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#12 300 File
#13 700 File
#14 Yellow File
#15 Extra
#16 Extra

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From: G. B. Barton

REPORT ON VISITS TO KAPL (6/8) AND TO ORNL (6/22 & 23)

During the course of conversation with personnel at the above sites information was obtained on three topics which would seem to be of interest to people at HAPO. The topics were:

1. **Margin of Safety in Purex Flowsheet**

KAPL reported that the Oak Ridge Purex flowsheet does not provide very much margin of safety for 1AW losses in event of elevated temperatures. It was estimated that a safety factor of 4% was present under flowsheet conditions and that this would be reduced by 1% for each 5°C temperature rise. The specified flow sheet becomes inoperable, due to uranium losses, at 45°C. The U goes down the column and eventually out the waste stream. This can be overcome by increasing the organic flow rate, increasing the TBP concentration or the extractant in the nitric acid concentration in the feed.

2. **Fluorocarbons as Pile Coolants**

Some unreported studies at Oak Ridge National Laboratory on the radiation stability of liquid perfluorocarbons have shown they have about the same stability as hydrocarbons. Apparently the increase in chemical stability of the fluorocarbons over the hydrocarbons does not extend to the high energy processes that occur with radiation damage. The molecules of the fluorocarbons are broken up, with the production of polymers and release of fluorine being the most important effects. The opinion was expressed that application of fluorocarbons as pile coolants did not appear promising.

The writer feels that the problem of corrosion in this system can be controlled and should be investigated further at HAPO by the Chemistry Unit.

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3. Simplified UF_4 Production

The production of UF_4 directly from a solution comparable to Uranium Recovery RCU has been developed through the laboratory scale at ORNL. The process consists of: (1) adsorption of the uranium from a uranyl nitrate solution in an ion exchange column, (2) washing off the excess nitric acid with water, (3) eluting the uranium with an excess of hydrofluoric acid, and (4) electrolyzing the resulting uranyl fluoride solution to form a slurry of UF_4.

The operating characteristics of the process are roughly indicated by the following data:

Uranium Adsorption

50 g/l feed $<$.000X g/l U waste. A dilute nitric acid solution is recovered which can be concentrated and reused.

Uranium Elution

Ave. concentration approximately 160 g/l U max. conc. during elution approx. 500 g/l.

Electrolysis

Soluble uranium 160 g/l in feed, 5 g/l in slurry.

The slurry is filtered and the filtrate recycled to the elution step.

Economic evaluation of the process leads to an estimated saving, over current dry conversion, of considerable magnitude.

In addition work is being carried out at K-25 on the direct electrolysis of UNH solutions after addition of HF and sulfamic acid.

Since the direct formation of UF_4 from plant solutions appears an attractive way to reduce the overall cost of uranium processing, it would appear worthwhile for Hanford personnel to become familiar with the processes as presently developed and participate in the planned pilot plant work for final development of a commercial process.

It was indicated that pilot plant building construction was budgeted for in fiscal '55. However, the chemistry of the process is essentially worked out at present and the remaining problems are the engineering ones of equipment and materials of construction so it appears feasable to proceed more rapidly than planned.

The writer suggests that the process and the desirability of piloting it at Hanford are worth careful consideration.

G.B. Barton

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