DOCKET NO. 20-36

Ktw for HEk

3pgs

MALLINCKRODT NUCLEAR CORPORATION

SAINT LOUIS 7, MISSOURI • U.S.A. • CENTRAL 1-8980

May 11, 1959

Mr. Lyle Johnson
Licensing Division
United States Atomic Energy Commission
Washington, D. C.

Dear Mr. Johnson:

Subject: <u>Direct Conversion of UF_6 to UF_4</u>

This letter is a request for the expansion of our Special Nuclear Materials License SNM-33 to include the manufacture of UF_4 (uranium tetrafluoride) by a direct conversion from UF_6 (uranium hexafluoride). The manufacturing process, for which the initial engineering design work has been completed, is essentially the same as described in our letter of July 10, 1958, on the same subject. It is expected that this unit will prepare uranium tetrafluoride of all assays, which will then be converted to uranium metal in our reduction facility. The design philosophy of this manufacturing unit is the same as that used in the Research and Development unit which has been licensed and operating for the past nine months. The nuclear safety of this unit, therefore, is on the basis of safe geometry within and spacing between the subunits. As an additional safety feature of the production facility, the entire process is one in which the uranium is unmoderated. Although of only secondary importance to the safety of this process, it is reassuring to consider that the treatment of Safonov[1] on poorly moderated systems predicts a critical mass of approximately 150 kg of U-235.

For reasons explained in our letter of July 10, 1958, we request that the attached physical layout of the proposed production facility and the description of the processing steps be kept "company confidential".

In summation, we are requesting a license for this manufacturing facility which we hope to have in production in July, this year.

Please do not hesitate to call or wire if we can supply any additional information.

Very truly yours,

MALLINCKRODT NUCLEAR CORPORATION

Gervaise W. Tompkin

Gervaise W. Tompkin
Manager, Research & Development

GWT/ma
Attachment

5-12-59

B-36

DOCKET NO. 70-36

May 12, 1965

PROCESS DETAILS FOR DRY CONVERSION OF UF_6 TO UF_4

Introduction:

The following described process is carried out within controlled atmosphere hoods in equipment of safe geometric configuration. In all cases, an 18" minimum edge to edge separation is maintained between safe geometry shapes. No interconnecting piping larger than 1" is used.

1. A solution of reductant is introduced into a safe geometry reaction vessel made of appropriate corrosion resistant material. The inside diameter of this vessel is five inches. This vessel is equipped with external coils for either heating or cooling.

2. The air in the system is evacuated and the system attached to a UF_6 cylinder heated in a manner identical to that used under our Special Nuclear Materials License No. SNM-33.

3. The UF_6 is introduced into the reaction vessel while the reductant solution is circulated from the bottom to the top of the reactor to insure adequate contact between the reductant and the UF_6. A slurry of UF_4 is produced by the reaction.

4. Following the completion of the introduction of the UF_6, the slurry is pumped to a porous metal filter 5.29 inches in diameter by 17 inches long. The UF_4 in the slurry is removed by the filter.

5. The filtrate is continuously withdrawn from the filter to a filtrate receiver six inches in diameter for uranium determination prior to discard or further recovery treatment, depending upon the uranium content.

6. The filter cake is withdrawn from the filters into trays 18" by 17" by 1.5" and transferred to ovens for drying. A single layer array of trays is maintained in the ovens to insure safe slab dimensions. It should be pointed out that the filter has a capacity of 300 cubic inches, neglecting the space occupied by the two inch central porous filter medium. Our calculations show that any cylindrical shape containing 300 cubic inches falls on the safe side of the "limited safe" cylinder height and diameter curve, Figure 4, X-1019, Part 4. Therefore, we anticipate no problem during the transfer of filter cake from the safe filter to the safe slab trays.

7. After drying, the UF_4 cake is transferred to three trays 8-1/4" by 15-5/8" by 1-1/4" high. Three of these trays are charged to a muffle box for further drying. The cross sectional areas of these three trays and their length fits within the limits prescribed for "limited safe cylinder heights and diameters", Figure 4, X-1019, Part 4.

8. After drying, the material is hand transferred to a lab grinder, whose grinding chamber contains less than 268 cubic inches.

9. The ground material is collected beneath the grinder in containers of either "always safe" volume or "always safe" diameter and stored pending reduction to metal in storage racks, maintaining a minimum spacing of 10" edge to edge.