



**ROCKY MOUNTAIN  
ENERGY**

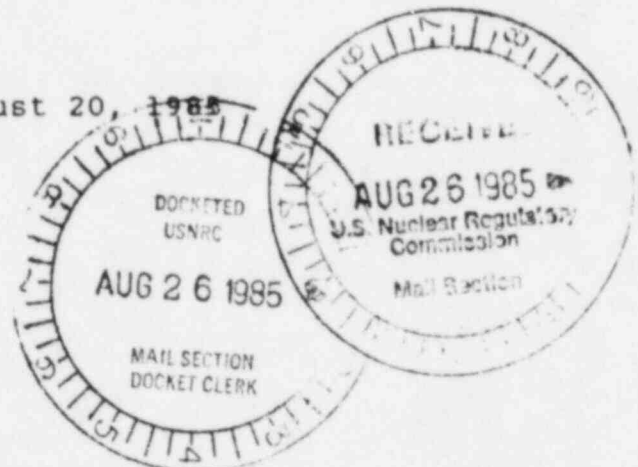
40-8380

RETURN ORIGINAL TO PDR, HQ

04008380310E

August 20, 1985

Mr. Randy Brich  
U. S. Nuclear Regulatory Commission  
Uranium Recovery Field Office  
P. O. Box 25325  
Denver, CO 80225



Dear Mr. Brich:

Re: Nine Mile Lake Decommissioning  
License SUA 1228, Docket No. 40-8380

Enclosed is RME's proposed cleanup "action level" for soil decontamination/removal at the Nine Mile Lake site as required by license condition no. 40 B. and C. Upon reviewing the language of the condition, it appears that no license amendment is required in this case, so no amendment fee is enclosed.

Pat Spieles and I appreciate the opportunity to have reviewed this information with you. We trust that you will find the methodology used to determine the proposed cleanup level of 24  $\mu$ R/hr. consistent with the requirement of condition no. 40 and are confident that removal of all soil yielding a gamma reading in excess of this level will result in decontamination of the site to background levels.

Please feel free to call me or Pat Spieles (307/237-8326) if you have any questions. Thanks again for your assistance and let me know when you might be available for a site visit.

Sincerely,

*Michael R. Neumann*

Michael R. Neumann  
Senior Licensing Specialist

MRN/asm  
Enclosure

cc: Edward Hawkins, NRC  
Pat Spieles, Supervisor - ISL Facilities  
Dr. Lyda Hersloff

DESIGNATED ORIGINAL

8509060349 850820  
PDR ADOCK 04008380  
C PDR

Certified By *Mary C. Ford*

8509060349 850820  
303 465 8544  
303 465 8544

**FEE EXEMPT**

*Add Info*  
*00849*

NINE MILE LAKE  
SOIL CONTAMINATION IDENTIFICATION

Introduction

Condition no. 40 B. of license SUA-1228 requires that RME develop a proposed cleanup action level for contaminated soils, in  $\mu\text{R/hr.}$ , which corresponds to a soil  $\text{Ra}^{226}$  content of 5 pCi/g above background. Because no R&D site baseline data for gamma levels or soil radium concentrations is available, a procedure was developed to approximate baseline conditions and define a gamma measurement level indicative of soil decontamination and will trigger soil removal for off-site disposal.

Procedure

A gross gamma survey was conducted on April 25, 1985, on lands adjacent to but upwind of the R&D site boundary to establish baseline conditions. Figure 1 shows the baseline survey location and sampling grid. All gamma reading locations were marked with surveyor's pin flags for future reference if required. The grid centroid was located at the casing of regional monitor well BM-12 which is a surveyed point.

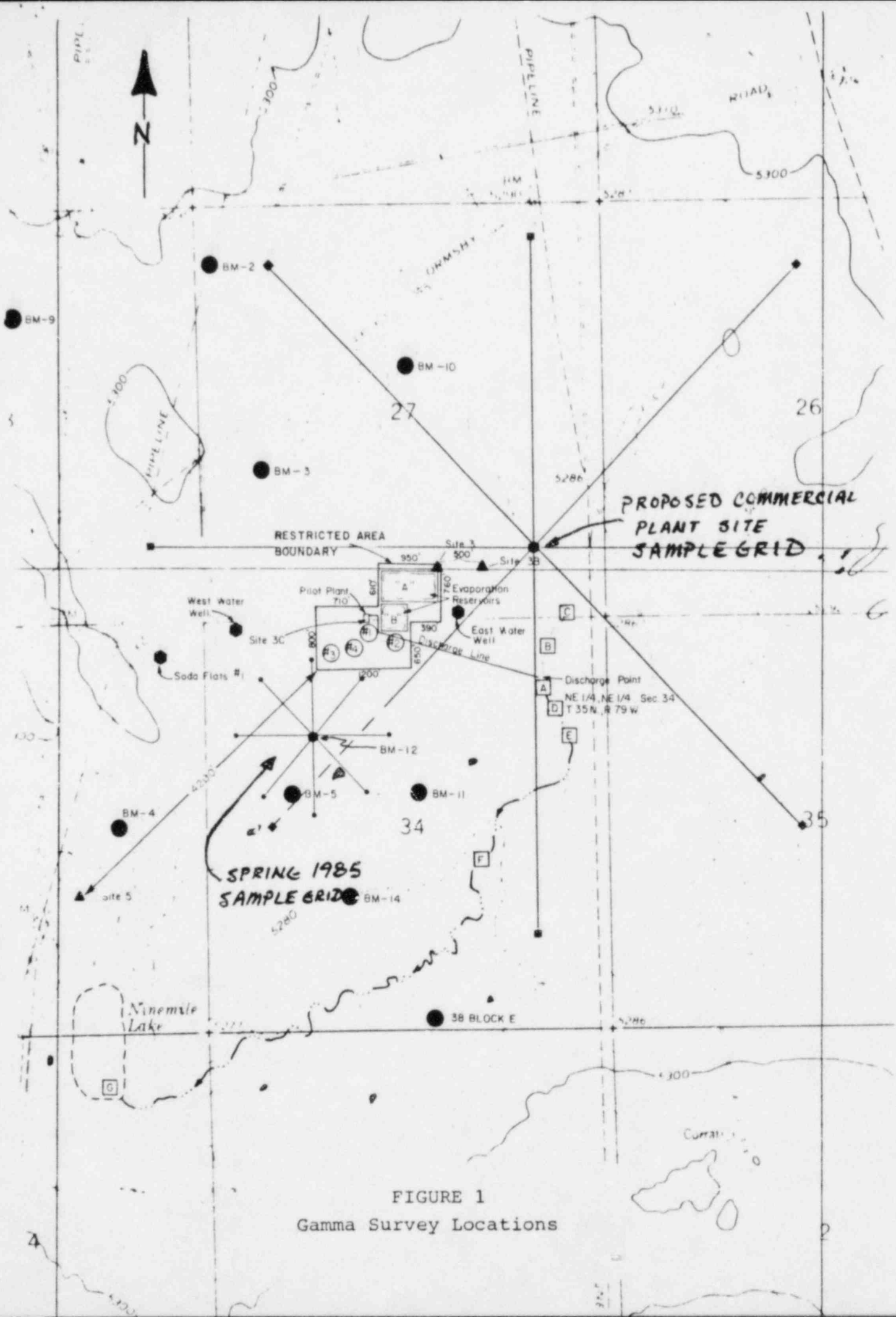


Table 1 presents results of the survey using two different meters. Results indicated the readings obtained with the Ludlum instrument were more accurate, and that the average error using the Victoreen was probably  $\pm 10 \mu\text{r/hr}$ . which is unsatisfactory for gamma surveys. Soil samples were collected at four divergent gamma reading locations and analyzed to determine percent moisture.

Next, 10 sites within the R&D permit boundary were designated for establishing a gamma reading - soil  $\text{Ra}^{226}$  correlation. Gross gamma readings were obtained using both the Ludlum Model 125 and Victoreen GM meters. Soil plug samples were taken to a depth of 15 cm. and sent to Accu-Labs for  $\text{Ra}^{226}$ ,  $\text{Th}^{232}$ , and  $\text{K}^{40}$  analyses. Split samples were also sent to Hazen Research for radium analysis in order to provide a QA cross check. Three gross gamma readings were obtained for each site at both a 1 meter and 5 cm. height above ground. Table 2 presents results of the gamma survey, and Table 3 gives soil radionuclide concentrations and soil moisture content for each gamma survey point.

#### Data Evaluation

Results of the gross gamma survey and soil sample analyses were analyzed using a standard correlation regression

TABLE I  
BASELINE GAMMA SURVEY

Direction: Reading <sup>1</sup> :	SOUTH		NORTH		EAST		WEST	
	A	(%H <sub>2</sub> O) B	A	(%H <sub>2</sub> O) B	A	(%H <sub>2</sub> O) B	A	(%H <sub>2</sub> O) B
BM-12	12.5	.018	12.5	.020	13	.020	13	.019
100'	13.5	.020	12.5	.025	12.5	.022	12.5	.020
200'	13	.015	12	.023	12	.018	12.5 (5.62)	.025
300'	13 (6.58)	.015	12	.015	13	.015	12.5	.020
400'	13	.030	12	.030	13	.030	12	.022
500'	13	.025	11.5	.015	12.5	.020	12.5	.020
600'	13.5	.025	11.5	.025	13 (5.53)	.012	13	.010
700'	14.5	.018	12	.018	13.5	.015	12	.020
800'	14	.015	12.5 (4.17)	.030	14	.015	12.5	.022
900'	14	.020	13	.028	13.5	.025	13	.022
1000'	15	.028	12.5	.025	13.5	.020	12	.018

$\bar{x}$  of A = 12.8  $\mu$ R/hr., s = 0.76, n = 44

$\bar{x}$  of B = 0.021 mR/hr., s = 0.005, n = 44

- <sup>1</sup> All values in column A obtained with a Ludlum 12S  $\mu$ R meter, Serial No. 12128. Calibrated 3/27/85 by the U. S. Bureau of Mines to a Ra-226 source. Readings given in  $\mu$ R/hr., taken at 1 meter ht.
- <sup>2</sup> All values in column B obtained with a Victoreen Thyac III GM meter, model 4900 with probe, Serial Nos. 2725 and 1852. Meter calibrated 3/27/85 by U. S. Bureau of Mines to a Ra-226 source. Readings given in mR/hr., taken at 1 meter ht.
- <sup>3</sup> % H<sub>2</sub>O = soil moisture content. Determined by oven drying-weight loss procedure.

TABLE 2  
SOIL GAMMA SURVEY RESULTS  
R&D TEST SITE

Measurement Site	5 cm. ht.		1 m. ht.	
	A <sup>1</sup>	B <sup>2</sup>	A	B
Well M-40	13	.025	12	.025
	14	.025	14	.025
	<u>12</u>	<u>.015</u>	<u>13</u>	<u>.020</u>
	Mean ( $\bar{x}$ )	13	13	.023
	Std.Dev. ( $\sigma$ )	1.0	1.0	.003
Well M-43	13	.025	13	.030
	11	.025	13	.025
	<u>11</u>	<u>.025</u>	<u>13</u>	<u>.020</u>
	( $\bar{x}$ )	11.7	13	.025
	( $\sigma$ )	1.2	0	.005
Well P-1A	13	.010	12	.028
	12.5	.012	11.5	.030
	<u>13.5</u>	<u>.012</u>	<u>12.5</u>	<u>.030</u>
	( $\bar{x}$ )	13	12.2	.029
	( $\sigma$ )	0.5	0.8	.011
Well PL-73	26	.018	21	.028
	25	.015	22.5	.030
	<u>24</u>	<u>.022</u>	<u>22</u>	<u>.022</u>
	( $\bar{x}$ )	25	21.8	.027
	( $\sigma$ )	1.0	0.8	.004
Well M-21	15	.017	15	.026
	14.5	.022	15.5	.021
	<u>16</u>	<u>.024</u>	<u>15</u>	<u>.021</u>
	( $\bar{x}$ )	15.2	15.2	.023
	( $\sigma$ )	0.8	0.3	.003
Well I-17	21	.018	24	.024
	20.5	.024	25	.040
	<u>22</u>	<u>.028</u>	<u>23</u>	<u>.027</u>
	( $\bar{x}$ )	21.2	24.1	.030
	( $\sigma$ )	0.8	0.8	.009
Well P-15	35.5	.022	28	.029
	34	.026	29.5	.025
	<u>36.5</u>	<u>.029</u>	<u>29</u>	<u>.032</u>
	( $\bar{x}$ )	35.3	28.8	.029
	( $\sigma$ )	1.3	0.8	.004

TABLE 2 (Continued)  
SOIL GAMMA SURVEY RESULTS  
R&D TEST SITE

Measurement Site	5 cm. ht.		1 m. ht.	
	A <sup>1</sup>	B <sup>2</sup>	A	B
Well I-19	24.5	.026	23.5	.017
	25	.028	23	.017
	<u>25</u>	<u>.027</u>	<u>24</u>	<u>.027</u>
	( $\bar{x}$ ) 24.8	.027	23.5	.020
	( $\sigma$ ) 0.3	.001	0.5	.006
Well I-18	19	.025	18	.027
	18	.025	18	.034
	<u>19.5</u>	<u>.021</u>	<u>18</u>	<u>.027</u>
	( $\bar{x}$ ) 18.8	.024	18	.029
	( $\sigma$ ) 0.8	.002	0	.004
Claim Stake	12	.010	12	.020
	14	.016	12	.017
	<u>15</u>	<u>.015</u>	<u>12</u>	<u>.016</u>
	( $\bar{x}$ ) 13.7	.014	12	.018
	( $\sigma$ ) 1.5	.003	0	.002

---

<sup>1</sup> All values in column A obtained with a Ludlum 12 S  $\mu$ r meter and given in  $\mu$ r/hr. Instrument calibrated to a Ra-226 source on 3/27/85 and compared with a CS-137 check source (#CS 7A) on 4/25/85.

<sup>2</sup> All values in column B obtained with a Victoreen GM gamma meter and given in mr/hr. Instrument calibrated to a Ra-226 source on 3/27/85 and compared with same cesium check source as Ludlum on 4/25/85.



TABLE 3

GAMMA EXPOSURE RATE VS.  $\text{Ra}^{226}$  ACTIVITY

Sample Site	Sample No.	Gamma* ur/Hr. 5 cm.	Gamma* ur/Hr. 1 mtr. (Y)	$\text{Ra}^{226}$ pCi/g Hazen	$\text{Ra}^{226}$ pCi/g Accu-Lab	$\text{Ra}^{226}$ pCi/g Avg. (X)	$\text{K}^{40}$ pCi/g	$\text{Th}^{230}$ pCi/g	% Moisture 2/15/85	% Moisture 5/8/85	Avg. % Moisture
M-40	1	12.7	12.3	1.3 $\pm$ 0.6	1.2 $\pm$ 0.5	1.25	2.9	0.8 $\pm$ 0.2	7.97	8.19	8.08
M-43	2	13.0	12.8	1.2 $\pm$ 0.6	1.3 $\pm$ 0.5	1.25	2.7	1.0 $\pm$ 0.3	6.44	9.03	7.74
P-1A	3	13.2	11.9	0.9 $\pm$ 0.5	0.8 $\pm$ 0.6	0.85	1.2	0.6 $\pm$ 0.2	3.28	4.58	3.93
PL-73	4	23.5	21.8	5.9 $\pm$ 1.5	6.5 $\pm$ 0.7	6.2	2.6	0.8 $\pm$ 0.2	6.02	6.78	6.40
M-21	5	15.5	14.3	2.2 $\pm$ 0.8	0.5 $\pm$ 0.4	1.35	2.9	0.8 $\pm$ 0.2	9.16	11.87	10.52
I-17	6	20.7	22.6	5.7 $\pm$ 1.4	5.4 $\pm$ 0.7	5.55	3.7	1.8 $\pm$ 0.4	12.12	10.42	11.27
I-18	7	17.9	18.2	2.8 $\pm$ 1.0	1.4 $\pm$ 0.5	2.1	2.1	0.7 $\pm$ 0.2	7.52	9.72	8.62
I-19	8	26.3	23.9	5.8 $\pm$ 1.2	4.9 $\pm$ 0.6	5.35	2.9	0.8 $\pm$ 0.2	7.53	13.73	10.63
P-15	9	37.3	27.5	17 $\pm$ 3	15 $\pm$ 1	16	2.5	1.0 $\pm$ 0.3	5.62	11.14	8.38
Downwind Claim Stake	10	12.8	12.1	1.1 $\pm$ 0.6	0.1 $\pm$ 0.3	0.5	2.1	0.5 $\pm$ 0.2	4.66	7.32	5.99
BM-12	11	12.3	11.7	0.8 $\pm$ 0.6	0.1 $\pm$ 0.4	0.45	2.8	0.7 $\pm$ 0.2	6.25	8.51	7.38
									$\bar{X}$ =6.96	$\bar{X}$ =9.21	$\bar{X}$ =8.09

\* Average of 9-10 readings over 4 days 2/15/85, 4/25/85, 5/3/85, 5/8/85.

<sup>1</sup> Hazen Research Laboratories, Golden, Colorado.

<sup>2</sup> Accu-Labs Research, Inc., Wheat Ridge, Colorado.

<sup>3</sup> All soil moisture values determined by oven drying - weight loss method.



statistical procedure. Correlations between gamma readings (in  $\mu\text{R/hr.}$ ) and soil  $\text{Ra}^{226}$  concentrations (in  $\text{pCi/g}$ ) were quite good with correlation coefficients ( $r$ ) of 0.88 and 0.96 for readings obtained at a height of 1 m. and 5 cm., respectively. Gamma readings used in this evaluation were an average of the two different lab results. Since condition 40 of the license stipulates that the majority of the gamma readings made for cleanup determination are to taken at a 1 m. height, the correlations were based on gamma exposures at 1 m.

Figure 2 shows a plot of gross gamma readings taken at 1 m. versus soil radium concentrations for each of the sample sites. Because sample data from P-15 is anomalous and a higher correlation coefficient is obtained when P-15 data is rejected ( $r=0.88$  with P-15;  $r=0.96$  without), the regression line was plotted excluding P-15 data. The curve indicates a background gamma reading when  $\text{Ra}^{226}$  is zero to be approximately 11  $\mu\text{R/hr.}$  Excluding P-15, the figure indicates that a total gamma exposure reading of 21.9  $\mu\text{R/hr.}$  corresponds to the presence of 5  $\text{pCi/g}$  of  $\text{Ra}^{226}$  in the soil.

The influence of soil moisture,  $\text{K}^{40}$ , and  $\text{Th}^{232}$  on gamma exposures was found to be statistically weak with respective correlation coefficients of 0.48, 0.34, and 0.48. Furthermore, there is little variation in the soil content of

NINE MILE LAKE  
GROSS GAMMA  
VS.  
SOIL RADIUM

$$n = 10$$

$$r = 0.96$$

$$y = (0.44)x + (-4.61)$$

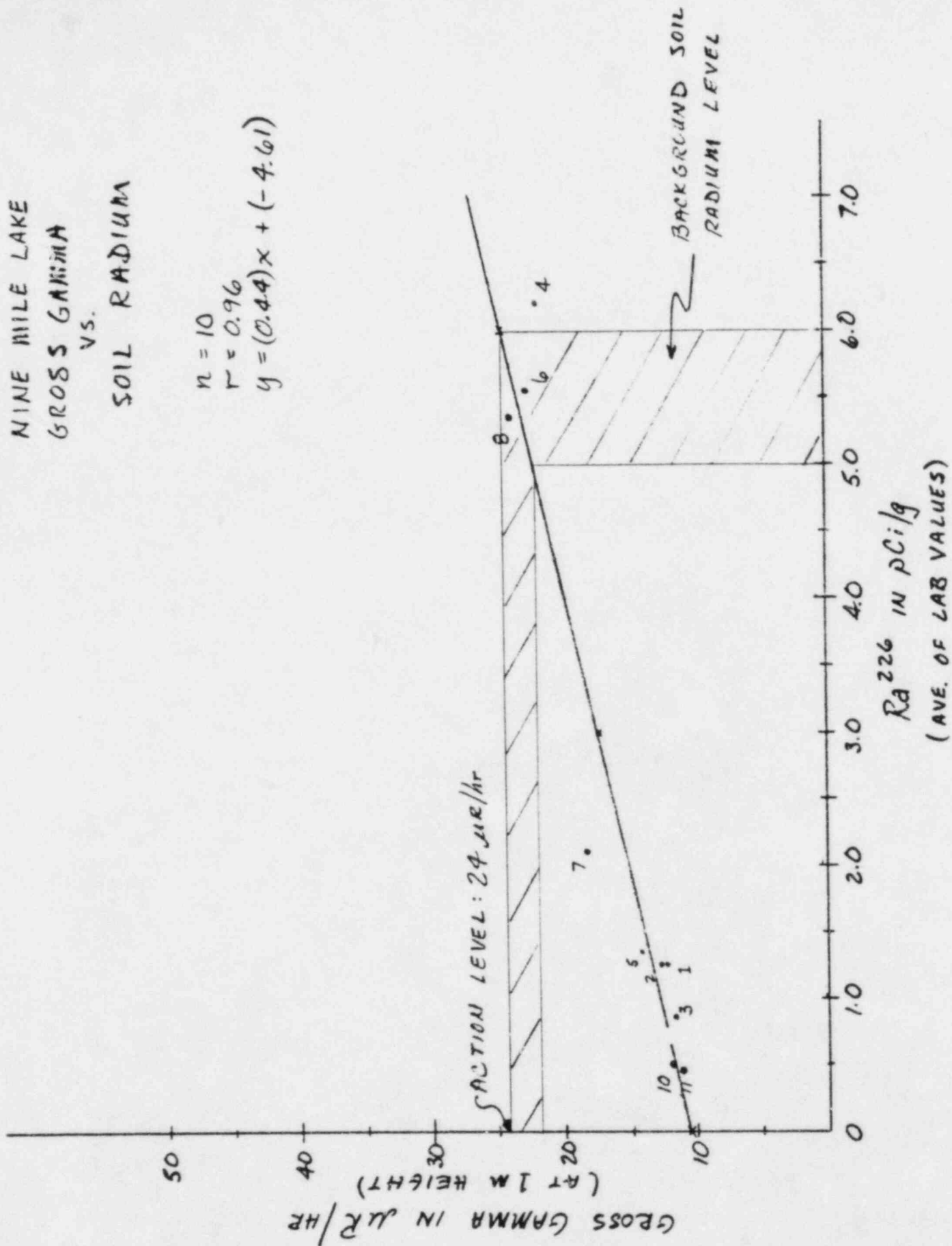


FIGURE 2

Potassium-40 ( $2.58 \pm 0.63$ ) and Thorium-230 ( $0.86 \pm 0.33$ ) between the various soil sampling locations. This consistency is reflected by the lack of correlation between gamma exposure and soil content.

The soil moisture content with a mean and standard deviation of  $8.09 \pm 2.19$  does not have a strong consistent relationship with the gamma readings ( $r=0.48$ ). One would expect that if the soil moisture was indeed a strong factor in the gamma readings that with increased moisture content, the gamma readings would decrease. This relationship was not found thus indicating that soil moisture at the levels found during this sampling period is not a factor in relating gamma measurements with Radium-226 soil analyses.

Based on these findings, it appears that no correction factor is required to predict soil radium concentrations from gross gamma readings. The final step is to calculate a gross gamma exposure level in  $\mu\text{R/hr.}$ , which corresponds to a soil  $\text{Ra}^{226}$  concentration of 5 pCi/g above background. Although no determination of background soil radium levels within the R&D test site were made, extensive data was obtained from an adjacent and partially overlapping area during the baseline sampling program for the proposed commercial plant site (Figure 1). Attachment A presents the

data which was collected from soil types identical to those within the test site. Based on 51 samples, a mean baseline soil  $\text{Ra}^{226}$  concentration of 0.999 pCi/g was obtained with a standard deviation of 0.57 and range from 0.0 to 2.44 pCi/g (not including counting error). Rounding off 0.99 pCi/g to 1.0, we conclude that soils containing 6 pCi/g or more of  $\text{Ra}^{226}$  can be reasonably presumed to indicate contamination. Referring back to Figure 2, it is evident that a gamma exposure of approximately 24.2  $\mu\text{R/hr}$ . indicates the presence of 6 pCi/g of  $\text{Ra}^{226}$  in the soil.

#### Conclusion

RME proposes that a gross gamma exposure of 24  $\mu\text{R/hr}$ . or more will be used to identify soils requiring cleanup (i.e., removal). Soils exceeding this level will either be removed or sampled to determine actual  $\text{Ra}^{226}$  concentrations and then handled accordingly.

DATE: February 28, 1980

TO: Lyda Hersloff, Mike Neumann

FROM: Pat Spieles *Pat*

SUBJECT: Baseline Soil Radiochemistry at the  
Nine Mile Lake Commercial Site

---

Attached are CDM/Acculab results and a map indicating the sample locations.

The sample sites were established according to the recommended grid in the NRC position paper. The locations are 500 feet apart.

PS/ph



environmental engineers, scientists,  
planners, & management consultants

January 31, 1980

Pat Spieles  
Rocky Mountain Energy  
P.O. Box 3719  
Casper, WY 82602

RE: 261-9024-40  
Per letter of 10-19-79

CAMP DRESSER & MCKEE INC.

11455 West 48th Avenue  
Wheat Ridge, Colorado 80033  
303 422-9469

REPORT OF ANALYSIS

Lab Designation	261-9024-40-1	261-9024-40-2	261-9024-40-3	261-9024-40-4	261-9024-40-5
Sponsor Designation	1	3	5	7	9
<u>Determination (pCi/g)</u>					
Radium-226 $\pm$ Precision*	0.6 $\pm$ 1.1	0.6 $\pm$ 1.5	0.8 $\pm$ 1.4	1.0 $\pm$ 1.5	0.8 $\pm$ 1.4
Thorium-230 $\pm$ Precision*	4.2 $\pm$ 0.8	6.2 $\pm$ 0.9	-	-	-
Lead-210 $\pm$ Precision*	0.3 $\pm$ 0.4	0.0 $\pm$ 0.8	-	-	-
Uranium (as U <sub>3</sub> O <sub>8</sub> ) (%)	<0.0002	<0.0002	-	-	-
Air Dry Loss (%)	4.3	6.0	2.8	5.0	3.0

\*Variability of the radioactive disintegration process (counting error) at the 95% confidence level,  $1.96\sigma$ .

Sediments reported on air dry basis.

Pat Spieles  
Page 2  
January 31, 1980

RE: 261-9024-40

REPORT OF ANALYSIS

Lab Designation	261-9024-40-6	261-9024-40-7	261-9024-40-8	261-9024-40-9	261-9024-40-10
Sponsor Designation	11	13	15	17	19
<u>Determination (pCi/g)</u>					
Radium-226 $\pm$ Precision*	1.2 $\pm$ 1.4	1.3 $\pm$ 1.4	1.5 $\pm$ 1.3	0.5 $\pm$ 1.6	0.6 $\pm$ 1.3
Thorium-230 $\pm$ Precision*	-	4.6 $\pm$ 0.8	-	-	-
Lead-210 $\pm$ Precision*	-	0.0 $\pm$ 0.4	-	-	-
Uranium (as U <sub>3</sub> O <sub>8</sub> ) (%)	-	0.0002	-	-	-
Air Dry Loss (%)	2.8	4.3	4.5	7.0	5.0

\*Variability of the radioactive disintegration process (counting error) at the 95% confidence level,  $1.96\sigma$ .

Sediments reported on air dry basis.



Pat Spieles  
Page 3  
January 31, 1980

RE: 261-9024-40

REPORT OF ANALYSIS

Lab Designation	261-9024-40-11	261-9024-40-12	261-9024-40-13	261-9024-40-14	261-9024-40-15
Sponsor Designation	21	23	25	27	29
<u>Determination (pCi/g)</u>					
Radium-226 $\pm$ Precision*	1.4 $\pm$ 1.1	1.3 $\pm$ 1.3	0.4 $\pm$ 1.6	1.6 $\pm$ 1.5	0.1 $\pm$ 1.3
Thorium-230 $\pm$ Precision*	-	4.7 $\pm$ 0.8	-	-	-
Lead-210 $\pm$ Precision*	-	0.0 $\pm$ 0.6	-	-	-
Uranium (as U <sub>3</sub> O <sub>8</sub> ) (%)	-	<0.0002	-	-	-
Air Dry Loss (%)	4.5	6.4	5.7	6.0	4.8

\*Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 1.96 $\sigma$ .

Sediments reported on air dry basis.

Pat Spieles  
Page 4  
January 31, 1980

RE: 261-9024-40

REPORT OF ANALYSIS

Lab Designation	261-9024-40-16	261-9024-40-17	261-9024-40-18	261-9024-40-19	261-9024-40-20
Sponsor Designation	31	33	35	37	39
<u>Determination (pCi/g)</u>					
Radium-226 $\pm$ Precision*	0.5 $\pm$ 1.4	1.1 $\pm$ 1.2	1.5 $\pm$ 2.4	0.9 $\pm$ 1.6	0.5 $\pm$ 1.6
Thorium-230 $\pm$ Precision*	-	3.2 $\pm$ 0.7	-	-	-
Lead-210 $\pm$ Precision*	-	0.1 $\pm$ 0.3	-	-	-
Uranium (as U <sub>3</sub> O <sub>8</sub> ) (%)	-	<0.0002	-	-	-
Air Dry Loss (%)	5.2	4.2	4.8	4.4	4.2

\*Variability of the radioactive disintegration process (counting error) at the 95% confidence level,  $1.96\sigma$ .

Sediments reported on air dry basis.

Pat Spieles  
Page 5  
January 31, 1980

RE: 261-9024-40

REPORT OF ANALYSIS

Lab Designation	261-9024-40-21	261-9024-40-22	261-9024-40-23	261-9024-40-24	261-9024-40-25
Sponsor Designation	41	43	45	47	49
<u>Determination (pCi/g)</u>					
Radium-226 $\pm$ Precision*	1.5 $\pm$ 2.0	1.8 $\pm$ 1.9	0.0 $\pm$ 2.2	1.8 $\pm$ 1.5	1.2 $\pm$ 1.6
Thorium-230 $\pm$ Precision*	-	5.8 $\pm$ 0.9	-	-	-
Lead-210 $\pm$ Precision*	-	0.3 $\pm$ 0.7	-	-	-
Uranium (as U <sub>3</sub> O <sub>8</sub> ) (%)	-	0.0002	-	-	-
Air Dry Loss (%)	3.9	6.4	5.6	6.8	11.5

\*Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 1.96 $\sigma$ .

Sediments reported on air dry basis.

Pat Spieles  
Page 6  
January 31, 1980

RE: 261-9024-40

REPORT OF ANALYSIS

Lab Designation	261-9024-40-26	261-9024-40-27	261-9024-40-28	261-9024-40-29	261-9024-40-30
Sponsor Designation	51	53	55	57	59
<u>Determination (pCi/g)</u>					
Radium-226 $\pm$ Precision*	0.1 $\pm$ 1.8	0.2 $\pm$ 1.7	1.0 $\pm$ 1.6	0.7 $\pm$ 1.2	1.5 $\pm$ 1.7
Thorium-230 $\pm$ Precision*	-	4.0 $\pm$ 0.7	-	-	-
Lead-210 $\pm$ Precision*	-	0.1 $\pm$ 0.6	-	-	-
Uranium (as U <sub>3</sub> O <sub>8</sub> ) (%)	-	<0.0002	-	-	-
Air Dry Loss (%)	7.8	7.6	8.4	8.3	7.8

\*Variability of the radioactive disintegration process (counting error) at the 95% confidence level,  $1.96\sigma$ .

Sediments reported on air dry basis.

Pat Spieles  
Page 7  
January 31, 1980

RE: 261-9024-40

REPORT OF ANALYSIS

Lab Designation	261-9024-40-31	261-9024-40-32	261-9024-40-33	261-9024-40-34	261-9024-40-35
Sponsor Designation	61	63	67	69	71
<u>Determination (pCi/g)</u>					
Radium-226 $\pm$ Precision*	1.4 $\pm$ 1.4	0.4 $\pm$ 1.2	0.4 $\pm$ 1.7	0.6 $\pm$ 1.2	0.6 $\pm$ 1.2
Thorium-230 $\pm$ Precision*	-	3.1 $\pm$ 0.6	-	-	-
Lead-210 $\pm$ Precision*	-	0.2 $\pm$ 0.3	-	-	-
Uranium (as U <sub>3</sub> O <sub>8</sub> ) (%)	-	<0.0002	-	-	-
Air Dry Loss (%)	9.4	2.6	4.0		

\*Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 1.96 $\sigma$ .

Sediments reported on air dry basis.

Pat Spielos  
Page 8  
January 31, 1980

RE: 261-9024-40

REPORT OF ANALYSIS

Lab Designation	261-9024-40-36	261-9024-40-37	261-9024-40-38	261-9024-40-39	261-9024-40-40
Sponsor Designation	73	75	77	79	81
<u>Determination (pCi/g)</u>					
Radium-226 $\pm$ Precision*	1.2 $\pm$ 1.6	0.8 $\pm$ 1.4	1.1 $\pm$ 1.6	0.5 $\pm$ 1.4	0.6 $\pm$ 1.3
Thorium-230 $\pm$ Precision*	5.5 $\pm$ 0.8	-	-	-	-
Lead-210 $\pm$ Precision*	0.0 $\pm$ 0.6	-	-	-	-
Uranium (as U <sub>3</sub> O <sub>8</sub> ) (%)	0.0002	-	-	-	-

\*Variability of the radioactive disintegration process (counting error) at the 95% confidence level,  $1.96\sigma$ .

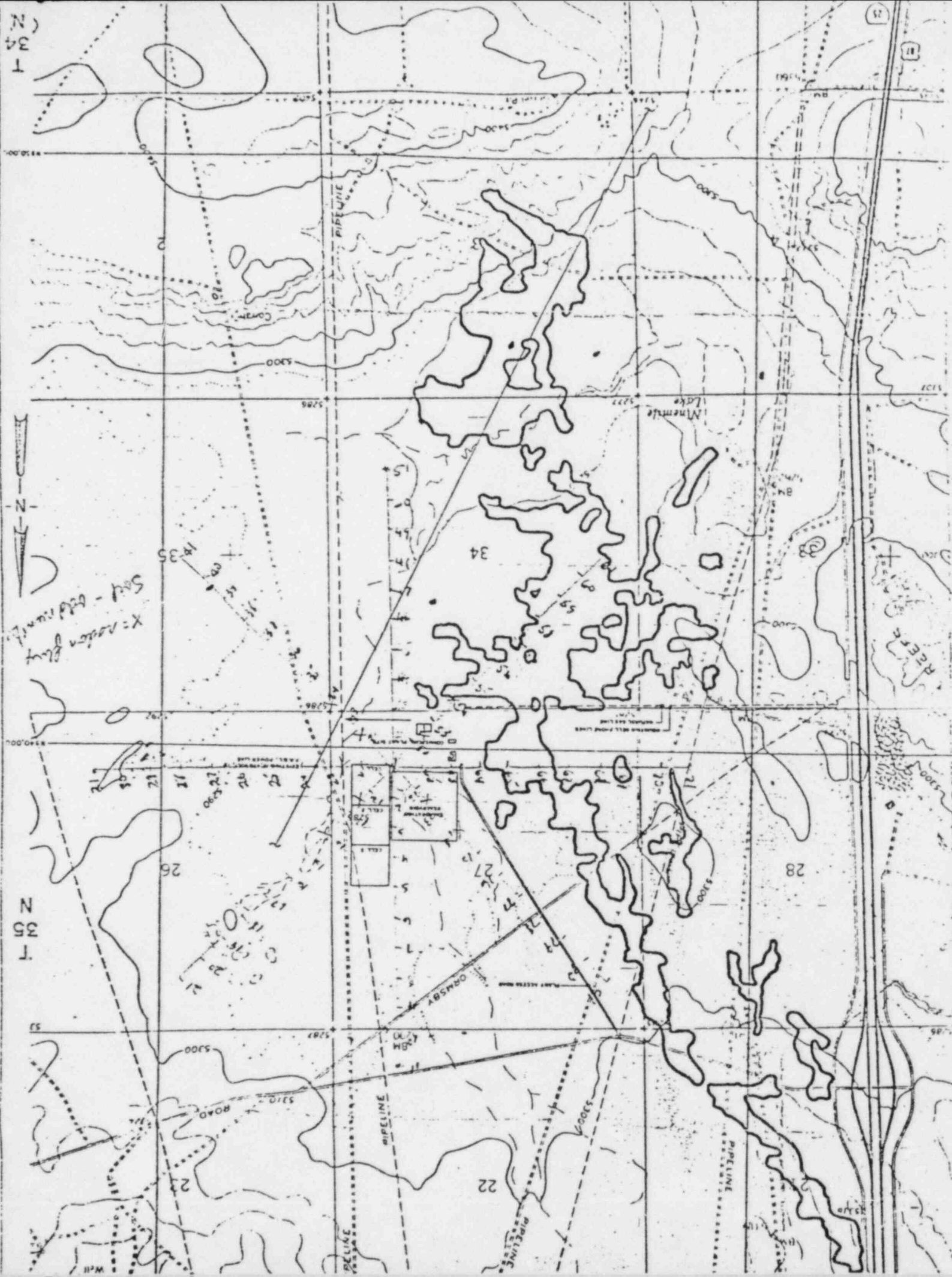
Sediments reported on air dry basis.

BY

Nancy Ebbesen

Nancy Ebbesen  
Radiochemistry  
Assistant Supervisor

NE/rjf



34  
T  
N

34  
T  
N

35  
T  
N

35  
T  
N

X: station blue  
Sed - old river

26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65  
66  
67  
68  
69  
70  
71  
72  
73  
74  
75  
76  
77  
78  
79  
80  
81  
82  
83  
84  
85  
86  
87  
88  
89  
90  
91  
92  
93  
94  
95  
96  
97  
98  
99  
100

22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65  
66  
67  
68  
69  
70  
71  
72  
73  
74  
75  
76  
77  
78  
79  
80  
81  
82  
83  
84  
85  
86  
87  
88  
89  
90  
91  
92  
93  
94  
95  
96  
97  
98  
99  
100

34

28

22

Merrill Lake

PIPELINE

PIPELINE

PIPELINE

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD



PREOPERATIONAL VEGETATION AND SOIL ANALYSES  
JULY, 1980, SAMPLING

Site	pCi/g Ra-226		pCi/g Th-230		pCi/g Pb-210		pCi/g Po-210		ppm Natural Uranium	
	CSMRI	CDM	CSMRI	CDM	CSMRI	CDM	CSMRI	CDM	CSMRI	CDM
<u>Vegetation</u>										
S-5 (Upwind Control)	0.2±0.3	0.2±0.25	0.0±1.1	0.02±0.10	1.2±1.5	1.1±0.54	1.3±0.9	0.4±0.2	2	0.08
S-6 (Downwind-Plant Site)	0.0±0.1	0.55±0.35	0.0±0.6	0.00±0.09	0.3±1.7	1.23±0.19	0.1±0.7	0.4±0.2	2	0.17
S-7 (Downwind-Pond Site)	0.3±0.3	0.33±0.23	0.0±0.6	0.02±0.08	2.1±1.8	0.56±0.24	0.2±0.7	0.6±0.3	2	0.08
Plant-Pond Site (Center)	0.1±0.2	0.48±0.29	0.0±0.6	0.00±0.08	1.2±1.3	1.06±0.26	0.4±0.8	0.6±0.2	2	0.5

<u>Soil</u>										
S-5	1.9±1.4	0.6±1.2	2.6±3.1	1.1±0.4	0.2±2.2	1.4±0.6			2	2.5
S-6	2.1±1.5	1.3±1.2	1.3±2.5	1.9±0.5	1.9±1.5	1.1±0.6			2	1.7
S-7	0.4±0.8	1.5±1.2	1.3±2.5	2.0±0.5	0.4±1.7	1.2±0.6			2	1.7
Plant-Pond Site	0.8±1.0	1.2±1.3	1.0±2.4	0.9±0.4	0.0±1.8	0.9±0.6			2	0.9

ROCKY MOUNTAIN ENERGY COMPANY  
 RADIOCHEMICAL ANALYSIS  
 EA 7920-132

SOILS

<u>Sample I.D.</u>	<u>Ra-226</u> <u>pCi/g</u>	<u>Th-230</u> <u>pCi/g</u>	<u>Pb-210</u> <u>pCi/g</u>	<u>Natural U</u> <u>pCi/g</u>
✓ S-5 8-3-79	2.44 ± 0.39	1.7 ± 1.2	1 ± 1	0.63
✓ S-6 8-3-79	0.91 ± 0.26	1.9 ± 1.5	1 ± 1	0.72
✓ S-7 8-3-79	2.24 ± 0.37	3.5 ± 2.3	1 ± 1	0.69
S-8 7-27-79	2.02 ± 0.36	2.0 ± 1.6	2 ± 1	0.82
S-10 7-27-79	0.51 ± 0.17	1.9 ± 1.7	1 ± 1	0.69
S-11 7-30-79	2.64 ± 0.38	4.5 ± 3.6	1 ± 1	1.03
S-12 7-31-79	1.47 ± 0.29	2.1 ± 2.9	0 ± 1	0.75
ER-1 7-27-79	1.63 ± 0.29	1.6 ± 1.8	1 ± 1	0.84