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US Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

SUBJECT : University of Wisconsin Nuclear Reactor (UWNR)
License R-74, Docket 50-156
Reportable Event in Accordance with Technical Specifications 6.7.c.4.
An Observed Inadequacy in the Implementation of Procedural Controls

Description of Event:

During testing of a facility modification that installed individual scram switches for the shim safety blades, to perform rod drop reactivity measurements, it was discovered that the lower limit switch assembly, which indicates when the shim safety blade has reached its full in position, was approximately 2.75 inches above the actual full in position. This lower limit switch assembly is the same device used to indicate the full in position of the shim safety blade during routine scram drop time testing. This is contrary to technical specification 3.3.1 which specifies the scram time measured from the instant a simulated signal reaches the value of the LSSS to the instant that the slowest scrammable control element reaches its fully inserted position shall not exceed 2 seconds. It appears this condition has existed since 1968, when the facility refueled with TRIGA fuel and an apparent inadequate facility modification review was conducted. This failure of an adequate facility modification review is being reported in accordance with technical specifications 6.7.c.4., an observed inadequacy in the implementation of procedural controls. It should be noted that an analysis of the historical scram drop time test data has shown technical specification 3.3.1 was never violated.

Corrective Actions:

Immediate corrective actions taken upon discovery of this condition was to modify the lower limit switch assembly to correctly position the assembly; thus, correctly indicate when the shim safety blade had reached its full in position. Scram drop time testing was then conducted. The results of the test demonstrated compliance with the 2 second limit; however, the drop time was 0.2 seconds longer, as is expected, due to the additional distance traveled.

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Discussion:

The shim safety blades at the UWNR are 40.5 inch long Boral sheets that are connected to the drive assembly, located on the core suspension bridge, by a 20 foot long connecting shaft that has a steel armature disc welded to the top of the shaft. The upper end of the connecting shaft is aligned above the blade through a guide tube which is attached to the core suspension bridge. During reactor operation, the disc is held by the scram magnet on the drive mechanism above the water level. When the reactor scrams, the magnet de-energizes and releases the connecting shaft and blade. The release completely separates the blade from the drive mechanism. The blade is then free to fall and drops into the core under the force of gravity.

The blade is guided throughout its travel in the core by a shroud located in the grid box between the fuel. Small flow holes at the bottom of the shroud minimize the effect of viscous damping on the scram time. The guide tube is also equipped with a dash pot assembly that receives a piston that is attached to the connecting shaft just below the armature disc. The purpose of this dash pot and piston arrangement is to decelerate the blade and connecting shaft over the last five inches of travel during the free fall following a scram.

The shim safety blade is full in when the bottom tip of the blade is located 1.5 inches below the active fuel region of the core, which is 15 inches in length. This is equal to a blade position of 0 inches. The blade drive has a 17 inch stroke from full in to full out. This means the tip of the blade is 0.5 inch above the active fuel region of the core when the blade is full out.

Scram drop time testing is performed by using two switch assemblies, the upper and lower. The upper switch assembly is mounted to the upper end of the control rod drive guide tube just below the armature disc, when the blade is magnetically coupled to the drive, and in the fully withdrawn position. The lower limit switch assembly consists of a mounting clamp, extension shaft, micro switch and lever arm. When the mounting clamp is attached to the core suspension bridge, the length of the extension shaft positions the lever arm at a point where the armature disc will contact it when the blade reaches the full in position; thereby opening the micro switch.

During the test, the reactor protection system is tripped and the scram drop timer starts. The coupling scram magnet is de-energized and the blade, connecting shaft with piston and armature disc, fall together as one assembly, into the core. The armature disc immediately contacts the upper limit switch and marks the release time and the start of the fall. When the blade reaches the full in position the armature disc contacts the lower limit switch and stops the drop timer. The release time (the time that it takes for a simulated signal to reaches the value of the LSSS to the instant that the blade starts to fall) and the total scram drop time are observed on the timer while the fall time is computed as the difference between the total scram drop time and the release time.

As it was noted earlier, the result of the mispositioned lower limit switch assembly was to stop the scram drop timer too early. Following the corrective actions to appropriately position the switch assembly, by lengthening the switch assembly extension shaft, the drop time was 0.2 seconds longer as a result of the additional 2.75 inches traveled. The previous 41 years of scram drop time testing results were reviewed and with the additional 0.2 seconds applied to the drop time it was concluded that the 2 second limit was never exceeded. Consequently technical specification 3.3.1 was never violated.

The fact that such a modification was conducted was reported to the Reactor Safety Committee in 1968. However no record of the facility modification review can be found; therefore, no root cause for the inadequacy of the facility modification review can be determined. A review of the existing facility modification review process currently in place, reveals no possibility of a similar event from occurring again and has been determined to address the observed inadequacy.

Sincerely,

Robert J. Agasie
Reactor Director

cc: Compliance Inspector, Region II, Craig Bassett
Facility Project Manager, Geoffrey Wertz
Reactor Safety Committee, RSC Document 1037