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10 December 1958

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

SUBJECT: Special Nuclear Materials License No. SNM-33

Dear Mr. Johnson:

Mallinckrodt Chemical Works has erected a new building at the Hematite, Missouri special nuclear material processing plant to house a production facility for pelleting enriched uranium dioxide. We are giving below (1) a general description of the process (2) specific details for radiation and dust control, and (3) provisions for radiation monitoring as specified under 10 CFR Part 71.

General Description of the Process

Specific steps in the manufacture of pellets will be as follows:

1. Addition of binder and lubricant to $UO_2$ powder.
2. Granulation
3. Drying
4. Pelleting
5. Low temperature pre-sintering
6. High temperature sintering
7. Gauging
8. Grinding
9. Loading pellets into fuel tubes
10. Packaging, storing and shipping

DOCKETED USAEC Division of Licensing & Regulation DEC 1 [illegible] 1958 Docket Officer

No draw req 12/17

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We are applying for extension of our SNM-33 license to cover the operations of this plant in accordance with the procedures to be described for uranium enriched in the isotope $U^{235}$ up to and including 5%. Reference to "limited safe" batch sizes would, in all cases, mean those quantities listed in Table XVII of K-1019 Part 4, Deleted, for the assay in question.

The first three process steps of blending, granulation, and drying are carried out in a single dust hood to insure positive isolation of any dust from the operators and from the main production area. The blender, granulator, and drying oven are separated from each other by not less than two feet edge to edge to insure complete isolation of "limited safe" batches which may be in the three pieces of equipment. A single drum containing a "limited safe" batch will be introduced into the hooded area. The drum will be emptied into a mixing bowl by a special drum inverter completely enclosed in the hood. The necessary binders and lubricants will be added and mechanically blended into the batch of oxide. The entire mixing bowl will then be transferred within the hood to a commercial granulator to develop the proper particle size. Material will fall directly from the granulator onto trays and will be transferred manually to the drying oven. The trays will be inserted into the drying oven on a batch basis. The entire hood system is exhausted to the atmosphere through two MSA type filters for positive removal of airborne dust to prevent contamination of the building roof and the environs.

Following completion of the drying operation, a single batch of trays will be unloaded into a drum, a sample taken for testing. After the lid is placed upon the drum, it will be removed from the hood and placed in a storage rack. The storage rack is constructed so that the drums are separated two feet edge to edge and a vertical spacing of two feet top to bottom maintained at all times. This is identical to the racks described and licensed in our other operations. The rack is constructed of steel angle iron. (See application dated February 4, 1958.)

When tests show that powders are acceptable, a single drum will be removed from the storage rack, placed in a dust hood and pneumatically transferred to a storage hopper on top of the pelleting press. This hopper is equipped with a valve and press feed will be discharged as required into a feed hopper on the press. The feed hopper attached to the press mechanism is 10" I.D. Since the press feed at this point has been shown to have a maximum density of 3.0 g/cc, the 10" diameter hopper attached to the press is safe geometry according to Table XV of K-1019, Part 4, Deleted, for assays up to and including 5% $U^{235}$. The pelleting press and all associated mechanisms are enclosed in a dust hood which is exhausted through MSA type filters to positively remove airborne contamination.

Following pressing, the pellets are automatically discharged from the press and fed to a continuous belt which passes through the pre-sintering furnace. The hearth opening in the furnace is 4" high by 14" wide which, according to Table XIII of K-1019, Part 4, Deleted, is a safe slab thickness for assays up to and

including 5%. Therefore, regardless of the possibility of furnace problems or belt feeder problems, this hearth and furnace afford nuclear control from a safe slab consideration.

The discharge end of the pre-sintering furnace delivers the pellets continuously into a hooded enclosure where the pellets are loaded onto trays for transfer to the high temperature sintering operation. The pre-sintering and high temperature sintering furnaces operate on a continuous basis. To maintain smooth operation, transfer of pellets from the pre-sintering to the high temperature sintering furnaces must be accomplished every hour. The accumulation, therefore, at the transfer hood will never exceed 40 pounds of $UO_2$. This quantity of $UO_2$ is a "limited safe" batch for up to 5% assay. In the event the pre-sintering furnace or the sintering furnaces need to be completely emptied, provision has been made to store the pellets temporarily in layers not to exceed two inches in depth with two feet spacing between layers. This would only occur under emergency conditions such as furnace repair, power failures, etc. The tray loading hood is exhausted to the atmosphere through MSA type filters to positively eliminate airborne dust.

Four high temperature sintering furnaces will be installed. The hearth height is four inches. Since the trays which carry the pellets through this furnace have a dimension of 2" x 5" x 7", and are loaded to a maximum of nine pounds of $UO_2$ pellets per tray, the uranium density in each tray is 3.1 g/cc over the tray volume. On this basis, the hearth height of four inches is within the safe slab dimension given in XIII of K-1019, Part 4, Deleted, for material up to and including 5% assay. The trays will be periodically discharged from the cooling end of the high temperature sintering furnaces and will be manually placed on a transfer cart and moved to a gauging station. At the gauging station the operator will transfer one tray at a time into the feed mechanism of the gauging machine. This mechanism will orient the pellets and pass them automatically to the gauging machine where they will be sized into acceptable, undersize, and oversize pellets. The undersize pellets will be collected batch-wise and returned to scrap recovery operations in our currently licensed facility. The acceptable pellets will be collected in a "limited safe" batch or less and transferred directly to the tube loading station. Oversize pellets will be collected in a "limited safe" batch or less and transferred to a centerless grinding station.

The centerless grinder is housed in a dust enclosure which is exhausted through MSA type filters to positively remove airborne contamination. Pellets from the grinder will be collected as a "limited safe" batch or less and transferred to the tube loading station. The coolant and lubricating solution used for the centerless grinder is continuously discharged from the machine to a filtering unit. The filtering is accomplished by gravity flow through an automatic paper filter. The depth of the liquid on the filter is controlled by a float valve and will be limited to 1 to 2 inches for efficient operation maintaining a safe slab dimension for the assay of uranium in question. The coolant solution with the uranium and grinding compound removed is recirculated to the machine. The centerless grinder and the filter have been especially designed for nuclear applications with the external filter provided to prevent accumulation of uranium-bearing sludges.

Tube loading will be accomplished manually in a specially designed dust enclosure which is exhausted to the atmosphere through MSA type filters. No more than a single "limited safe" batch will be permitted at the tube loading station at one time. Following loading, tubes will be placed directly in shipping containers. Since these shipping containers will vary depending upon the length, diameter, and assay of the uranium in the tubes, they will be covered by individual requests for approval.

General Safety Considerations

The building has been constructed of fire resistant materials throughout. The area will be equipped with a high level radiation monitor in accordance with our proposed installation covered in our letter of 28 November 1958.

The discussion above covers the general process, specific health and safety provisions and general area high level radiation monitoring. We are specifically requesting extension of our Special Nuclear Material License No. SNM-33 to include the pellet operation described for uranium up to and including 5% $U^{235}$ content. Operations will be carried out at our Hematite, Missouri location. All other auxiliary operations necessary, such as packaging, transportation, analytical, and storage of raw materials, will be in accordance with our present licensed procedures.

If there is further information required, please contact me immediately by collect telegram or telephone in order to prevent any undue delay in the consideration of this application.

Very truly yours,

MALLINCKRODT CHEMICAL WORKS

W. M. Leaders

W. M. Leaders
Technical Director
Special Metals Division

WML:dj