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Docket 70-36
Project S-8
October 22, 1963

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UNITED NUCLEAR CORPORATION, CHEMICALS DIVISION, APPLICATION FOR RENEWAL, DOCKET NO. 70-36, JULY 15, 1963

SYMBOL: DLR:RHO

REFERENCE: Memo, Luke to Nussbaumer, dated July 31, 1963

We have reviewed the subject application and delineated below are our comments and the additional information that we will need to complete our nuclear safety review:

1. The applicant should confirm that special nuclear material not held under this license will be isolated from material under this license in accordance with Part 70.57, proposed; or no distinction shall be made between this licensed material and other special nuclear material (not isolated) and the material shall be received, processed, stored and shipped as provided for in this license.

2. The applicant should submit a description and evaluation of procedures to independently confirm the package contents of all special nuclear material, including scrap, upon receipt into the facility. This analysis of the package contents should include confirmation of the isotopic content, unless the material is handled and processed as fully enriched uranium. Incoming shipments should be held in isolated arrays (see Part 70.57, proposed) until the package contents are confirmed. The handling of wet and damaged packages should also be delineated.

3. We are unable to confirm that the muffle box coolers will be safe from accidental criticality in case of inleakage of water. The use of Table 3, ORNL-2367, to justify the nuclear safety of the spacing of the spray cooler, Section 303.3.2, does not appear to be applicable. In the reference, there was six inches of full density water between the cylinders.

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4. The applicant states that certain hoods and glove boxes are air exhausted to control dust, yet the diagrams show some of these same hoods are not filtered, i.e., hood (240-2-19). We request a nuclear safety analysis of the long term particle build-up in these vent lines, also discuss the possibility of particle build-up in vent lines between the hoods and the filters in hoods where filters are used.

5. Limiting the quantity of uranium compounds to that which can be contained in a limited safe volume in glove box (240-2-34) and hood (240-2-7), does not in itself insure nuclear safety unless concurrent additional controls are used. This may include excluding water lines from the hoods and other possible sources of moderating materials or the total quantity of material is always handled in a safe volume container.

6. In several hoods or glove boxes, nuclear safety depends on maintaining a minimum one-foot spacing between safe geometry and/or mass containers or equipment. In some of these hoods spacer blocks will be used. Describe the means by which this minimum spacing will be maintained in other hoods.

7. In Section 301.3.2, describe the nuclear safety of the vent bottle, page 12, last paragraph. Also, in this section we have been unable to confirm the nuclear safety of the upper tees of the dissolver columns. On page 20, TID-7016, Rev. 1, it states reduced diameters should extend 18 inches from the intersection. From the description given the 4-inch diameter extends only 8 inches.

8. Figure 14, referred to in Section 301.3.4, is missing from the license renewal application. We are unable to continue our review of this section until this drawing has been submitted.

9. Confirmation that all references to limited safe mass, volume or geometry will be based on optimum moderation and reflection except as explicitly provided for in the license application.

10. Confirmation that the maximum quantity of U-235 in the form of uranium metal in the packaging hood (240-2-7) and uranium metal storage containers, Section 301.4.2, will be 10 kg.

11. We are willing to accept the values of the multiplication factor, k_{eff}, obtained from Figure 4, K-1317, for purposes of solid angle calculations provided the vessel wall thickness is less than or approximately equal to that of Schedule 40 pipe. However, if there is additional reflector material between two or more interacting units the values from Figure 4 should not be used as they were calculated from bare units.

12. A nuclear safety analysis should be submitted of all lines and vessels which will be employed to collect steam condensate or cooling water which will demonstrate they will be safe from accidental criticality in case of a possible uranium leakage. This nuclear safety analysis should include all possible steam heated UF_6 vaporizer ovens, unless the oven does not contain more than one limited safe mass, and spray coolers. Confirmation that the condensate discharge lines from the ovens and coolers do not contain any valves or traps and that there is no possibility for condensate to accumulate within the ovens or coolers, which could be hazardous in the event of accidental leakage.

13. Confirmation that only one limited safe mass will be collected in the 15-gallon drum located within the milling hood (240-3-10), or submit a nuclear safety analysis of the collection drum.

14. Confirmation that utility hood (240-4-7) will not contain more than one limited safe mass or one limited safe volume container of uranium, or describe in greater detail the nuclear safety of the hood. A limited safe volume of material does not insure nuclear safety unless there is no other source of moderating materials within the hood, such as water lines, or the total quantity of material is always handled in a safe volume container.

15. Confirmation that there are no water lines or any other source of moderating material in glove box (240-2-23), where nuclear safety is based on moderation control. Also, describe the nuclear safety of the 15-gallon bomb slag collection drum when it is removed from the glove box.

16. Please evaluate the neutron interaction of tanks (240-2-1 through 6) with the product storage shelves, the 11-liter bottle storage racks and any other equipment in this area.

17. The entire problem of uranium hold-up in the system between additions of limited safe batches has not been included in the nuclear safety analysis of sections 302.6 and 303.5. Batch sizes should be reduced to account for uranium hold-up from previous operations in Sections 302.6, 303.5, and 303.7. We also request confirmation that a maximum of one limited safe batch will be processed in any vessel at one time during the scrap recovery operations of Section 303.7, or submit a revised nuclear safety analysis. In a large process vessel, such as the dissolver, a safe concentration does not necessarily insure nuclear safety if precipitation may take place. Also, a limited safe batch surrounded by a uranium solution reflector will be more reactive than a water reflector.

18. We are unable to confirm the nuclear safety of the filtrate collection and hold tanks. The safety analysis of these tanks should take into account the possibility of forming a critical slab in the vessels, if precipitate gets through the filter. A method of calculating this minimum critical mass is given on page 51, HW-71666.

19. Describe the nuclear safety of the uranium hold up within the centerless grinder (255-2-7) in addition to the settling tank which has been described.

20. We agree that if moderation could be completely excluded from the oxide contained in the dry box (255-2-14) there would be no criticality problem for enrichments less than about five percent; on the other hand, the pick-up of moisture from the air can reach as high as an H/U^{235} of 25 for 2 w/o enriched oxide. Therefore, nuclear safety controls should be based on the actual operating conditions in the plant, and procedures must be described for preventing certain credible accidents, such as mal-operation of the furnaces and intermediate storage that may result in moisture pick-up between furnace operations.

21. We agree that the procedures given in Section 401.3 for processing $UO_2SO_4 \cdot 3D_2O$ at a 20 w/o enrichment is safe from accidental criticality if it is confirmed that normal operation of the box is suspended as long as heavy water will be held in storage within the box. However, we do not agree that Figure 8, page 183, Karlsruhe Criticality Control Symposium, shows that the critical mass of D_2O moderated uranium is greater than the critical mass of H_2O moderated uranium for all dilutions. The figure shows that for a volume fraction of U^{235} less than 0.001 the critical mass of D_2O moderated uranium system is less than the critical mass of a light water moderated uranium system. Because of the special nature of jobs of this type, we request the applicant to submit a nuclear safety analysis for our approval prior to commencement of the operation.

22. We require additional information in order to determine that the proposed in-process floor storage areas and outside storage areas will be safe from accidental criticality. The applicant should submit positive design features which will insure the spacing requirements for nuclear safety. We do not consider painting design on the floor will insure proper spacing. Additionally, the in-process storage areas should have a railing around the array and the outside storage areas should be fenced in, in order to guard against accidental dislocations of the storage arrays by vehicles, forklift trucks, hand carts and overhead loads. All storage arrays must be covered by the monitor alarm system.

23. Calculations should be submitted demonstrating that if a criticality accident of 300 r at one foot occured, the intervening shielding between the possible sources of radiation and detector heads would permit at least 20.8 mr/hr to reach detector head. We have confirmed that the detector heads are within 120 feet of possible sources of radiation, except some possible proposed outside storage areas, but it is not evident that the attenuation of concrete has been considered, as for example, in the enriched uranium storage area of building 255-1. We request confirmation that in the event of a power failure to the monitor alarm system either emergency power will be provided or immediate evacuation plan instituted until power is restored to the monitor alarm system. Confirmation

that a practice evacuation drill, including sounding the criticality alarm, will be conducted at least once every three months for each operation and maintenance shift.

24. Confirmation that there will be no unsafe containers, vacuum cleaners, incinerators, etc., except as explicitly provided for in the license application and described in the text of the nuclear safety analysis, in any area containing more than 500 g U^{235}. This should include sumps and other points of possible spill accumulation in case of leaky vessels. In case of a uranium spill inside a hood, the solution should form a safe slab in the bottom of the hood or a nuclear safety analysis should be submitted demonstrating a criticality hazard would not result.

25. Confirmation that there will be no direct connection through a valve or drain from a safe geometry container to one of unsafe geometry. This should include, but not limited to, overflow lines and their associated vessels.

26. The applicant has not submitted a structural integrity analysis of the shipping containers in accordance with Section V, Renewal Application Guide. We recommend the applicant be informed that since the publication of the proposed revision of 10 CFR 71, alternate interim criteria for Class III packaging have been developed which provide a greater degree of flexibility in design of containers. A copy of these interim criteria should be sent to the applicant and he should be informed the interim criteria may be used as an alternate to those specified in 10 CFR 71, Section 71.65, provided, however, they must be used in their entirety and not in combination with requirements of Section 71.65. Delineated below are other comments on the shipping containers, which have been identified by their B.E. permit numbers.

<u>B.E. Permit 1111</u>

We are unable to confirm that a 5.75" I.D. by 35" high cylinder is geometrically safe. We do not consider a 5-inch I.D. polyethylene bottle or a light weight metal can as providing a sufficient degree of containment (for either moderation control or geometry) during shipment when nuclear safety depends on geometry control.

B.E. Permit 549

Confirmation that no more than 10 kg U^{235} in the form of metal biscuits will be placed in each shipping container. It must be emphasized that Figure 12, page F-17, K-1580, is applicable only to fully enriched, undiluted, unalloyed uranium metal; Figure 12 is not applicable to alloys or compounds of any enrichment. For compounds and solutions having uranium densities greater than 3.2 g/cc, you propose that the basis for shipment is safe volume. Describe how the density correction will be made and how the inner container will be constructed to insure a safe volume, including a structural integrity analysis of the modified inner container. We request revised nuclear safety evaluation taking into account the above information.

B.E. Permit 1351

We see no objection to the proposed use of this container for uranium compounds. However, we request that the uranium metal loading be limited to 10 kg U^{235} instead of 12 kg uranium as proposed. This safe mass will apply over the H/X range of 0 - 2, while at greater degree of moderation the safe volume of 2.3 liters will apply.

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