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RADIOMETRIC ANALYSIS OF URANIUM ORE SAMPLES FROM WESTERN NUCLEAR INC., RAWLINS, WYOMING

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MINERAL SCIENCES DIVISION

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C. McMahon* and G.G. Eichholz**

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SUMMARY OF RESULTS

Eleven uranium ore samples submitted by Western Nuclear Inc. have been assayed radiometrically. The samples contained 3-4% potassium and it was found, that by making a small correction for potassium in the beta equivalent value, uranium assay values could be obtained that were in good agreement with chemical values.

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INTRODUCTION

Earlier this year the advice of the Mines Branch Laboratories was requested by Mr. B.E. Stapley of Electronic Associates Ltd., Willowdale, Ont. concerning a problem in radiometric assaying of uranium ores. It appeared that one of the company's customers, Western Nuclear Inc. of Rawlins, Wyoming, was encountering difficulties in the application of the standard "equilibrium method" of beta-gamma assaying (1) to some of their ore. Western Nuclear had indicated that they had obtained better results with a procedure advocated by R.L. Blake and using Blake's equipment. Analysis of Blake's procedure showed that he merely recommended calibrating the equipment with some assayed material of the mine's own ore, thus camouflaging any disequilibrium features of the radioactive contents in the calibration constants. In addition, the Blake procedure required very high-grade standards for calibration. However, as the Blake method utilized essentially no factors not normally usable in the equilibrium method, it was arranged to assay a representative series of samples in Ottawa to establish the reasons for the observed discrepancies.

Eleven samples were shipped in March 1961 by Western Nuclear Inc. After some unusual shipping delays the samples were received late in May 1961.

TEST RESULTS

After some preliminary radiometric assays it became evident that the U_3O_8 values obtained were almost invariably above the values supplied by the company, which were for other samples from the same locations. Some chemical checks were obtained which on the whole confirmed the company values. In addition, the beta equivalents were observed to be consistently high, strongly suggesting a high potassium content. This factor was confirmed by chemical determination of the potassium content of the samples, performed by the Control Analysis Section, Extraction Metallurgy Division of the Mines Branch.

Table 1 summarizes all the assay results obtained for these samples. The second column ("label assays") represents the U_3O_8 content quoted in the covering letter from Western Nuclear Inc., dated March 29, 1961. The next three columns

contain the radiometric U_3O_8 results obtained by the standard beta-gamma procedure. Columns 6 and 7 contain the Mines Branch chemical assays for U_3O_8 and K. The last column contains the value of U_3O_8 content obtained by correcting the beta equivalent for potassium content by subtracting 0.002-0.003% U_3O_8 equivalent. This is based on the familiar relationship 1% K $\simeq$ 0.0007% U_3O_8 valid for most end-window counters and infinitely thick sources. It is seen that the corrected U_3O_8 values agree fairly well with the chemical values. The samples fluctuate widely in their state of equilibrium and seem to include some secondary material. A major discrepancy remained only for sample L, which has a lower potassium assay than the rest. The possibility of the presence of thorium in this sample was considered; however, a careful study of its gamma-ray spectrum by Mr. J.L. Horwood of the Mineral Sciences Division indicated no detectable contribution to the radiation by thorium. This sample may have suffered leaching by weathering which thus could have contributed to its non-equilibrium condition.

TABLE 1

Summary of Assay Results

Sample No.	Labelled Chemical Content $\%U_3O_8$	Radiometric Values			Chem. Assays		Radiometric Corrected $\%U_3O_8$
		γ equiv. U_γ	β equiv. U_β	$\%U_3O_8$	$\%U_3O_8$	%K	
D	0.042	0.029	0.038	0.050		3.48	0.045
E	0.023	0.049	0.042	0.033		3.28	0.028
F	0.008	0.087	0.054	0.011	0.0107	3.63	0.007
G	0.080	0.091	0.090	0.089		3.60	0.084
H	0.005	0.0055	0.0075	0.010	0.0046	3.74	0.004
I	0.058	0.054	0.061	0.070		3.88	0.063
J	0.033	0.124	0.096	0.060		3.88	0.053
K	0.109	0.089	0.099	0.11		3.05	0.107
L	0.517	0.267	0.328	0.407	0.514	2.59	0.403
M	0.063	0.071	0.073	0.076		3.81	0.069
N	0.065	0.110	0.098	0.082	0.070	3.68	0.076

CONCLUSIONS

The tests have shown that the standard beta-gamma method of radiometric assaying is applicable to the samples submitted by Western Nuclear in spite of their complex content. It is necessary to compensate for the high potassium content of the ore; however, this can be achieved adequately by subtracting 0.003% U_3O_8 from the beta-equivalent value when calculating the U_3O_8 content by the standard formula, $2.3U_\beta - 1.3U_\gamma = U$.

REFERENCE

1. G.G. Eichholz, J.W. Hilborn and C. McMahon, Can. Journ. Phys., 31, 613, 1953.

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