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January 26, 2017

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U.S. Nuclear Regulatory Commission
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RE: Reply to Notice of Violation

The Notice of Violations dated Dec. 21, 2016 includes the determination of two severity level IV violations. These violations are not being contested or disputed, and are addressed separately.

A. Response to #50-288/2016-202-02

The violation states in part "contrary to this requirement, from Oct. 6 to Oct. 16, 2016, the reactor was operated or attempted to be operated when the logarithmic channel was not operable."

1. The reason for the violation, or, if contested, the basis for disputing the violation or severity level.

The logarithmic channel was verified operational on Oct. 5 2016, and reinstalled. Verification included correct electrical connections and response to test signals. After installation, the source interlock function was verified operational by manually moving the start-up source. The log channel followed power changes and read on the same order of magnitude as the other channels. Using the Safety Analysis Report (SAR) descriptions, and Technical Specifications (TS) as a basis, the Senior Reactor Operators (SROs) and Reactor Operators (ROs) with concurrence from the Director deemed the log channel operable.

On Oct 16, 2016, while at 2.5 mW the log channel was found to be unresponsive to signal and reading high. The reactor was shut down and the NRC notified.

The SROs determined that the ground for the log channel had come loose. The ground wire was reattached and the log channel readings returned to normal. In response to the NRC Inspector's request, the reactor has not been operated since October 22, 2016. Further verification of the log channel's operability has not been completed.

Operable as defined in Reed's TS "A System or component is operable when it is capable of performing its intended function."

Reed's Safety Analysis Report sect 7-3 states:

A020
IEDI
NRR

The only safety related feature of the Log channel is the source interlock, which ensures that rods cannot be withdrawn if there is not neutron induced signal. Once the reactor is above 5 watts the log channel is no longer needed.

The relevant technical specifications

TS 3.2.3 table 4 - The log channel is used to actuate the source interlock.

TS 3.2.3 table 3 - The log channel is not required to have a high power scram

TS 4.2 The log channel is not required to be calibrated.

Using the aforementioned documents, the log channel was operable up until the ground wire came loose on Oct. 16, 2016. However, we acknowledge that the channel could be calibrated and provide further information to the operator at powers above 5 W.

2. The corrective steps that have been taken and the results achieved.

The reactor has not been operated since October 22, 2016 at the request of the NRC. A new log channel with fission chamber was ordered in 2015. The NRC has requested to be present for the installation.

3. The corrective steps that will be taken to avoid further violations.

A new log channel with fission chamber is being installed that will be less prone to signal interference. Reed will request the following change to TS 4.2.

The current TS 4.2 f. reads

f. A channel calibration of the Linear and Percent Power Channels in TS 3.2.2, Table 2, shall be performed annually.

Proposed language of TS 4.2 f.

f. A channel calibration of the Linear, Percent Power and Log Channels in TS 3.2.2, Table 2, shall be performed annually.

When this change goes into effect, Reed's affected standard operating procedures will be modified to reflect the change.

4. The date when full compliance will be achieved.

We expect that it will take up to 9 months to fully complete all steps including modifying the Reed's standard operating procedures. Therefore, these corrective actions will be completed by Jan. 1, 2018.

B. Response to #50-288/2016-202-03

The violation states in part that the licensee replaced the detection chamber associated with the percent power channel with a fission chamber which was not as described in the SAR without performing an evaluation of the change using the criteria in 10 CFR 50.59 (c)(1).

1. The reason for the violation, or, if contested, the basis for disputing the violation or severity level.

On 8/9/2016, the detector associated with the percent power channel was removed from the core for repair. Upon removal the detector was identified as a fission chamber configured to function with the percent power channel. This detector is original to the reactor installation in 1968.

A 10 CFR 50.59 screening for a replacement of the detector with a similarly configured fission chamber was completed. Standard Operating Procedure SOP 60 requires the RO or SRO to evaluate the performance specifications of the equipment being replaced. Since the detector being replaced was a fission chamber, installing a fission chamber with the same specifications screened out of the full 10 CFR 50.59 evaluation. Specifically, the installation returned the core to its original operational configuration. Part of the consideration for using a replacement fission chamber is that a fission chamber is an ion chamber^{1,2}. The detectors use the same principles and signal analysis to determine the power level. The use of a fission chamber on the percent power channel resulted in an equivalent if not more sensitive system than described in the SAR. However, this second fission chamber was also not operational and was subsequently removed. An uncompensated ion chamber was installed on the percent power channel, as consistent with the SAR

2. The corrective steps that have been taken and the results achieved.

The fission chamber was replaced by a boron lined ion chamber on 10/14/2016. Calibration of the chamber has not been completed.

3. The corrective steps that will be taken to avoid further violations.

The standard operation procedure and form (SOP 60 and SOP 60A) used for 10 CFR 50.59 screening will be changed. The current form reads

"Does the proposed activity involve a design change to any safety significant or Technical Specifications required piece of equipment (i.e. not a like for like replacement)?"

The proposed wording is

"Does the proposed activity involve a design change to any safety significant or Technical Specifications required piece of equipment (i.e. not a like for like replacement)? When servicing older or original equipment on the reactor, please verify and document that the SAR description is accurate and updated.

¹[https://ansn.iaea.org/Common/documents/Training/TRIGA%20Reactors%20\(Safety%20and%20Technology\)/chapter3/mainsystem54.htm](https://ansn.iaea.org/Common/documents/Training/TRIGA%20Reactors%20(Safety%20and%20Technology)/chapter3/mainsystem54.htm)

² <http://nuclearpowertraining.tpub.com/h1013v2/css/Wide-Range-Fission-Chamber-76.htm>

4. The date when full compliance will be achieved.

These corrective actions will be completed by March 30, 2017.

Respectfully,

A handwritten signature in black ink, appearing to read 'Melinda Krahenbuhl', written in a cursive style.

Melinda Krahenbuhl Ph.D.
Director, Reed Research Reactor

cc: Lorraine Arvin, Ph.D., Vice President and Treasurer
Nigel Nicholson Ph.D., Dean of Faculty