50-285 Docket

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

May 5, 1988

MEMORANDUM FOR: Charles E. Rossi, Director
Division of Operating Events Analysis

THRU: Lester Rubenstein, Assistant Director for
Region IV Reactors and Special Projects
Division of Reactor Projects - III,
IV, V and Special Projects

FROM: Jose A. Calvo, Project Director
Project Directorate IV
Division of Reactor Projects - III,
IV, V and Special Projects

SUBJECT: FORT CALHOUN SAFETY INJECTION AND REFUELING WATER TANK (SIRWT) LEVEL DETECTION

During the recent meeting to discuss the status of Region IV plants, the failure of instrument air system check valves in the supply lines to the subject instrumentation was determined to need further review. Since your division was given the lead for the preparation of correspondence on the problem, the following information is being provided to aid in this effort.

This situation appeared when the licensee found that the check valves leaked excessively during testing. In order to conduct the test, the instrument air supply to the SIRWT bubblers was secured, and a nitrogen bottle was utilized to supply the gas pressure. When the licensee realized that the valves were failing the test, the test setup with the N_2 bottle was left in place to assure a reliable source of gas pressure remained available. Subsequently, the licensee found that the check valves that were installed were designed for high temperature water or steam service. Therefore, the valves were replaced with a new design employing soft seats and a spring-loaded disc that is acceptable for air service (the N_2 bottles have been removed). If the testing had not been performed and the valves not replaced, it is possible that the Recirculation Actuation Signal (RAS) during a LOCA event would have prematurely transferred the suction of the High Pressure Safety Injection Pumps to the containment sump. Since an as-found leak rate test was not done on the original check valves, it is not possible to state just how long the air accumulators would have maintained the bubblers operable. Additionally, there are other factors which could affect the air system availability such as the return of the air compressor after the load shedding sequence or the occurrence of a coincident loss of off-site power. In these cases, the air supply source may be returned before a sufficient demand had been placed on the system to cause premature RAS actuation. In a worst case scenario assuming immediate loss of air pressure, the high pressure pumps may not obtain suction from the sump. The pumps in this situation may fail in about two minutes without operator action. Since SIRWT remote level would also be lost, the operator must rely on containment sump level and injection duration to determine if an override to return to SIRWT suction is appropriate.

The SIRWT level instrumentation is provided by an air bubbler system that determines tank level by sensing air backpressure. Two channels of tank level are provided with the air pressure being converted to an analog level signal by a local transmitter. Separate from this level detection is a set of four bubblers which have Static-O-Ring pressure switches that are used to provide the low tank level input into the Recirculation Actuation Signal set-up circuitry. The SIRWT low level (tank level of 16 in.) signal combines with either the Pressurizer Pressure Low signal (PPLS) or the Containment Pressure High signal (CPHS) to set-up the RAS. The RAS performs the function of securing the low pressure safety injection pumps and transferring suction for the High Pressure Safety Injection and the Containment Spray Pumps from the SIRWT to the containment sump. Although the initiation of RAS is annunciated in the control room, no direct level readings are available from this portion of the circuit. The analog level transmitters have both high and low level alarm functions also annuciated in the control room.

Since both the tank level instrumentation and the low tank level input device for RAS set-up require instrument air, events which affect the status of the air supply have a possible consequence on their function. In addition to the obvious loss of the instrument air compressors during a loss of off-site power event, the compressors are deenergized during a load shedding sequence in a loss of coolant event. Because of this possibility, the SIRWT low level switches for RAS were designed with a supply of air that is guaranteed by the incorporation of instrument air supply check valves to isolate the bubblers upon loss of air pressure and the use of air accumulators. The problem noted by the licensee, however, was that during leak testing, each of these valves leaked excessively. This would have resulted in a bleeding down of the air pressure in the accumulators at a rate determined by the residual pressure in the instrument air system. The premature bleeding down of the bubbler air supply could cause the actuation of the low level input into the RAS set-up circuit at a premature time. Since the analog level instruments do not utilize air accumulators, the function of these instruments is not maintained when the instrument air pressure is lost. Depending on the leakage and demand on the instrument air system, the length of time that air will be available will vary. The RAS input will occur when the air pressure drops to approximately 0.5 psig. and the level indication will trend down as pressure decreases. The low level alarm will be received as sensed level reaches 186 inches.

The consequences of an event which requires the initiation of safety injection will change from that analyzed if the time of inititation of the RAS signal is premature. Transient analysis for the Loss of Coolant Accidents assume that a specified quantity of SIRWT water of a specified boron concentration and temperature is injected. A premature RAS will secure the low pressure injection pumps and shift the high pressure safety injection pumps to a recirculation mode. This may occur at a time which is insufficient to allow proper suction to be established from the sump. Since the RAS also cause the mini-flow recirc lines back to the SIRWT to shut, the high pressure pumps may fail within two minutes due to insufficient flow for cooling if suction cannot be established. Although the RAS circuit design has a means to override the signal and realign the valves, the loss of instrument air fails the SIRWT control room

level instruments low such that the operator will not know true level. His only information is that the time to drawdown the tank should be about 20 minutes. An early RAS would be indicative of an instrument problem or a major loss of water inventory.

In the case of Fort Calhoun, the instrument air system is not classified as safety-related. Also, the air isolation check valves are not required to be tested during surveillance or inservice testing or periodically inspected. This fact was first addressed by a Safety System Outage Modification Inspection (SSOMI) in September 1986. The need to verify the condition and functionally of this valves was further highlighted during the water ingress into the instrument air system event on July 6, 1987. Subsequently, the licensee has agreed to periodically leak test various air supply check valves.

If you should need further assistance in the preparation of the Information Notice on this subject, please contact Patrick Milano, on ext. 21347.

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cc: T. Murley
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