

December 14, 1981

Docket No. 50-213
LS05-81-12-039

Mr. W. G. Council, Vice President
Nuclear Engineering and Operations
Connecticut Yankee Atomic Power Company
Post Office Box 270
Hartford, Connecticut 06101



Dear Mr. Council:

SUBJECT: SEP TOPIC VI-7.C.3, PWR LOOP ISOLATION VALVES POWER
AND CONTROL SYSTEM DESIGN - HADDAM NECK

Enclosure 1 is our contractor's draft technical evaluation of this topic. Enclosure 2 is the staff's draft safety evaluation report that is based on Enclosure 1. As a result of our review of our contractor's work, we have concluded that the electrical design of the valve control circuitry and the reactor protection system interface with the loop isolation valves is acceptable pending completion of SEP Topics XV-7 and XV-19.

Please inform us if your as-built facility differs from the licensing bases assumed in our assessments within 30 days of receipt of this letter. This evaluation will be a basic input to the integrated safety assessment for your facility unless you identify changes needed to reflect the as-built conditions at your facility. This topic assessment may be revised in the future if your facility design is changed or if NRC criteria relating to this topic is modified before the integrated assessment is complete or if SEP Topic XV-7 or XV-19 indicate a need to prevent spurious valve closure.

Sincerely,

Dennis M. Crutchfield, Chief
Operating Reactors Branch No. 5
Division of Licensing

Enclosure:
As stated

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UNITED STATES
NUCLEAR REGULATORY COMMISSION

WASHINGTON, D. C. 20555

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Sincerely,

for *Thomas V. Wambach*
Dennis M. Crutchfield, Chief
Operating Reactors Branch No. 5
Division of Licensing

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SYSTEMATIC EVALUATION PROGRAM
TOPIC VI-7.C.3
PWR LOOP ISOLATION VALVES
POWER AND CONTROL SYSTEM DESIGN

HADDAM NECK

Docket No. 50-213

October 1981

F. G. Farmer
EG&G Idaho, Inc.

10-19-81

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SYSTEMATIC EVALUATION PROGRAM
TOPIC VI-7.C.3
PWR LOOP ISOLATION VALVES
POWER AND CONTROL SYSTEM DESIGN

HADDAM NECK

1.0 INTRODUCTION

The objective of this review is to determine if the primary loop isolation valve power and control system is in compliance with current licensing criteria.

The specific requirements for loop isolation valve power and control system design derive from IEEE 279-1971, which states that the bypass of a protective function will be removed automatically whenever permissive conditions are not met and which also assures that a single electrical failure or operator error will not result in loss of capability of the protection system to perform its safety function.¹ The criteria are further defined in Branch Technical Position ICSB 18².

2.0 CRITERIA

Current licensing criteria from ICSB 18 are:

1. Failures in both the "fail to function" sense and the "undesirable function" sense of components in electrical systems including valves and other fluid system components should be considered in designing against a single failure, even though the valve or other fluid system component may not be called upon to function in a given safety operational sequence.
2. Where it is determined that failure of an electrical system component can cause undesired mechanical motion of a valve or other fluid system component and this motion results in loss of the system safety function, it is acceptable, in lieu of design changes that also may be acceptable, to disconnect power to the electric systems of the valve or other fluid system component. The plant Technical Specifications should include a list of all electrically-operated valves, and the

required positions of these valves, to which the requirement for removal of electric power is applied in order to satisfy the single failure criterion.

3. Electrically-operated valves that are classified as "active" valves, i.e., are required to open or close in various safety system operational sequences, but are manually-controlled, should be operated from the main control room. Such valves may not be included among those valves from which power is removed in order to meet the single failure criterion unless (a) electrical power can be restored to the valves from the main control room, (b) valve operation is not necessary for at least ten minutes following occurrence of the event requiring such operation, and (c) it is demonstrated that there is reasonable assurance that all necessary operator actions will be performed within the time shown to be adequate by the analysis. The plant Technical Specifications should include a list of the required positions of manually-controlled, electrically-operated valves and should identify those valves to which the requirement for removal of electric power is applied in order to satisfy the single failure criterion.
4. When the single failure criterion is satisfied by removal of electrical power from valves described in 2. and 3. above, these valves should have redundant position indication in the main control room and the position indication system should, itself, meet the single failure criterion.
5. The phrase, "electrically-operated valves," includes both valves operated directly by an electrical device (e.g., a motor-operated valve or a solenoid-operated valve) and those valves operated indirectly by an electrical device (e.g., an air-operated valve whose air supply is controlled by an electrical solenoid valve).

3.0 DISCUSSION AND EVALUATION

3.1 Discussion. Haddam Neck has four main coolant loops, each of which has two motor-operated loop isolation valves.³ Plant Technical Specifications require at least one loop operating above 1% power, at least three loops operating above 10% power, and all four loops operating above 65% power.⁴ The Technical Specifications do not require power to be removed from the loop isolation valves. No interlocks or administrative procedures exist to prevent inadvertent closure of loop isolation valves

during power operation. Additionally, each valve operate switch uses only a single set of contacts to initiate valve closure, and is, therefore, potentially subject to a failure which would close a valve.⁵ The steam line break detection logic will not be compromised by isolation of any loop.^{6,7}

3.2 Evaluation. The Haddam Neck loop isolation valve power and control system design includes the potential for a single failure, either human or mechanical, to cause an inadvertent loop isolation valve closure. Therefore, the design does not meet current licensing criteria.

4.0 SUMMARY

The Haddam Neck loop isolation valve power and control system design is susceptible to single failure, and thus, does not comply with current licensing criteria.

5.0 REFERENCES

1. IEEE Standard 279, "Criteria for Protection Systems for Nuclear Power Generating Stations."
2. Branch Technical Position ICSB 18, "Application of the Single Failure Criterion to Manually-Controlled Electrically-Operated Valves."
3. Haddam Neck drawing 16103-26007, Revision 11, dated 2-25-78.
4. "Technical Specifications for the Connecticut Yankee Atomic Power Company Haddam Neck Plant," Amendment 20, paragraph 3.3.C.
5. Haddam Neck drawing 16103-32112, Sheet 27, Revision 4, dated 10-22-68.
6. Letter, CYAPCo (Council) to NRR (Crutchfield), dated 7-22-81.
7. Haddam Neck drawing 16103-32011, Sheet 11C, Revision 11, dated 2-5-79.

SYSTEMATIC EVALUATION PROGRAM

TOPIC VI-7.C.3

HADDAM NECK

TOPIC VI-7.C.3: PWR LOOP ISOLATION VALVES POWER AND CONTROL SYSTEM DESIGN

I. INTRODUCTION

Haddam Neck has valves in the reactor coolant loops that can close during reactor operation. The thermal effects of steady state operation with one loop isolated is addressed in Topic IV-1.A. The purpose of Topic VI-7.C.3 is to review the effects of valve closure on the reactor protection system. The transient thermal effects of valve closure will be addressed in Topics XV-7 and XV-19.

II. REVIEW CRITERIA

The review criteria are presented in Section 2 of EG&G Report 0191J, "PWR Loop Isolation Valves Power and Control System Design."

III. RELATED SAFETY TOPICS AND INTERFACES

The scope of review for this topic was limited to avoid duplication of effort since some aspects of the review were performed under related topics. The related topics and the subject matter are identified below. Each of the related topic reports contain the criteria and review guidance for its subject matter.

V-3	Overpressurization Protection
V-10.B	RHR Reliability
VI-4	Containment Isolation
IV-1.A	N-1 Loop Operation
XV-7	Reactor Coolant Pump Seizure
XV-19	LOCA ECCS Analysis

IV. REVIEW GUIDELINES

The review guidelines are presented in Sections 7.2 and 7.3 of the Standard Review Plan.

V. EVALUATION

As noted in EG&G Report 0191J, any Haddam Neck loop isolation valve is subject to spurious closure as a result of a single failure. The reactor protection system logic is not affected by closing a loop isolation valve.

VI. CONCLUSION

The thermal consequences of loop isolation valve closure should be evaluated as part of SEP Topics XV-7 and XV-19.