JUN 16 1988

IMUF:GHB

DOCKET NO: 70-36

LICENSEE: Combustion Engineering, Inc. (CE)
Hematite, Missouri

SUBJECT: SAFETY EVALUATION REPORT, REVISED LICENSE AMENDMENT APPLICATION DATED APRIL 29, 1988, AND SUPPLEMENT DATED JUNE 6, 1988, RE PROCESSING URANIUM CONTAINING UP TO 5 WEIGHT PERCENT U-235

Background

CE is currently licensed to possess and use uranium enriched up to 4.1 w/o U-235. On December 28, 1987, CE submitted an application to increase the U-235 enrichment to 5 w/o. Following a site visit and discussions on April 14-15, 1988, by the reviewer, CE submitted the revised application. The submittal includes proposed new license conditions (Part I) and a revised safety demonstration (Part II). A supplement, dated June 6, 1988, was submitted following additional discussions by telephone.

Discussion

CE has revised Part I of the application to change the maximum U-235 enrichment to 5 w/o and to revise certain technical requirements for nuclear criticality safety. For individual units which are spaced by the surface density method, CE has dual criteria, viz., a specified safety factor for optimumly moderated and fully reflected units and a maximum fraction of the optimumly moderated but unreflected spherical unit. CE has extended Table 4.2.4 to provide allowable sizes for units enriched up to 5 w/o U-235. This approach is acceptable, but it must be emphasized that the dual limits in Sections 4.2.3 and 4.2.5 must be satisfied.

In Section 4.2.3, CE has revised the k-effective limit for single units and for an array of units. CE proposed a k-effective limit of ≤ 0.95 for all activities except for the UF_6-UO_2 conversion process in the oxide plant. Because CE did not propose a k-effective limit for the oxide plant, the staff recommends the following license condition:

> Notwithstanding the statement in Section 4.2.3 of the application, the k-effective of a unit or an array of units shall not exceed 0.95 unless specifically authorized by the license.

The licensee modified the section of the license containing assumptions and criteria for establishing safe individual units and arrays. Proposed criteria

were provided for moderation control units and for units with optimum moderation and full reflection. This has the potential for confusion in the safe application of criteria. To assure nuclear criticality safety, the staff recommends the following license condition:

> Nuclear criticality safety evaluations performed by the licensee in accordance with Section 2.7, Part I of the application, shall be based on assumptions of optimum moderation and reflection of individual safe units and of arrays.

The staff notes that the license does not require an independent review of k-effective calculations by a qualified nuclear criticality specialist. To correct this oversight, the staff recommends the following license condition:

> Nuclear criticality safety evaluations involving k-effective calculations performed by a Nuclear Criticality Specialist shall be independently reviewed and approved by an individual having, as a minimum, the qualifications of a Nuclear Criticality Specialist.

It should be noted that CE's practice has been consistent with this proposed license condition. The condition provides reasonable assurance that the practice will be continued.

The licensee failed to recognize that Section 8.1, Part II of the application, is based on uranium enriched to 4.1%. This problem was identified in the April 8, 1988 letter to the licensee and was discussed during the site visit on April 14-15. The licensee was notified of this error again by telephone on May 27, 1988 and submitted revised pages on June 6, 1988. The safety demonstration now reflects use of 5 w/o enriched uranium.

In Section 8.1.6, Part II of the application, the licensee described the powder packaging process. A 10-mil poly bag will be used inside a stainless steel (SS) container to package the UO_2 powder for storage pending shipment. In this section, the licensee described the moisture content as "typically" <0.05 w/o water. At this water level, the moderating effect of the poly bag will not be significant and will be offset by the poison effect of the SS container.

The licensee maintains an option to process the powder into pellets for shipment rather than shipping the powder. The first steps in the pelletizing operation are agglomeration, drying, and granulation. The powder and binder are agglomerated in a 25.7-liter blender. The material is dropped onto a drying belt, and then into a 15-liter granulator and collected in 11"x13" metal containers. The agglomerator volume exceeds the 22-liter volume specified in Table 4.2.4, Part I of the application. The license also assumed moderation control, but proposed unquantified limits for hydrogenous material in the agglomeration hood. In addition, the licensee failed to provide a spacing demonstration for the agglomeration and granulation process.

Agglomerated powder is stored on the mezanine above the moderation control storage conveyors. The k-effective for the array was calculated assuming a mass limit of 41 kg UO_2 and a water limit of 2 w/o. These assumptions are not justified in Part II nor limited by license conditions in Part I.

Pressing is done by attaching a 5-gallon pail of powder to a 29-liter hopper on the pellet press. Pellets are collected in sintering trays with a maximum volume of 4 liters. The hopper exceeds the allowable volume limit for an SIU in Table 4.2.4.

The bases for nuclear criticality safety for agglomeration, storage, and pelletizing processes have not been provided. To allow the licensee some capability to process the higher enrichment, the staff propose the following license condition:

> For uranium enriched to more than 4.1 w/o U-235, the licensee shall limit the agglomeration/granulation process, each agglomerated powder storage location, and the pellet pressing operation to safe mass units as specified in Table 4.2.4, Part I of the application.

The remaining operations of dewaxing, sintering, grinding, inspection, and packaging are done using the safe slab limit specified in Table 4.2.4, Part I. The centrifuge operation for grinder coolant is volume limited in accordance with Table 4.2.4.

The licensee has revised the nuclear safety analyses for several process steps in scrap recovery. In Section 8.7.3, Part II of the application, the licensee could not justify the dissolver as a reflected infinite cylinder, so the safety factor for full reflection in the license was applied to the bare cylinder. The dissolver is neither infinitely long nor a bare cylinder. The licensee also violated the spacing criteria. Had the licensee performed a buckling conversion on the dissolver dimensions and considered the dissolver to be nominally (partially) reflected, the safety demonstration would have been acceptable. The staff's analysis demonstrated safety of the dissolver.

In Section 8.7.5, the licensee made similar errors in the application of his criteria. In addition, dimensions of the precipitator are based on UO_2 - H_2O mixtures rather than the UNH - UO_4 mixtures. Use of dimensions for solutions would not have required the licensee to violate his criteria.

The licensee conservatively calculated k-effective for the precipitate dryer. The notable conservative assumption was neglecting structural steel in the calculation. Including the steel in the system would have reduced the k-effective below 0.92. The license limit for k-effective is 0.95.

In Chapter 9, Part II of the application, the licensee has revised the detailed analysis of the UF_6 - UO_2 conversion process. The conversion process takes place in three 10-inch diameter reactors. Each reactor has a 12-inch diameter disengaging column on top of the 10-inch process column. The licensee's analysis of a worst-case situation yielded a k-effective of 0.95 for the reactor and a k-effective of 0.97 for the array. The worst case assumed that the entire reactor was filled with UO_2 and moderated with condensed steam. There are a number of controls and alarms which make this worst-case situation very conservative.

Loss of power to the reactor would result in termination of steam flow and automatic purging by nitrogen. An alarm would sound upon loss of furnace heating. If an operator did not respond to the alarm and the steam condensed, high pressure conditions would cause termination of steam flow. If all of these controls failed, more than 8 hours of steam flow would be required to fill the 10-inch reactor with condensed steam. The reactor is unloaded at 2-hour intervals so that the water would be discharged through the powder valve system. The licensee has proposed a license condition which would require calibration of the high pressure switches every six months. This calibration, combined with the failsafe alarm features of the temperature controllers, provides reasonable assurance that the worst-case scenario is not feasible. Accordingly the high k-effective values can be accepted by the staff.

Conclusion/Recommendation

The staff concludes that the licensee can safely process uranium enriched to 5 w/o U-235. Subject to the above recommended license conditions, approval of the application is recommended.

The Region III Principal Inspector has no objection to this action.

Original Signed By:

George H. Bidinger
Uranium Fuel Section
Fuel Cycle Safety Branch
Division of Industrial and
Medical Nuclear Safety, NMSS

JUN 16 1988

Approved by: ORIGINAL SIGNED BY:

Jerry J. Swift, Section Leader
Uranium Fuel Section

* See previous concurrence

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JUN 16 1988

DOCKET NO.: 70-36

LICENSEE: Combustion Engineering

FACILITY: Hematite, Missouri

SUBJECT: CATEGORICAL EXCLUSION FOR AMENDMENT OF LICENSE SNM-33 TO INCREASE THE U-235 ENRICHMENT LIMIT TO 5.0 PERCENT

By letters dated December 28, 1987, April 29, 1988, and June 6, 1988, Combustion Engineering submitted for NRC review and approval an application for amendment of License No. SNM-33 to increase the U-235 enrichment limit from 4.1 to 5.0 percent. There will be no quantitative change in effluent discharge and only a slight change in qualitative aspects of effluent discharge. Therefore, no environmental compromises are involved. Criticality safety analyses by the licensee and NRC staff demonstrate that the present safety margin provided by limiting the k-effective of a unit or an array of units to ≤ 0.95 will continue to be maintained for the processing and storage of uranium enriched to 5.0 w/o. Thus, the increase in the uranium enrichment authorized for possession and use at the facility does not significantly increase the potential for a nuclear criticality accident. Accordingly, the staff has concluded that the following conditions have been met:

1. There is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite,

2. There is no significant increase in individual or cumulative occupational radiation exposure,

3. There is no significant construction impact, and

4. There is no significant increase in the potential for or consequences from radiological accidents.

Therefore, in accordance with 10 CFR 51.22(c)(11), neither an Environmental Assessment nor an Environmental Impact Statement is warranted for this proposed action.

FOR THE NUCLEAR REGULATORY COMMISSION

ORIGINAL SIGNED BY:

Leland C. Rouse, Chief
Fuel Cycle Safety Branch
Division of Industrial and
Medical Nuclear Safety, NMSS

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* See previous concurrence

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