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January 28, 1994

Mr. Charles Gaskin
U.S. Nuclear Regulatory Commission
Division of Fuel Cycle
Safety and Safeguard, 4E4
Washington, DC 20555

SUBJECT: **ANALYSES OF MAGNESIUM ELEKTRON SAMPLES (RFTA #94-002)**

DOCKET #40-8984

Dear Mr. Gaskin:

Enclosed are the analytical results for soil, sediment, and water samples from Magnesium Elektron, Inc. of Flemington, NJ; these analyses were performed in accordance with the Request For Technical Assistance (RFTA) #94-002. All samples were analyzed by gamma spectrometry and selected samples were analyzed by alpha spectrometry to determine relative abundances of uranium isotopes. Total uranium was calculated on the basis of the U-238 concentration, determined by gamma spectrometry, and relative natural activity abundances (0.511:0.023:0.466) of the U-234, U-235, and U-238 isotopes; total natural thorium was calculated from the sum of the Th-228 and Th-232 concentrations.

Tables 1 and 2 summarize the results of the gamma spectrometry analysis and the total uranium and total thorium calculations for solid and water samples, respectively. Results of alpha spectrometry analyses are presented in Table 3. On the basis of these results, it appears that the contaminants are from the thorium and uranium decay series.

In soil and sediment the two principle thorium isotopes (Th-232 and Th-228) are present in essentially equal concentrations, indicating that this decay series is present in secular equilibrium. The uranium isotopes (U-234, U-235, and U-238) are in their naturally occurring abundances. Other members of the uranium decay series are present; however, key radionuclides, such as Ra-226, are not present at the same concentrations as the precursor uranium isotopes and it thus appears that the uranium series equilibrium has been disrupted. In most solid samples the Ra-226 level is higher than the U-238 level.

Contamination in the water samples is predominantly uranium, in naturally occurring isotopic abundances, but without significant concentrations (in comparison with uranium levels) of the decay series daughters. On the basis of these combined findings, it appears that the Ra-226 and certain other uranium series daughters are staying with the solid waste fraction, while the uranium itself is relatively soluble and remains in the liquid waste stream.



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We apologize for the longer-than-usual time to complete these analyses; however, due to the relatively high concentration levels, some samples required special handling and dilution, and the very fine particle size of the contaminant allowed almost complete loss of radon during sample preparation, thus requiring that samples be sealed and stored for daughter ingrowth, prior to analyses.

If you have questions, please call me at (615) 576-2908 or Mark Laudeman at (615) 576-3561.

Sincerely,

Michele Landis
Projects Manager
Environmental Survey and
Site Assessment Program

MRL:ttc

Enclosure

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TABLE 1

RADIONUCLIDE CONCENTRATIONS IN SOIL AND SEDIMENT SAMPLES
MAGNESIUM ELEKTRON, INC.
FLEMINGTON, NEW JERSEY

| Sample ID | Radionuclide Concentrations (pCi/g dry weight)[a] | | | | | |
|---|---|---|---|---|---|---|
| | U-238 | Th-232 | Th-228 | Ra-226 | Total U[c] | Total Th[d] |
| 6-C3-2S | 136 ± 30[b] | 62.6 ± 6.7 | 64.8 ± 6.6 | 179.0 ± 6.0 | 290 | 130 |
| 6-C3-1S | 106 ± 15 | 35.1 ± 3.3 | 36.7 ± 3.9 | 152.0 ± 4.0 | 230 | 72 |
| 6-D3-2S | 162 ± 18 | 75.0 ± 5.9 | 77.3 ± 3.8 | 239.2 ± 4.6 | 350 | 150 |
| 6-D3-1S | 162 ± 34 | 86.6 ± 8.0 | 85.5 ± 6.1 | 471.9 ± 8.3 | 350 | 170 |
| 6-D4-2S | 92 ± 16 | 42.6 ± 3.4 | 43.2 ± 2.6 | 85.5 ± 2.9 | 200 | 86 |
| 6-D4-1S | 177 ± 26 | 93.5 ± 6.3 | 85.4 ± 4.2 | 398.9 ± 6.0 | 380 | 180 |
| 10-B-2S | 116 ± 14 | 58.6 ± 3.4 | 57.8 ± 3.2 | 69.9 ± 2.2 | 250 | 120 |
| 10-B-1S | 290 ± 38 | 138 ± 10 | 158.6 ± 7.9 | 666 ± 11 | 620 | 300 |
| 6-C2-1S | 105 ± 24 | 55.3 ± 6.5 | 59.9 ± 5.3 | 340.4 ± 8.1 | 230 | 120 |
| 6-C2-2S | 111 ± 22 | 40.5 ± 4.4 | 41.1 ± 3.9 | 26.8 ± 2.5 | 240 | 82 |
| 10C-12S | 194 ± 19 | 91.7 ± 5.6 | 96.1 ± 4.8 | 290.7 ± 5.5 | 420 | 190 |
| 11E-12S | 148 ± 24 | 51.8 ± 5.5 | 57.1 ± 3.6 | 185.2 ± 4.6 | 320 | 110 |
| Pond 7 | 26.7 ± 5.2 | 10.1 ± 1.1 | 12.0 ± 0.9 | 39.9 ± 1.2 | 57 | 22 |
| Pond 6 | 51.7 ± 6.3 | 27.4 ± 1.8 | 26.5 ± 1.4 | 142.1 ± 1.9 | 110 | 54 |
| Pond 5 | 16.4 ± 2.5 | 5.1 ± 0.6 | 6.1 ± 0.6 | 25.9 ± 0.6 | 35 | 11 |

[a]Wet weight to dry weight ratio averages approximately 1.6.
[b]Uncertainties represent the 95% confidence level, based only on counting statistics.
[c]Calculated from U-238, assuming natural isotopic abundances.
[d]Sum of Th-228 and Th-232 concentrations.

TABLE 2

RADIONUCLIDE CONCENTRATIONS IN WATER SAMPLES
MAGNESIUM ELEKTRON, INC.
FLEMINGTON, NEW JERSEY

| Sample ID | Radionuclide Concentrations (pCi/l) | | | | | |
|---|---|---|---|---|---|---|
| | U-238 | Th-232 | Th-228 | Ra-226 | Total U[b] | Total Th[c] |
| 1A-03A | 39,700 ± 2,100[a] | <140 | <130 | <80 | 85,200 | <270 |
| 1A-03B | 27,000 ± 1,500 | <110 | <120 | 41 ± 77 | 59,400 | <230 |

[a]Uncertainties represent the 95% confidence level, based only on counting statistics.
[b]Calculated from U-238 concentration, based on natural isotopic ratios.
[c]Calculated from sum of Th-232 and Th-238 concentrations.

TABLE 3

URANIUM ISOTOPIC ANALYSES
MAGNESIUM ELEKTRON, INC
FLEMINGTON, NEW JERSEY

| Sample ID | Radionuclide Concentration | | |
|---|---|---|---|
| | U-234 | U-235 | U-238 |
| 6-C2-2S (soil) | 154.9 ± 5.7[a] pCi/g | 6.6 ± 1.5 pCi/g | 155.0 ± 5.7 pCi/g |
| 6-D4-1S (soil) | 230 ± 11 pCi/g | 9.9 ± 2.5 pCi/g | 230 ± 11 pCi/g |
| Pond 7 (soil) | 35.9 ± 3.0 pCi/g | 1.45 ± 0.91 pCi/g | 37.3 ± 3.0 pCi/g |
| 1A-03A (water) | 31500 ± 1800 pCi/l | 1830 ± 510 pCi/l | 30600 ± 1800 pCi/l |
| 1A-03B (water) | 30000± 1900 pCi/l | 1590 ± 560 pCi/l | 34500 ± 2000 pCi/l |

[a]Uncertainties represent the 95% confidence level, based only on counting statistics.