

This document was produced
by scanning the original publication.

Ce document est le produit d'une
numérisation par balayage
de la publication originale.

Dr. J. Conroy

~~INDUSTRIAL CONFIDENTIAL~~

**Declassified
Déclassifié**

CANADA

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

OTTAWA

MINES BRANCH INVESTIGATION REPORT 60-74

**MEASUREMENT OF SODIUM LOSSES
IN A LEACH CIRCUIT**

by

J. D. KEYS

MINERAL SCIENCES DIVISION

COPY NO. **1**

JULY 11, 1960

FR 60-74

01-7989963

Declassified
Déclassifié
Industrial Confidential

Mines Branch Investigation Report IR 60-74

MEASUREMENT OF SODIUM LOSSES IN A LEACH CIRCUIT

by

J.D. Keys*

- - -

SUMMARY OF RESULTS

The disposition of sodium during the leaching of Beaverlodge uranium ore has been determined using radioactive sodium. A short time leach has been employed to take advantage of the 15 hour half-life of radioactive sodium-24.

The results of the test indicate that within the experimental error the sodium appears primarily in the pregnant solution, with a small amount in the wash and an insignificant amount remaining in the cake.

* Senior Scientific Officer, Physics and Radiotracer Section,
Mineral Sciences Division, Mines Branch, Department of
Mines and Technical Surveys, Ottawa, Canada.

INTRODUCTION

At the request of Eldorado Mining and Refining Limited the disposition of sodium during the leaching of Beaverlodge uranium ore has been determined. In the operational recovery cycle, approximately ten per cent of the sodium has not been accounted for and the intention was to determine whether or not there was exchange occurring between the sodium and other elements in the leach tailings. A small-scale test was carried out at the Mines Branch using Beaverlodge ore and a sodium carbonate solution containing radioactive sodium. The per cent sodium appearing in the pregnant solution, the wash, and the cake were determined, from which conclusions have been drawn regarding the disposition of the sodium.

EXPERIMENTAL PROCEDURE

Sodium in the form of sodium carbonate was activated to saturation in the neutron source at the Mines Branch for a period of six days. To 1500 ml of leach solution containing 112.5 g activated sodium carbonate were added 75 g Na_2SO_4 , and 22.5 g NaHCO_3 . This was combined with about 1 kg of ore. The mixture was placed in an autoclave and maintained at a temperature of 115°C and a pressure of 80 lb/in.² for 4 hours. At the end of this time, the mixture was filtered giving the pregnant solution, then washed

giving the wash solution, with the remainder forming a cake. Each fraction was counted separately and the specific activity determined. The sodium content in each case was determined by comparison with solutions and cake, into which a known quantity of radioactive sodium had been introduced.

EXPERIMENTAL RESULTS

A standard cake for counting purposes was obtained by mixing 112.5 g activated Na_2CO_3 with 929 g tailings. From this a 471 g sample was cut and counted with a scintillation counter. This sample contained 22.1 g sodium from which it was determined that 1 g standard cake contained 4.69×10^{-2} g sodium. Since the activated sodium employed in the test and in the standard cake was withdrawn from the neutron source at the same time, it was possible to use the standard as a reference throughout the test period and it was not necessary to correct for decay.

The standard solution was formed by dissolving 9 g $\text{Na}_2^{24}\text{CO}_3$ in 220 ml H_2O . This $\text{Na}_2^{24}\text{CO}_3$ was withdrawn from activation 5.1 hr after the start of the experiment. In order that comparisons could be made between the count rate of this standard with that of the leach and wash solutions, it was necessary to correct for the fact that the activity in the latter cases had decayed for 5.1 hr. This was accomplished by extrapolating 9 g $\text{Na}_2^{24}\text{CO}_3$ back to zero time to obtain the equivalent amount

at the starting time. If 11.4 g $\text{Na}_2^{24}\text{CO}_3$ had been added at that time, the activity would have diminished to give the activity recorded when 9 g $\text{Na}_2^{24}\text{CO}_3$ were withdrawn. The standard solution was, therefore, assumed to be composed of 11.4 g $\text{Na}_2^{24}\text{CO}_3$ in 220 ml H_2O . From this it was possible to deduce that 1 ml standard solution contained 2.25×10^{-2} g sodium.

The results of the measurements are shown in Table 1, using the following values for standards:

1 g standard cake contained 4.69×10^{-2} g sodium.

1 ml standard solution contained 2.25×10^{-2} g sodium.

TABLE 1

Experimental Results

	<u>Standard Cake</u>	<u>Test Cake</u>
Counts/10 min	1674	39
Background	30	30
Net count/10 min	1644	9
Weight of sample	471 g	666 g
Count/g/10 min	3.49	1.35×10^{-2}
Ratio $\frac{\text{sample}}{\text{standard}}$ c/g/10 min	1	3.85×10^{-3}
Sodium content per gram	4.69×10^{-2} g	1.81×10^{-4} g

	<u>Standard Solution</u>	<u>Leach Solution</u>	<u>Wash Solution</u>
Count/10 min	378	652	104
Background	30	30	30
Net count/10 min	348	622	74
Volume of sample	220 ml	220 ml	220 ml
Count/ml/10 min	1.58	2.82	3.36×10^{-1}
Ratio $\frac{\text{sample}}{\text{standard}}$ c/ml/10 min	1	1.79	0.213
Sodium content per ml	2.25×10^{-2}	4.03×10^{-2}	4.80×10^{-3}
Total volume		1440 ml	1050 ml
Total sodium content		58 g	5.04 g
Equivalent Na_2CO_3		133.5 g	11.6 g
Standard deviation		$\pm 20 \%$	$\pm 40 \%$

CONCLUSIONS

Within the limits of experimental error, the results indicate that the main portion of the sodium is contained in the leach solution with the remainder located in the wash solution. The amount of sodium remaining in the cake is insignificant.

The validity of the tests is somewhat in doubt as the leaching time was 4 hours compared with the normal 18 hours. There is a possibility that the tests may be repeated at a later date with a full 18 hours' leaching time. In that event, it would be necessary to obtain activated sodium carbonate commercially, as the saturation activity available with the Mines Branch neutron source would be insufficient for reasonable counting statistics.

ACKNOWLEDGMENTS

The author wishes to acknowledge the assistance of Messrs. E. G. Joe and G. Stonhill, Eldorado Mining and Refining Limited, at whose request the investigation was carried out, in performing the leaching operation. The standard samples were prepared by C. McMahon, and J. L. Horwood operated the counting apparatus.

- - -