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RESTART OF CORE SPRAY AND LOW PRESSURE COOLANT INJECTION SYSTEMS, NUREG 0737, ITEM II.K.3.21, OYSTER CREEK NUCLEAR GENERATING STATION

D. J. Morken

NRC Research and/or Technical Assistance Report

PRELIMINARY

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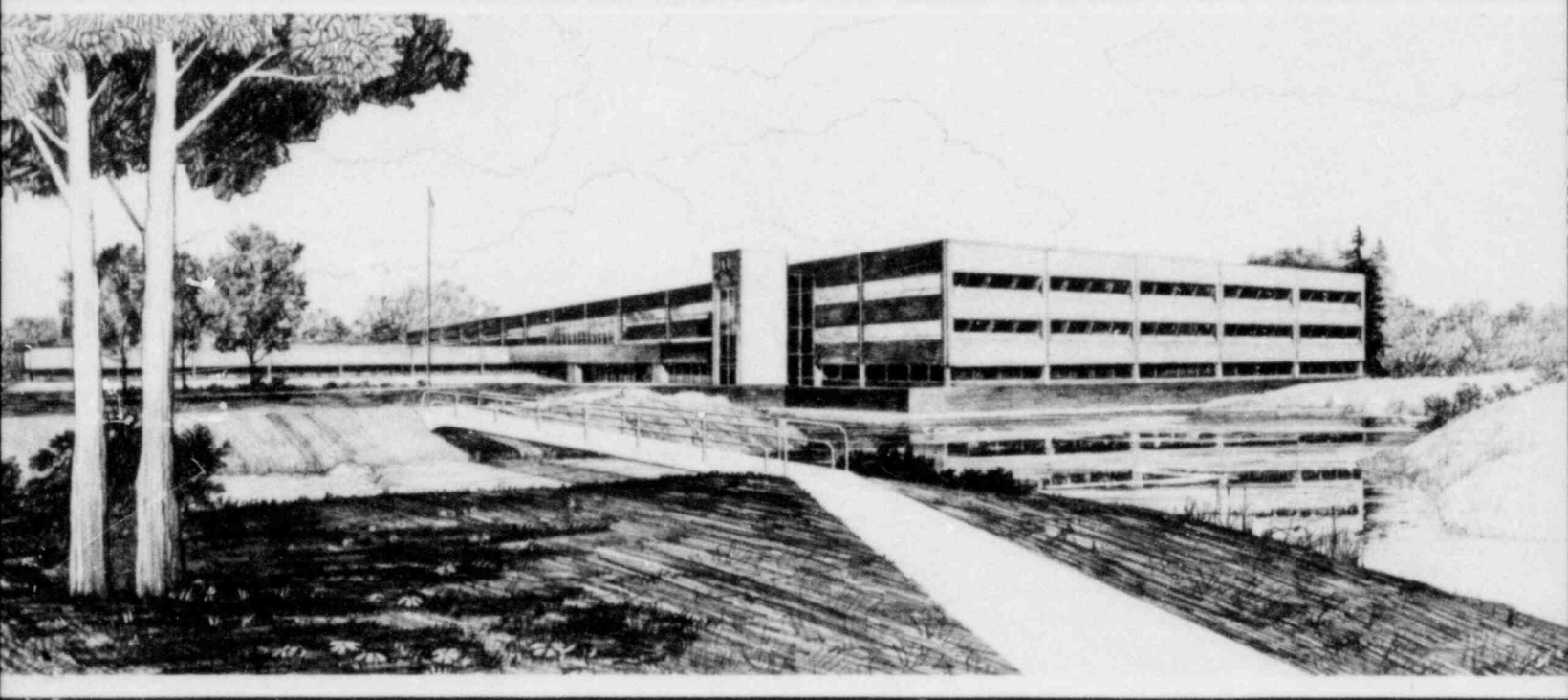

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INTERIM REPORT

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RESTART OF CORE SPRAY AND LOW PRESSURE COOLANT INJECTION SYSTEMS
NUREG 0737, ITEM II.K.3.21
OYSTER CREEK NUCLEAR GENERATING STATION

Docket No. 50-219

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EG&G Idaho, Inc.

April 1982

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ABSTRACT

In response to D. G. Eisenhut's letter, dated October 31, 1980, which transmitted the requirements of NUREG 0737, Jersey Central Power and Light Company submitted their assessment of the restart of the core spray system on low reactor water level at Oyster Creek Nuclear Generating System.

This report contains an evaluation of the Jersey Central Power and Light Company's proposed modifications and changes to their technical specifications that were submitted in response to the NRC position on NUREG 0737, Section II.K.3.21.

FOREWORD

This report is submitted as a part of the "Operating Reactors TMI Lessons Learned, NUREG 0737, Response Evaluation" being conducted for the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Division of Licensing, by EG&G Idaho, Inc., Reliability and Statistics Branch.

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TECHNICAL EVALUATION REPORT

RESTART OF CORE SPRAY AND LOW PRESSURE INJECTION SYSTEMS
NUREG 0737, ITEM II.K.3.21
OYSTER CREEK NUCLEAR GENERATING STATION

1.0 INTRODUCTION

On May 7, 1980, the NRC requested the Jersey Central Power and Light (JCP&L) Company to assess the capability of the Oyster Creek Nuclear Generating Station's core spray system to restart automatically on loss of reactor water level after the coolant flow had been stopped by the operator.[1] JCP&L was also requested to propose design modifications as needed to meet the requirements of NUREG 0737, Item II.K.3.21,[2] describe how the modification will comply with IEEE Standards 279-1971, Sections 4.12, 4.13, and 4.16,[3] and provide logic and schematic drawings, test procedures, changes to technical specifications and sufficient documentation to demonstrate that the system, as modified, will not degrade proper system functions.

2.0 DESIGN BASE CRITERIA

The design base criteria that were applied for this task are contained in NUREG 0737, Section II.K.3.21. The NRC position states "the core spray and low pressure coolant injection system will not restart automatically on loss of water level if system flow has been stopped by the reactor operator and an initiation signal is still present. The core spray and the low pressure coolant injection system should be modified so that these systems will restart automatically, if required, to assure adequate core cooling." Further, the system design modifications should be in accordance with IEEE Standard 279-1971, Sections 4.12, 4.13, and 4.16.

3.0 DISCUSSION AND EVALUATION

Oyster Creek Nuclear Generating Station as presently configured, utilizes only one core spray cooling system, namely, the low pressure core spray system.

The following provides a brief description of the existing system, the proposed modification to comply with NUREG 0737, and an evaluation of how the proposed modification complies with the design basis criteria.

3.1 Existing Core Spray System[4]

The existing core spray system is comprised of two redundant loops with two core spray pumps, two booster pumps, piping, valves and control logic for each loop.

Initiation of the core spray is from reactor Lo-Lo water level or from high containment pressure. These two initiating functions are also part of the initiation logic for other engineered safety feature (ESF) systems. The core spray valves are aligned when the reactor pressure drops to a preset value.

Core spray initiation is automatic or it may be started manually. Core spray pump trip is by operator action by remotely tripping the pump breakers. If either core spray initiation signal (Lo-Lo reactor water level or high containment pressure) is still present after a core spray pump has been tripped, the pump breaker cannot be reset without physically racking out the breaker or disconnecting the initiation signal wiring to the breaker due to the anitpump and spring charging design of the breaker. Reinstallation of the breaker or reconnection of the signal wiring while an initiation signal is still present will automatically restart the pumps. The redundant core spray valves cannot be closed as long as either core spray initiation signal is present.

The manual pump control switch is spring loaded to return to the normal (automatic) position when released. Indication of pump status is from indicating lights actuated by contacts on the pump motor breakers.

3.2 Proposed Modification

JCP&L has proposed modifying the control logic in each core spray and booster pump motor breaker to provide a semi-automatic restart of the pumps.

The modification consists of relocating the trip contacts of the pump control switch to a new trip relay logic circuit. Contacts from reactor level switch auxiliary relays will be placed in series with the control switch trip contacts and the new trip relay logic circuit. This will permit tripping the pumps only when reactor water level has returned to normal. The new trip relays are time delay on drop out (TDDO) to permit sequencing the pumps upon restart to prevent simultaneous pump loading with possible degradation of the power distribution system. Auxiliary relays, actuated by the TDDO relays, have contacts in the breaker trip coil circuit to provide the pump trip function, and contacts in the breaker closing circuit to interrupt an initiation signal (high containment pressure) to the breaker closing mechanism, permitting the breaker to reset for the next closing action.

Contacts from a latching relay in the new trip relay logic installed in series with contacts from the emergency core cooling system reset switch will latch the trip relay logic around the control switch trip contacts until the reset switch is actuated. When the trip circuit is energized and latched in, an annunciator in the control room will indicate this condition.

With this configuration, the core spray system pumps can be manually stopped when the reactor water level has returned to normal. The breaker closing signal from high containment pressure is interrupted, permitting reset of the breaker. A decrease in reactor water level will open the level auxiliary contacts in the trip logic circuit, dropping out the TDDO relays, and initiate restart of the core spray pumps in a timed sequence.

Key lock switch contacts will be connected to bypass the reactor water level auxiliary relay contacts for each pump breaker to permit tripping the pump during low reactor water level if required. The keys to the bypass switches will be administratively controlled. The key operated switch will light up with a flashing light and an annunciator alarm in the control room will be activated when the switch is in the bypass position.

The logic design uses redundant relays, switch contacts and relay contacts throughout each pump control circuit. Although not yet written, JCP&L proposes to modify the Oyster Creek technical specifications and operating procedures to cover the requirements of the proposed modification.

3.3 Evaluation

The proposed modification will provide manual trip control of the individual core spray pumps at normal reactor water level. It will also provide for automatic restart of the pumps if the reactor water level again falls below the level set point. Manual key lock switches, under administrative control, permit bypassing the low reactor level signals in the trip logic circuit and the bypass condition is annunciated. The proposed circuit is redundant throughout and will not fail due to a single failure event.[3] However, the operators should be cautioned by procedures and warning signs on the console that inadvertent pump start of the core spray pumps will occur if the ECCS reset switch is actuated while there is still an initiation signal from high containment pressure and/or Lo-Lo reactor water level present. Further, he should be cautioned that a pump cannot be started with the control switch as long as the trip circuit is latched in. With the antipump circuit in the breaker control mechanism defeated, the breaker will cycle to the closed then open position as long as the control switch handle is held in the closed position. This would result in jogging the pump.

4.0 CONCLUSIONS

Based on the criteria set forth in NUREG 0737 Section II.K.3.21, the necessity to rack out the breaker or disconnect the core spray initiation signal to permit reset of the breaker for restart of the core spray is unacceptable. The proposed modification to the core spray system at Oyster Creek Nuclear Generating Station will meet the requirements identified in Section 2 of this report. It also complies with IEEE Standard 279-1971.[3]

The technical specifications had not yet been rewritten as requested in Ref. 1, hence they could not be reviewed for adequacy.

Consideration should be given to identify to the reactor operator the capability of pump restart on logic reset and pump jogging upon attempted manual start with the trip logic not reset.

5.0 REFERENCES

1. NRC Letter, D. G. Eisenhut to all operating reactors, dated May 7, 1980.

2. NUREG 0737, "Clarification of TMI Action Plan Requirements," Nuclear Regulatory Commission, Office of Nuclear Reactor Regulations, dated October 31, 1980.

3. IEEE Standard 279-1971, "Criteria for Protection for Nuclear Power Generating Stations."

4. General Electric Elementary Diagram 718E644, Sheets 1 and 2, Revision 12, Core Spray Control; Drawings 0223R0173, Sheets 18 and 24, Revision 8, Sheets 25 and 26, Revision 11, Core Spray Pump Power Control; and Drawings 011688328 Sheets A, B, C, and D, Revision 11, Core Spray Booster Pump Power Control.

5. Letter I. R. Finfrock, JCP&L to D. G. Eisenhut NRC, Subject, "Oyster Creek Nuclear Generating Station, Docket No. 50-219, NUREG 0737," dated February 10, 1981.