

## TECHNICAL EVALUATION REPORT

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

## MILLSTONE NUCLEAR POWER STATION UNIT NO. 2

1.0 INTRODUCTION

Based on the information supplied by Northeast Nuclear Energy Company (NNECo), this report addresses the electrical, instrumentation, and control system design aspects of the Containment Ventilation Isolation (CVI) system and other Engineered Safety Feature Actuation System (ESFAS) functions for the Millstone 2 plant. Millstone 1 is the subject of a separate Systematic Evaluation Program review (SEP Topic VI-4).

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. NNECo was one of the licensees who first reported a reportable occurrence of this type<sup>1</sup>. It was found that, when the high radiation signal to the CVI system is overridden, additional safety signals are prevented from initiating containment isolation. Administrative controls were imposed to keep the purge valves closed until a design change could be incorporated.

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"<sup>2</sup> to all Boiling Water Reactor (BWR) and Pressurized Water Reactor (PWR) licensees. NNECo responded to the letter<sup>2</sup> on January 3, 1979<sup>3</sup>. NNECo addressed several NRC concerns in a letter of January 16, 1980<sup>4</sup>. On April 27, 1979<sup>5</sup>, NNECo proposed changes in the Millstone Unit 2 Technical Specifications to prohibit reactor operation (Modes 1, 2, 3, and 4) when the containment purge valves are not locked shut.

## 2.0 EVALUATION OF MILLSTONE NUCLEAR POWER STATION UNIT 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 ESFAS equipment:

1. Guideline No. 1--In keeping with the requirements of General Design Criteria 55 and 56, the overriding<sup>a</sup> 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,

---

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.

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 ESFAS should be designed and qualified as safety grade equipment.
3. Guideline No. 6--the overriding or resetting<sup>a</sup> of the ESFAS 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

The Millstone 2 plant has two ESFAS channels which close independently and separately the inboard and outboard isolation valves.<sup>b</sup> The valves can be opened by manual control only. The initiating signals which close all containment purge valves are listed below:

### Automatic

1. High radiation on any particulate or gaseous containment monitor. One-out-of-four logic.

---

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. Proposed circuit modifications and new administrative controls are described later in this section.

2. Safety Injection Actuation caused by low low pressurizer (1585 psig) or high containment pressure (5 psia). Both of these are two-out-of-four logic (two-out-of-three logic if one channel is bypassed for testing).

#### Manual

1. Manual actuation of safety injection.
2. Manual actuation of containment isolation.
3. Manual actuation of the valves.

Valve control switches incorporate ESFAS override capability by rotating the switch to the safe (closed) position and then back to the open position while the ESFAS still calls for valve closure. These switches are not covered or enclosed. The override condition is not annunciated, however, valve status lights provide this information to the operator. Reset of automatic and manual actuation is by unguarded pushbutton switches. The actuation signal remains until the initiating signal is clear and the reset actuated.

NNECo has committed to change the described circuit during the 1980 refueling outage.<sup>4</sup> The valve closure signal generated by safety injection actuation for containment isolation will be electrically disconnected from the purge valve actuation circuitry. Technical Specification changes have been submitted that require all containment purge valves to be locked closed when the reactor is in an operating mode.<sup>5</sup> The high containment radiation actuation circuit (and override circuitry) will remain functional during all modes of operation.

#### 2.3 Containment Ventilation Isolation System Design Evaluation

Guideline 1 requires that no signal override can prevent another safety actuation signal from functioning. With the above mentioned NNECo modification, when the Technical Specification changes are approved, this guideline is met in that only radiation can actuate closure of the purge isolation valves, and the valves are only open

when the reactor is not in an operating mode. Technical Specifications will prohibit opening these valves while in an operating reactor mode.

Guideline 2 requires that reset and override switches have physical provisions to aid in administrative control of the switches. The momentary contact reset switches have no such provision, and do not comply with this guideline. The valve position switches, which also initiate an override condition, have no such provision, and do not comply with this guideline. Overriding of the radiation signal is still possible. NNECo has not committed to cover or otherwise make access to these switches more adaptable to administrative control.<sup>4</sup>

Guideline 3 requires that system level annunciation be provided whenever an override affects the performance of a safety system. The Millstone 2 plant does not conform to this guideline; there is no annunciated alarm when a valve override is used. NNECo has not committed to provide an annunciator, even though the radiation high signals can be overridden.<sup>4</sup>

Guideline 4 requires that isolation of the CVI system be actuated by several diverse signals. High radiation at the containment gaseous or particulate monitors will cause closure of the CVI valves, should the valves be open. The Millstone 2 plant meets the intent of this guideline because the containment purge valves are locked closed when the unit is operating, and diverse radiation monitors actuate containment purge valve isolation when the unit is in a non-operating mode.

Guideline 5 requires that isolation actuation signals be derived from safety grade equipment. The Millstone 2 radiation signals, which are the only signals that actuate isolation of the CVI valves, conform to this guideline.<sup>4</sup> The signals removed from CVI actuation were safety grade.

Guideline 6 requires that no resetting of isolation logic will, of itself, automatically open the isolation valves. The Millstone 2 plant conforms to this guideline.<sup>4</sup>

## 2.4 Other Engineered Safety Feature Actuation System Circuits

The Safety Injection Actuation signal (SIAS) can be blocked for depressurization if three of the four channels of pressurizer pressure are less than 1735 psig. Unprotected momentary contact pushbutton switches for each ESFAS channel are used to achieve this bypass. The bypass is automatically removed should the pressurizer pressure in two channels exceed 1735 psig. This override does not conform to guideline 2. A similar system can block isolation of the main steam isolation valves below 585 psig. This override does not conform to guideline 2 because of the unguarded pushbutton switches.

Keylock switches are provided for bistable trip bypass to change the ESFAS logic from two out of four channel to two out of three channel. Use of these switches is annunciated, and only one channel can be bypassed at any time. When this bistable trip bypass is used, no other signals are bypassed. The use of these switches is in conformance to the NRC guidelines.

No other manual overrides have been identified in this review of the material submitted by NNECo for this audit.

We recommend that NNECo make the design changes necessary to bring the SIAS and main steam isolation valve overrides into compliance with the NRC guidelines.

## 3.0 CONCLUSIONS

The electrical, instrumentation, and control design aspects of the containment ventilation isolation valves and other ESFAS signals for Millstone 2 was evaluated using the design guidelines stated in Section 2.1 of this report. After modification (removing the safety injection signal for the CVI actuation logic) during the planned 1980 refueling, the CVI system will comply with the NRC guidelines except for the unprotected valve actuation logic reset and override switches and the lack of annunciation when the radiation channel override is

active. Since high radiation causes CVI valve closure in a non-operating mode, and this actuation signal can be overridden, the NRC should require NNECo to provide the Millstone 2 unit with design features to (a) aid in the administrative control of valve actuation logic reset and override controls, and (b) annunciate when an override affects system performance.

NNECo should provide covers or other physical features to facilitate administrative control for all override switches for other operating bypasses in the ESFAS.

#### 4.0 REFERENCES

1. NNECo letter, E. J. Ferland to Boyce H. Grier, NRC, Region 1, "Reportable Occurrence 50-336/78-16/1P," dated July 26, 1978, Serial No. MP-2-945.
2. NRC/DOR letter (A. Schwencer) to all BWR and PWR licensees, "Containment Purging During Normal Plant Operation," dated November 28, 1978.
3. NNECo letter, W. G. Council to R. Reid, NRC, "Millstone Nuclear Power Station Unit No. 2 Containment Purging," Docket No. 50-336, January 3, 1979.
4. NNECo letter, W. G. Council to Director of Nuclear Regulatory Commission, NRC, "Containment Purge System, ESF Equipment/Component Design," Docket No. 50-336, January 16, 1980.
5. NNECo letter, W. G. Council to R. Reid (NRC), dated April 27, 1979.