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SYSTEMATIC EVALUATION PROGRAM TOPIC VI-4, ELECTRICAL, INSTRUMENTATION, AND CONTROL ASPECTS OF THE OVERRIDE OF CONTAINMENT PURGE VALVE ISOLATION, R. E. GINNA NUCLEAR POWER PLANT

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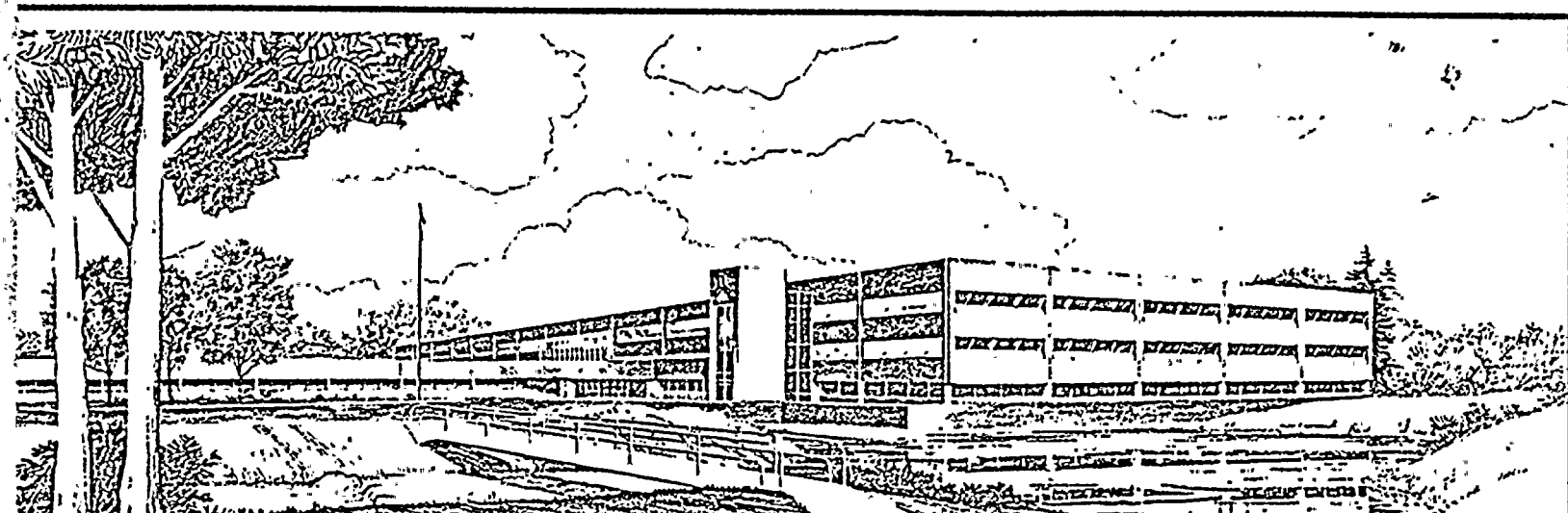

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SYSTEMATIC EVALUATION PROGRAM

TOPIC VI-4

ELECTRICAL, INSTRUMENTATION, AND CONTROL ASPECTS OF THE OVERRIDE OF CONTAINMENT PURGE VALVE ISOLATION

R. E. GINNA NUCLEAR POWER PLANT

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ABSTRACT

This SEP technical evaluation, for the R. E. Ginna Nuclear Power Plant, reviews the design capacity of the electrical, instrumentation, and control systems of the containment ventilation isolation system and other related engineered safety feature functions.

FOREWORD

This report is supplied as part of the "Electrical, Instrumentation, and Control Systems Support for the Systematic Evaluation Program (II) being conducted for the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Division of Licensing by EG&G Idaho, Inc., Reliability & Statistics Branch.

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TOPIC VI-4

ELECTRICAL, INSTRUMENTATION, AND CONTROL ASPECTS OF
THE OVERRRIDE OF CONTAINMENT PURGE VALVE ISOLATION

R. E. GINNA NUCLEAR POWER PLANT

1.0 INTRODUCTION

Based on the information supplied by the Rochester Gas and Electric Company (RGE) this report addresses the electrical, instrumentation, and control system design aspects of the Containment Ventilation Isolation (CVI) system and other related Engineered Safety Feature (ESF) functions for the Ginna plant.

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. Lack of proper management controls, procedural inadequacies, and circuit design deficiencies contributed to these instances. 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.

The NRC is now reviewing the electrical override aspects of containment purging and venting 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, which required a review of these systems by the licensee. RGE responded on February 16, 1979[3], March 30, 1979[4], and March 17, 1980[5]. The Final Safety Analysis Report (FSAR) and Westinghouse Drawing No. 882D612, Sheet 6,[6] also contain design information reviewed for this report. RGE letters of March 2, 1981,[7] November 19, 1979[8] and December 1, 1981[9] also contain information on the control systems that was reviewed for this report.

2.0 EVALUATION OF THE R. E. GINNA NUCLEAR POWER PLANT

2.1 Review Guidelines. The intent of this evaluation is to determine if the actuating signals for the ESF equipment meet the following NRC criteria:

1. Guideline No. 1--In keeping with the requirements of General Design Criteria 55 and 56, the override[a] of one

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a. The following definitions are 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.

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

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.

Additionally, this review uses the following NRC design guidelines:

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 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 the four containment purge valves, the two containment depressurization valves, and the two radiation monitor valves will occur on any of the following conditions[2]:

1. High containment radiation

2. Safety injection signal (high containment pressure can initiate a safety injection signal).

RGE has indicated that these signals are derived from equipment "designed and constructed as a Class 1E system."[5] However, the radiation channels have not been shown to be Class 1E.

These eight valves (except for the radiation monitor valves) are air-operated butterfly valves and are used so that one is redundant for another on the same air line. Valve position lights show the actual valve position. The solenoid valves fail closed on loss of air or on loss of power. The radiation monitor valves are air-operated diaphragm valves which have either a check valve or a manual valve for redundancy.

The logic of the containment isolation and the CVI valves is shown in reference 6. In both systems, the manual actuation is overridden along with the automatic actuation signals by operation of a reset switch (one per safeguards train). This logic has since been modified as outlined below.[7]

As a result of the short-term lessons learned, the CVI valve control circuits have been modified to provide individual resetting of each isolation valve. Resetting a valve after automatic closure now requires operation of a key-locked reset switch and a valve reset (guarded) pushbutton switch. The valve then goes to the position the valve control circuit requires. Administrative procedure requires the valve controller to be in the closed position before resetting the valve logic.

2.3 Containment Ventilation Isolation System Design Evaluation. Guideline 1 requires that no signal override can prevent another safety actuation signal from functioning. Ginna has override provision in the reset switches.[7] The circuits involved have been modified to comply with this guideline.

Guideline 2 requires that reset and override switches have physical provisions to aid in the administrative control of these switches. The reset switches are keylocked. The individual valve reset switches are guarded. This guideline is satisfied.

Guideline 3 requires system level annunciation whenever an override affects the performance of a safety system. The literal intent of this guideline is not satisfied by the Ginna design; however, individual status lights monitor the status of each individual valve override. Thus, operators will be aware of the status of any overrides.

Guideline 4 requires that isolation of the CVI valves be actuated by several diverse signals. This criterion is met in that:

1. Safety injection will initiate isolation.

2. High pressure in the reactor building will initiate safety injection.

3. High-level radiation trips will initiate isolation.

Guideline 5 requires that isolation actuation signals be derived from safety grade equipment. The radiation monitors used to initiate isolation are not Class 1E equipment. This guideline is not completely satisfied.

Guideline 6 requires that no reset of isolation logic will, of itself, automatically open the isolation valves. The isolation reset logic at the Ginna station has been modified so that no single operator action will open a path from containment to the atmosphere. Two divisions, each with identical operator actions needed to open its valve, are involved. Each division has a key locked master reset switch. Additionally, for a valve to be opened, an individual reset switch for that valve must be operated before the valve control switch can function. Thus, the intent of this guideline is satisfied.

2.4 Other Related Engineered Safety Feature System Circuits. Guideline 2 requires that reset and override switches have physical provision to aid in the administrative control of these switches. There are some ESF override (reset) switches that are pushbuttons, with no physical restraint.[3] The NRC should require that RGE install any additional provisions needed to conform to guideline 2.

Guideline 6 requires that no reset of isolation logic will, of itself, automatically open the isolation valves. While the main feedwater isolation valves were identified as not conforming with this guideline,[3] further investigation shows that these isolation valves are interlocked so that a reset of the safety injection signal will not automatically reopen the valves when they are in the automatic mode of operation.[9] They are operated in a non-automatic mode only below 15% of reactor power which is for about 5 hours per startup.

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

3.0 SUMMARY

The NRC issued a letter, "Containment Purging During Normal Plant Operation," which requested RGE to review purging requirements, controls, and procedures for purging at the R. E. Ginna Nuclear Power Plant.

The electrical, instrumentation, and control design aspects of the containment ventilation isolation valves for the Ginna station were evaluated using the design gudelines stated in Section 2.1 of this report. These guidelines are satisfied except that the radiation channels used to initiate isolation of the CVI system are not qualified as Class 1E equipment.

The NRC should require that this deficiency be corrected. Other ESF systems have deficiencies as outlined in Section 2.4. The NRC should also require that these be corrected.

4.0 REFERENCES

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

2. RGE letter, L. D. White, Jr., to Director of Nuclear Reactor Regulation, U.S. NRC, "Containment Purging During Normal Plant Operations," January 2, 1979.

3. RGE letter, L. D. White, Jr., to Director of Nuclear Reactor Regulation, U.S. NRC, "Review of Safety Actuation Circuits with Overrides," February 16, 1979.

4. RGE letter, L. D. White, Jr., to Director of Nuclear Reactor Regulation, U.S. NRC, "Review of Safety Actuation Circuits with Overrides," March 30, 1979.

5. RGE letter, L. D. White, Jr., to Director of Nuclear Reactor Regulation, U.S. NRC, "SEP Topic VI-4, Containment Isolation System," March 17, 1980.

6. Drawing, Westinghouse Logic Diagram No. 882D612, Sheet 6, Revision 7, "Safeguards Actuation Signals."

7. RGE letter, J. E. Maier to Director of Nuclear Reactor Regulation, NRC, "SEP Topic VI-4, Containment Isolation (Purge Valve Reset)," March 2, 1981.

8. RGE letter, L. D. White to Director of Nuclear Reactor Regulation, NRC, "Discussion of Lessons Learned Short Term Requirements," November 19, 1979.

9. RGE letter, L. D. White to Director of Nuclear Reactor Regulation, NRC, "SEP Topic VI-4, Containment Isolation (Electrical)," December 1, 1981.