EG&G Idaho, Inc.

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Subject of this Document: Electrical, Instrumentation & Control Aspects of the Override of Containment Purge Valve Isolation and Other Safety Feature Signals, Oconee Nuclear Station, etc.

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Responsible NRC Individual and NRC Office or Division: Paul Shemanski, Division of Operating Reactors

This document was prepared primarily for preliminary or internal use. It has not received full review and approval. Since there may be substantive changes, this document should not be considered final.

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ELECTRICAL, INSTRUMENTATION AND CONTROL ASPECTS OF THE OVERRIDE OF CONTAINMENT PURGE VALVE ISOLATION AND OTHER SAFETY FEATURE SIGNALS, OCONEE NUCLEAR STATION, UNIT NOS. 1, 2 AND 3, DOCKET NOS. 50-269, 50-270 AND 50-287, TAC NOS. 10209, 10208 AND 10207

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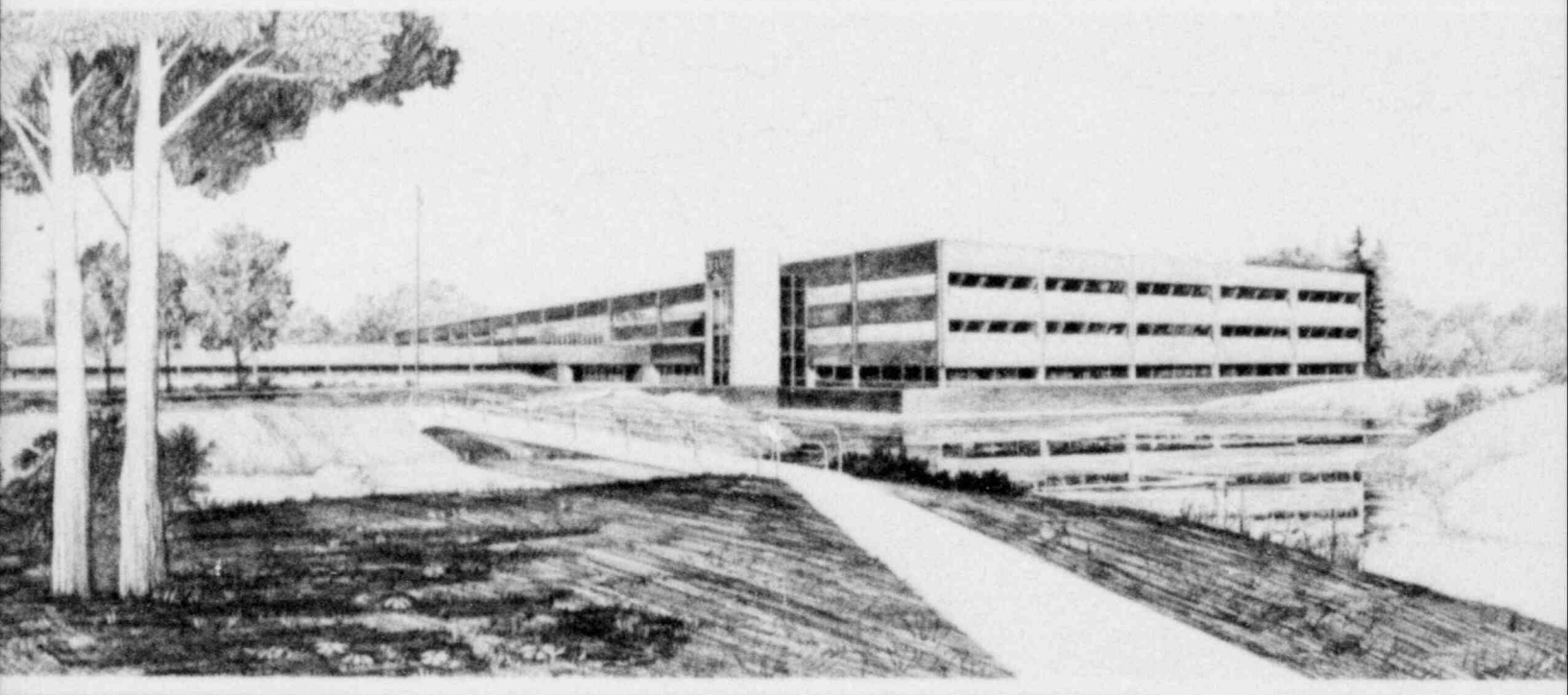
U.S. Department of Energy
Idaho Operations Office • Idaho National Engineering Laboratory



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INTERIM REPORT

TECHNICAL EVALUATION REPORT

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

OCONEE NUCLEAR STATION UNIT NOS. 1, 2, AND 3

Revision 1

Docket Nos. 50-269, 50-270, and 50-287
TAC Nos. 10209/10208/10207

February 1980

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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.

FIN No. A6256

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

OCONEE NUCLEAR STATION, UNIT NOS. 1, 2, AND 3

Revision 1

1.0 INTRODUCTION

Based on the information supplied by Duke Power Company (DPC), this report addresses the electrical, instrumentation, and control systems design aspects of the Containment Ventilation Isolation (CVI) system and other related Engineered Safeguards Protection System (ESPS) functions for the Oconee 1, Oconee 2, and Oconee 3 plants. DPC has verified that these systems are identical in all three plants[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 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"[2] to all Boiling Water Reactor (BWR) and Pressurized Water Reactor (PWR) licensees. DPC responded to the letter by letters of January 5, 1979[3] and September 25, 1979.[4] Portions of these were clarified in telephone conversations of October 10, 1979[1] and October 11, 1979[5]. An additional letter of October 19, 1979[6] tells

of modifications to the actuation signals of the purge valves. An additional telephone conversation on December 26, 1979[7] clarified projected schedules.

2.0 EVALUATION OF OCONEE NUCLEAR STATION UNITS 1, 2, AND 3

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 ESF equipment:

1. Guideline No. 1--In keeping with the requirements of General Design Guidelines 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.

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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.

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

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 on 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

Each of the Oconee units has two ESPS trains which close independently and separately the inboard and outboard isolation valves. The valves can only be opened by manual control switches. The initiating signals which will close the valves are listed below:

1. Bistable signals which comprise the High Pressure Coolant Injection signal[6]:

   a. Containment pressure high (4 psig)

   b. Low reactor coolant pressure[b] (1500 psig).

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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.

b. The Oconee units are being modified to have low reactor coolant system pressure as an additional actuation signal to the CVI[1]. This modification is expected to be completed before startup from refueling for Units 1 and 2, and at the first available forced outage for Unit 3[7].

2. In addition to the above initiating signals, any of the following containment vent radioactivity levels exceeding its setpoint will close the outboard valves:

   a. Air particle monitor

   b. Iodine monitor

   c. Radioactive gas monitor.

The valve closure signal resulting from the automatic actuation signal can be reset, once the initiating signal is gone, at the ESPS panel or at a benchboard to allow manual opening of any of the CVI valves.

Manual control of the inboard (motor-operated) valves is by rotary spring return to neutral switches. Manual control of the outboard pneumatically operated valves is by maintained-contact, rotary switches. The control system is such that the automatic closure signals will close the valves even if the switch is in the "open" position. The control system prevents valve opening except when the switch is rotated to the "open" position, thus preventing reopening of the motor-operated valves when the automatic "close" initiating 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. Motor-operated valves remain in their last position. Valve position lights, "open" and "closed", are provided on the control console.

Both the inboard and the outboard CVI valves are controlled by separate ESPS trains, with the three radiation monitoring channels also able to close the outboard valves. The radiation channels will initiate closure of the outboard CVI valves should any of the radiation monitors trip or lose power. Once a closure signal has been received, the valves cannot be opened until the initiating signal is gone and the logic then reset by a manual pushbutton switch (these switches are located inside ESPS cabinets or have covers where mounted on a bench board). There is no provision to override an actuation signal.

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 provisions to override a safety actuation signal, and is in conformance with this guideline.

Guideline 2 requires that any reset or override switches have physical provisions to aid in the administrative control of the switches. With no override switches and with reset switches inside the ESPS cabinets or covered, this guideline is met.

Guideline 3 requires system level annunciation whenever an override effects the performance of a safety system. With no provision for overriding a safety signal, this guideline is satisfied.

Guideline 4 requires that isolation of the CVI system be actuated by several diverse signals. Upon the inclusion of the low reactor coolant system pressure trip as a CVI actuation signal, the Oconee units will meet this requirement in that:

1. The same signals that initiate safety injection also initiate CVI valve closure

2. The reactor building pressure is a portion of this signal

3. Radiation high signals will actuate closure of the outboard valves.

With the present design, radiation signals do not initiate closure of the inboard valves, therefore, the single failure of an outboard valve to close on a high radiation signal (such as might occur with a refueling accident) would prevent containment isolation. It is recommended that DPC modify the inboard valve control circuits so that detection of high radiation levels will close both the inboard and outboard valves.

Guideline 5 requires that the isolation actuation signals be derived from safety grade instruments. The Oconee plants do not have safety grade radiation channels, and do not satisfy this guideline. It is recommended that DPC upgrade their systems to provide safety grade radiation equipment for CVI.

Guideline 6 requires that no resetting of isolation logic will, of itself, automatically open the isolation valves. The inboard, motor operated valve controls conform to this guideline. However, the outboard, pneumatically operated valves have maintained contact control switches, and the control system will permit these valves to open (with the control switch in the open position) when the isolation logic is reset. DPC is designing a modification to correct this deficiency, and conformance to guideline 6 is expected (see footnote b on page 3).

2.4 Other Related Engineered Safeguard Protection System Circuits

The material submitted by DPC was identified as tyical of the ESPS actuation circuits for the Oconee units. DPC has stated that no manual override features exist in these circuits.[3] No manual overrides have been identified in our review of the material submitted for this audit.

Guideline 6, however, is not complied with in other portions of containment isolation, because the same circuits that the CVI valves have are used. DPC has identified those pneumatically operated valves that would be susceptible to automatic motion on reset of valve actuation logic, and will modify these as with the CVI valve logic[7]. The scheduled completion is the same as identified in footnote b on page 3. This same modification will include the addition of the low reactor coolant pressure signal as an actuation signal.[7]

3.0 CONCLUSIONS

The electrical, instrumentation, and control design aspects of the containment ventilation isolation valves and other related ESPS signals for the Oconee units were evaluated using the design guidelines stated

in Section 2.0 of this report. With the completion of the modifications that DPC is presently committed to,[7] the CVI complies with the review quidelines except for the radiation monitors used to provide one of the diverse acutation signals. These radiation monitors are not class 1E equipment and do not cause closure of the inboard valves. It is recommended that the NRC require that both the inboard and the outboard valves be actuated to close by class 1E radiation channels for all three Oconee units.

Other containment isolation valves have been determined to have the capability to change state upon reset of the isolation logic. DPC is committed to modify the control circuits for these valves before restart from the current refueling outage for Units 1 and 2, and as soon as a forced outage of sufficient length occurs for Unit 3. This modification will prevent containment isolation valve motion on the reset of the actuation logic.

4.0 REFERENCES

1. Telecon, R. L. Gill, DPC, A. C. Udy, EG&G Idaho, October 10, 1979.

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

3. DPC letter, W. O. Parker, Jr. to H. R. Denton, NRC, "Oconee Nuclear Station, Docket Nos. 50-269, 50-270, 50-289", January 5, 1979.

4. DPC letter, W. O. Parker, Jr. to H. R. Denton, NRC, "Oconee Nuclear Station, Docket Nos. 50-269, 50-270, 50-287", September 25, 1979.

5. Telecon, R. L. Gill, DPC, A. C. Udy, EG&G Idaho, October 11, 1979.

6. DPC letter, William O. Parker, Jr. to Harold R. Denton, NRC, "Oconee Nuclear Station, Docket Nos. 50-269, 50-270, 50-287," October 19, 1979.

7. Telecon R. L. Gill, DPC, R. F. Scholl, Jr., NRC-DOR, A. C. Udy, EG&G Idaho, December 26, 1979.