

JUN 16 1988

*Dated: 0700-0036*

IMUF:GHB  
70-36  
SNM-33, Amendment No. 8

Combustion Engineering, Inc.  
C-E Power Systems Group  
ATTN: Dr. P. L. McGill, Vice President  
Nuclear Fuel  
1000 Prospect Hill Road  
Windsor, Connecticut 06095-0500

Gentlemen:

In accordance with your application dated April 29, 1988, and supplement dated June 6, 1988, and pursuant to Title 10, Code of Federal Regulations, Part 70, Condition No. 6 of License No. SNM-33 is hereby amended to authorize possession and use of uranium enriched to a maximum 5.0 weight percent in the U-235 isotope. This authorization is subject to the following additional License Conditions:

31. 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.
32. 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.
33. 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.
34. 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.

These conditions were discussed and agreed to by your Mr. Eskridge and Mr. Bidinger of my office.

All other conditions of the license shall remain the same.

*R-7*

Combustion Engineering, Inc.

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Revised License No. SNM-33 incorporating Amendment No. 8 and our Safety Evaluation Report are enclosed.

FOR THE NUCLEAR REGULATORY COMMISSION

Original Signed By:

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

Enclosures:

- 1. Revised License No. SNM-33
- 2. Safety Evaluation Report

cc w/encls:

Mr. A. E. Scherer, Director  
Nuclear Licensing

Mr. C. B. Brinkman, Manager  
Washington Nuclear Operations

Mr. J. A. Rode, Plant Manager  
Hematite Fuel Manufacturing

Mr. H. E. Eskridge, Supervisor  
Licensing, Safety and Accountability

Distribution w/encl

Docket No. 70-36

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*See previous correspondence*

OF: IMUF:	IMUF:	IMUF:	IMSB:
NAME: GHBidinger:mh/ht	VLTharpe:	JJSwift:	LCRouse:
DATE: 06/ /88	06/ /88	06/ /88	06/16/88

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**MATERIALS LICENSE**

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and Title 10, Code of Federal Regulations, Chapter I, Parts 30, 31, 32, 33, 34, 35, 40 and 70, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer byproduct, source, and special nuclear material designated below; to use such material for the purpose(s) and at the place(s) designated below; to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified below.

Licensee		
1. Combustion Engineering, Inc.		3. License number SNM-33 Amendment No. 8
2. P. O. Box 107 Hematite, Missouri 63047		JUN 16 1988
		4. Expiration date December 31, 1988
		5. Docket or Reference No. 70-36

- |  |                                  |  |
|--|----------------------------------|--|
| 6. Byproduct, source, and/or special nuclear material                  | 7. Chemical and/or physical form | 8. Maximum amount that licensee may possess at any one time under this license |
| A. Uranium enriched to maximum 5.0 weight percent in the U-235 isotope | A. Any, excluding metal powder   | A. 8,000 kilograms contained U-235   |
| B. Uranium, any U-235 enrichment                                       | B. Any                           | B. 350 grams   |
| C. Source material (Uranium and Thorium)                               | C. Any, excluding metal powder   | C. 50,000 kilograms  |
| D. Cobalt-60   | D. Sealed sources                | D. .40 millicuries, total  |
9. Authorized Use: For use in accordance with the statements, representations, and conditions contained in Part I of the licensee's renewal application dated February 26, 1982, and supplements dated July 21, 1982; February 21, 1983; May 31, 1984; April 29 and June 6, 1988; and letters dated February 29, 1984, January 20, 1986, and March 30, 1987.
10. Authorized Place of Use: The licensee's existing facilities in Hematite, Missouri, as described in the referenced license renewal application.
11. Quarterly inspections by the Supervisor, NLS&A, or his representative shall be preplanned and shall be documented. Such documentation shall be maintained for 2 years.

**MATERIALS LICENSE  
SUPPLEMENTARY SHEET**

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12. A written report shall be made by the NLS&A Supervisor to the Plant Manager every 6 months reviewing employee radiation exposure (internal and external) and effluent release data to determine:
  - a. if there are any upward trends developing in personnel exposure for identifiable categories of workers, types of operations, or in effluent releases;
  - b. if exposures and releases can be lowered in accordance with the ALARA commitment; and
  - c. if equipment for effluent and exposure control is being properly used, maintained, and inspected.
13. The licensee shall leak test sealed sources in accordance with the enclosed "License Condition For Leak Testing Sealed Byproduct Material Sources".
14. Release of equipment and material from the plant site or to clean areas onsite shall be in accordance with the enclosed "Guidelines on Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material," dated August 1987.
15. Pursuant to 10 CFR 20.302, the licensee is prohibited to treat waste and scrap materials containing uranium enriched in U-235 and/or source material by incineration.
16. Within 60 days of the date of this license renewal, the licensee shall submit to the NRC a description of a proposed monitoring program to determine the quantity and environmental effects of radioactivity on spent limestone rock used as onsite fill material and to determine the environmental effects of outdoor storage of the alpha-contaminated material.
17. The licensee shall survey spent limestone rock discharge from each HF scrubber for beta contamination. Rock with beta contamination which exceeds five times the background of fresh rock shall not be used for landfill.
18. Within 60 days of the date of this license renewal, the licensee shall submit to NMSS a plan, including schedule, for the disposal of alpha-contaminated spent limestone rock.
19. The licensee shall decontaminate the two evaporation ponds such that the average residual contamination in each pond does not exceed the appropriate limit of either 250 picocuries of insoluble uranium or 100 picocuries of soluble uranium per dry gram of soil. The Tc-99 concentrations in a composite sample for each pond shall be determined.

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20. a. If the radioactivity in plant gaseous effluents exceeds 105  $\mu\text{Ci}$  per calendar quarter, the licensee shall, within 30 days, prepare and submit to the Commission a report which identifies the cause for exceeding the limit and the corrective actions to be taken by the licensee to reduce the release rates. If the parameters important to a dose assessment change, a report shall be submitted within 30 days which describes the changes in parameters and includes an estimate of the resultant change in dose commitment.
- b. In the event that the calculated dose to any member of the public in any consecutive 12-month period is about to exceed the limits specified in 40 CFR 190.10, the licensee shall take immediate steps to reduce emissions so as to comply with 40 CFR 190.10. As provided in 40 CFR 190.11, the licensee may petition the Nuclear Regulatory Commission for a variance from the requirements of 40 CFR 190.10. If a petition for a variance is anticipated the licensee shall submit the request at least 90 days prior to exceeding the limits specified in 40 CFR 190.10.
21. The licensee shall maintain and execute the response measures of his Radiological Contingency Plan submitted to the Commission by letter dated December 28, 1987. The licensee shall also maintain implementing procedures for his Radiological Contingency Plan as necessary to implement the Plan. The licensee shall make no change in his Radiological Contingency Plan that would decrease the response effectiveness of the Plan without prior Commission approval as evidenced by a license amendment. The licensee may make changes to his Radiological Contingency Plan without prior Commission approval if the changes do not decrease the response effectiveness of the Plan. The licensee shall furnish the Chief, Fuel Cycle Safety Branch, Division of Industrial and Medical Nuclear Safety, NMSS, U. S. Nuclear Regulatory Commission, Washington, DC 20555, a report containing a description of each change within 6 months after the change is made.
22. At the end of the plant life, the licensee shall decontaminate the facilities and site in accordance with the general decommissioning plan submitted in the enclosure to the letter dated January 12, 1979, so that these facilities and grounds can be released to unrestricted use. The financial commitment to assure that funds will be available for decommissioning in the letter dated March 8, 1979, is hereby incorporated as a condition of the license.
23. The licensee shall continue the soil sampling program for the spent limestone fill areas, as described in the letter dated February 29, 1984, until discontinuance is authorized by the Commission.
- <sup>1</sup>. The report or petition should be submitted to the Director, Office of Nuclear Material Safety and Safeguards, with a copy to the Regional Administrator, Region III.

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24. The monitoring program for the spent limestone shall include:
- Continuous air sampling at the center of, and approximately 1 meter above, the uncovered spent limestone piles for a minimum 2-year period. The weekly samples may be composited and analyzed for uranium activity on a quarterly basis. The lower limit of detection shall be  $10^{-16}$   $\mu\text{Ci/ml}$ , or
  - Measurement of the uranium activity on the surface of the spent limestone. Prior to conducting such a program, the licensee shall submit the sampling and analytical program to the NRC for approval.
25. Processing of  $\text{UF}_6$  in 10-ton cylinders is not authorized.
26. The 10-ton  $\text{UF}_6$  cylinders shall be equipped with valve protectors.
27. The concrete pad for storage of  $\text{UF}_6$  cylinders and the surrounding area shall be sloped or graded so that any spilled combustible fluids would not be confined to the storage area.
28. No combustibles shall be stored on the concrete pad.
29. A  $\text{CO}_2$  fire extinguisher shall be readily available near the storage pad.
30. In addition to the controls in Section I of the enclosure to the letter dated March 30, 1987,  $\text{UF}_6$  cylinders which are in transport and containing  $\text{UF}_6$  heels shall be either sealed, in sealed overpacks, or in sealed vehicles.
31. 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.
32. 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.
33. 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.

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- 34. 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 operating to safe mass units as specified in Table 4.2.4, Part I of the application.

FOR THE NUCLEAR REGULATORY COMMISSION

Original Signed By:

By: Leland C. Rouse  
 Division of Industrial and Medical  
 Nuclear Safety, NMSS  
 Washington, DC 20555

Date:

*97HB*  
*6-10-88*  
*6-13-88*  
*LC (6/16/88)*  
 JUN 16 1988

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  $\leq 0.95$  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.

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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: Jerry J. Swift, Section Leader  
Uranium Fuel Section

\* See previous concurrence

OFC: IMUF *	: IMUF	: IMUF	: IMSB	:
NAME: GHBidinger:lg/ht/mh	: VLThapre	: JSwift	: LCRouse	:
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