

October 16, 1981

Docket No. 50-255
LS05-81-10-026



Mr. David P. Hoffman
Nuclear Licensing Administrator
Consumers Power Company
1945 W. Parnall Road
Jackson, Michigan 49201

Dear Mr. Hoffman:

SUBJECT: SEP TOPIC IV-2, REACTIVITY CONTROL SYSTEMS - PALISADES
NUCLEAR POWER PLANT

Enclosed is a copy of our evaluation of SEP Topic IV-2, Reactivity Control Systems for Palisades. This assessment compares your facility, as described in Docket No. 50-255, with the criteria currently used by the regulatory staff for licensing new facilities. Please inform us if your as-built facility differs from the licensing basis assumed in our assessment.

Your response within 30 days of the date you receive this letter is requested. If no response is received within that time, we will assume that you have no comments or correction. 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 assessment may be revised in the future if your facility design is changed or if NRC criteria relating to this subject are modified before the integrated assessment is completed.

In future correspondence regarding this topic, please refer to the topic number in your cover letter.

Sincerely,

Dennis M. Crutchfield, Chief
Operating Reactors Branch #5
Division of Licensing

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ADD:
T. MICHAELS*

Enclosure:
As stated

cc w/enclosure:
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SAFETY EVALUATION REPORT
SEP TOPIC IV-2, REACTIVITY CONTROL SYSTEMS
INCLUDING FUNCTIONAL DESIGN AND
PROTECTION AGAINST SINGLE FAILURES
PALISADES NUCLEAR POWER PLANT
DOCKET NO. 50-255

I. INTRODUCTION

The purpose of this evaluation is to insure that the design basis for the Palisades reactivity control systems is consistent with analyses performed to verify that the protection system meets General Design Criterion 25. General Design Criterion 25 requires that the reactor protection system be designed to assure that specified acceptable fuel design limits are not exceeded for any single malfunction of the reactivity control systems, such as accidental withdrawal of control rods. Reactivity control systems need not be single failure proof. However, the protection system must be capable of assuring that acceptable fuel design limits are not exceeded in the event of a single failure in the reactivity control systems. The review criterion, covered in this evaluation, is addressed in Section II. Review areas that are not covered, but are related and essential to the completion of this topic, are covered by other SEP topics addressed in Section III. The scope of the SEP topics is defined in the "Report on the Systematic Evaluation of Operating Facilities" dated November 25, 1977.

This report is limited to the identification of inadvertent control rod withdrawals and malpositioning of control rods which may occur as a result of single failure in the electrical circuits of the control rod system.

II. REVIEW CRITERION

The review criterion for this topic is based upon Section 7.7, Part II of the NRC Standard Review Plan. In the specific case of the reactivity control systems a single failure shall not cause plant conditions more severe than those for which the reactor protection system is designed.

III. RELATED SAFETY TOPICS

The following listed review areas are not covered in this report, but are related and essential to the completion of this topic. These review areas are covered by other SEP topics as indicated below.

1. Analyses of the consequences of control rod withdrawals and the malpositioning of control rods which may occur as a result of single failures in the electrical circuits of the reactivity control systems are covered by SEP Topic XV-8, "Control Rod Misoperation (System Malfunction or Operator Error)"
2. Analyses of reactivity insertions occurring as a result of inadvertent boron dilutions are covered in SEP Topic XV-10, "Chemical and Volume Control System Malfunction that Results in a Decrease in Boron Concentration in the Reactor Coolant."

IV. REVIEW GUIDELINES

The purpose of this evaluation is to identify inadvertent control rod withdrawals and malpositioning of control rods which may occur as a result of single failures in the electrical circuits of the control rod system for the Palisades Nuclear Power Plant.

V. EVALUATION

Information was provided in Consumers Power Company letter dated July 31, 1981, describing design features which limit control rod withdrawals and malpositioning of control rods caused by failures within the control rod system at the Palisades Nuclear Power Plant.

Based upon an audit review of the information provided by the licensee, we conclude that the following may occur as a result of single failures:

- 1) Any rod or group of rods may be inadvertently withdrawn or inserted until the plant trips. (Shutdown rods must be withdrawn for a group of regulating rods to be moved).
- 2) Regulating rods may be inadvertently withdrawn or inserted in sequence until the plant trips. (Shutdown rods must be withdrawn).
- 3) A rod or group of rods cannot be withdrawn or inserted when commanded to be withdrawn or inserted.
- 4) In AUTO, the regulating rod sequence (multiple rod motions) may be activated when an individual rod is moved manually. (Movement continues until manual control switch is released or plant trips).
- 5) Two rods in different groups, a rod and part length group, or a rod and a group may be withdrawn or inserted when a rod is manually withdrawn or inserted. (Movement continues until manual control switch is released or plant trips).
- 6) Two rods in same group, all part length rods or an entire group move when an individual rod in that group is moved manually. (Movement continues until manual control switch is released or plant trips).
- 7) A rod does not move when its group moves.
- 8) Two groups of rods may move instead of one group of rods.
- 9) Regulating rods may be controlled automatically when under manual control.

- 10) A shutdown rod may exceed exercise limits with regulating rods withdrawn.
- 11) A rod may drift into core.
- 12) A rod or rods may drop into core.

The evaluation of rod motion is based upon the availability of interlock circuits associated with the rod control system such that certain consequential effects of single failures within the rod control system are precluded by the operability of these interlocks. The basis for the assumption that these interlocks will be operable is that a failure in the interlock circuits will be identified and corrected during routine maintenance or as a result of system fault investigation. The effects of single failures occurring after an undetected failure has occurred in the interlock system are not included in the evaluation. This is consistent with the basis used for plants currently under operating license review.

The 12 types of control rod misoperation can be characterized as rod insertion or withdrawal of one or more rods or group of rods (full or part-length). SEP Topic XV-8 considered the effects of rod withdrawals and rod drops of full length rods. The range of reactivity worths analyzed bounds the potential reactivity changes from the single failures of full length rods described above. The staff concluded in Topic XV-8 that current criteria were satisfied for these events.

Since part-length rods are no longer used for reactor control, topic XV-8 did not specifically address any malfunctions associated with them.

The evaluation of Topic IV-2, however identified single failures that could cause one or more part-length rods to be inserted into the reactor. (Withdrawal would not be of concern since the rods are positioned above the core.)

Accordingly, the staff evaluated the effects on the reactor of insertion of part-length rods. The part-length control rod design is presented in Section 3.3 of the FSAR. The effects of malpositioning these rods is described in Section 14.6 of the FSAR. The part-length rods are similar in design to the full length rods over the first quarter of the rod length, therefore the effects of inserting a part-length rod will be comparable to inserting a full length rod until the non-poison area of the rod enters the core. Insertion of one or more part-length rods would tend to cause an overall power reduction with local changes in power peaking. The rod drop analysis has demonstrated that the protection system can accommodate these effects.

A core power reduction without a corresponding change in turbine demand would drop the cold leg temperature. The operator would also have individual-to-group deviation alarms available if some part-length rods move, and rod position indications. The upper and lower sections of the ex-core nuclear detectors provide additional information concerning axial flux distribution to the operator. Thus there is reasonable assurance that part-length rod malfunctions (rod drop, undetected malpositioning) would not cause an event that would exceed fuel damage limits.

VI. CONCLUSION

The staff has reviewed the reactivity control systems to identify control rod misoperation that may occur as a result of a single failure. We conclude that the licensee has adequately assessed the effects of such failures and that with respect to this topic, the Palisades plant design meets applicable criteria.