TEXAS ENGINEERING EXPERIMENT STATION

THE TEXAS A&M UNIVERSITY SYSTEM

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Office of the Director

12 April 1983

Mr. G. L. Madsen, Chief
Reactor Project Branch 1
U.S. Nuclear Regulatory Commission
Region IV
611 Ryan Plaza, Suite 1000
Arlington, Texas 76011

Ref: Docket No. 50-128/82-83, License R-83

Dear Mr. Madsen:

In reference to the inspection of the Nuclear Science Center Reactor on December 20 and 21, 1982 by Mr. G. L. Constable concerning operation of the NSCR in excess of licensed steady state power, the following is submitted in reply to the notice of violation in your letter of March 16, 1983.

Stated Violation

Texas A&M University facility license, Section 2.A, requires that the reactor be operated in accordance with limitations described in the license. The following are three examples of a failure to adhere to license conditions involving one event.

1. Section 3A requires that the licensee may operate the reactor at steady state power levels up to a maximum of 1000 Kilowatts (thermal). Contrary to the above, on December 4 and 6, 1982, the Texas A&M pool reactor was operated at approximately 1370 kilowatts (thermal).

2. Technical Specification, Section 3.3.3, "Reactor Safety System," requires that the reactor shall not be operated unless the safety channels (power level) function to scram the reactor when steady state power level exceeds 125%.

Contrary to the above, reactor safety channels (power level) were not operable during the period December 4 through 9, 1982, due to an improperly conducted power level calibration test resulting in non-conservative calibration of the power level indicators that caused the reactor trip point to be set at about 157% of licensed steady state power level.

3. Technical Specification, Section 6.7, "Reporting Requirements," requires that a report be made to the NRC within 24 hours by telephone and telegraph of a violation of a limiting condition for operation (LCO).

   Contrary to the above, the Texas A&M facility was in violation of LCO 3.3.3, "Reactor Safety System," (Item 2 above) from December 4 through 9, 1982. The licensee did not report this condition to the NRC until December 17, 1982.

Immediate Corrective Actions Taken to Avoid Further Violations and the Results of These Actions

Following the investigation into the cause of error in the pool calorimetric measurement of December 4, 1982, it was concluded that three significant factors contributed to the incident of violation of steady state licensed power. As a result of these findings, NSC management took immediate action in regard to correcting the following:

1. An improperly prepared reference ice bath which produced an error of approximately 37% in the measured heatup rate during performance of the calorimetric.

2. A weakness in reactor operator training that contributed to Item 1 above.

3. Failure of NSC management to provide adequate guidelines in the SOP's to reduce errors of judgement concerning the magnitude of the power adjustment that was made following the calorimetric. Also the SOP's did not point out the importance of observing certain reactor operating and facility parameters following the calorimetric to verify normal reactor operations. This reflected an operating philosophy lacking in awareness of and attention to changing parameters and reasonable questioning of these changes.

In reference to Items 1 and 2 above, special training sessions were held for reactor operations personnel to demonstrate the proper preparation of an ice bath. A special plastic holder was fabricated to maintain a fixed position of the thermocouples placed in the ice bath. This holder provided for the use of a thermometer to monitor the ice bath during performance of the pool calorimetric procedure. A thermometer with a temperature range of $-5^{o}C$ to $+5^{o}C$ with $1/20^{o}C$ scale increments was secured. It is now possible to monitor the ice bath with extreme accuracy to detect any error associated with the ice bath. The plastic holder also eliminates any possibility that a junction

could accidently touch the metal walls of the ice bath thermos. This new equipment has been used on three occasions and has provided assurance that the ice bath is not introducing errors into the performance of the calorimetric procedure. The training which was conducted using the new ice bath equipment has resulted in operations personnel being aware of the initial ice bath error and what to look for to prevent a reoccurrence in the future.

In reference to Item 3, a directive was issued and noted in the reactor operations log restricting adjustments of the reactor power level following a calorimetric. Adjustments that result in an increase in reactor power shall not exceed 10% of the actual measured power. This directive will be followed until the pool calorimetric SOP for reactor power measurement is reviewed and final restrictions and guidelines are established as scheduled in Appendix A. At present a log sheet is being kept in the reactor control room that reflects area radiation monitor (ARM) readings and facility air monitoring readings at one hour intervals. This has been helpful in pointing out changes in building radiation levels due to experiments and facility activities such as maintenance or the handling of radioactive materials. Having documented changes in radiation levels due to specific experiments and other facility activities, changes resulting from reactor operations can be more readily identified.

In addition to facility radiation monitoring, the new log sheet provides for the recording of control rod heights for 1 Mw operation, and a comparison with previous heights is made on a daily basis. Any large changes require an explanation such as the effect of Xenon or experiments in the reactor. The log sheet also requires a documented tour of the facility by a SRO at 4 hour intervals during reactor operations. This tour provides information concerning facility activities. Already these measures are aiding operations personnel in day-to-day observance of operating reactor and facility parameters.

Future Corrective Steps Which Will be Taken to Avoid Further Violations

As discussed in the Enforcement Conference of March 4, 1983, maximum effort will be placed on the review of existing SOP's to evaluate their effectiveness concerning actions taken for correcting abnormal operating conditions and guidelines on decision making. In this regard a list of SOP's and a tentative schedule for their review is attached as Appendix A.

In addition to the SOP review, NSC and Nuclear Engineering Department staff plan to investigate further the parameters of the pool calorimetric that could lead to errors in the measurement. As an example, initial investigation indicates that the equilibrium conditions for the pool water, pool shield walls and reactor building environment are very important. Allowable variances in initial conditions need to be determined and limits established and incorporated in the SOP for the pool calorimetric procedure.

Achievement of Full Compliance

In regard to maintaining licensed steady state reactor power by the performance of the pool calorimetric procedure, it is felt by the NSC management that compliance has been achieved. This has been demonstrated by the satisfactory performance and results of pool calorimetric measurements following changes to equipment, special training of reactor operations personnel, and the placing of interim restrictions on the magnitude of power level increase adjustments resulting from the pool calorimetric. Immediate actions were taken to achieve compliance concerning the stated violation; however, a longer time frame is required to achieve review of SOP's and to fully establish an operating philosophy of awareness of changes in reactor and facility parameters and how, by monitoring, they can be used to improve reactor and personnel safety. The time frame for SOP review is indicated in Appendix A.

Comments and Clarification of the Stated Violation

The statement of violation that the reactor safety channels (power level) were "not operable" is misleading and implies that this system was not certified operational as per Technical Specification 4.3.2(b) during the period December 4 through December 9, 1982. It is realized that the trip settings of the safety amplifier would result in a reactor trip at 157% of licensed power, however, the system was in operation and would have performed its intended safety function as stated in Technical Specification 3.3.3. That function is to protect the fuel from damage due to an unsafe condition by preventing operating temperatures in excess of the safety limit for FLIP fuel (1150^{o}C or 2100^{o}F). Based on the above arguments it is respectfully requested that the violation be clarified to indicate that the safety channels were operating during the stated period although with a nonconservative trip point setting that would result in a reactor trip of about 157% of licensed steady state power.

Closure

It is important to the Texas Engineering Experiment Station that the Nuclear Science Center continue to operate in a safe and competent manner as has been its past history. Even though this occurrence was not a significant threat to public safety, it is important that the areas of weakness contributing to this event receive our immediate attention and maximum efforts to upgrade and correct them. In particular we are sensitive to identified delays in reporting this incident to the NRC. Such has not been the demonstrated track record of the NSC in the past and will not be the case in the future. All levels of management from the NSC up through this office are committed to reporting to the NRC in the future even the <u>potential</u> existence of a reportable event or occurrence. This commitment, plus the emphasis discussed above on fully establishing a more questioning attitude and philosophy on the past of all NSC operations staff, should preclude such delays in identifying, reporting, and correcting problems in the future.

Our facility has a high utilization, and we are looked upon by other TRIGA reactor facilities for leadership. We plan to maintain that position within the research reactor community. We will be happy to provide additional information concerning this event and we share your concerns for preventing a reoccurrence.

Sincerely,

W. Arthur Porter
Director

cc: Feenan Jennings, Chairman
Reactor Safety Board

C. A. Erdman, Head
Department of Nuclear Engineering and
Head, Nuclear Engineering Research

D. E. Feltz, Director
Nuclear Science Center

APPENDIX A

REVIEW OF STANDARD OPERATING PROCEDURES

Based on a preliminary review of standard operating procedures (SOP's) for the Nuclear Science Center the following procedures have been prioritized for modification, review, and approval on the timetable provided. Quarterly Reactor Safety Board meetings will be held to obtain the necessary review and approval once the revisions have been made and local NSC approval has been obtained. It should be noted that these procedures are considered essential for day-to-day operations and are therefore, receiving first priority. An 18 month period (6 quarters) is considered to be adequate for completing this review and modification. However, it is also planned to review the remaining chapters of the SOP's not included in this schedule in a tentative time frame of an additional 6 months. Therefore, over the next two years we feel that a complete, up to date, set of SOP's will be developed. The following schedule will be implemented May 1, 1983, and RSB meetings will be scheduled toward the latter part of each quarter:

1st Quarter (1 May 1983 - 31 July 1983)

SOP	
II-B	Operations Records
II-E	Pulsing Operation
II-J	Power Calibration
II-L	Pulse Calibration
III-C	Linear Power Measuring Channel Maintenance and Surveillance
III-P	Millivolt Potentiometer Maintenance and Surveillance
VII-A	Health Physics Administration

2nd Quarter (1 August 1983 - 31 October 1983)

SOP	
II-C	Reactor Startup
II-D	Steady State Operation
II-F	Reactor Shutdown
II-K	Control Rod Calibration
III-G	Reactor Pulse Power Surveillance
IV-A	Experiment Approval
VII-B1, VII-B12	Health Physics Maintenance and Surveillance

3rd Quarter (1 November 1983 - 31 January 1984)

SOP

III-A	General (Reactor Maintenance and Surveillance)
III-B	Fuel Element Temperature Measuring Channel Maintenance and Surveillance
III-D	Log-N Measuring Channel Maintenance and Surveillance
IV-B	Sample Handling Procedure
II-H	Fuel Manipulations
II-I	Reactor Core Manipulations
VII-B13, VII-B17	Health Physics Maintenance and Surveillance

4th Quarter (1 February 1984 - 30 April 1984)

SOP

II-M	Response to Alarms
III-E	Safety Power Measuring Channel Maintenance and Surveillance
III-F	Pulse Power Measuring Channel Maintenance and Surveillance
III-J	Transient Rod Drive Maintenance and Surveillance
IV-C	Pneumatic System Operation
IV-G	In-Pool Irradiations
VII-C1, VII-C5	Radioactive Materials Control

5th Quarter (1 May 1984 - 31 July 1984)

SOP

II-A	General Organization and Responsibilities
II-G	Movement of Reactor Bridge
II-N	Response to Abnormal Reactivity Changes
III-I	Scram Circuit Surveillance
III-K	Control Rod Inspection
III-L	Control Rod Drive Maintenance
III-M	Annual Control Rod Calibration and Determination of Shutdown Margin
VII-C6, VII-C15	Radioactive Materials Control

6th Quarter (1 August 1984 - 31 October 1984)

SOP

II-O	Reactor Operator and Senior Reactor Operator Requalification Program
III-N	Reactor Bridge and Pool Light Maintenance
III-O	Reactor Pool Surveillance
III-Q	Special Nuclear Materials Accountability
III-R	Evacuation Horn System Surveillance
IV-D	Beam Port Experiments
IV-F	Neutron Radiography Beam Port No. 4
VII-D	Health Physics Training
VII-E	Personnel Dosimetry

As previously noted Chapters I and VI will be reviewed for necessary changes following the completion of this schedule. The security and emergency plan Chapters (VIII, IX) will be reviewed separate to this schedule to implement the recently approved facility license renewal.