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STATUS AND PROGRESS REPORT

JULY 1958

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OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

July 1958

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OAK RIDGE NATIONAL LABORATORY

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OAK RIDGE NATIONAL LABORATORY

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This Status and Progress Report summarizes those AEC activities at the Laboratory which are classified Confidential. Some of the topics are included every month, but many of them are reported on a bimonthly schedule. Program 4700 is covered in a separate report.

PROGRAM 2000 — SPECIAL NUCLEAR MATERIALS

Metal Recovery. — The recovery of uranium and Np^{237} from Paducah fluorinator ash was continued. To date, 23 tons of ash has been processed, with the separation of 480 g of neptunium from 15 tons of uranium. Solvent extraction losses for uranium and neptunium were less than 0.10 and 0.01%, respectively. Plant throughput averaged 660 lb of ash per day. (AEC Activity 2351)

PROGRAM 4000 — REACTOR DEVELOPMENT

GENERAL REACTOR RESEARCH

Power Reactor Fuel Reprocessing: Darex Process. — In corrosion tests on possible materials of construction for the feed adjustment tank, the rates of corrosion of plain, welded, and stressed specimens were of the order of 0.02 mil/month or less in exposures of 2900 to 4000 hr. There was no indication of localized attack. Under heat transfer conditions (metal temperature ~135°C) corrosion rates were likewise negligible. (AEC Activity 4301)

Power Reactor Fuel Reprocessing: Mechanical Processing. — In the currently preferred method of removing the stainless steel cladding and the Na-K bond from SRE fuel rods, one end cap is removed, hydraulic pressure is applied inside the cladding, which is mechanically restrained radially, the other end cap is removed, and the slugs are forced from the expanded tube. Detailed drawings of proposed equipment are being prepared. (AEC Activity 4301)

Power Reactor Fuel Reprocessing: Thorium Fuels. — Good decontamination and satisfactory handling properties resulted when used solvent containing 10% or less tributyl phosphate in Amsco was treated with lime. Lime treatment of solutions containing as much as 75% tributyl phosphate or large quantities of hydrolysis products was not successful without prior treatment with 0.1 M KOH. Solvent from Thorex runs on short-decayed feed produced stable emulsions with lime even when pretreated with 0.1 M KOH.

Distribution coefficients indicated that a solvent extraction system can be designed by which protactinium and uranium can be extracted away from thorium nitrate and fission products with diisobutylcarbinol. For protactinium and uranium the coefficients were as high as 10 and 2, respectively, while for thorium and fission products they were $< 10^{-2}$. Optimum conditions are being determined. (AEC Activity 4301)

Fused Salt--Fluoride Volatility Processing. — After the ARE fuel was processed, a series of nine runs was started in the Volatility Pilot Plant for the recovery of U-235 from salt previously used in criticality experiments. After four of these runs were completed, the system was plugged so badly that the plant was shut down for repairs. The salt as received had a high nickel content, and corrosion caused the nickel fluoride content to exceed the solubility limits. After repair of the system, the fuel salt was diluted with nickel-free barren salt. No major difficulties are being encountered at this time.

In equipment studies, anhydrous HF was pumped at rates up to 10 lb/hr through a cycle including a boiler, a superheater, a condenser, and a receiver, with a Lapp diaphragm pump with Monel trim. It was necessary to cool the pump head and valve chamber to 0°C or lower to overcome vapor binding.

Over-all corrosion rates of INOR-1 during exposure for 1010 hr to $NaF-ZrF_4$ at 650°C with flowing HF were 1.7 and 5.2 mils/month as determined by weight loss and metallographic examination, respectively. The corresponding rates for INOR-8 were 1.5 and 1.7. (AEC Activity 4302)

CHEMISTRY

Druhm Process. — In run D-7 a total of 19.6% of the uranium introduced as UF_6 to the reactor through a three-concentric-tube nozzle was collected as massive metal. Run D-8, which lasted for 44 min, was made with the reactants introduced through separate nozzles; several porous metal buttons of unknown purity were formed. (AEC Activity 5310)

Feed Materials Processing. — Reduction of UF_6 to UHg_4 by lithium amalgam at -16 to 0° C gave a yield of only 10%. At 25 to 50° C the yield was 84 to 86.5% when the Li/U mole ratio was 8 to 9, but at 100° C it was only 78%, and at 200° C, 68%; Li/U mole ratios >9 did not improve the yield. Separation of UHg_4 from UF_4, LiF, and mercury by centrifugation of the product amalgam was only 18 to 30% complete, and by settling it was <10% complete when the residual lithium concentration in the mercury was >0.7 M.

Forty pounds of feed was prepared for the Fluorox fluidized-bed reactor, and the revisions on the 4-in.-dia reactor system were completed. The apparent corrosion rate of the Inconel reactor in run FBR-18 was 0.44 in./year. A complete Fluorox flowsheet, including by-product recycle, was prepared. Experimental data on the hydrogen reduction of UO_2F_2 were obtained in the temperature range 400 to 550° C. (AEC Activity 5310)

Ion Exchange Technology. — Determinations of Dowex 21K resin bead sizes in the chloride-, sulfate-, and uranium-loaded forms indicate that the sulfate form is the largest, with the chloride form 3.1% smaller and the uranium-loaded form 7.3% smaller in diameter. (AEC Activity 5310)

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Approved by: Alvin M. Weinberg, Director

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