PENNSTATE

(814) 865-6351
FAX: (814) 863-4840

College of Engineering
Radiation Science and Engineering Center

Breazeale Nuclear Reactor Building
The Pennsylvania State University
University Park, PA 16802-2301

January 18, 2000

Document Control Desk
United States Nuclear Regulatory Commission
Washington, DC 20555

Re: Proposed Changes to Technical Specifications
License No. R-2, Docket No. 50-5

Dear Sir or Madame:

Three changes to the Technical Specifications (TS) for the Penn State Breazeale Reactor (PSBR) are proposed for your review and approval. The first change reflects a recent administrative change in the reporting chain for the reactor. The second change requests exemptions be added to several specifications to permit reactivity measurements for the reactor and for experiments without violation of the specifications. The third change increases the allowable pool water temperature recognizing the higher operating temperature for the demineralizer resins now in use. These changes were reviewed by the Penn State Reactor Safeguards Committee on January 11, 2000.

A copy of the proposed Technical Specification changes for TS 6.1.1 (pages 38 and 39), 6.2.4 (page 42), 6.5.2 (Page 44), 3.1.2 (page 10), 3.1.4 (page 11), 3.7.a & b (page 25), and 3.3.6 (page 21) is attached.

Change 1 (Pages 38, 39, 42, and 44)
On December 8, 1999 the reporting chain for the Director of the PSBR (Level 2) was modified by the Vice President for Research, Dean of the Graduate School (Level 1) to have the Director report directly to the office of the Dean of Engineering. When the Nuclear Engineering Department was merged with the Mechanical Engineering Department to form the Mechanical and Nuclear Engineering Department (M&NE) in 1998, fiscal and administrative responsibilities for the reactor moved to the Dean's office in order to not unduly burden the M&NE Department Head and to assure that the reporting chain for the Director was not lengthened. The Nuclear Engineering Program Chair remained in the chain for historic reasons. Experience since the merger demonstrated that the administration of the reactor would best be served by shortening the reporting chain. The Nuclear Engineering Program Chair remains available to provide technical consultation to both the Director and the Dean's office; the Chair also remains as a resource in the reactor's emergency plan. The proposed changes to TS 6.1.1, 6.2.4, and 6.5.2 recognize this administrative change to the reporting chain.

Change 2 (Pages 10, 11, and 25)
In December 1999 the PSBR went from Core Loading 50 to a new Core Loading 51. This core loading change was made to accommodate the decreasing reactivity of the core resulting from fuel burnup. As physics measurements were being conducted to verify rod worths, excess reactivity, shutdown margin, and experiment reactivities for Loading 51, a situation was encountered where the performance of one of the measurements could have caused the specification for excess reactivity to have been exceeded. The

A020

TS for the PSBR do not presently contain any exemptions for the conduct of the physics measurements such as are present for many other reactors. This proposed change would provide exemptions such that measurements can be made without violation of the specifications. The exemptions are only for conduct of the measurements and are not applicable for normal operation. If the measurement found a condition that would violate a specification, operation in that condition would be prohibited. Two examples: if a measurement found that an experiment would cause the excess reactivity specification to be violated, then the experiment would be prohibited or would be modified to provide compliance with the specification before being performed; and if measurement showed some aspect of a particular core loading caused a reactivity specification to be violated, the core loading would be modified before normal operation was permitted. In both cases it is necessary to perform the measurement in order to determine whether the specification is met. All of the measurements are performed under "zero power conditions" and thus the added restriction during the measurement that power levels be no greater than 1 kW. The reactivity measurements are normally conducted in the range of 5 to 900 watts. The proposed changes to TS 3.1.2, 3.1.4, and 3.7.a & b provide the appropriate exemptions to allow physics measurements to be performed without violation of those specifications.

Change 3 (Page 21)

In October 1998 the pool water recirculation demineralizer for the PSBR was changed from a rechargable cation-anion resin bed to a precharged mixed bed demineralizer. The resins for this mixed bed demineralizer have an upper operating temperature limit of 140 °F (60 °C). The old resins had an upper operating temperature limit of 100 °F (37.5 °C). The upper operating temperature of the resins is the basis for TS 3.3.6 which specifies maintaining the pool water temperature at a level that will not cause damage to the resins. The proposed change to TS 3.3.6 recognizes the increased operating range of the resins and provides greater flexibility of operation, particularly during determinations of reactor power by calorimetric means.

If you have any questions regarding these proposed changes, please call the Director, Dr. Sears at 814-865-6351 for clarification or further information.

Sincerely,

Dr. Eva J. Pell
Vice President for Research and
Dean of the Graduate School

EJP:CFS/skr

Pc: M. Mendonca
T. Dragoun
L. Burton
J. Brenizer
D. Sathianathan
F. Sears
T. Flinchbaugh

Subscribed to the sworn before me on this 18th day of January, 2000.
Notary Public in and for Centre County, Pennsylvania.

Susan K. Ripka

NOTARIAL SEAL
SUSAN K. RIPKA, Notary Public
The Pennsylvania State University
Centre County, PA
My Commission Expires May 12, 2003

5.4 Fuel Storage

Specifications

a. All fuel elements shall be stored in a geometrical array where the keff is less than 0.8 for all conditions of moderation.

b. Irradiated fuel elements shall be stored in an array which shall permit sufficient natural convection cooling by water such that the fuel element temperature shall not reach the safety limit as defined in Section 2.1 of the Technical Specifications.

5.5 Reactor Bay and Exhaust Systems

Specifications

a. The reactor shall be housed in a room (reactor bay) designed to restrict leakage. The minimum free volume (total bay volume minus occupied volume) in the reactor bay shall be 1900 m^3.

b. The reactor bay shall be equipped with two exhaust systems. Under normal operating conditions, the facility exhaust system exhausts unfiltered reactor bay air to the environment releasing it at a point at least 24 feet above ground level. Upon initiation of a building evacuation alarm, the previously mentioned system is automatically secured and an emergency exhaust system automatically starts. The emergency exhaust system is also designed to discharge reactor bay air at a point at least 24 feet above ground level.

5.6 Reactor Pool Water Systems

Specification

The reactor core shall be cooled by natural convective water flow.

6.0 ADMINISTRATIVE CONTROLS

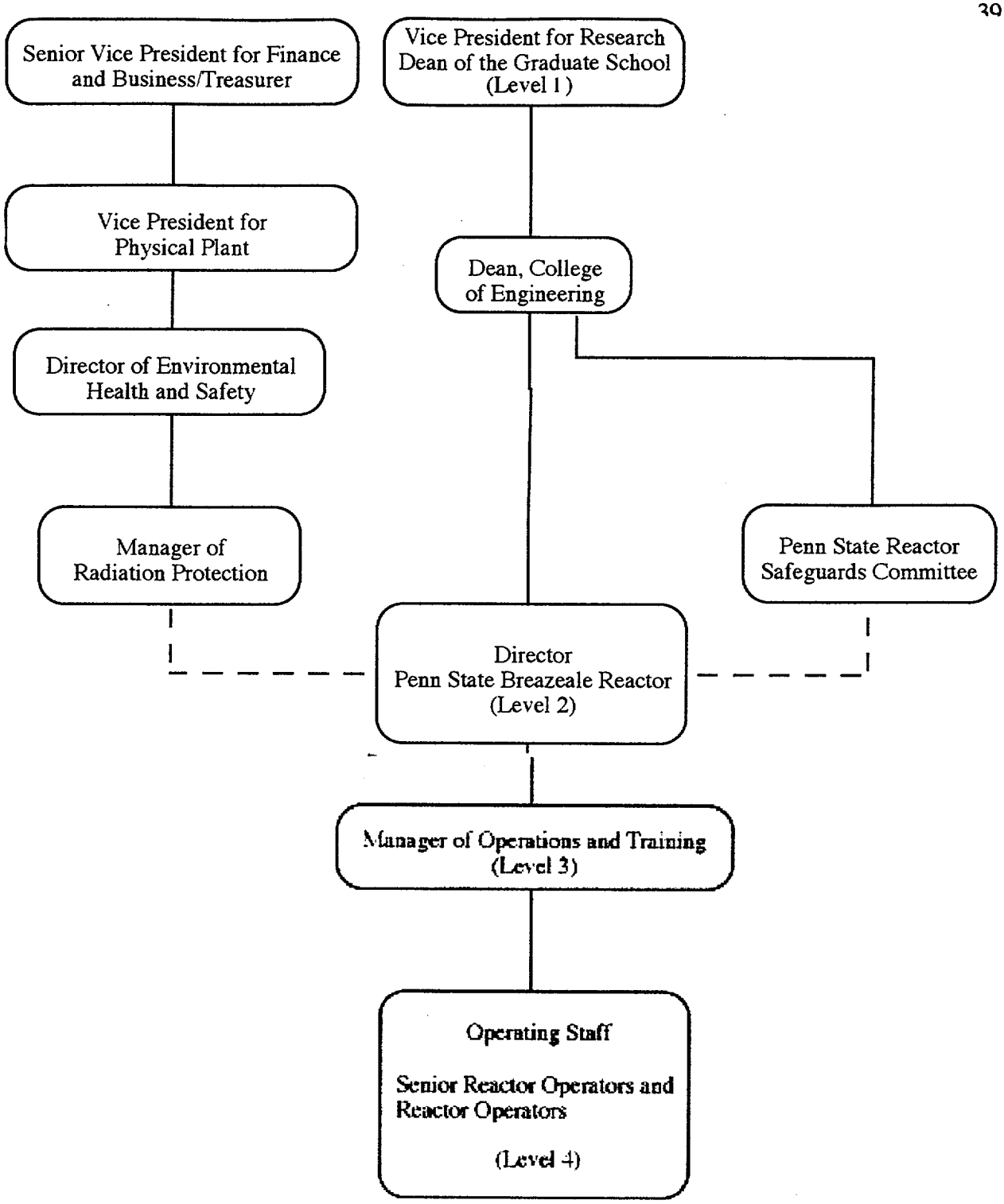
6.1 Organization

6.1.1 Structure

The University Vice President for Research Dean of the Graduate School (level 1) has the responsibility for the reactor facility license. The management of the facility is the responsibility of the Director (level 2), who reports to the Vice President for Research, Dean of the Graduate School through the office of the Dean of the College of Engineering. Administrative and fiscal responsibility is within the office of the Dean.

The minimum qualifications for the position of Director of the PSBR are an advanced degree in science or engineering, and 2 years experience in reactor operation. Five years of experience directing reactor operations may be substituted for an advanced degree.

The Manager of Radiation Protection reports through the Director of Environmental Health and Safety, the assistant Vice President for Safety and Environmental Services, and to the Senior Vice President for Finance and Business/Treasurer. The qualifications for the Manager of Radiation



ORGANIZATION CHART

d. Operating abnormalities having safety significance.

e. Special reports listed in 6.6.2.

f. Audit reports.

6.2.4 Audit

The audit function shall be performed annually, not to exceed 15 months, preferably by a non-member of the reactor staff. The audit function shall be performed by a person not directly involved with the function being audited. The audit function shall include selective (but comprehensive) examinations of operating records, logs, and other documents. Discussions with operating personnel and observation of operations should also be used as appropriate. Deficiencies uncovered that affect reactor safety shall promptly be reported to the office of the Dean of the College of Engineering. The following items shall be audited:

a. Facility operations for conformance to Technical Specifications, license, and procedures (at least once per calendar year with interval not to exceed 15 months).

b. The requalification program for the operating staff (at least once every other calendar year with the interval not to exceed 30 months).

c. The results of action taken to correct deficiencies that may occur in the reactor facility equipment, systems, structures, or methods of operations that affect reactor safety (at least once per calendar year with the interval not to exceed 15 months).

d. The reactor facility emergency plan and implementing procedures (at least once every other calendar year with the interval not to exceed 30 months).

6.3 Operating Procedures

Written procedures shall be reviewed and approved prior to the initiation of activities covered by them in accordance with Section 6.2.3. Written procedures shall be adequate to ensure the safe operation of the reactor, but shall not preclude the use of independent judgment and action should the situation require such. Operating procedures shall be in effect and shall be followed for at least the following items:

a. Startup, operation, and shutdown of the reactor.

b. Core loading, unloading, and fuel movement within the reactor.

c. Routine maintenance of major components of systems that could have an effect on reactor safety.

d. Surveillance tests and calibrations required by the technical specifications (including daily checkout procedure).

e. Radiation, evacuation, and alarm checks.

f. Release of Irradiated Samples.

g. Evacuation.

d. A report shall be prepared which shall include an analysis of the causes and extent of possible resultant damage, efficacy of corrective action, and recommendations for measures to prevent or reduce the probability of recurrence. This report shall be submitted to the PSRSC for review.

6.5.2 Action to be Taken in the Event of a Reportable Occurrence

In the event of a reportable occurrence, (1.1.34) the following action shall be taken:

a. The reactor shall be returned to normal or shutdown. If it is necessary to shutdown the reactor to correct the occurrence, operations shall not be resumed unless authorized by level 2 or designated alternates.

b. The Director or a designated alternate shall be notified and corrective action taken with respect to the operations involved.

c. The Director or a designated alternate notify the office of the Dean of the College of Engineering and the office of the Vice President for Research, Dean of the Graduate School.

d. The Director or a designated alternate shall notify the Chairman of the PSRSC.

e. A report shall be made to the PSRSC which shall include an analysis of the cause of the occurrence, efficacy of corrective action, and recommendations for measures to prevent or reduce the probability of recurrence. This report shall be reviewed by the PSRSC at their next meeting.

f. A report shall be made to the Document Control Desk, USNRC Washington, DC 20555.

6.6 Reports

6.6.1 Operating Reports

An annual report shall be submitted within 6 months of the end of The Pennsylvania State University fiscal year to the Document Control Desk, USNRC, Washington, DC 20555, including at least the following items:

a. A narrative summary of reactor operating experience including the energy produced by the reactor, and the number of pulses $\geq$ \$2.00 but less than or equal to \$2.50 and the number greater than \$2.50.

b. The unscheduled shutdowns and reasons for them including, where applicable, corrective action taken to preclude recurrence.

c. Tabulation of major preventive and corrective maintenance operations having safety significance.

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

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% Δk/k (~$7.00). During measurements made to determine the excess reactivity, this specification is suspended provided the reactor is operated at power levels no greater that 1 kw.

Basis

Limiting the excess reactivity of the core to 4.9% Δk/k (~$7.00) prevents the fuel temperature in the core from exceeding 1150°C under any assumed accident condition as described in the Safety Analysis Report, Section IX .

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% Δk/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% Δk/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.

3.1.4 Pulse Mode Operation

Applicability

These specifications apply to the energy generated in the reactor as a result of a pulse insertion of reactivity.

Objective

The objective is to ensure that the safety limit will not be exceeded during pulse mode operation.

Specifications

a. The stepped reactivity insertion for pulse operation shall not exceed 2.45% Δk/k (~$3.50) and the maximum worth of the poison section of the transient rod shall be limited to 2.45% Δk/k (~$3.50). During measurements made to determine the worth of the poison section of the transient rod, this specification is suspended provided the reactor is operated at power levels no greater that 1 kw.

b. Pulses shall not be initiated from power levels above 1 kw.

Bases

a. Experiments and analyses described in the Safety Analysis Report, Section IX.C., show that the peak pulse temperatures can be predicted for new 12 wt% fuel placed in any core position. These experiments and analyses show that the maximum allowed pulse reactivity of 2.45% Δk/k (~$3.50), prevents the maximum fuel temperature from reaching the safety limit (1150°C) for any core configuration that meets the requirements of 3.1.5.

   The maximum worth of the pulse rod is limited to 2.45% Δk/k (~$3.50) to prevent exceeding the safety limit (1150°C) with an accidental ejection of the transient rod.

b. If a pulse is initiated from power levels below 1 kw, the maximum allowed full worth of the pulse rod can be used without exceeding the safety limit.

3.1.5 Core Configuration Limitation

Applicability

These specifications apply to all core configurations except as noted.

Objective

The objective is to ensure that the safety limit (1150°C) will not be exceeded due to power peaking effects in the various core configurations.

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 Experiments

Applicability

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% Δk/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% Δk/k (~$2.00). During measurements made to determine specific worth, this specification is suspended provided the reactor is operated at power levels no greater that 1 kw. When a movable experiment is used, the maximum allowed pulse shall be reduced below the allowed pulse reactivity insertion of 2.45% Δk/k (~$3.50) to ensure that the sum is less 2.45% Δk/k (~$3.50).

b. A single secured experiment shall be limited to a maximum of 2.45% Δk/k (~$3.50). The sum of the reactivity worth of all experiments shall be less than 2.45% Δk/k (~$3.50). During measurements made to determine experimental worth, this specification is suspended provided the reactor is operated at power levels no greater that 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.

Basis

Experience indicates that 5 microsiemens/cm is an acceptable level of water contaminants in an aluminum/stainless steel system such as that at the PSBR. Based on experience, activation at this level does not pose a significant radiological hazard, and significant corrosion of the stainless steel fuel cladding will not occur when the conductivity is below 5 microsiemens/cm.

3.3.6 Coolant Temperature Limits

Applicability

This specification applies to the pool water temperature.

Objective

The objective is to maintain the pool water temperature at a level that will not cause damage to the demineralizer resins.

Specification

An alarm shall annunciate and corrective action shall be taken if during operation the bulk pool water temperature reaches 140°F (60°C).

Basis

This specification is primarily to preserve demineralizer resins. Information available indicates that temperature damage will be minimal up to this temperature.

3.4 Confinement

Applicability

This specification applies to reactor bay doors.

Objective

The objective is to ensure that no large air passages exist to the reactor bay during reactor operation.

Specifications

The reactor bay truck door shall be closed and the reactor bay personnel doors shall not be blocked open and left unattended if either of the following conditions are true.

a. The reactor is not secured, or

b. Irradiated fuel or a fueled experiment with significant fission product inventory is being moved outside containers, systems or storage areas.