MALLINCKRODT CHEMICAL WORKS

MANUFACTURERS OF
FINE CHEMICALS FOR MEDICINAL, PHOTOGRAPHIC
ANALYTICAL AND INDUSTRIAL PURPOSES

ST. LOUIS 7, MO

January 21, 1957

Mr. Lyall Johnson, Chief
Licensing Division
Division of Civilian Application
U. S. Atomic Energy Commission
Washington 25, D. C.

Dear Mr. Johnson:

Reference is made to our License SNM-33 as revised which permits us to receive and possess uranium enriched in the U-235 isotope for use in making uranium oxides. We hereby request that SNM-33 be further revised to permit us to receive and possess uranium enriched in the U-235 isotope for use in making Uranyl Sulfate as described in the attachment.

The operations described in the attachment will be carried out at our Hematite, Missouri plant where all general procedures and equipment for control of health and safety, material and criticality outlined in previous applications will be applicable. The process as described will be utilized for material enriched to approximately 20% in U-235. For fully enriched material, we would propose the same process with the exception that no mixing of batches would be permitted and the 0.7 pound batch size would be maintained throughout the process.

We trust that the information contained herein will be adequate to permit you to issue the necessary revision to our license. As you doubtless know, we are presently negotiating with representatives of the Japanese and Danish Governments for the conversion of 20% UF_6 to Uranyl Sulfate for reactors which they are purchasing from the Atomics International Division of North American Aviation.

Very truly yours,

Frederick M. Belmore

Frederick M. Belmore
Special Asst. to the President

FMB/ck

Attachment

City of St. Louis
State of Missouri

Notary Wanda Baker

Subscribed and sworn to before me this 21 day of January 1957

My commission expires My Commission

FORM 83

MALLINCKRODT CHEMICAL WORKS

ST. LOUIS.

ATTACHMENT TO APPLICATION DATED JAN. 21, 1957

FOR REVISION TO LICENSE SNM-33

SUBJECT: General Procedure for the Preparation of Uranyl Sulfate from Uranium Hexafluoride of Approximately 20% U-235 Content.

The steps involved in the production of uranyl sulfate from uranium hexafluoride are as follows:

1. Hydrolysis of UF_6
2. Precipitation of Ammonium Diuranate
3. Filtration
4. Drying
5. Decomposition to U_3O_8
6. Milling U_3O_8
7. Transfer of U_3O_8
8. Preparation of uranyl sulfate solution
9. Evaporation
10. Drying of uranyl sulfate
11. Grinding
12. Packaging

The operations 1 through 5 will be the same as that used in the process to produce weapons-grade uranium dioxide. The batch size through these steps will be 318 grams (0.7 lb.) of uranium which is limited by the equipment size.

The U_3O_8 will be transferred in covered trays from the decomposition furnace to the transfer dry box. Here four batches will be mixed and placed in a stainless steel ball mill container of "always safe" design, five inches in diameter. The ball mill, properly sealed, will be removed from the dry box and put into position on the ball mill drive. This equipment will be mounted under the transfer dry box (or other suitable position).

Following this operation the ball mill will be returned to the transfer dry box and the U_3O_8 transferred to a tared polyethylene bottle and weighed. A maximum of 1600 grams U_3O_8 (1360 gU) will be placed in this bottle.

The bottle containing the U_3O_8 is next transferred to a large hood which will serve as a process hood for the uranyl sulfate preparation. Here the U_3O_8 is transferred to a three liter distillation flask. The transfer will be made using a flexible plastic tube attached to the neck of the polyethylene bottle and extending down into the distillation flask. A rubber sleeve on the flexible tubing will serve as a dust-tight seal at the opening of the flask.

A separatory funnel is connected through a rubber stopper to the neck of the distillation flask. Addition of reagents such as sulfuric acid will be made through this separatory funnel. The distillation arm of the flask will be connected to a water cooled condenser. The distillate will be caught in a suitable container. It will be tested for uranium, and if any is found, will be recovered by standard methods.

The distillation flask will be heated by a heating mantle clad with stainless steel sheet. The heating mantle and distillation flask will be enclosed in a stainless steel tank of suitable size as a prevention against loss if the glassware should break.

The uranyl sulfate solution prepared in the flask is then transferred to two Pyrex trays (8" x 1 1/2") located in the same hood, but two feet away. These Pyrex trays are placed in a stainless steel tray (24" x 36" x 4") located on top of a hotplate of the same size. The evaporation of the uranyl sulfate to near dryness will be carried out in this equipment. Approximately one inch above the Pyrex trays will be suspended a stainless steel sheet (18" x 24" x 1/16"). This will serve to prevent loss of uranyl sulfate during the evaporation process. Because of equipment limitations there will be no more than two batches in this hood at one time, one in the distillation flask and one in the evaporation trays.

The uranyl sulfate is then transferred to stainless steel drying trays of "always safe" design and the trays are transferred to the drying ovens for necessary drying.

The dried uranyl sulfate is taken to the transfer dry box at a time when U_3O_8 is not in this hood. The material is ground in a stainless steel try with a stainless steel rolling pin.

While still in the transfer dry box, the material is packaged in polyethylene bottles of "safe design", and then stored in a "bird-cage" for shipment to the customer.