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Richland, Washington
November 5, 1954

REMOVAL OF THE COMPOUND LAYER
FROM DEPLETED WANDER TRANSITION
SLUGS BY THE USE OF SODIUM HYDROXIDE

By

Norman L. Brandt

Plant Engineering Sub-Station

November 5, 1954

WANDER ATOMIC PRODUCTS OPERATION

Richland, Washington

Classification Cancelled

Or Changed To

By Authority Of DGC

By TSC

Date 11/2/71

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GENERAL ELECTRIC COMPANY
RICHMOND, WASHINGTON

REPORT OF INVENTION

TO: W. H. Clymer, New York, Chief, Patent Branch

ATTACHED HERETO IS A DESCRIPTION OF WHAT MAY BE AN INVENTION

REMOVAL OF THE COMPOUND LAYER FROM DECAYED HANFORD URANIUM SLINGS BY THE USE OF SODIUM HYDROXIDE.

II. THE NAME, TITLE OR POSITION OF THE INVENTOR, AND PERMANENT ADDRESS OF THE INVENTOR

Norman L. Brandt, Engineer, Hanford Atomic Products Operation, 1504 Butterant,
Richmond, Washington

III. REFERENCE TO ANY PREVIOUS APPLICATIONS OF THE INVENTOR, AND STATE WHERE THE INVENTION WAS MADE, AND THE DATE WHEN MADE, AND THE NAME OF THE INVENTOR

HW-28,722. Removal of the Compound Layer from Decayed Hanford Uranium Slings by the use of Sodium Hydroxide. Dated May 15, 1953.

Letter to W. W. Porter, dated April 17, 1953, "A Proposal for the Investigation of Change in the Slur Recovery Process."

IV. THE APPROXIMATE DATE OF THE INVENTION, AND THE NAME OF THE INVENTOR, AND THE NAME OF THE INVENTOR, AND THE NAME OF THE INVENTOR, AND THE NAME OF THE INVENTOR

April 17, 1953.

V. PERSONS WHOSE NAMES ARE TO BE PLACED AS INVENTORS, AND THE NAME OF THE INVENTOR, AND THE NAME OF THE INVENTOR, AND THE NAME OF THE INVENTOR

William W. Porter, Hanford Atomic Products Operation, Richmond, Washington
107 Adams St., Richmond, Washington

Ernest I. Kramer, Jr., Hanford Atomic Products Operation, Richmond, Washington
1402 Perkins, Richmond, Washington

Norman L. Brandt, Jr. 11/5/53

SIGNED (SUPERVISOR)

DATE

DEPARTMENT

11-5-53

Manufacturing - Metal Preparation Section

NOTE: SUGGESTIONS FOR PREPARING THE INVENTION REPORT, AND THE NAME OF THE INVENTOR, AND THE NAME OF THE INVENTOR, AND THE NAME OF THE INVENTOR

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HW 29871

REMOVAL OF THE COMPOUND LAYER FROM DEFORMED HANFORD URANIUM SLUGS BY THE
USE OF SODIUM HYDROXIDE

Extracted from Document #HW 29871

INTRODUCTION

About twenty five to thirty per cent of the uranium slugs shipped to the Metal Preparation Section do not meet specifications and are rejected. These rejected slugs are recovered by a chemical process and prepared for re-canning. The canning operation provides a coating of metal composed principally of elemental aluminum and silicon with traces of copper and tin, which bonds the aluminum on to the slug. The elements in intimate contact with the slug combine chemically with the uranium to form the tenacious compound layer.

The current recovery process consists essentially of a sodium hydroxide sodium nitrate bath for chemically removing the aluminum on and the bonding medium, followed by hydrofluoric acid and nitric acid baths to remove the remaining compound layer and to pickle the slugs before they are returned to the process canning line.

Recent studies have indicated the possibility of using a more economical means of recovery. This involves the mechanical removal of the aluminum on and most of the bonding medium, followed by a chemical removal of the residual compound layer by a solution of sodium hydroxide.

SUMMARY AND CONCLUSIONS

Small scale experiments indicate that a 5% caustic solution readily removes the compound layer from deformed, triple dipped and less dipped uranium slugs. Full scale tests of this recovery method should be made to define its process feasibility.

DISCUSSION

Manufacturing Engineering recommended in a letter, A Proposal for the Investigation of Change in the Slug Recovery Process, dated April 17, 1964 that the feasibility of replacing the hydrofluoric and nitric acids by a sodium hydroxide solution be investigated. This proposal was prompted by experimental results and theory relating to the ability of a sodium hydroxide solution to remove the various elements and compounds comprising the compound layer on slugs, and the consequent large gains which would result if this chemical agent could be adopted for use in recovering rejected slugs.

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Discussion (Continued)

Previous experiments showed that the compound layer on non-uranium slugs could be removed by caustic treatment. It was thought that some combination of concentration of sodium hydroxide and time of treatment would remove this compound layer from uranium slugs, even though some elements, notably silicon, may have compounded with the uranium. Preliminary investigation confirms this idea.

Variation of concentration and duration of treatment led to the use of 50 per cent sodium hydroxide at its boiling point for a period of two hours. This treatment on triple-dipped slugs results in a complete removal of the compound layer. Slugs so treated are satisfactorily canned after being processed through the regular slug pickling bath. The compound layer on lead-dipped slugs is removed by the same procedure in less than two hours. Although concentrations of about 25 per cent sodium hydroxide produce a reasonably clean slug, higher concentrations are required to insure the removal of uranium silicide, which appears to be the compound most resistant to the caustic treatment.

A concentration of 50 per cent sodium hydroxide is available commercially and can be used directly from storage tanks, thus eliminating the need for intermediate mixing tanks. Also, after several charges of slugs are cleaned, the sodium hydroxide solution may be neutralized by nitric acid from other processes. This neutralization affords a possible method for recovering the uranium dissolved by either the acid or the caustic.

Results of the dissolution tests are in agreement with those of an earlier report by Hyman, Makins and Winner, of the Manhattan Project, which shows that bare uranium slugs dissolve at a rate less than 0.2 per cent by weight per hour in 50 per cent sodium hydroxide.

The experiments for removing the compound layer by the use of sodium hydroxide were made with four and eight inch Hanford uranium slugs from both the triple dip and lead dip canning processes. These slugs were de-canned prior to processing in the caustic solution. The slugs were supported on stainless steel rods in the bottom of a 12" x 6" tank constructed from steel plate. The solution level was maintained at approximately one inch above the slugs and was boiled constantly to insure continuous movement of the liquid around the surface of each slug. The water boiled off was replaced from time to time to maintain the bath concentration.

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CONCLUSIONS AND RECOMMENDATIONS

Experimental results indicate that the process for recovering silver may be made more economical, simpler and safer. When used in a plant with a mechanical stirrer, a solution hydrolysis recovery may yield a method of reducing the time and cost of increasing the capacity of this operation. Handling of handling using hydrofluoric and nitric acids would be eliminated. Substantial savings (about 50%) in the expenditure for program X equipment may be realized.

ADDITIONAL

Subsequent to the issuance of the original report, as shown above, full scale process tests have been completed. The use of a mechanical stirrer and of the new and larger has been effective in improving and is currently in use.

The new process reduces the volume of the waste used in the old process. The time of stirring, however, has been reduced to 1 hour.

Experiments to date show that (1) increasing the NaOH may be required, and (2) that effective removal of the elemental silver in cases as the reduction of the NaOH increases.

TABLE I. SUMMARY OF TESTS, 1953-1954

15% NaOH	15% NaOH	15% NaOH	15% NaOH	15% NaOH	15% NaOH	15% NaOH	15% NaOH	15% NaOH	15% NaOH
15% NaOH	15% NaOH	15% NaOH	15% NaOH	15% NaOH	15% NaOH	15% NaOH	15% NaOH	15% NaOH	15% NaOH

Time, hours: 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5, 9.0, 9.5, 10.0

TABLE II. SUMMARY OF TESTS, 1953-1954

15% NaOH	15% NaOH	15% NaOH	15% NaOH	15% NaOH	15% NaOH	15% NaOH	15% NaOH	15% NaOH	15% NaOH
15% NaOH	15% NaOH	15% NaOH	15% NaOH	15% NaOH	15% NaOH	15% NaOH	15% NaOH	15% NaOH	15% NaOH

Time, hours: 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5, 9.0, 9.5, 10.0

ATTENTION:

Harold L. Grant
Manufacturing Engineering

Henry J. Grant 4/15/53

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