TECHNICAL EVALUATION REPORT

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

BRUNSWICK STEAM ELECTRIC PLANT UNIT NOS. 1 AND 2

Docket Nos. 50-325 and 50-324

July 1980

A. C. Udy
Reliability and Statistics Branch
Engineering Analysis Division
EG&G Idaho, Inc.

TAC Nos. 10184 and 10183

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

CONTENTS

TECHNICAL EVALUATION REPORT

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

BRUNSWICK STEAM ELECTRIC PLANT UNIT NOS. 1 AND 2

1.0 INTRODUCTION

Based on the information supplied by Carolina Power and Light Company (CP&L), this report addresses the electrical, instrumentation, and control systems design aspects of the Containment Ventilation Isolation (CVI) system and other related Engineered Safety Feature (ESF) system functions for the Brunswick 1 and Brunswick 2 units. The Final Safety Analysis Report (FSAR) indicates that these systems are identical in both units, and provides additional design information.

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. CP&L responded on December 29, 1978[2], January 19, 1979[3], and May 1, 1979[4].

A plant visit was made by NRC staff members on June 11, 1979. This revealed that the single failure criteria was not met. CP&L wrote a Licensee Event Report (LER) #2-79-023[5]. This gave some temporary circuit changes and revision of operating precedures and emergency instructions that eliminated the reported deficiencies, and reported that future permanent changes would be made. Details of these permanent changes were reported in letters of April 1, 1980[6] and May 19, 1980[7].

2.0 EVALUATION OF BRUNSWICK STEAM ELECTRIC PLANTS UNITS 1 AND 2

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 Criteria 55 and 56, the override[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.

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

---

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.

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.

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

Automatic closure of containment isolation valves will occur on any of the following conditions:

1. Two drywell pressure high (2 psig) signals and two reactor vessel water level low (12.5 in.) signals are combined to form a hybrid one-out-of-two-taken-twice logic for isolation of each valve train. These signals are of safety grade, and also actuate high pressure coolant injection (safety injection).

---

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.

2. Two radiation detectors in the reactor building ventilation exhaust duct provide inputs to two separate channels of radiation monitors that initiate isolation of both valve trains. The licensee has stated that these channels satisfy the requirements of IEEE Standard 279[6]. Valve closure is initiated should either radiation channel trip (at 11 mr/hr).

As modified,[6] the control of the solenoid-operated and of the motor-operated CVI valves are similar with spring-return to neutral control switches . Valve position lights show the actual valve position. The solenoid valves fail closed on loss of air or loss of power. Should a motor-operated valve control circuit lose power, the last position is maintained.

Prior to the NRC visit and subsequent LER,[5] a single override switch could override all unit safety actuation signals for all CVI valves. Each plant now has one manual two position override switch that can bypass all automatic closure relay contacts for the inboard valves. A separate switch has been provided for the override of the isolation signal to the outboard valves. These switches are adjacent to indicator lights that indicate the status of the override, and will be changed to keylocked switches during 1980 in both units.[7] This modification will also provide an automatic cancellation of the override should any isolation signal occur after the override is established.[6]

There is no provision for manual reset of the safety actuation signal; it is removed automatically when the initiating condition is gone. The CVI valves are prevented from changing position on either an automatic reset of the actuation signal or when a override condition is manually established.

2.3 Containment Ventilation Isolation System Design Evaluation

Guideline 1 requires that no signal override can prevent another safety actuation signal from functioning. The Brunswick units have two trains of valve override logic which could override all safety actuation signals for (separately) the inboard and the outboard valves. Reference 5 reports that the override capability was removed and that operating procedures and emergency instructions were revised to show this. Reference 6 indicates that the original override control was modified and separated into two override channels, each override switch bypassing all actuation signals. A future modification will defeat this override for subsequent isolation signals[6]. This modification will be installed in both units during the year 1980[7], and after installation, the Brunswick station will be in conformance with guideline 1.

Guideline 2 requires that reset and override switches have physical provisions to aid in the administrative control of these switches. The override switches, at present, have no such provision. CP&L is committed to changing these switches,[7] during 1980, to keylocked switches so that this guideline is satisfied. The CVI systems in the Brunswick units do not have reset switches.

Guideline 3 requires system level annunciation whenever an override affects the performance of a safety system. While status lights are provided; the Brunswick units are not in compliance with the literal requirement to provide annunciation. After the modification to automatically defeat the override on subsequent isolation signals, annunciation may not be needed since the CVI valves will isolate on any subsequent isolation signal.

Guideline 4 requires that isolation of the CVI valves be actuated by several diverse signals. The Brunswick units meet this requirement in that:

1. The same signals that initiate safety injection also initiate CVI system isolation

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

3. Radiation trips on high radiation level in the reactor building ventilation exhaust ducts will initiate isolation.

Guideline 5 requires that isolation actuation signals be derived from safety grade equipment. The Brunswick units meet this requirement.

Guideline 6 requires that no reset of isolation logic will, of itself, automatically open the isolation valves. The Brunswick units comply with this guideline.

2.4 Other Related Engineered Safety Feature System Circuits

Reference 3 states that, of all the safety actuation signal circuits, manual overrides which additionally override safety actuation signals exist only "for those controlled by plant procedures." CP&L clarified this to be the ability to turn off individual residual heat removal pumps and core spray pumps.[7] Indicator lights indicate when a pump has been stopped. The pumps are started automatically. The ability to shut down an individual pump is in agreement with the NRC position of establishing manual control as the accident progresses.

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

3.0 SUMMARY

The NRC issued a letter, "Containment Purging During Normal Plant Operation," which requested CP&L to review purging requirements, controls, and procedures for purging at the Brunswick station.

During the course of the NRC review of this topic, CP&L has modified the CVI valve control and override circuits to eliminate a potential single failure that could result in opening all CVI valves from an isolated condition and to prevent any valve motion except those initiated by an operator. The modifications presently completed are:

(a) A second switch was added to control the override of the outboard CVI valves. This function was removed from the switch that now controls the inboard CVI valves.

(b) Valve control switches and circuits were changed to require operator action each time a CVI valve is opened.

Further modifications to be made in 1980 that were also identified as part of this review are:

(a) Installing keylocked switches in place of the present override switches.

(b) Providing an automatic cancellation of an override should any isolation condition occur after the override is established.

The electrical, instrumentation, and control design aspects of the containment ventilation isolation valves and other related ESF signals for the Brunswick plants were evaluated using the design gudelines stated in Section 2.1 of this report.

CP&L has not provided annunciation for when an override is established for the CVI valve; however, status lights are provided. This is not in strict conformance with NRC Guideline 3.

With this exception, the CVI system will comply with the NRC guidelines after the unit modifications are completed during 1980. These modifications are scheduled to be done during the 1980 refueling

outage for Unit 1, and at the first available outage of sufficient length after August 1, 1980, but in no case after December 31, 1980, for Unit 2.[7]

4.0 REFERENCES

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

2. CP&L letter, E. E. Utley to T. A. Ippolito, NRC, "Containment Purging During Normal Plant Operation," dated December 29, 1978, serial GD-78-4411.

3. CP&L letter, E. E. Utley to T. A. Ippolito, NRC, "Containment Purging During Normal Plant Operation," dated January 19, 1979, serial GD-79-187.

4. CP&L letter, E. E. Utley, to T. A. Ippolito, NRC, "Containment Purging During Normal Plant Operation," dated May 1, 1979, serial GD-79-1159.

5. CP&L letter, B. J. Furr to J. P. O'Reilly, NRC, "Licensee Event Report 2-79-023," dated June 22, 1979, serial GD-79-1623.

6. CP&L letter, E. E. Utley, to Office of Nuclear Reactor Regulation, NRC, "Response to Request for Additional Information on Containment Purging," April 1. 1980, Serial NO-80-519.

7. CP&L letter, E. E. Utley, to Office of Nuclear Reactor Regulation, NRC, "Response to Request for Additional Information on Containment Purging," May 19, 1980, Serial No. NO-80-750.