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October 20, 1989

Charles Bechhoefer, Presiding Officer
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Re: In the Matter of Combustion Engineering, Inc.
(Hematite Fuel Fabrication Facility, Special
Nuclear Material License No. SNM-33)
Docket No. 70-36-MLA, ASLBP No. 89-593-01-MLA

Dear Judge Bechhoefer:

Enclosed are answers to the three questions posed to Combustion Engineering, Inc. (C-E) in your Memorandum and Order of September 25, 1989. Each question has been repeated, essentially as presented, and is followed by C-E's response.

Sincerely

Michael A. Bauser

Michael A. Bauser

Enclosure: Service List

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October 20, 1989

RESPONSES TO QUESTIONS POSED TO
COMBUSTION ENGINEERING, INC.
IN MEMORANDUM AND ORDER DATED
SEPTEMBER 25, 1989

As part of its May 1, 1989, application for a license amendment, and again in the further information filed on August 18, 1989, the Applicant has set forth certain criticality considerations as part of its description of the process of filling of bulk storage hoppers. It states that "the K_{eff} is 0.9744±0.0032." It is my understanding, however, that the K_{eff} normally found acceptable by the NRC Staff is 0.95. See ANSI/ANS-8.1-1983, as incorporated in NRC Regulatory Guide 3.4, "Nuclear Criticality Safety in Operations With Fissionable Materials at Fuels and Materials Facilities" (Rev. 2, March, 1986). In addition, the current license includes a provision limiting the K_{eff} to not in excess of 0.95 unless specifically authorized (license SNM-33, Amendment 13, at ¶ 31). Therefore, I have the following questions:

(1) What justification are you providing for using a K_{eff} greater (i.e., less conservative) than 0.95?

Response: NRC Regulatory Guide 3.4, Revision 2, "Nuclear Critically Safety in Operations with Fissionable Materials at Fuels and Materials Facilities," sets forth a method acceptable to the NRC for complying with the requirements of 10 C.F.R. 70 that applications for specific licenses contain proposed procedures to avoid accidental criticality. As stated in its Introduction, Regulatory Guide 3.4 describes

> procedures acceptable to the NRC staff for preventing accidental criticality in operations with fissionable materials at fuels and materials facilities . . . and for validating calculational methods used in assessing nuclear criticality safety.

Enclosure

Regulatory Guide 3.4 endorses the methods of ANSI/ANS-8.1-1983, "Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors," a standard of the American National Standards Institute ("ANSI") and the American Nuclear Society ("ANS"). The Applicant's application meets or exceeds all of the requirements of ANSI/ANS-8.1-1983, and conforms to the requirements of Regulatory Guide 3.4.

As noted in Part B of Regulatory Guide 3.4, ANSI/ANS-8.1-1983 does not address the margin of safety to be used with the method. So long as K_{eff} remains less than 1, accidental criticality does not occur. Illustrative of the degree of safety provided by the design of C-E's system, under normal operation the value of K_{eff} for the UF_6-UO_2 plant analyzed in Paragraph 8.3.4.1 of the application is calculated to be 0.2835 ± 0.0050.

ANSI/ANS-8.1-1983 applies a "Double Contingency Principle" to nuclear criticality safety analyses. Under this principle, as stated in section 4.2.2 of ANSI/ANS-8.1-1983,

> Process design should, in general, incorporate sufficient factors of safety to require at least two unlikely, independent, and concurrent changes in process conditions before a critically accident is possible.

In order to provide a more meaningful and limiting analysis, Combustion Engineering evaluated conditions which required many

changes in process conditions or failures to act (rather than the two required by ANSI/ANS-8.1-1983) before reaching the physical limits which result in the K_{eff} of 0.9744 ± 0.0032. These include:

1. Failure of all heating elements (change in process conditions).
2. Failure of low temperature alarm.
3. Failure of operator to respond to R-3 temperature indicator.
4. Failure of pressure control system to close steam control valve (change in process conditions).
5. Failure of high pressure alarm.
6. Failure of high pressure switch to close steam inlet valve (change in process conditions).
7. Failure of operator to respond to R-3 pressure indicator.
8. Failure of rupture disc to rupture (change in process conditions).
9. Failure of operator to follow procedures which require unloading R-3 reactor every 2 hours (change in process conditions). (It takes at least three such failures (6 hours) to fill R-3).
10. In spite of #9, above, operator continues to open valve from R-2 to R-3 (change in process conditions).

The analysis also included the conservative assumptions: (a) that certain process vessels are surrounded by water, and (b) that a water mist of 0.001 g/cc exists in the oxide conversion room. Even under these incredibly extreme conditions C-E's application

shows that, the UF_6-UO_2 plant array remains subcritical with a calculated K_{eff} equal to 0.9744 ± 0.0032.

It should be noted that no special significance attaches to the K_{eff} value of 0.95 mentioned in the question. While that value of K_{eff} represents a condition further removed from criticality than a higher value, the regulatory requirement is simply to remain subcritical, a condition achieved so long as K_{eff} is, in fact, less than one. C-E did not re-analyze the plant using "credible abnormal" conditions, i.e., the two unlikely changes situation, because the condition actually analyzed is more conservative and more limiting. Moreover, since no specific value of subcritical K_{eff} is required by applicable standards and regulations, it was felt that the analysis in the application promoted greater understanding of the inherent safety margins in the process. The NRC Staff previously considered the use of similar conservative assumptions by the Applicant, and found them acceptable. (See NRC Safety Evaluation Report for Amendment 8 to License SNM-33, dated June 16, 1988, pp. 3 and 4.)

(2) What changes in your application, if any, would result if you were to be limited to a K_{eff} of 0.95 or less?

Response: If a limit on K_{eff} of 0.95 were imposed on the UF_6-UO_2 plant, the Applicant would be required to expend additional time and incur additional expense to perform nuclear criticality

safety analysis utilizing only the double contingency principle, rather than the more conservative contingencies currently utilized. Such an analysis would result in lower values of K_{eff}, but would not provide any better demonstration of the criticality safety of the array. On the contrary, since the Applicant would not be expected to perform two analyses, the more limiting demonstration of margins and the better understanding it provides would be lost in future applications for amendments.

(3) What would be the effect on your operations if I were to include a provision in your amended license comparable to ¶ 31 of your current license, covering the information submitted at ¶ 8.3.4.1 of your amendment application?

Response: So long as the values of K_{eff} reported for the unit and array of units discussed at Paragraph 8.3.4.1 of the amendment application are specifically authorized by the license, a continuation of the condition of Paragraph 31 of the license would not affect operations. It should be noted that comparable values of K_{eff} are currently so authorized. This does not mean, however, that modification or deletion of Paragraph 31 may not be appropriate at some future time.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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ATOMIC SAFETY AND LICENSING BOARD PANEL

Before Administrative Judge: Charles Bechhoefer

In the Matter of	)	
COMBUSTION ENGINEERING, INC.	)	Docket No. 70-36-MLA
(Hematite Fuel Fabrication Facility, Special Nuclear Materials License No. SNM-33)	)	ASLPB No. 89-593-10-MLA

CERTIFICATE OF SERVICE

I hereby certify that copies of the Letter to Charles Bechhoefer, Presiding Officer, from Michael A. Bauser, dated October 20, 1989, and the Enclosure thereto, have been served upon the following persons by United States mail, postage prepaid and properly addressed, on the date shown below:

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U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Administrative Judge*
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Attn: Chief, Docketing & Service Section
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* Also served via messenger.

Colleen P. Woodhead, Esq.*
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Dated this 20th day of October, 1999.

Michael A. Bauser

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