

May 23, 2001

Dr. Eva J. Pell  
Vice President for Research and Dean of the Graduate School  
Pennsylvania State University  
304 Old Main  
University Park, PA 16802-1504

SUBJECT: ISSUANCE OF AMENDMENT NO. 35 TO FACILITY OPERATING LICENSE  
NO. R-2 — PENNSYLVANIA STATE UNIVERSITY (PENN STATE) BREAZEALE  
REACTOR (TAC NO. MA8019)

Dear Dr. Pell:

The Commission has issued the enclosed Amendment No. 35 to Facility Operating License No. R-2 for the Penn State Breazeale Reactor. The amendment consists of change numbered 2 in your letter dated January 18, 2000, as supplemented on April 13, 2001. The amendment makes changes that suspend limiting conditions of operations for excess reactivity, transient rod reactivity worth, and experiment reactivity worth during surveillance testing. A copy of the related safety evaluation supporting Amendment No. 35 is also included.

Should you have any questions on this amendment, I would be pleased to hear from you. My telephone number is (301) 415-1128.

Sincerely,

*/RA/*

Marvin M. Mendonca, Senior Project Manager  
Events Assessment, Generic Communications and  
Non-Power Reactors Branch  
Division of Regulatory Improvement Programs  
Office of Nuclear Reactor Regulation

Docket No. 50-5

Enclosures: 1. Amendment No. 35  
2. Safety Evaluation

cc w/enclosures: Please see next page

Pennsylvania State University

Docket No. 50-5

cc:

Mr. Eric J. Boeldt, Manager  
of Radiation Protection  
The Pennsylvania State University  
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University Park, PA 16802-1504

Dr. C. Frederick Sears, Director  
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Mr. William P. Dornsife, Director  
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PENNSYLVANIA STATE UNIVERSITY

DOCKET NO. 50-5

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 35  
Licensee No. R-2

1. The U.S. Nuclear Regulatory Commission (the Commission) has found that:
  - A. The application filed by the Pennsylvania State University (the licensee), dated January 18, 2000, as supplemented on April 13, 2001, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the regulations of the Commission as stated in 10 CFR Chapter I;
  - B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;
  - C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public and (ii) that such activities will be conducted in compliance with the rules and regulations of the Commission;
  - D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public;
  - E. This amendment is issued in accordance with 10 CFR Part 51 of the regulations of the Commission and all applicable requirements have been satisfied; and
  - F. Prior notice of this amendment was not required by 10 CFR 2.105 and publication of notice for this amendment is not required by 10 CFR 2.106.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the enclosure to this license amendment, and paragraph 2.C(2) of License No. R-2 is hereby amended to read as follows:

- (2). Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 35, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective on the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

*/RA/*

Ledyard B. Marsh, Branch Chief  
Events Assessment, Generic Communications and  
Non-Power Reactors Branch  
Division of Regulatory Improvement Programs  
Office of Nuclear Reactor Regulation

Enclosure: Appendix A Technical  
Specifications Changes

Date of Issuance: May 23, 2001

ENCLOSURE TO LICENSE AMENDMENT NO. 35

FACILITY LICENSE NO. R-2

DOCKET NO. 50-5

Replace the following pages of the Appendix A Technical Specifications with the enclosed pages. The revised pages are identified by amendment number and contain vertical lines indicating the areas of changes.

Remove

10  
25

Insert

10  
25

### 3.1.2 Reactivity Limitation

#### Applicability

This specification applies to the reactivity condition of the reactor and the reactivity worth of control rods, experiments, and experimental facilities. It applies to all modes of operation.

#### Objective

The objective is to ensure that the reactor is operated within the limits analyzed in the Safety Analysis Report and to ensure that the safety limit will not be exceeded.

#### Specification

- a. The maximum excess reactivity above cold, clean, critical plus samarium poison of the core configuration with experiments and experimental facilities in place shall be 4.9%  $\Delta k/k$  (~\$7.00).
- b. During initial measurements of maximum excess reactivity for a new core/experimental configuration this specification is suspended provided the reactor is operated at power levels no greater than 1 kw. If the power level exceeds 1 kw, power shall be reduced to less than 1 kw within one minute. This exemption does not apply for the annual confirmatory measurement of excess reactivity required by TS 4.1.2.

#### Basis

Limiting the excess reactivity of the core to 4.9%  $\Delta k/k$  (~\$7.00) prevents the fuel temperature in the core from exceeding 1 150°C under any assumed accident condition as described in the Safety Analysis Report, Section IX. The exemption allows the initial physics measurement of maximum excess reactivity for a new core/experimental configuration to be measured without creating a reportable occurrence. Maintaining the power level less than 1 kw during this exemption assures there is no challenge to the safety limit on fuel temperature.

### 3.1.3 Shutdown Margin

#### Applicability

This specification applies to the reactivity condition of the reactor and the reactivity worth of control rods, experiments, and experimental facilities. It applies to all modes of operation.

#### Objective

The objective is to ensure that the reactor can be shut down at all times and to ensure that the safety limit will not be exceeded.

#### Specification

The reactor shall not be operated unless the shutdown margin provided by control rods is greater than 0.175%  $\Delta k/k$  (~\$0.25) with:

- a. All movable experiments, experiments with movable parts and experimental facilities in their most reactive state, and
- b. The highest reactivity worth control rod fully withdrawn.

#### Basis

A shutdown margin of 0.175%  $\Delta k/k$  (~\$0.25) ensures that the reactor can be made subcritical from any operating condition even if the highest worth control rod should remain in the fully withdrawn position. The shutdown margin requirement may be more restrictive than Specification 3.1.2.



Specification

An ALARA program shall be in effect.

Basis

Having an ALARA program will ensure that occupational exposures to radiation and the release of radioactive effluents to the environs will be ALARA. Having such a formal program will keep the staff cognizant of the importance to minimize radiation exposures and effluent releases.

3.7 Limitations of ExperimentsApplicability

These specifications apply to experiments installed in the reactor and its experimental facilities.

Objective

The objective is to prevent damage to the reactor and to minimize release of radioactive materials in the event of an experiment failure.

Specifications

The reactor shall not be operated unless the following conditions governing experiments exist:

- a. The reactivity of a movable experiment and/or movable portions of a secured experiment plus the maximum allowed pulse reactivity shall be less than 2.45%  $\Delta k/k$  (~\$3.50). However, the reactivity of a movable experiment and/or movable portions of a secured experiment shall have a reactivity worth less than 1.4%  $\Delta k/k$  (~\$2.00). During measurements made to determine specific worth, this specification is suspended provided the reactor is operated at power levels no greater than 1 kw. When a movable experiment is used, the maximum allowed pulse shall be reduced below the allowed pulse reactivity insertion of 2.45%  $\Delta k/k$  (~\$3.50) to ensure that the sum is less than 2.45%  $\Delta k/k$  (~\$3.50).
- b. A single secured experiment shall be limited to a maximum of 2.45%  $\Delta k/k$  (~\$3.50). The sum of the reactivity worth of all experiments shall be less than 2.45%  $\Delta k/k$  (~\$3.50). During measurements made to determine experimental worth, this specification is suspended provided the reactor is operated at power levels no greater than 1 kw.
- c. When the keff of the core is less than 1 with all control rods at their upper limit and no experiments in or near the core, secured negative reactivity experiments may be added without limit.
- d. An experiment may be irradiated or an experimental facility may be used in conjunction with the reactor provided its use does not constitute an unreviewed safety question. The failure mechanisms that shall be analyzed include, but are not limited to corrosion, overheating, impact from projectiles, chemical, and mechanical explosions.

Explosive material shall not be stored or used in the facility without proper safeguards to prevent release of fission products or loss of reactor shutdown capability.

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 35 TO

FACILITY OPERATING LICENSE NO. R-2

PENNSYLVANIA STATE UNIVERSITY

DOCKET NO. 50-5

1.0 INTRODUCTION

By letter dated January 18, 2000, the Pennsylvania State University (the licensee or Penn State) submitted a request that included 3 changes to the Technical Specifications (TSs). License Amendment No. 34 March 16, 2000 authorized 2 of these TSs changes. This safety evaluation addresses the last of the proposed changes. This last change request suspends limiting conditions of operations (LCOs) for excess reactivity, transient rod reactivity worth, and experiment reactivity worth during certain surveillance testing conditions. The licensee supplemented their amendment request for this third change by letter dated April 13, 2001.

2.0 EVALUATION

The proposed change would allow testing to establish the reactivity worth without being in violation of the LCO if the value were determined to be beyond the limiting condition for operation. The change would also limit the testing to low power levels (less than 1 kilowatt). The change would be applicable to testing only and not to normal operation.

The NRC staff discussed the change with the licensee. The licensee said that the change would allow for maximum use of the fuel and reduce fuel movement. Therefore, the NRC staff concluded that the proposed change would be consistent with the principle of as low as reasonably achievable (ALARA) for radiation protection.

The NRC staff reviewed the Safety Analysis Report. The Safety Analysis Report analyzed potential reactivity injection accidents which the NRC staff has accepted. The Safety Analysis Report assumed a \$3.5 injection of positive reactivity at 1 kilowatt. The results showed that the reactivity transient would not exceed the safety limit. The licensee discussed the reactivity worth of the reactor control rods, the transient rod and the experiments during testing. The licensee pointed out that at 1 kilowatt the reactivity worth of all these components would be less than \$3.5 under normal core conditions. The staff confirmed from the Safety Analysis Report that the potential reactivity addition from these components was less than the \$3.5.

The licensee also pointed out that they control testing with procedures not only to limit potential transients, but also to prevent reactivity worth deviations from analyzed acceptable conditions. Further, in response to a request for additional information the licensee stated that changes to core loading and conduct of testing require management approval. Finally in this regard, the licensee indicated that the return to routine operations required confirmation of acceptable

reactivity values in accordance with procedure. The NRC staff concluded that these administrative controls provide acceptable assurance that variations in reactivity worth beyond those allowed or potential reactivity transients are not likely.

In response to a request for additional information, the licensee provided an analysis. This analysis showed a considerable margin to the safety limit for a 10% departure from the allowed reactivity limits for the current core. The NRC staff considered even larger variations in reactivity values and found substantial margins to the safety limit fuel temperature due to reactivity transients. Therefore, the NRC staff concluded that a variation in the reactivity values would not likely exceed safety limits even if all precautions were not effective to prevent a reactivity transient during the measurement of excess reactivity worth, transient rod reactivity worth, or experiment reactivity worth.

In response to a request for additional information, the licensee revised proposed TS 3.1.2 to clarify that the exemption for testing does not apply to the annual confirmatory measurement of excess reactivity required by TS 4.1.2. Further, the licensee withdrew the request for modification to TS 3.1.4 related to this proposed change.

Based on the above, the proposed changes to the TS are acceptable.

### 3.0 ENVIRONMENTAL CONSIDERATION

This amendment involves changes in the installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 or changes in inspection and surveillance requirements. The staff has determined that this amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released off site, and no significant increase in individual or cumulative occupational radiation exposure. Accordingly, this amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9).

This amendment also involves changes in recordkeeping, reporting, or administrative procedures or requirements. Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(10).

Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of this amendment.

### 4.0 CONCLUSION

The staff has concluded on the basis of the considerations previously discussed that (1) because the amendment does not involve a significant increase in the probability or consequences of accidents previously evaluated, or create the possibility of a new or different kind of accident from any accident previously evaluated, and does not involve a significant reduction in a margin of safety, the amendment does not involve a significant hazards consideration; (2) there is reasonable assurance that the health and safety of the public will not be endangered by the proposed activities; and (3) such activities will be conducted in compliance with the Commission's regulations, and the issuance of this amendment will not be inimical to the common defense and security or the health and safety of the public.

Principal Contributor: Marvin M. Mendonca

Date: May 23, 2001