Enclosure

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TECHNICAL EVALUATION REPORT

ELECTRICAL, INSTRUMENTATION, AND CONTROL ASPECTS OF THE OVERRIDE OF CONTAINMENT PURGE VALVE ISOLATION AND OTHER SAFETY FEATURE SIGNALS

ARKANSAS NUCLEAR ONE--UNIT 1

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1.0 INTRODUCTION

Based on the information supplied by Arkansas Power and Light Company (AP&L) and information in the Final Safety Analysis Report, this report addresses the electrical, instrumentation, and control system design aspects of the Containment Ventilation Isolation (CVI) system and other related Engineered Safeguards Actuation System (ESAS) functions for Arkansas Nuclear One--Unit 1.

Several instances have been reported where the automatic closure of the containment ventilation or purge isolation valves would not have occurred because the safety actuation signals were manually overridden or blocked during normal plant operations. These events resulted from a lack of proper management controls, procedural inadequacies, and circuit design deficiencies. These events also brought into question the mechanical operability of the valves themselves. These events were determined by the Nuclear Regulatory Commission (NRC) to be an Abnormal Occurrence (#78-05) and accordingly, were reported to Congress.

As follow-up of this Abnormal Occurrence, the NRC is reviewing the electrical override aspects and the mechanical operability aspects of containment purging for all operating reactors. On November 28, 1978, the NRC issued a letter, "Containment Purging During Normal Plant Operation"[1] to all Boiling Water Reactor and Pressurized Water Reactor licensees. AP&L responded to the letter by letters of December 29, 1978[2], January 30, 1979[3], and April 2, 1979[4]. A February 22, 1980 letter[5] answered several additional concerns. A December 12, 1979 letter[6] contained an interim committment to have the purge valves closed whenever Arkansas Nuclear One--Unit 1 is in an operating mode.

2.0 EVALUATION OF ARKANSAS NUCLEAR ONE--UNIT 1

2.1 Review Guidelines. The intent of this evaluation is to determine if the following NRC requirements are met for the safety signals to all ESAS equipment:

1. Guideline No. 1--In keeping with the requirements of General Design Criteria 55 and 56, the overriding[a] of one type of safety actuation signal (e.g., radiation) should not cause the blocking of any other type of safety actuation signal (e.g., pressure) for those valves that have no function besides containment isolation.

2. Guideline No. 2--Sufficient physical features (e.g., key lock switches) are to be provided to facilitate adequate administrative controls.

3. Guideline No. 3--A system level annunciation of the overridden status should be provided for every safety system impacted when any override is active. (See R.G. 1.47.)

Incidental to this review, the following additional NRC design guidelines were used in the evaluation:

1. Guideline No. 4--Diverse signals should be provided to initiate isolation of the containment ventilation system. Specifically, containment high radiation, safety injection actuation, and containment high pressure (where containment high pressure is not a portion of safety injection actuation) should automatically initiate CVI.

2. Guideline No. 5--The instrumentation and control systems provided to initiate the ESAS should be designed and qualified as safety grade equipment.

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a. The following definition is given for clarity of use in this evaluation:

Override: The signal is still present, and it is blocked in order to perform a function contrary to the signal.

3. Guideline No. 6--The overriding or resetting[a] of the ESAS actuation signal should not cause any valve or damper to change position.

Guideline 6 in this review applies primarily to other related ESF systems because implementation of this guideline for containment isolation will be reviewed by the Lessons Learned Task Force, based on the recommendations in NUREG-0578, Section 2.1.4. When containment isolation is not involved, consideration on a case-by-case basis of automatic valve repositioning upon reset may be considered acceptable. Acceptability would be dependent upon system function, design intent, and suitable operating procedures.

2.2 Containment Ventilation Isolation Circuits Design Description. Arkansas Nuclear One--Unit 1 has two ESAS trains which close independently and separately the inboard and outboard containment ventilation isolation (CVI) valves. The valves can only be opened by manual control switch. High containment pressure (4 psig)[4] or low reactor coolant system (RCS) pressure[5] will automatically initiate isolation of the CVI valves.

The actuation signal resulting from the automatic initiation signal cannot be reset or overridden. However, once the initiating condition is gone, the high containment pressure or the low RCS pressure signal can be reset to allow manual opening of the CVI valves.

Manual control of the CVI valves is by rotary, spring return to neutral position switches. The control system prevents valve opening except when the switch is rotated to the "open" position, thus preventing reopening of the valves when the automatic closure signal is manually reset. Loss of power to the control system or loss of air to the solenoid valve closes the solenoid-operated isolation valves while motor-operated valves remain in their last position. Valve position lights, "open" and "closed," are provided on the control console.

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a. The following definition is given for clarity of use in this evaluation:

Reset: The signal has come and gone, and the circuit is being cleared in order to return it to the normal condition.

Since AP&L has not yet demonstrated valve operability during a design basis accident, the utility has committed[6] to maintain the purge valves in a closed position whenever the reactor is in an operating mode. This committment is only until the utility demonstrates the operability of the valves.

2.3 Containment Ventilation Isolation System Design Evaluation. Guideline 1 requires that no signal override can prevent another safety actuation signal from functioning. The CVI system has no override capability and is, therefore, in compliance with this guideline.

Guideline 2 requires that any reset or override switches have physical provisions to aid in the administrative control of the switches. AP&L has shown no evidence that additional physical provisions exist for reset switches (there are no override switches). The literal requirements of guideline 2 are not met; however, the NRC has found this design acceptable where the reset switch serves only to reset logic after an actuation condition is cleared (see the Safety Evaluation Report for Millstone, Unit 2, same topic). On this basis, Arkansas Nuclear One--Unit 1 has acceptable reset switch provisions.

Guideline 3 requires system level annunciation whenever an override effects the performance of a safety system. The AP&L design has no override for the CVI system; therefore, compliance with this guideline is inherent.

Guideline 4 requires that isolation of the CVI system be actuated by several diverse signals. Arkansas Nuclear One--Unit 1 provides for CVI on high containment pressure or low RCS pressure. The unit FSAR indicates that these same signals actuate safety injection. This is acceptable. However, additional actuation signals derived from high radiation levels (gaseous, particulate, and iodine) in the unit vent and in the containment atmosphere are needed if the purge valves are ever to be open when the unit is in an operating mode. The NRC should require AP&L to provide either the needed radiation monitors or technical specification requirements that the purge valves be securely closed when the unit is in an operating mode.

Guideline 5 requires that the isolation signals be derived from safety grade instruments. The present actuation signals are derived from safety grade equipment in compliance with this guideline. The NRC should require that the additional high radiation signals used are derived from safety grade equipment.

Guideline 6 requires that no resetting of isolation logic will, of itself, automatically open the isolation valves. The present control circuits conform to this guideline.

2.4 Other Related Engineered Safeguard Actuation System Circuits. The Arkansas Nuclear One--Unit 1 Emergency Core Coolant System (ECCS) has bypass capability to allow normal shutdown.[5] This bypass requires a permissive condition to be entered (on controlled RCS pressure decrease) and is automatically removed on a return of RCS pressure to approximately 250 psig above the bistable setpoint. This bypass prevents "actuation of high and low pressure injection, isolation, and cooling systems during a normal shutdown."[5]

This bypass does not comply with the literal requirements of guidelines 2 or 3; however, the bypass is automatically removed if the permissive condition necessary to enter the bypass is removed. Physical provisions for the bypass switches are served by permissive circuits. Annunciation is not deemed necessary when automatic removal of the bypass exists.

No other manual override capability has been identified in the review of the material submitted by AP&L for this audit.

3.0 SUMMARY

The electrical, instrumentation, and control design aspects of the containment ventilation isolation valves and other related ESAS signals for Arkansas Nuclear One--Unit 1 were evaluated using the design guidelines

stated in Section 2.1 of this report. The CVI system meets the NRC guidelines except that high radiation levels do not initiate isolation of the CVI valves. Should the purge valves be opened when the unit is in an operating mode, the NRC should ensure that class 1E radiation level trips will isolate the containment atmosphere. Alternatively, AP&L should be required to incorporate in the the Arkansas Nuclear One--Unit 1 technical specifications requirements that the purge valves be securely closed whenever the unit is in an operating mode.

4.0 REFERENCES

1. NRC/DOR letter (A. Schwencer) to all BWR and PWR licensees, "Containment Purging During Normal Plant Operation," dated November 28, 1978.

2. AP&L letter (Daniel H. Williams) to Director of Nuclear Reactor Regulation, NRC, "Containment Purging During Operation," dated December 29, 1978, Serial 1-128-9.

3. AP&L letter (Daniel H. Williams) to Director of Nuclear Reactor Regulation, NRC, "Containment Purging During Operation," dated January 30, 1979, Serial 1-019-17.

4. AP&L letter (Daniel H. Williams) to Director of Nuclear Reactor Regulation, NRC, "Reactor Building Purging During Operation," dated April 2, 1979, Serial 1-049-2.

5. AP&L letter (David C. Trimble) to Director of Nuclear Reactor Regulation, NRC, "Reactor Building Purge System," dated February 22, 1980, Serial 1-020-17.

6. AP&L letter (David C. Trimble) to Director of Nuclear Reactor Regulation, NRC, "Reactor Building Purging During Normal Operation," dated December 12, 1979, Serial 1-129-8.