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SUBJECT: Forwards justification for monthly rod block monitor surveillance in support of 840530 application for amend to License DPR-22. Probability of single rod withdrawal error acceptably low, per GE evaluation.

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Director  
Office of Nuclear Reactor Regulation  
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Washington, DC 20555

MONTICELLO NUCLEAR GENERATING PLANT  
Docket No. 50-263 License No. DPR-22

Supplemental Information Related to License  
Amendment Request Dated May 30, 1984  
ARTS

The NRC Staff has raised concerns about the proposed surveillance frequency of the Rod Block Monitor (RBM) as a result of their review of the May 30, 1984 License Amendment Request.

We will administratively ensure that the RBM is functionally tested monthly. Over the past 13 years the RBM system has proven to be very reliable. Only one significant failure has occurred. And in that case the system failed in the safe direction causing a rod block. The next License Amendment Request will contain a request to change the RBM surveillance from the 1-to-3-months proposed in the May 30, 1984 submittal to monthly.

General Electric has prepared an evaluation of the probability of a single Rod Withdrawal Error (RWE) causing a safety limit violation and found the probability acceptably low, assuming monthly RBM surveillance(see attachment).

  
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Attachment

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ATTACHMENT 1

JUSTIFICATION FOR MONTHLY  
ROD BLOCK MONITOR SURVEILLANCE AT MONTICELLO  
IN SUPPORT OF ARTS TECHNICAL SPECIFICATION REVISIONS

Introduction:

An estimate is made of the safety related significance of monthly Rod Block Monitor (RBM) surveillance intervals at Monticello. The figure of merit used to demonstrate the adequacy of monthly surveillance is the probability of occurrence of a Rod Withdrawal Error (RWE) which results in a violation of the MCPR safety limit,  $P_{VIOL}$ , when the RBM is required to be operable per Technical Specifications. Under ARTS the RBM is required to be operable when the plant is operating on a limiting rod pattern -- a pattern from which the complete (unblocked) withdrawal of any single control rod could violate the MCPR safety limit. ARTS provides a conservative definition of such a pattern: limiting rod pattern exists when MCPR performance is below 1.40 and thermal power is above 90% of rated, and when MCPR is below 1.70 and thermal power is below 90% of rated.

Conclusion:

The probability of a single unblocked RWE at Monticello (even without RBM) resulting in a MCPR safety limit violation is approximately  $10^{-5}$ /year because of the inherent thermal margins in the plant design. In addition, typical plant MCPR technical specifications require that large thermal margins (relative to RWE transient requirements) be maintained to mitigate other pressurization events. A review of eight years of Monticello operation (cycles 5 to 10) did not identify any instance in which the plant operated for a significant period (based on incremental exposure accumulation date reported to General Electric) on a RWE limiting rod pattern. Operation with the RBM system with monthly surveillance is expected to reduce the single RWE-related MCPR safety limit violation probability to  $<10^{-6}$ /year. As this probability is extremely small, monthly surveillance on the RBM at Monticello is judged acceptable.

Evaluation:

The probability of a single RWE caused safety limit violation is approximated by the equation,

$$P_{VIOL} \cong P_{OL} \cdot P_{RWE} \cdot P_{SLV} \cdot P_{R1F} \cdot P_{R2F} \quad (E-1)$$

Where:

- $P_{VIOL}$  = probability of safety limit violation
- $P_{OL}$  = probability of being in a RWE limiting rod pattern
- $P_{RWE}$  = probability of a RWE event
- $P_{SLV}$  = probability of a safety limit violation during an unblocked RWE initiated from approximately the limiting rod pattern defining MCPR.
- $P_{R1F}, P_{R2F}$  = probability of RBM channel 1, 2, respectively, failing in a manner that allows greater rod withdrawal than a fully functional channel.

The probability of a single RWE caused safety limit violation at Monticello without an RBM system (fully disabled 100% of operating time) is therefore:

$$P_{\text{VIOL}}(\text{No RBM}) \cong P_{\text{OL}} \cdot P_{\text{RWE}} \cdot P_{\text{SLV}} \quad (\text{E-2})$$

A review of Monticello exposure accounting data maintained by General Electric for the operating period July 1976 to June 1984 did not identify any instance in which the plant was believed to be operating on a RWE limiting rod pattern. This period spanned operating cycles 5 to 10. The lowest process computer recorded value for MCPR above 90% power was 1.46. Based on this data, the frequency of being on a limiting rod pattern at Monticello is conservatively estimated at 1% (or  $10^{-2}$  at any random time).

The frequency of occurrence of a RWE event,  $P_{\text{RWE}}$ , is estimated conservatively by GE to be  $10^{-1}$ /year: per ARTS results used to define the RWE limiting rod pattern MCPR definitions, the probability of violating the MCPR safety limit,  $P_{\text{SLV}}$ , from near the limiting initial MCPR is approximately  $10^{-2}$  for an unblocked RWE. Therefore, per equation (E-2), the probability of a safety limit violation even without an RBM system (anytime) is very small:

$$P_{\text{VIOL}}(\text{No RBM}) \cong (10^{-2}) (10^{-1})/\text{yr} (10^{-2})$$

$$P_{\text{VIOL}}(\text{No RBM}) \cong 10^{-5}/\text{yr}$$

In addition, there has been no known instance in the many years of BWR operation wherein both channels of RBM simultaneously failed in a manner that would allow unrestricted control rod withdrawal. Nevertheless, recognizing that detailed RBM reliability assessment has not been performed, it is conservatively estimated that with monthly surveillance the failure probability of each RBM does not exceed 30% such that the probability of both channels simultaneously failing,  $P_{\text{R1F}} \cdot P_{\text{R2F}}$ , is less than  $10^{-1}$ .

Then, per equation E-1, the probability of a single RWE event violating the safety limit MCPR when using monthly RBM surveillance is estimated at  $10^{-6}$ /year. This probability is judged acceptable in relation to the potential limited event consequences and the insignificant improvement expected with more frequent surveillance, of protection provided on other plants with less thermal margin, and the likelihood of multiple control rod withdrawal errors whose low expected frequency and consequence excludes them explicit consideration in the licensing process.