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April 28, 1997

Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Re: Response for Additional Information, Penn State Breazeale Reactor Docket No. 50-5 dated March 7, 1997

Dear Sir or Madame:

Attached is the response to the Request for Additional Information, Penn State Breazeale Reactor Docket No. 50-5 dated March 7, 1997. On March 27, 1997, Dr. Warren F. Witzig, Interim Director, requested a revised response date of April 30, 1997. This was accepted as satisfactory by Mr. Marvin Mendonca.

The response answers the questions and have led to a revised SAR &TS, revision 1, April 24, 1997 as a response to question number eight.

Sincerely,

Dr. Rodney A. Erickson
Vice President for Research
Dean of the Graduate School

RAE:WFW/db4030.97

Attachments

pc: Region I Administrator

A020

Subscribed to the sworn before me on this 29th day of April, 1997,
Notary Public in and for Centre County, Pennsylvania.

Bonnie L. Burris

Notarial Seal
Bonnie L. Burris, Notary Public
State College Boro, Centre County
My Commission Expires Nov. 22, 1999

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RESPONSE TO

REQUEST FOR ADDITIONAL INFORMATION

PENN STATE BREAZEALE REACTOR

DOCKET NO. 50-5

(APRIL 24, 1997)

Question 1:

1. TS section 2.2 and others require a correlation of fuel temperature in the Maximum Elemental Power Density (MEPD) location to the fuel temperature in other core locations. Provide a description or reference to the description for this correlation (e.g., the calculations or experiments to establish and verify the location of the instrumented element).[a]

   Also, provide a description of the administrative process that will be used if this methodology is to be changed.[b]

Answer 1a:

The limited safety system setting for fuel temperature shall be 650° C with the instrumented fuel element located in a core position which has been calculated[1] to be the position with the "MEPD". Some research activities may preclude locating the instrumented fuel element in the MEPD core position and so a safe reliable alternative would then be necessary. An example of an alternative is to measure the fuel temperature in a specific core location and then calculate the fuel temperature in the "MEPD" location using equation 22 on page IX-10 in the proposed revised SAR. When the instrumented fuel element is not in the position of the MEPD, the LSSS shall be reduced by the calculational and/or experimental method described to maintain a 500°C safety margin from the 1150°C safety limit as if the MEPD fuel temperature was being measured. The value of the symbol "NP" to be used in equation 22 for the MEPD position in the core is determined by calculations which have been bench marked against experiments. Bench marking is necessary to assure validity of the calculation. Both calculations and/or experiments are used to provide the fuel temperature in a core position as required. Reference "1" illustrates the current calculational method and this method will change as calculational improvements occur. Any change in calculational method will be bench marked against an experiment to assure validity and documented.

Answer 1b:

The regular administrative process at the RSEC will be used if any change in the methodology is to be made. Standard Operating Procedure, SOP-3, Core Loading and Fuel Handling, as amended is the administrative process.

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[1] 1. See reference 27 on page IX - 46 of the proposed revised SAR. A New Fuel Management Plan for the Penn State TR16A Reactor. P.6. Boyle, D.E. Hughes & S.H. Levine. This paper has been submitted to the Nuclear Technology Journal on 3-31-97. Also see page IX - 2 of the SAR.

Question 2:

2. The Bases for TS 3.1.1.a on reactor operational power level states in part that: "Small local variations can occur about the maximum allowed power for a given core loading during normal operation and still provide a large margin of safety in that maximum fuel temperature remains well below the safety limit. See Safety Analysis Report, section IX." The License section 2.C(1) on "Maximum Power Level" and the subject TS do not have provisions for power operation above 1 megawatt(MW). Provide specific reference to the analysis that shows that small local variations of power will not adversely effect safety analyses results and provide a proposed license and specification change to allow operation in this manner or up to a maximum power level that is demonstrated acceptable by analyses.

   License variations that have been found acceptable at other research reactors include specifying a steady-state power level up to the value for 100% power and a "Maximum Power Level" of less than or equal to the high power level trip set point. For example, the University of Michigan license states: "The licensee is authorized to operate the facility at a steady-state power level of 2.0 megawatt (thermal). The maximum power level shall not be in excess of 2.2 megawatts (thermal)." It should be noted that the 2.2 megawatts corresponds to the Limiting Safety System Setting and all safety analyses should be based on this value.

   Answer 2:

   The SAR uses a power level of 1.15 MW (15% over the steady state power of 1.00 MW) in the calculation of the Limiting Safety System Setting (LSSS). A LSSS of a measured fuel temperature of 650°C protects the core as the maximum fuel temperature is calculated to be below the safety limit of 1150°C for a sudden reactivity insertion of a $1 at steady state power. See page IX-25 of the SAR, Evaluation of The Limiting Safety System Setting (LSSS).

   For pulse operation, a $3.50 reactivity insertion starting from ambient pool temperature results in a maximum fuel temperature of 1095°C, which is below the safety limit of 1150°C. See pages IX-25 and 26 of the SAR.

Question 3:

3. TS section 3.1.4, 3.7.a and 3.7.b specify increased stepped reactivity insertion for pulse operation. This is greater than allowed by License section 2.C(1). Additionally, the License wording for reactivity insertion is not consistent with relatively recent licenses for pulse power levels (e.g., Armed Forces Radiobiology Research Institute "...pulse power levels not to exceed a pulse reactivity insertion of 4.00 dollars"). Propose a License change to be consistent with TS and current licensing practices.

   Answer 3:

   Attachment A is the proposed changes to be made to the license R-2 and to the proposed Tech Specs revision 1.

Question 4:

4. TS 3.1.5.d includes allowance for Normalized Power (NP) to be greater than 2.2 with decreasing allowed pulse worth. The bases for this specification indicates that the maximum NP will be calculated by an accepted method per administrative procedure. Provide a description of the calculational technique that will be used, and a description of the administrative process that will be used if this calculational technique is to be changed.

Answer 4:

The maximum fuel temperature rise averaged over the radius of a fuel element at its mid plane can be calculated by equation 29 (page IX-12 of the SAR) for a reactor pulse. The empirical constants in equation 29 have been determined experimentally (page IX-19, SAR, section 5. Evaluation of the Pulse Data for Fuel Element I-14). Also see tables 9-2, 9-3 and 9-4 in the SAR. The value of NP to be used in equation 29 to calculate the maximum fuel temperature rise is determined analytically and/or experimentally as described in the answer to question one above. The regular administrative process will be used if the calculational technique is to be changed, ie., Standard Operating Procedure, SOP-3, Core Loading and Fuel Handling as amended.

Question 5:

5. TS 3.2.4, Table 2b, the minimum count rate on the source level interlock was eliminated "since this channel reads in fraction of full power." Provide a TS value in fraction of full power that is acceptable for this function (i.e., corresponds approximately to the previous "two neutron induced counts per second"), or justification as to why it is not needed and/or practical.

Answer 5:

The present console of the reactor indicates a fraction of full power for the source level interlock rather than a number of neutron induced indications for such a counts per second. Historically, operators have used a specific count per second, for example 2, to give assurance that actual neutron induced nuclear reactions were sufficiently above the inherent noise in the channel. An arbitrary criteria. The basis for table 2b is given on page 17, of the TS, Bases g. which states that the operator must assure that sufficient neutrons are available for a proper reactor start up. It is judged that this condition of assurance is reached when the low count rate interlock is exceeded as defined in Standard Operating Procedures, SOP-02, check out procedure.

Question 6:

6. For TS 3.2.4, Bases b, provide a description or reference to the analyses or rationale which established the acceptability of the power level scram (e.g., reference to the SAR sections that establish the acceptability of the scram setpoint).

Answer 6:

Technical Specifications 3.2.4 Basis b (page 17) is to provide an adequate safety margin for a core experiment in which the calculated or measured value of the maximum fuel temperature will not exceed the safety limit of 1150°C. The analysis for setting the power level scram at a value below 115% (1.15 MW) power (see table 2a, TS., page 16) is given in the SAR, page IX-25, C. Evaluation of the Limiting Safety System Setting (LSSS).

Question 7:

7. TS 6.6.2.a specifies that special reports are to be made "by telephone and confirmed in writing by telegraph or similar concurrence to the USNRC, Operations Center, Washington, DC 20555, to be followed by a written report to USNRC, Document Control Desk" 10 CFR 50.4, specifies that written communications should be sent to the Document Control Desk. Proposed changes to ensure that both written communications are addressed to the Document Control Desk.

Answer 7:

There shall be a report no later than the following working day by telephone to the USNRC, Operations Center, Washington, DC 20555 and confirmed in writing by telegraph or similar conveyance to the USNRC, Document Control Desk, Washington, DC 20555. This shall be followed by a written report to the USNRC, Document Control Desk, Washington, DC 20555, with a copy to the USNRC Regional Administrator, that describes the circumstances of the event within 14 days of any of the following:

Question 8:

8. Page IX-25 has changes (i.e., changes in LSSS setting from 700°C to 650°C) that are not marked by change bars. Provide verification that all changes are indicated by change bars in SAR and TS.

Answer 8:

A review of the SAR and TS has led to the revised SAR and TS, revision 1, April 24, 1997.

Question 9:

9. The Safety Analysis Report (SAR) Section for the loss of coolant accident analysis indicates on page IX-28 that it was assumed that the reactor is operated continuously for one week at 1 megawatt (MW). Provide an analysis considering continuous operation to equilibrium decay heat conditions for 1 MW operations.

Answer 9:

The analysis has been performed as illustrated in the SAR pages IX-27 to IX-36 for the case where the reactor has been operating continuously for 10 years at 1.0 MW prior to the LOCA. For the 6" pipe break with its attendant 1360 seconds (22.6 min) for the water to fall below the bottom of the core, the maximum fuel equilibrium temperature is 607°C. This value is well below the value of 950°C established as a maximum fuel temperature during a LOCA (See SAR pages IX-32, IX-35 & 36).

WFW:TLF:DEH/jl1011.97

Attachment A

Tech Specs

- Definitions

  Steady State Power Level

  Steady state power level is the maximum power level (1.0 MW) used in all operations except for power channel calibrations, see 4.2.5 Overpower Scram.

  Maximum Power Level

  Maximum Power Level is the maximum power (1.10 MW) to be used for power channel calibrations only. Also see section 4.2.5.

- Add On Page 9

  Specifications:

  3.1.1a ...and for power channel calibration
  3.1.1c ...A maximum power level shall be no greater than 1.10 MW for brief periods to calibrate power channels.

  Basis:

  c. Operation at 1.10 MW is within the bounds established by the SAR for both steady state operations and pulse operation. See pages IX 25 & 27 of the SAR.

- License Document

  1. Maximum Power Level

     The licensee may operate the reactor at power levels not in excess of 1.0 megawatts (thermal), the maximum power level shall not be in excess of 1.10 megawatts, and in the pulsing mode with reactivity insertions not to exceed 2.45 $\Delta K/K$.

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