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MOUND LABORATORY

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MONSANTO CHEMICAL COMPANY
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Miamisburg, Ohio

cc

To Dr. R. A. Stanifort

Date April 9, 1952

At

Subject Trip to Argonne March 27, 28, 1952

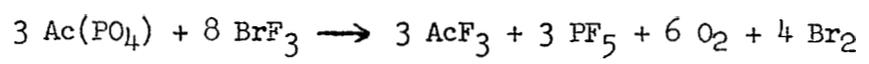
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During the visit Dr. Manning, Dr. Katz, Dr. Fred, and Dr. Hagemann served as hosts and were quit free in placing their time and efforts at my disposal.

The first conversations were with Dr. Manning who arranged for the contacts during the rest of the visit. He mentioned the meeting on April 2nd in Washington but thought that he would not be there but that Dr. Hagemann would probably attend.

Dr. Katz discussed the problems of preparing actinium compounds. He felt that the fluoride could be produced readily by precipitation from aqueous solution. A second method would be:



The iodate salt of actinium could also be used, the essential criterion being that the anion form a volatile fluoride. The reactants could be mixed, the BF_3 being added mechanically or by distillation, and then warmed. All of the products are volatile except AcF_3 which would remain behind. This method has been used to prepare PuF_4 .

Dr. Katz thought that the bromide might be prepared by the method of Kleinhixl and Creamers (J. Am. Chem. Soc., 50, 959 (1928)). This method, described for PuCl_3 and PuBr_3 in National Nuclear Energy Series Volume 14B, involves evaporating a strongly acid solution of the metal in a current of the hydrogen halide.

Dr. Hagemann was quite willing to talk of his experiences in isolating actinium. Several times he volunteered the expression that he was glad he didn't have that task now. He said they had not experienced any trouble of gassing from the ion exchange column, however their column separation had been prefaced by a TTA extraction. When they were dealing with radium they used a relative

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gamma count to fix the relative amounts of radium, but depended upon the figures of Eldorado Mining for the total quantity. This method of assay was considered inadequate. Dr. Hagemann remembered that the radium slug cans were numbered on the sides (four different places) and probably on the ends, and that the crucibles were numbered. The actinium he sent to Los Alamos was oxide. For special studies actinium was purified by another column separation, mercury cathode electrolysis, oxalate precipitation, or a hydroxide precipitation. When recovering material used in spectrographic studies, contaminated with aluminum, copper, iron and nickel, two mercury cathode electrolysis steps followed by two oxalate precipitations were used. By the time he was finished he thought that it would have been better to start with the carbonate.

Dr. Hagemann is writing a chapter on "Chemistry of Actinium" for Volume 14A of National Nuclear Energies Series and he will send a copy to Frank Mead. He would like to have Mound Laboratory personnel read it and criticize it in light of any experience they may have had.

The sample of actinium which had been requested was to provide material for samples for emission spectroscopy and beta ray spectroscopy. According to Dr. Hagemann the only work on actinium at Argonne is the emission spectroscopy, beta-ray spectrometry, and an estimation of the half life from following the growth of actinium from protoactinium. No more work on actinium is expected to start in the next two years. The best value of the half life is about 22 years, the figure of 27 years came from Curie, I. and Bouissures, Cahiers Phys. No. 26, 1, (1944) and is not given much weight by Argonne people.

Beta-ray spectrometry work is under Mel Freedman, who was on vacation, however we talked to Frank Wagoner who was familiar with this work. Using a double-focusing spectrometer they have obtained beta-ray spectra of actinium in a fairly pure form and at several stages during the time while daughters were growing into the mixture. Definite changes in the spectra were observable. Most of the strong beta energy peaks occurred from 20 to 40 Kev. Fairly pure (freshly isolated) actinium showed a very complicated beta ray spectrum. The data were much more complete than that seen in Oak Ridge. The Argonne people have not had time to undertake an interpretation of their data.

Dr. Hagemann would like to receive a copy of the report which Paul Engle wrote following his visit to Argonne.

The question was asked if Winkleblack was considering or should consider the provision of facilities in the P.P.R. which would make it useful in the actinium program.

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A meeting was arranged with Dr. L. S. Myers, Jr., of the Biological Assay Group at Argonne. The questions posed to him had been suggested by Dr. Anthony. When asked if they had developed any methods for assay of radium or actinium in biological fluids or tissues he referred me to ANL-4509 "Procedures of the Biological Assay Group at Argonne National Laboratory" by Schubert, Myers, and Jackson. This report outlines procedures for radium in urine and feces. For tissues he recommends digestion in 16M HNO₃ and evaporation to a white ash. If excessive calcium is present the solution may have to be diluted to prevent precipitation of calcium sulfate. The radium method is not secret and has been published (Nucleonics, Vol. 7, No. 1, pp. 60-64 (1950)). If one uses this published procedure he should ignore the column separation.

Dr. Myers had no direct experience at Argonne in assaying for actinium. In the matter of tolerance he said that the actinium chain was considered the same as plutonium due to similarities in metabolism. The tolerance level for actinium and its daughters is taken as seven disintegrations per minute per 1.5 liters of body fluids. Due to the probable similarity of behavior of plutonium and actinium he suggested that a bismuth phosphate and a lanthanum fluoride precipitation, calibrated for efficiency of actinium recovery, might be useful as concentration steps. He assumed that alpha counting would be necessary. If this is true, then, he suspected, a waiting period of about six months after taking the sample would have to elapse to permit establishment of equilibrium conditions. He wondered how one would differentiate between the effects caused by radiation from actinium and those caused by radiation from actinium and those caused by radiation from the daughter products.

Dr. Myers knows of and is using the long digestion procedure for assay of polonium in feces, but wonders if any short cuts have been discovered. He would be very much interested in hearing of any procedures developed for actinium.

In general, except for emission spectroscopy, beta ray spectroscopy and the old experiment on half-life, no work is now being done on actinium at Argonne. There was no program for renewing work in this field, in fact, one gathered the impression that there was a hesitance toward working with the material. The old building where Dr. Hagemann did his work is just now (in the next six months) being refinished after a complete removal of the air conditioning duct work.



D. L. Timma

DLT:pm

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