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MASTER

ANALYSIS OF INADVERTENT OPENING OF PRIMARY
MOTOR/GENERATOR SET GENERATOR FIELD BREAKERS

C. J. Naretto

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RELIABILITY AND STATISTICS
BRANCH

TECHNICAL REPORT

ANALYSIS OF INADVERTENT OPENING OF PRIMARY
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-ENGINEERING ANALYSIS DIVISION-

IDAHO NATIONAL ENGINEERING LABORATORY

LOFT TECHNICAL REPORT

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Abstract

A subjective analysis was made to determine the probability the PSMG generator field breakers would be opened by inadvertent operator action.

1.0 Discussion

An attempt has been made to determine the probability that a control room operator would inadvertently open the PSMG's field breakers thus negating the primary coolant pumps coastdown capability.

The quantification of the probability of a particular action by an individual is a matter of judgment. To quote from the Reactor Safety Study, Appendix III, Section 6.1, "Because the total available data on the whole are somewhat meager, human reliability analysis as applied to nuclear power plants is still somewhat subjective".

In the course of this study, a visit was made to the facility control room in order to view first-hand the panel containing the PSMG field breakers as well as meet with operating personnel (the control panel is depicted in LOFT photograph 74-1706).

From discussions with control room personnel, review of operating procedures with technical support personnel, physical layout of the panel in question, and reading a portion of the Reactor Safety Study, it appears that the inadvertent opening of the four PSMG field breakers is a very low probability event for the following reasons:

1. The PSMG field breaker switches are well defined and isolated from other controls on a separate panel. The potential for their being mistaken for other switches seems quite low.
2. During normal nuclear operations, there is no need for the operator to be in the vicinity of the subject panel except to make pump speed adjustments. The pump speed controls are approximately a foot-and-a-half above the PSMG field switches and are completely different in appearance and function (a small thumb wheel as opposed to a large L-shaped handle). Mistaking one for the other seems highly improbable.

3. Normal control room procedures call for the manipulation of the PSMG field breaker switches to be accomplished only upon specific instructions from the shift supervisor. This eliminates potential errors of decision on the part of the operator.
4. If, in spite of the above, the operator opens any one field breaker, a visual and an audible alarm will be activated. This should lessen the likelihood that he would open the three remaining field breakers.

2.0 Conclusions

In view of the control panel design, applicable administrative controls and procedures, and the alarm system incorporated it appears that the opening of all four PSMG set generator field breaker switches by inadvertent operator action is a limited fault (extremely unlikely event). As to quantifying the probability of such an event, Appendix III, Section 6.1 of the Reactor Safety Study states in part "...specialists in this field (i.e. human reliability analysis) view with skepticism any task error rate less than 10^{-5} for any but the simplest human acts".

3.0 Assumptions and Ground Rules

1. No attempt was made to account for the actions of saboteurs and/or deranged individuals whose purpose is the deliberate disruption of plant operations.
2. It is assumed that the control room operators have a clear understanding of normal reactor operations.
3. It is assumed that operators actions vis-a-vis the field breakers switches are under a shift supervisors direct control.
4. It is assumed the indicator lights on the panel above the switches are working.
5. The analysis concerns only faults initiated by overt operator action. Faults initiated by electrical or mechanical malfunctions are not considered.
6. A normal control room situation is assumed to exist with the reactor operating normally at power (i.e. the stress level to which the operators are subjected is sufficient to keep them alert, but not so high as to be deleterious to performance).
7. It is assumed the PSMG room is unmanned during normal reactor operation which would preclude the opening of the field breakers in that room by operator error.