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TRIP REPORT - ARGONNE NATIONAL LABORATORY
MAY 4-7, 1953

The Argonne National Laboratory was visited on May 4-7 for discussion of the Co-60 shield which is being constructed at Hanford. The basic unit, while patterned after the Oak Ridge design, will employ Co sources, container turret and many controls that were adapted from those in use at ANL. Discussions involving Gordon Rogers and the writer with Roland Blomgren and Leon Markheim of the Remote Control Division of ANL were held to consider possible shielding modifications, source containers and safety interlocks. No major design changes were deemed necessary but several suggestions relative to controls and access tubes to the radiation chambers were received. E. J. Hart and Sheffield Gordon of the Chem. Div. have several units in operation and information relative to operation and calibration procedures was obtained from them.

While at ANL, the opportunity was taken to talk to a number of people in Chem. and Chem. Eng. regarding separations work. The following notes were taken from these discussions:

The mixer settler units are being employed in continuing the "Halex" studies essentially as outlined in ANL-4872. The ORNL-846 flowsheet (except for diluent) is being followed with no head-end and emphasis is being placed on the 1A scrub unit. Excellent decontamination is being obtained with two cycles. Pu activity is due mostly to Zr-Nb while Ru tends to follow the uranium.

Greater β . γ radiation stability has been found for CCl_4 than had been previously indicated. However, the photochemical effect from laboratory light in CCl_4 systems

containing UNH is very important. A 15 watt fluorescent light at 1/2 inch was found to produce Cl^- at the rate of about 1 mg. liter^{-1} min^{-1} from a IAP solution. More complete data are available.

Apparatus for IAW concentration (1 gal/hr) is expected to be in operation in 1-2 months. Corrosion in the still pots has caused some trouble and is believed to be catalyzed by chromium.

Another Purex problem receiving attention is the study of dispersion and settling phenomena. This program, aimed at predicting and understanding mixer-settler operation, is actually quite similar to studies that are underway at Hanford. This work is in the initial stages but Vogel and Rogers feel that this is a very important area and expect to devote considerable effort to this program during the next year. Work underway now includes (1), literature research on emulsions, and (2) relative stability of aqueous continuous and organic continuous dispersions as produced by a mixer-settler stirrer.

The program on dry fluorides under Vogel is concerned with (1) heat transfer data on interhalides, (2) phase diagrams of UF_6 - BrF_3 and BrF_3 - Br_2, (3) PuF_3 and PuF_4 solubilities, (4) the kinetics of BrF_3 - metal reactions and (5) vapor-liquid equilibria of various BrF_3 systems. The phase study of Br_2 - BrF_3 is nearly complete and indicates a eutectic at -9°C in the bromine-rich end. PuF_3 solubility studies include the use of SbF_5 and other reactive fluorides as solubilizing agents. A 400 g/ton Pu-U alloy is being prepared for dissolving studies.

Fluorine chemistry was also discussed with Katz of the Chem. Division. His work is currently divided between studying the physical properties of BrF_3 systems and the production of PuF_6. Recent data from Harwell appears to give somewhat greater hope for the stability of PuF_6 than is indicated by Florin. Katz has succeeded in producing some PuF_6 with BrF_3 and PuF_4 and has found that certain metal fluorides, notably silver, prevent the reaction. Reactions of BrF_3 with oxides are also being studied. Physical property investigations have centered around conductimetric and spectrophotometric studies of BrF_3 - Br_2 and BrF_3 - HF systems. From these studies the amount of free bromine in a Br_2 - BrF_3 mixture is found to be extremely small. Katz's group is also investigating the vapor density of pure hydrogen fluoride in the region 20-175° C and 100-5500 mm. Hg. This is of practical importance as it will supply missing data in the higher pressure region and is of fundamental interest since there is still some confusion as to the state of polymerization in gaseous HF.

The high temperature separations work has been largely taken over by Feder who is continuing the program on the now fashionable methods involving molten uranium. Studies on electrodeposition of uranium from fused salt baths as described in recent ANL Chem. Eng. quarterly reports are continuing. The next approach will be to use a fluoride bath in place of the LiCl - KCl mixture. An attempt to product UF_6 electrochemically will also be made. Work is continuing on a small scale on extraction from aqueous halide systems using hexone. As a sidelight to this work it was found that metallic bismuth is a good scavenger for Ru from chloride systems.

Other discussions were had with Vogler on dissolution of Zr-containing slugs, Fineman on waste disposal, and in the Chemistry Division with Peppard on the use

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of mono and di alkyl phosphates for extraction and separation of actinides and lanthanides from aqueous solutions and with Wilkinson on facilities for plutonium metallurgy. A brief tour was made of the Cp-2 and Cp-3 as well as Cp-5 which is under construction.

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