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April 15, 1986

2CAN048608

Mr. George W. Knighton, Director
PWR Project Directorate No. 7
Division of PWR Licensing - B
U. S. Nuclear Regulatory Commission
Washington, DC 20555

SUBJECT: Arkansas Nuclear One - Unit 2
Docket No. 50-368
License No. NPF-6
Revisions to Emergency Operating Procedure (EOP)
Technical Guidelines for ICC Monitoring System,
NUREG-0737, Item II.F.2

Dear Mr. Knighton:

Our March 18, 1986 letter (2CAN038607) committed to providing revisions to the EOP technical guidelines. The revisions to Sections IV and VII.10.0, incorporating the ICC Monitoring System, are given as Attachments 1 and 2, respectively.

These revisions are submitted for NRC review and approval. Subsequent to NRC approval, revisions to the station EOP and Operating Procedures will be made based on these EOP technical guidelines.

Section IV of the ANO-2 EOP technical guidelines is entitled "Technical Issues Affecting Emergency Procedures." Part 2.0 of Section IV deals with Inadequate Core Cooling.

The revision to Section IV affects Page 7. The explanation of future additional instrumentation available to monitor the approach to, existence of and recovery from ICC (labeled "D") is deleted and the paragraphs contained in Attachment 1 are inserted.

Section VII.10.0 of the ANO-2 EOP technical guidelines is entitled "Inadequate Core Cooling Recovery Options." Part 10.4 to Section VII deals with Major Parameter Response.

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The revision to Section VII.10.0 affects Page 13. Item "E," Reactor Vessel Level Monitoring System (RVLMS) given in Attachment 2, is inserted following Item "D," Pressurizer Level Response.

Very truly yours,

J. Ted Enos

J. Ted Enos, Manager
Nuclear Engineering and Licensing

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Attachments

ATTACHMENT 1

REVISION TO SECTION IV OF ANO-2
EMERGENCY OPERATING PROCEDURE
TECHNICAL GUIDELINES

Following the accident at Three Mile Island, Unit 2, the Nuclear Regulatory Commission (NRC) identified the need for additional instrumentation to detect inadequate core cooling (ICC). ANO-2 was required to review and upgrade existing instrumentation to assure that information on the RCS subcooling margin and the temperature indicated by the core exit thermocouples (CETs) over an elevated temperature range were available to operators in the control room. In addition, the NRC required that additional instrumentation to provide an unambiguous, easy-to-interpret indication of Reactor Vessel Water Level be installed.

In response to these NRC requirements, a Reactor Vessel Level Monitoring System (RVLMS) was installed for ANO-2. Two gamma thermometer probes were installed to provide level and temperature indication in the upper head plenum of the ANO-2 reactor vessel. Each probe contains multiple sensors distributed axially along its length. Absolute thermocouples provide for temperature indication and differential heated thermocouples provide for collapsed water level indication.

The RVLMS will provide additional information to the operators which may be used with other indications (i.e., pressurizer level, RCS saturation margin, CET temperatures) to indicate void formation in the reactor vessel head or to track the inventory of coolant in the vessel and reactor coolant system. The information provided by the RVLMS will also improve the ability of the plant operators to diagnose the approach of ICC and to assess the adequacy of responses taken to restore core cooling.

The ANO-2 EOP will be updated to incorporate the use of the RVLMS into various recovery tabs to provide additional information on RCS inventory control, void information in the reactor vessel head, and the approach to ICC conditions. These updates will be made following the final checkout of the RVLMS during ANO-2 2R5 refueling outage.

ATTACHMENT 2

REVISION TO SECTION VII OF ANO-2
EMERGENCY OPERATING PROCEDURE
TECHNICAL GUIDELINES

E. Reactor Vessel Level Monitoring System (RVLMS)

The RVLMS consists of two gamma thermometer probes which provide coolant level and temperature indication in the upper head and plenum regions of the ANO-2 reactor vessel. Each probe contains multiple sensors distributed axially along its length.

The probes are contained in existing instrument guide tubes in which appropriate vent holes have been machined to enable reactor coolant entry and exit. The guide tubes function as manometer tubes designed to create a single-phase, collapsed water level in the tube. The vent holes are designed to maximize phase separation and to minimize the clearing time needed to create the collapsed liquid level required to unambiguously indicate void formation in the reactor vessel head and coolant inventory in the reactor vessel and the reactor coolant system.

The RVLMS will provide additional information to the operators which may be used with other indications (i.e., pressurizer level, RCS saturation margin, CET temperature) to track reactor coolant inventory. The information provided by the RVLMS will also improve the ability of the plant operators to diagnose the approach to ICC and to access the adequacy of actions taken to restore core cooling.

The collapsed liquid level indication provided by the RVLMS can provide the operators with reactor coolant inventory trend information during the approach to an ICC event and the recovery from an ICC event. The level information allows the operators to determine if reactor vessel inventory is increasing or decreasing thereby providing verification that the operators' actions to mitigate the consequences of an ICC event are appropriate.

The reactor coolant temperature indications provided by absolute thermocouples contained within the probes can be used in conjunction with the CETs located at the top of each string of self powered neutron detectors. As long as the core is covered by at least a two-phase mixture, the fluid temperature indicated by the absolute thermocouples will remain subcooled or at saturation temperature. If significant core uncovery occurs, the steam will become superheated as it passes the uncovered portion of the fuel. The absolute thermocouple temperature will continue to rise as more of the core is uncovered. If the two-phase or liquid level starts to rise, the absolute thermocouple temperature will start to fall. This temperature will continue to fall until the level in the core is recovered, and the fluid temperature will return to a saturation value or possibly a subcooled value.

Allowances should be made for instrument limitations when reading reactor coolant water level. Collapsed liquid level in the plenum region cannot be monitored with the RCPs running due to turbulent flow conditions. The level sensors which are distributed axially along the probes (approximately two foot intervals) indicate their current status as WET, DRY or QUENCH. Therefore, collapsed water level can only be quantified within these axial space increments. Some time delay in the sensor response to changing water level can be expected due to manometer tube drain time and sensor response time.

Allowances should also be made for possible instrument inaccuracies when reading absolute thermocouple temperatures. With the RCS at saturation, temperature indications should indicate near saturation temperature for the present RCS pressure. Instrument inaccuracies may allows indicated temperatures to read on either side of actual saturation temperature. If this situation occurs, relative readings and relative changes should be used to analyze core conditions. Comparisons should always be made with the temperature indicated by the hot leg RTDs if uncovery is suspected.