KSU Mechanical & Nuclear Engineering

# Nuclear Research & Education Reactor

50.188

07 November 2005

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

Gentlemen:

Pursuant to 10CFR50.59(b) the following items are submitted for the Kansas State University TRIGA Mark II Nuclear Reactor Facility.

In addition to the changes implemented at the facility under 50.59 evaluation, two changes were submitted and approved for implementation at the KSU reactor, noted for reference purposes only:

**License Amendment No. 15** increased possession limit of fully enriched U-235 from 20 grams to 90 grams for use in fission chambers and reactor experiments.

**License Amendment No. 16** increased possession limit of U-235 less than 20% enriched from 3.98 to 4.20 kg, and corrected a typographical error in the safety evaluation for amendment 15.

## A. Changes to the Facility

### *Removal of Line Conditioner*

**Background**

The facility was originally equipped with two line conditioners regulating instrument power for the control room and the 22-foot level. Power was supplied to the power level instruments, rod control system, and temperature monitors. Low voltage lockout relays were eventually installed on the power supply to the line conditioners to prevent automatic reenergization until incoming AC is stable following power outages.

The line conditioner supporting the control room equipment failed, and the vendor does not support repairs on a unit of this vintage. Equipment which was originally supported by the line conditioner has been replaced since line conditioner installation. The nuclear power level instruments, inlet and outlet primary cooling temperature indicators, and the fuel temperature indicators are solid state instruments, with internal power regulation. The rod control system is not particularly sensitive to noise, in fact is extremely noisy (because of the electromechanical relays and microswitches in the scram and rod drive systems). Finally, while the power supply lockout on loss of voltage prevents immediate renergization of the rod drive system and therefore supports assurance of

A020

shutdown conditions, uninterruptible power supply development since the original installation provide the ability to maintain the nuclear instrumentation for a period of time that could be used to verify reactor shutdown conditions. A UPS also provides power regulation (the UPS output was verified to be sine wave vice stepped DC approximating a sine wave). Therefore it was proposed that the line conditioner be removed, the lockout relay maintained for the rod drive and reactor protection system, and the nuclear instrument power supply be provided by a UPS through a separate AC line.

### Status

The modification is fully implemented.

### Safety Significance

This installation does not negatively affect any aspect of safety for the public or the facility, and provides improved capability for monitoring shutdown conditions.

## *Temperature Indicators*

### Background

The thermocouples in the primary coolant system are original equipment. Three instruments (primary inlet, primary outlet, and one fuel temperature) were installed on a three position switch reading two different types of thermocouples. Another fuel temperature indicator (with an auxiliary output relay controlling a scram relay) was mounted on an auxiliary panel. The fuel temperature instruments during shutdown conditions read zero. A third instrumented fuel element is installed in the K-State reactor, but not indicated. The temperature monitoring instruments used standard balanced bridge systems available at construction to drive analog meters. Process measurement technology has improved since the construction of the K-State reactor.

During the reporting period, the interface with the scram relay failed. This meter was replaced with a functional equivalent, solid state meter. Following this replacement, the other process temperature instruments were replaced so that inlet and outlet are separate installations, and all instrumented fuel elements have indicators. All thermocouples were calibrated during installation of the meters. Some of the instrument channels could not be calibrated, and, it was discovered that some of the thermocouples were originally installed with wire that is not thermocouple lead wire; the wire was replaced with thermocouple lead wire. One of the instrumented elements was discovered to have a failed thermocouple; the thermocouple was removed form the measuring circuit.

A 4$^{th}$ temperature monitor provides an alarm on high pool water temperature, but no indicator. This unit is being replaced to contain a functional indicator and alarm, but will not be visible from the front of the console. The meters are currently installed in a free-standing panel located on the control room console;

when the final replacement is complete, the free standing panel will be converted into a plate mounted in the console.

### Status

The temperature monitors are installed as indicated, in a free-standing panel. When the final replacement is complete, the panel will be permanently mounted in the control console.

### Safety Significance

This installation does not negatively affect any aspect of safety for the public or the facility, and provides improved capability for monitoring. The new installation can be easily calibrated, and has a peak temperature recorder that has proven particularly useful in monitoring pulses.

## *Change in Core Configuration*

### Background

Excess reactivity has decreased until some extended operations were limited. The lithium-deuterium oxide (LiDO) experiment dry tube was measured to have significant negative reactivity while the facility has not been used since installation. Therefore it was decided to remove the facility in coordination with the 2005 control rod inspection. The LiDO tube was removed, and testing indicated that reactivity worth limits were not met because the worth of one control rod was significantly higher with the LiDO tube removed. A graphite element and a fueled element were exchanged to increase the worth of another control rod and decrease the worth of the most reactive rod; subsequent testing showed all reactivity limits to be adequately met.

### Status

The core configuration is complete, including verification of reactivity limits.

### Safety Significance

The removal of the LiDO and the subsequent fuel rod and graphite element exchange do not negatively affect any aspect of reactor safety.

## *Area Monitors*

### Background

The KSU reactor Technical Specifications requires that "Area radiation monitors are located in the reactor bay and shall be operating when the beam port experiment facilities are being utilized." The complement of area monitors

includes one beam port monitor indicating and alarming locally and in the control room. Beam port facilities are provided with connectors so that the monitor can be moved to beam ports in use. During the past 24 months, all beam ports have been used and occasionally simultaneously.

Facility management identified an opportunity for improved radiological controls by installing multiple beam port monitors. The installed radiation monitor system instrument rack is fully populated with instrument channels, and an additional rack and instrument channels are required. A request was been made for support to install and populate a second instrument rack to support beam port area monitoring.

**Status**

Installation is in progress, with completion expected before the end of calendar year 2005.

**Safety Significance**

This installation does not negatively affect any aspect of safety for the public or the facility. To the extent that this enhanced monitoring allows the reactor operator at the controls and experimenters to monitor radiological conditions at beam ports in use, this will improve personnel safety.

## B. Personnel Changes

New reactor operator licenses were issued on February 9, 2005 to J. Aagaaard (OP-70464), A. A. Bahadori (OP-70720), A. T. Cebula (OP-70466), A. D. Meyer (OP-70467), L. D. Retzlaff (OP-70468), and R. N. Von Fange (OP-70469). A Senior Operator License (upgrade) was issued to J. W. Van Meter (SOP-70446).

Removed as licensed operators were K. S. Bors (SOP-70355), J. D. Leeds OP-70403), and M. F. Ohmes (SOP-70356).

## C. Changes in Test and Experiments

None

Paul M. Whaley
KSU Nuclear Reactor Facility

Cc D. Hughes, USNRC Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission Region IV
KSU Nuclear Reactor Safeguards Committee