with white ash chips and black slag chips, coal.
3	7½ - 9	1025	Mostly ash and slag mixed with sand, ceramic material.
4	9 - 14	750	Like above, coal, ceramic material.
5	14 - 15½	525	Like above - ash, slag, coal mixed with sand, ceramic material.
6	15½ - 17	480	Like above.
7	17 - 20	450	Brown fine-medium sand mixed with ash and slag.
8	20 - 22	260	Brown fine-medium sand with white ash and black slag.
9	22 - 24	280	Light gray to white fine to medium sand.
10	24 - 28	325	White fine-medium sand.
11	28 - 31½	220	Like above with black slag and cinders.
12	31½ - 33	180	Sand mixed with slag and ash.

GROUND LEVEL CPM AT AUGERHOLE 4450 CPM

GLEN RIDGE SITE

Location GR-1

SAMPLE #	INCHES	GROSS COUNTS PER MINUTE	LITHOLOGY
1	0-9	720	brown fine to medium sand and silt with black slag chips and organic material
2	9-10	700	white and brown medium sand with black slag chips and organic material. Some white chips
3	10-12	660	like above with fine sand and silt, pieces of coal
4	12-13	540	brown and white fine to medium sand, silt, with black and white slag chips. Coal
5	13-15	440	like above
6	15-19½	580	like above
7	19½-23	645	like above
8	23-24	560	like above
9	24-26	880	white medium sand with white chips. Piece of coal
10	26-31	800	white medium sand with white chips
11	31-34	820	like above but mixed with brown sandy silt and black slag chips. Coal
12	34-35	780	white medium sand mixed with white ash, black slag chips, and coal
13	35-36	785	like above
14	36-37	815	like above

GROUND LEVEL CPM AT AUGERHOLE 642 CPM

GLEN RIDGE SITE

Location GR-2

SAMPLE #	INCHES	GROSS COUNTS PER MINUTE	LITHOLOGY
1	0-6	57	dark brown very fine dand and silt with black and white slag chips
2	6-9	69	brown fine to medium sand and silt with black and white slag chips
3	9-10	73	like above
4	10-12	50	like above
5	12-14	50	like above
6	14-17	75	like above
7	17-19	68	like above

GROUND LEVEL CPM AT AUGERHOLE 100 CPM

GLEN RIDGE SITE

Location GR-3

SAMPLE #	INCHES	GROSS COUNTS PER MINUTE	LITHOLOGY
1	0-9	1040	white medium to coase sand, brown silty sand, black slag chips, white ash
2	9-12	1079	like above with white clayey silt
3	12-16	1225	white clayey silt mixed with sand
4	16-19	1870	like above
5	19-23	1040	brown medium sand and silt with some black slag chips
6	23-28	885	like above

GROUND LEVEL CPM AT AUGERHOLE 1580 CPM

GLEN RIDGE SITE

Location GR-4

SAMPLE #	INCHES	GROSS COUNTS PER MINUTE	LITHOLOGY
1	0-7	345	dark brown medium sand and silt with black slag chips and organic material
2	7-9	300	like above
3	9-12	200	brown fine to medium sand and silt mixed with white ash and black slag chips, pieces of coal
4	12-14	700	like above
5	14-18	765	like above. Piece of green-blue bottle glass
6	18-21	5180	white medium sand mixed with black slag chips, white ash, white chips, and white clayey silt
7	21-24.5	3000	like above
8	24.5-27	1600	like above
9	27-30	1600	like above with piece of coal

GROUND LEVEL CPM AT AUGERHOLE 1580 CPM

GLEN RIDGE SITE

Location GR-5

SAMPLE #	INCHES	GROSS COUNTS PER MINUTE	LITHOLOGY
1	0-8	500	dark brown fine to medium sand with black and white slag chips
2	8-10	345	like above
3	10-13	700	like above with ash
4	13-15	685	like above with white medium sand
5	15-19½	900	mixture of ash, coal, brown and white sand and silt
6	19½-23	840	like above
7	23-24	725	gray ash, slag, and coal
8	24-26	595	like above
9	26-29	525	like above
10	29-31	700	like above
11	31-32	490	like above
12	32-34	395	like above
13	34-36½	536	like above

GROUND LEVEL CPM AT AUGERHOLE 1040 CPM

GLEN RIDGE SITE

Location GR-6

SAMPLE #	INCHES	GROSS COUNTS PER MINUTE	LITHOLOGY
1	0-7	630	mixture of ash, brown sand and silt, black and white slag, coal
2	7-9	750	like above with white fine sand and silt
3	9-10	585	like above
4	10-13	860	like above, greenish blue bottle glass
5	13-15	710	like above
6	15-19	450	like above

GROUND LEVEL CPM AT AUGERHOLE 1500 CPM

GLEN RIDGE SITE

Location GR-7

SAMPLE #	INCHES	GROSS COUNTS PER MINUTE	LITHOLOGY
1	0*	5000+	brown and white medium sand with black and white slag chips. Organic material

* sampled at gateport at entrance to field

Locality GR-8

SAMPLE #	INCHES	GROSS COUNTS PER MINUTE	LITHOLOGY
1	0*	8200	brown and white medium sand with black and white slag chips. Organic material

* sampled in field from anthills

X-RAY ANALYSIS OF CARNOTITE

SPECTRUM MAY 9, 1986

ACCELERATING VOLTAGE 15.0 KEV

INCIDENCE ANGLE 90.0 DEGREES

EFFECTIVE TAKE-OFF ANGLE [illegible] DEGREES

STANDARDLESS EDS ANALYSIS
(ZAF CORRECTIONS VIA MAGIC V)

ELEMENT & LINE	K-RATIO	WEIGHT PERCENT	PRECISION 2 SIGMA	OXIDE FORMULA	OXIDE PERCENT	NO. OF CATIONS IN FORMULA
AL KA	0.0197	5.97	0.27	AL2O3	11.27	0.8007
SI KA	0.0743	20.06	0.42	SIO2	42.91	2.5869
CA KA	0.0231	3.62	0.16	CAO	5.07	0.3273
TI KA	0.0049	0.83	0.10	TIO2	1.39	0.0629
V KA	0.0552	8.62	0.33	V2O5	15.40	0.6131
FE KA	0.0098	1.34	0.16	FEO	1.73	0.0872
PB MA	0.0168	3.89	0.29	PBO	4.19	0.0680
U MA	0.0875	15.91	0.51	UO2	18.05	0.2421
O *		39.76				
TOTAL					100.00	4.7891

NUMBER OF CATIONS CALCULATED ON BASIS OF 9 OXYGEN ATOMS.

* DETERMINED BY STOICHIOMETRY

X-RAY ANALYSIS OF BARIUM SULPHATE

SPECTRUM MAY 9, 1985

ACCELERATING VOLTAGE 18.3 KEV

INCIDENCE ANGLE 90.0 DEGREES

EFFECTIVE TAKE-OFF ANGLE 22.1 DEGREES

STANDARDLESS EDS ANALYSIS
(ZAF CORRECTIONS VIA MAGIC V)

ELEMENT & LINE	K-RATIO	WEIGHT PERCENT	PRECISION 2 SIGMA	OXIDE FORMULA	OXIDE PERCENT	NO. OF CATIONS IN FORMULA
SI KA	0.0148	4.07	0.25	SIO2	9.71	0.6573
S KA	0.0796	14.23	0.37	SO3	35.53	2.0121
BA LA	0.4202	49.95	1.28	BAO	55.76	1.6491
O *		31.76				
TOTAL					100.00	4.3185

NUMBER OF CATIONS CALCULATED ON BASIS OF 9 OXYGEN ATOMS.

* DETERMINED BY STOICHIOMETRY

ANALYTICAL EQUIPMENT USED IN STUDY

1. Zeiss Stereomicroscope (magnification 20X to 200X), Department of Geological Sciences, Rutgers University, New Brunswick, NJ - used for visual examination and description of samples.

2. Jeol Scanning electron microscope with x-ray analyses, Gee-O-Kem, Somerset, NJ - used for high resolution examination of grains and particles, and identification of elements and minerals by x-ray analysis.

3. Gamma spectrometry system equipped with a teledyne sodium iodide crystal and a Tracor Northern TN 7200 multichannel analyzer, Radiation, Environment, Health and Safety Department, Rutgers University, New Brunswick, NJ - used for identification of radium-226 radioisotope.

Attachment

Radiological Characteristics of the Radium Contaminated Soil from Montclair - Glen Ridge, NJ

Number of Containers and Quantities of Excavated Soil

During the 1985 construction season, excavations were conducted at three sites in Glen Ridge and Montclair. All of the material excavated was placed in sealed 55 gallon drums or 44 cubic foot steel boxes. This work is summarized as follows:

TABLE 1 - SUMMARY OF EXCAVATION QUANTITIES

Site	Containers Drums	Filled Boxes	Total Volume in Containers	Total Weight of Container Contents
Carteret Street	3,739	16	1,043.9 CY	1,151.5 T
Lorraine Street	4,383	35	1,250.2 CY	1,599.2 T
Virginia & Franklin	6,280	33	1,763.3 CY	2,499.2 T
TOTAL	14,402	84	4,057.4 CY	5,249.9 T

The values tabulated above include the 4,902 drums and 33 boxes in storage at the VF Site. Since these containers have not been processed or weighed through the transloader, only estimated net weights are available for these drums and boxes. The estimates were developed from sample drums and boxes which were weighted; the estimated net weight for each drum is 775 pounds and for each box is 4,000 pounds. These values are used in the above table and in all other calculations related to the contents of these drums and boxes.

Radiological Characteristics of Excavated Soil

During the excavation program, soil samples were collected for counting in the field laboratory. The samples were collected at random from the working faces of the excavation and placed in clean plastic bottles for transport to Eberline's field laboratory at the Oak Street Yard. In the laboratory each sample was counted in the shielded counting well using an integrating syntilometer for approximately ten (10) minutes per sample. The counting results were recorded in the laboratory along with the site of origin and control number for each sample.

A total of 478 bottle samples were collected and counted during the 1985 excavation program.

TABLE 2 - DISTRIBUTION OF BOTTLE SAMPLES BY SITE

Site	Number of Samples from Each Site	Percent of Samples From Each Site
Carteret	63	13.3%
Lorraine	271	56.9%
Virginia-Franklin	142	29.8%
TOTAL	476	100.0%

Before being used in further analyses, each reported value was doubled. This factor was applied to correct for the difference between the field measurement of activity per unit of wet soil weight and standard analytical methods based on activity per unit of dry soil weight. The correction factor is based on experience over many years of work at many sites and not strictly on the ratio of wet to dry weight of the soils at the Montclair and Glen Ridge Site. This correction factor has been empirically established as broadly applicable and there is no evidence indicating that this factor is not applicable to these sites.

The radiological content estimates resulting from the bottle samples are summarized in the following tables.

TABLE 3 - NUMBER OF SAMPLES IN EACH RANGE BY SITE

Range of Activity	Carteret	Lorraine	Virginia-Franklin	Totals
all samples	63	271	142	476
all samples < 2000 pCi/g	62	258	141	461
all samples < 750 pCi/g	59	246	141	446
all samples < 200 pCi/g	57	221	132	410

TABLE 4 - AVERAGE ACTIVITY OF SAMPLES IN EACH RANGE BY SITE FOR ALL SITES WEIGHTED BY NUMBER OF SAMPLES

Range of Activity	Carteret (pCi/g)	Lorraine (pCi/g)	Virginia-Franklin (pCi/g)	Averages* (pCi/g)
all samples	430.80	466.10	128.77	360.79
all samples except highest	110.79	279.08	64.54	190.07**
all samples < 2000 pCi/g	110.79	123.37	64.54	103.69
all samples < 750 pCi/g	58.35	68.24	64.54	65.76
all samples < 200	31.50	26.85	43.71	35.71

*Averages weighted according to numbers of samples in each range from each site, not according to weights of material excavated from each site.

**Excludes highest sample from each site.

TABLE 5 - PERCENT OF BOTTLE SAMPLES IN EACH RANGE
BY SITE BASED ON NUMBER OF SAMPLES

Range of Activity	Carteret	Lorraine	Virginia-Franklin	Averages*
all samples	100 %	100 %	100 %	100 %
all samples < 2000 pCi/g	98.4%	95.2%	99.3%	96.8%
all samples < 750 pCi/g	93.7%	90.8%	99.3%	93.7%
all samples < 200	90.5%	81.5%	93.0%	86.1%

*Averages weighted according to numbers of samples in each range from each site, not according to weights of material excavated from each site.

TABLE 6 - DISTRIBUTION OF BOTTLE SAMPLES AND SOIL
EXCAVATED BETWEEN SITES

Site	Percent of Bottle Samples (by Number)	Percent of Material Excavated (by Weight
Carteret	13.3%	21.9%
Lorraine	56.9%	30.5%
Virginia/Franklin	29.8%	47.6%
TOTALS	100.0%	100.0%

TABLE 7 - AVERAGE ACTIVITY IN EACH RANGE FROM BOTTLE SAMPLE RESULTS
WEIGHTED ACCORDING TO PORTION OF SOIL EXCAVATED FROM EACH SITE

Range	Averages*
all material	297.80 pCi/g
all material except highest	140.10 pCi/g
all material < 2000 pCi/g	92.61 pCi/g
all material < 750 pCi/g	64.31 pCi/g
all material < 200 pCi/g	40.27 pCi/g

*Averages are weighted according to weights of material excavated from each site, not according to numbers of bottle samples.

Umetco Minerals Corporation

WHITE MESA MILL • P.O. BOX 669 • BLANDING, UTAH 84511
☎ (801) 678-2221

January 21, 1988

Mr. Harry J. Pettengill
U. S. Nuclear Regulatory Commission
Region IV
Uranium Recovery Field Office
Box 25325
Denver, CO 80225

Re: Umetco Minerals Corporation
SUA-1358: Docket No. 40-8681
White Mesa Mill, Utah

Dear Mr. Pettengill:

The purpose of this letter is to authorize you to deal directly with Harold R. Roberts, General Manager of Landmark Reclamation Company or their representative in regards to the New Jersey radium tailings so that any Licensing actions can be accomplished in a timely manner. These tailings may be disposed of at the White Mesa Mill if Landmark is the successful bidder.

Please feel free to contact me if you have any questions.

Very truly yours,

John S Hamrick

John S. Hamrick
Site Environmental Coordinator
Umetco Minerals Corporation
White Mesa Mill

xc
E. W. Shortridge
D. K. Sparling
H. R. Roberts
Central File

B/2

LANDMARK RECLAMATION

40-8681

04008681100R

RETURN ORIGINAL TO PDR, HQ.

January 20, 1988

JAN 1988 RECEIVED

DOCKETED USNRC JAN 21 1988 MAIL SECTION DOCKET CLERK

Mr. Harry J. Pettengill
U. S. Nuclear Regulatory Commission
Region IV
Uranium Recovery Field Office
Box 25325
Denver, Colorado 80225

Dear Mr. Pettengill:

Landmark Reclamation (Landmark), acting as a subcontractor to Nuclear Assurance Corporation (NAC), is proposing to receive tailings material from cleanup of a radium processing site in the state of New Jersey and to process and dispose of this material in the White Mesa Mill tailings impoundment. This proposal is being undertaken with the concurrence of the partners of the White Mesa Mill; Umetco Minerals Corporation and our parent company, Energy Fuels Nuclear, Inc. You will shortly be receiving authorizition from Umetco Minerals to deal directly with Landmark on licensing activities for this project.

The activities at the New Jersey clean up site and transport of the material to the White Mesa Mill site will be the responsibility of NAC. Landmark will assume responsibility at the White Mesa Mill, receive the material, conduct verification of shipping manifests and inventory of material, and arrange for processing and final disposal of the tailings material.

This letter is a formal request for amendment to the White Mesa mill Source Material License (# SUA 1358) to receive, process and permanently dispose of this material.

This material is coming from several sites in the state of New Jersey which were dump sites in the early 1900's from the milling of carnotite ore from Paradox Valley, Montrose County, Colorado. This ore was processed for radium extraction at a plant in the New Jersey area in the early 1900's and radium processing ended in 1926.

Attached for your review are several items of information received from the state of New Jersey, through NAC, which give basic background information on the history of the tailings material, the cleanup and sampling programs, and a characterization of the radiological aspects of this material. Any additional information on this tailings material which becomes available will be forwarded to your attention.

License Fee Information on next page

DESIGNATED ORIGINAL

Certified By

One Tabor Center 1200 17th Street Suite 2500 Denver, Colorado 80202
303/595-0933

9403300228

Activities planned at the White Mesa Mill site will involve the receipt of tailings material contained in 55 gallon drums and metal storage boxes shipped to the White Mesa site according to Department of Transportation and U. S. Nuclear Regulatory Commission regulations and guidelines. The material is contained in 9,525 55-gallon drums and 51 B-12 metal storage boxes containing approximately 4000 lbs each. The total amount of material is approximately 3,912 tons.

An initial verification will be made to ensure that all containers have arrived intact with no shipping damage and that all containers received correspond to shipping manifests from NAC at the New Jersey site. Activities will then involve the removal of tailings material from the storage containers (55 gallon drums in metal storage boxes) and placement of this material on the ore storage pad at the White Mesa Mill for processing, once the mill resumes operation in mid-1988. All existing license conditions for employee and environmental health and safety will be followed with the appropriate documentation for all activities involving the handling of this material.

Because of the relatively low radiological activity of this material, the impact of final disposal in the White Mesa Mill tailings system will cause no additional radiological considerations for the maintenance and ultimate reclamation of the tailings disposal cells. Depending on the specific time period in which this material is processed through the White Mesa Mill, it would be our intention to discharge this material into the central part of Cell 2 or the eastern edge of Cell 3. Documentation will be provided to the NRC as to discharge points for tailings slurry at the time the material is processed through the mill. The material will, in fact, end up as a homogeneous mixture with the other uranium-bearing ores being processed at that time and will not end up in the tailings cells as an isolated pocket of specific material.

The only revision to the operating procedure for the White Mesa Mill will be for verification of receipt of the material at the White Mesa Mill and the removal of material from the shipping containers prior to being fed to the mill process. These revisions to the operating procedures will result in no additional employee exposure or environmental impact to the White Mesa Mill area.

Enclosed is a check for $150.00 to cover the cost of initiating this license amendment request.

Feb 88-1
1012
1152
2A
Amendment
2/3/88
2/11/88

Timing for approval of this request is very critical as we must have authorization to receive the material at the time of bid submittal to the State of New Jersey. Bids are to be submitted by February 11, 1988, and I would appreciate an initial indication from your office if there is any problem in meeting this deadline.

If you have any questions or require additional information, please feel free to contact me.

Very truly yours,

Harold R. Roberts

Harold R. Roberts
General Manager

HRR:smm

Enclosures