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ELECTRICAL, INSTRUMENTATION AND CONTROL ASPECTS OF THE OVERRIDE OF CONTAINMENT PURGE VALVE ISOLATION AND OTHER SAFETY FEATURE SIGNALS, ARKANSAS NUCLEAR ONE - UNIT 2, DOCKET NO. 50-368, TAC NO. 10219

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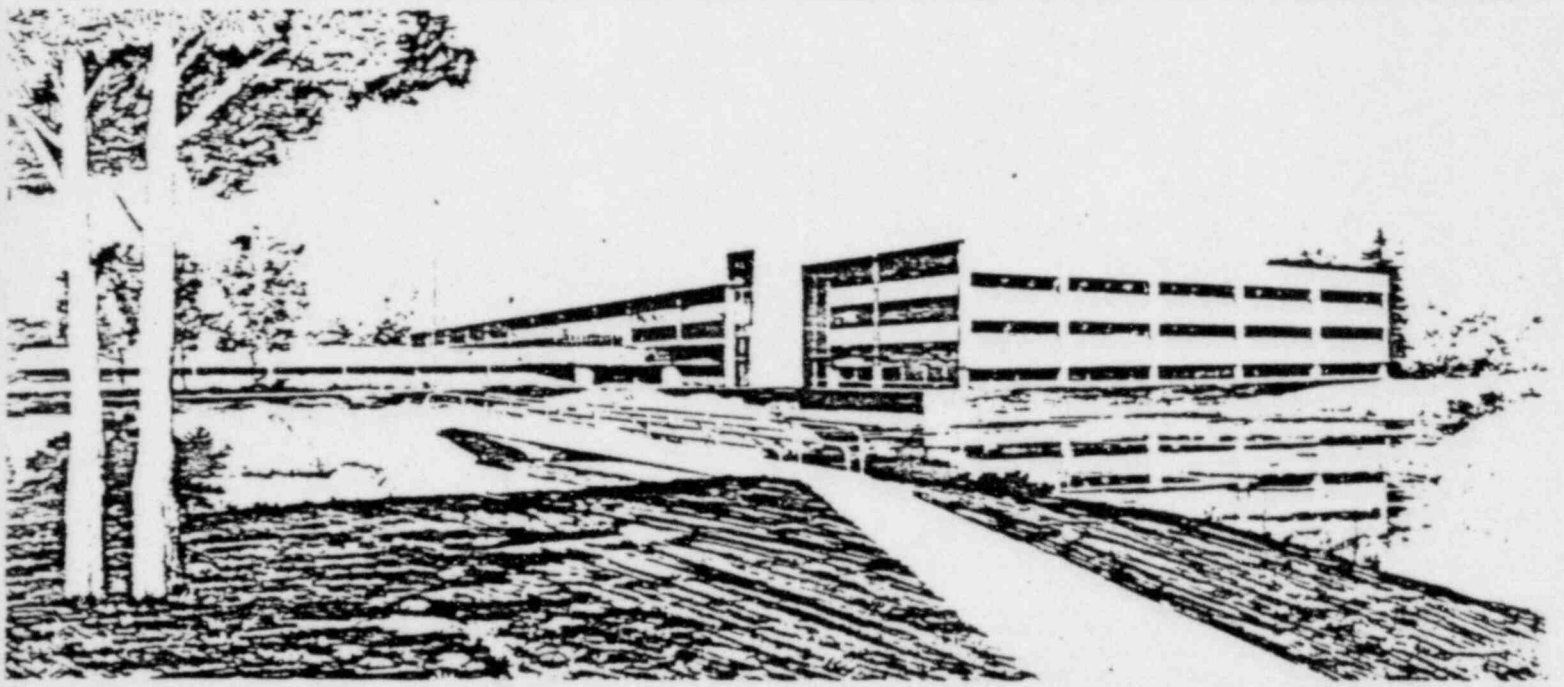

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INTERIM REPORT

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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 2

Docket No. 50-368
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April 1980

A. C. Udy
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ABSTRACT

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. This report addresses electrical, instrumentation, and control design aspects for these valves, and the ability of the unit containment ventilation system to isolate on several diverse parameters. Other related systems were audited to the same guidelines.

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EICS Support

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TECHNICAL EVALUATION REPORT

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

ARKANSAS NUCLEAR ONE--UNIT 2

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 systems design aspects of the Containment Ventilation Isolation (CVI) system and other related Engineered Safeguard Feature Actuation System (ESFAS) functions for Arkansas Nuclear One--Unit 2.

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 a 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. A February 22, 1980 letter[2] from AP&L to the NRC provided some specific answers to questions asked concerning the containment purge system.

2.0 EVALUATION OF ARKANSAS NUCLEAR ONE--UNIT 2

2.1 Review Guidelines

The intent of this evaluation is to determine if the following requirements are met for the safety signals to all ESF 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 ESF 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 ESF 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 2 has two ESAS trains which close independently and separately the inboard and outboard containment ventilation isolation valves. The valves can only be opened by manual control switch. The CVI valves are closed automatically by either a high containment pressure (20 psia) signal or a low Reactor Coolant System (RCS) pressure signal[2]. These signals are derived from safety grade equipment.[2] The FSAR indicates that these same signals also initiate safety injection. These signals can be reset, once the initiating condition is gone, at the ESFAS panel 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

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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.

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.

It should also be noted that the unit Technical Specifications, Section 3.6.1.6, require the containment purge supply and exhaust isolation valves to be closed whenever the unit is in an operating mode.

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 the reset switches. The literal requirements of this guideline 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 2 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 capability for the CVI system; 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 2 provides for CVI on either high containment pressure or low RCS pressure. These are derived from the same instruments that initiate safety injection. Additional radiation level (gaseous, particulate, and iodine) signals (in the unit vent and in the containment atmosphere) should be provided

to initiate CVI valve closure before any change to Technical Specifications 3.6.1.6 is allowed. The NRC has no requirement that the purge valves be automatically closed when the unit is in a non-operating mode. No changes by AP&L are needed to comply with this guideline.

Guideline 5 requires that the isolation actuation signals be derived from safety grade instruments. The existing actuation signals are derived from safety grade equipment. Additional circuits (as recommended in the above paragraph) should be of 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 Feature Actuation System Circuits

The ESFAS pressurizer pressure bypass (provided to allow normal plant shutdown and depressurization) circuits do not conform with the literal requirements of guideline 2 as AP&L has shown no evidence that the bypass switches are physically protected to prevent inadvertent switch actuation. However, this bypass requires a permissive condition for use and can only be entered when the pressurizer pressure is less than 400 psia. The bypass is automatically removed above 500 psia. This bypass is annunciated.[2] The permissive circuits function to physically prevent the use of the bypass when use is not authorized; therefore, guideline 2 is satisfied.

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 2 were evaluated using the design guidelines stated in Section 2.1 of this report. The CVI system meets these guidelines.

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, David C. Trimble, to Director of Nuclear Reactor Regulation, NRC, "Containment Purge System," February 22, 1980, Serial 2-020-08.

CONTAINMENT SYSTEMS

LIMITING CONDITION FOR OPERATION

3.6.1.7 The containment purge supply and exhaust isolation valves listed in Table 3.6-1, Part B shall be locked closed. The containment vent header isolation valves listed in Table 3.6-1 Part A shall be locked closed.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

With one containment purge supply and/or one exhaust isolation valve open, close the open valve(s) within one hour or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.6.1.7.1 The containment purge supply and exhaust isolation valves listed in Table 3.6-1 Part B and the containment vent header isolation valves listed in Table 3.6-1 Part A shall be determined locked closed at least once per 31 days.

3/4 4.6.3 CONTAINMENT ISOLATION VALVES

LIMITING CONDITION FOR OPERATION

3.6.3 The containment isolation valves specified in Table 3.6-1 shall be OPERABLE with isolation times as shown in Table 3.6-1.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

With one or more of the isolation valves(s) specified in Table 3.6-1 inoperable, maintain at least one isolation valve OPERABLE in each affected penetration that is open and either:

a. Restore the inoperable valve(s) to OPERABLE status within 4 hours or

b. Isolate each affected penetration within 4 hours by use of at least one deactivated automatic valve secured in the isolation position, or

c. Isolate each affected penetration within 4 hours by use of at least one closed manual valve or blind flange; or

d. Be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.6.3.1 The isolation valves specified in Table 3.6-1 shall be demonstated OPERABLE prior to returning the valve to service after maintenance, repair or replacement work is performed on the valve or its associated actuator, control or power circuit by performance of a cycling test, and verification of isolation time.

SURVEILLANCE REQUIREMENTS (Continued)

4.6.3.2 Each isolation valve specified in Table 3.6-1 shall be demonstrated OPERABLE during the COLD SHUTDOWN or REFUELING MODE at least once per 18 months by:

a. Verifying that on a Phase A containment isolation test signal, each Phase A isolation valve actuates to its isolation position.

b. Verifying that on a Phase B containment isolation test signal, each Phase B isolation valve actuates to its isolation position.

4.6.3.3 The isolation time of each power operated or automatic valve of Table 3.6-1 shall be determined to be within its limit when tested pursuant to Specification 4.0.5.

4.6.3.4 The containment purge supply and exhaust isolation valves listed in Table 3.6-1 Part B and the containment vent header isolation valves listed in Table 3.6-1 Part A shall be demonstrated OPERABLE at intervals not to exceed ___ months. Valve OPERABILITY shall be determined by verifying that when the measured leakage rate is added to the leakage rates determined pursuant to Specification 4.6.1.2.d for all other Type B and C penetration, the combined leakage rate is less than or equal to 0.60La. However, the leakage rate for the containment purge and vent isolation valves shall be compared to the previously measured leakage rate to detect excessive valve degradation.