SAFETY EVALUATION

SE 96-0022 Rev 0

PART 1: DESCRIPTION OF CHANGE (Preparer)

A) Document Identification	B) Revision if Approved	C) PIS Number
TMR 96-0003	0	C1102D0162 (CRD 34-31)

D) Description of Change:
Temporary removal of input signal to the "CONTROL ROD OVERTRAVEL " alarm window 3D105 from Control Rod Drive 34-31 Position Indication Probe. (continued on page 2)

E) List of affected/reviewed UFSAR/TS sections: 4.5.2.2, Figures 4.5-11 through -14, 7.7.1.1.5.2, Table 7.7-1, Figure 7.7-1, sh. 1, 15.4.9/ 3.1.3.2, 3.1.3.6, 3.1.3.7.

F) List any associated license change requests (LCRs): N/A

PART 2: SAFETY EVALUATION (Preparer)

A) Will the proposed change:

Yes	No		
☐	☑	1.	Increase the probability or the consequences of an accident previously evaluated in the UFSAR?
☐	☑	2.	Increase the probability or the consequences of a malfunction of equipment important to safety previously evaluated in the UFSAR?
☐	☑	3.	Create the possibility of an accident of a different type than any previously evaluated in the UFSAR?
☐	☑	4.	Create the possibility of equipment malfunction of a different type than any previously evaluated in the UFSAR?
☐	☑	5.	Reduce the margin of safety as defined in the bases for any technical specification?

Provide the basis for each answer individually on a Continuation Sheet.

B) Unreviewed safety question? Answer "Yes" if any of the above boxes are checked "Yes."

☐ Yes ☑ No

C) Prepared by A. Klemptner *A Klemptner* Date 03/12/96

PART 3: REVIEW AND APPROVAL (Rvwr/Appvr/OSRO)

A) Reviewed by *[signature]* Date 3-12-96

B) Approved by *[signature]* Date 3-13-96

C) OSRO Chairman *[signature]* Date 3/13/96

NOTE: If an unreviewed safety question is involved, and/or the proposed activity leads to the need for a change in the Operating License, Technical Specifications, or Environmental Protection Plan, consult Nuclear Licensing.

DTC: TPMMLS DSN: MLS07003 Rev. 0 P1/1 File: 1703.22 Date: 082595 Recip:_____
DTC: VSSERC DSN: _____ File: 0923 IP: I

The purpose of this Safety Evaluation is to perform a 10 CFR50.59 review of a temporary modification TMR 96-0003, Rev. 0. This TMR will temporarily defeat the rod overtravel alarm function for Control Rod Drive (CRD) 34-31 Position Indication Probe (PIP).

PROBLEM DESCRIPTION:

DER 96-0155 was initiated on February 14, 1996 in response to an unexpected actuation of alarm annunciator window 3D105, "CONTROL ROD OVERTRAVEL". The position of every control rod in the core is continuously sensed by an associated position indication probe (PIP) and displayed in the full-core and 4-rod group indicators at Control Room Panel H11P603. The position indication actuation device is a magnetically coupled reed switch. A column of these switches is mounted on the probe structure of the CRD unit. As the control drive moves, the magnet located in the base of the CRD drive piston causes individual reed switches to close. Reed switches are numbered sequentially from 00 (fully inserted rod) to 48 (fully withdrawn rod). If the control rod in the full-out position (position 48) becomes uncoupled from its drive mechanism, the CRD will drift or may withdraw to activate the overtravel alarm. The overtravel of any CRD is indicated by a common annunciator alarm Window 3D105. The generation of an alarm signal is an indication of a potential fault in the PIP circuitry, if none of the rods are selected or moving. Any ground on the input pins of the grouping terminal cards that assemble the CRD overtravel signals from the PIPs would cause this indication. TMR 96-0003 was prepared to isolate a faulty rod overtravel input signal from CRD 34-31 PIP into the common alarm circuit.

EXISTING DESIGN:

Rod Position Information System (RPIS) provides control rod position information to visual displays used by the reactor operators to monitor the rod movements. Each CRD is equipped with a position indicator probe fitted with glass-enclosed reed switches. The switches are actuated by a ring magnet located at a bottom of the drive piston (see UFSAR, Figure 4.5-14). One switch is located at each position corresponding to an index tube groove, thus allowing indication at each latching point. An additional switch is located at each midpoint between latching points to indicate the intermediate positions during drive motions and is used to indicate rod drift. A drifting rod is indicated by an alarm and red light in the main control room.

One additional switch (an overtravel switch) is located at a position below the normal full-out position (Position 48). If the rod drive piston moves to overtravel position, an alarm is sounded in the main control room. The overtravel alarm is one of the several ways to verify that the drive-to-rod coupling is intact because the drive cannot be physically withdrawn to the overtravel position when the control rod is coupled to its drive. Coupling integrity can be checked by attempting to withdraw the drive to the overtravel position.

RPIS provides two kinds of visual displays at the Control Room Panel (COP) H11P603: full-core and 4-rod group display.

The full-core display includes a group of status indicators for each rod in the core. The following information for each control rod is presented in the display: Rod fully inserted (green), Rod fully withdrawn (red), Rod identification (coordinate position, white), Accumulator trouble (amber), Rod scram (blue), and Rod drift (red).

The 4-rod group display shows the position of any one operator-selected rod plus the positions of several adjacent rods. Position is shown as a two-digit decimal number valued from 00 (rod full-in) and 48 (rod full-out). A white light indicates which of the four rods in the group is selected for movement.

The position signals of selected control rods, together with a rod identification signal, are provided as inputs to the on-line process computer and the Rod Worth Minimizer (RWM). The computer can, on demand, provide a full core printout of control rod positions.

PROPOSED CHANGE:

TMR 96-0003, Rev. 0 will temporarily defeat the rod overtravel alarm function for CRD 34-31. This work will be performed in the Relay Room Panel H11P615 by disconnecting Pin "X" in the multi-conductor receptacle J1X125 of plug-connected cable 233271-OK. This temporary modification will remove one input to the overtravel alarm circuit to facilitate the performance of surveillance procedures in the presence of a faulty sustained overtravel alarm signal from CRD 34-31.

The overtravel indication is used to determine control rod's coupling status during periodic surveillances and while monitoring rod position information during normal plant operation.

Periodic surveillances test the coupling of the rods by attempting to withdraw the rod drive beyond the 48 and Full-out position in compliance with the Technical Specifications (TS) 4.1.3.6 requirements. The current procedure verifies that control rod settled back to position 48 and annunciation window 3D105, CONTROL ROD OVERTRAVEL is clear.

The behavior of the 48, Full-out, and overtravel indications may all be used to reach and verify a conclusion regarding the coupling integrity of the control rods, since they are sensed by the switches of the same type and by a similar electronic process. An uncoupled rod would be indicated by (a) activation of the overtravel alarm, (b) loss(blanking) of the position 48 display, and (c) de-energization of Full-out light, and (d) activation of the rod drift alarm.. Consequently, an alternate method to determine rod coupling integrity during surveillance testing and normal plant operation has been specified by General Electric (GE) via a letter GE-NE-C1100256-13, Rev. 1. The alternate method takes credit for the operability of the control rod 48 position and Full-out rod position indication to confirm that CRD 34-31 is coupled.

Review of CRDs corrective maintenance activities, and DER data base information did not identify any uncoupling events in the past associated specifically with CRD 34-31. Reactor Engineering's "PIP Malfunctions Tracking Log" does not show any malfunctions associated with CRD 34-31 after it was replaced in Forced Outage 95-02 (Work Request 000Z952306) other than an overtravel alarm..

To support conclusions of this Safety Evaluation, the following administrative measures should be incorporated into the TMR 96-0003 implemention plan :

1. Second licensed operator or other technically qualified person is present at the COP H11P603 to observe rod position indication whenever a planned CRD 34-31 coupling integrity check is to be performed, and
2. CRD 34-31 is declared INOPERABLE if a malfunctioning of control rod 48 position indication, Full-out rod position indication, or Rod Drift alarm is detected at position 48.

DESIGN BASE CRITERIA:

The RPIS is part of the Reactor Manual Control System (RMCS). The RPIS electronically processes data from the CRD assembly position and indicator probe, and distributes the processed data to operators displays, annunciators, the process computer, and the RWM. The RPIS is part of a power generation system and is not classified as safety related. The design basis for the RPIS is to provide the means for reactor operators to determine control rod position, and provide an indication of the CRD drift and overtravel.

The RPIS complies with the requirements of the 10CFR50, Appendix A, General Design Criteria (GDC) 13 (Instrumentation & Control), where the instrumentation is required to be provided to monitor and control variables that can affect the fission process within reactor core over their anticipated ranges for normal operation, and for anticipated operational occurrences.

DESIGN BASE CRITERIA MET:

The RPIS provides the means to determine the OPERABILITY of an individual control rod based on a combination of factors, primarily, scram insertion times, the control rod coupling integrity, and the ability to determine the control rod position. Control rod position may be determined by the use of operable position indicators, or by moving control rods to a position with an operable indicator. Coupling verification is performed to ensure the control rod is connected to the CRD mechanism and will perform its intended function when necessary. The overtravel position feature provides a positive check on the coupling integrity, since only an uncoupled rod can reach the overtravel position. The overtravel position feature will not be impacted by TMR 96-0003, since indicators other than overtravel alarm are still available to the operator, i.e.

(a) loss(blanking) of the position 48 display,
(b) de-energization of full-out light, and
(c) activation of rod drift alarm, for determination of CRD 34-31 coupling integrity.

FOR: TIM COLBURN

FROM: FERM RESIDENT OFFICE

SAFETY EVALUATION CONTINUATION SHEET

UNREVIEWED SAFETY QUESTION DETERMINATION

1. Will the proposed change increase the probability or the consequences of an accident previously evaluated in the UFSAR?

No. Accidents are defined as hypothesized events that effect one or more of radioactive material barriers and which are not expected during the course of plant operations. The most severe accident associated with the control rods is Control Rod Drop Accident (CRDA) described in UFSAR, Section 15.4.9.

The CRDA results from a stuck control rod dropping out of the core after becoming disconnected from its drive, and after the drive has been fully withdrawn. The control rod drop accident (CRDA) is the result of a postulated event in which a high worth control rod is inserted out-of-sequence into the core. Subsequently, it becomes decoupled from its drive mechanism. The mechanism is withdrawn, but the uncoupled control rod is assumed to be stuck in place. At a later optimum moment, the control rod suddenly falls free and drops out of the core. This action results in the removal of large negative reactivity from the core, which in turn results in a localized power excursion.

To limit the worth of the rod that would be dropped in a BPWS operating mode, the RWM is used below the low power setpoint to enforce the banked position withdrawal sequence (BPWS). The RWM is programmed to follow the BPWS. For BPWS, the effective withdrawal is in the form of (stepped) defined bank patterns.

Control rod coupling integrity is required to ensure compliance with the analysis of the CRDA in the UFSAR. The temporary loss of overtravel alarm signal for CRD 34-31 will have no impact on operator's ability to determine the coupling integrity of CRD 34-31, because other alternate indications remain available to the operator to determine the coupling integrity at all reactor levels.

Therefore, the probability or the consequences of an accident previously evaluated in the UFSAR and the radioactivity release dose to on-site or off-site personnel will not be increased.

2. Will the proposed change increase the probability or the consequences of a malfunction of equipment important to safety previously evaluated in the UFSAR?

The RPIS, together with other rod control systems, is used to limit the worth of any single control rod to mitigate the effects of the postulated CRDA or any rod withdrawal error. The RPIS displays and annunciators provide reactivity indication and, therefore, are important to the operators for mitigation of the consequences of the Anticipated Operating Occurrences (AOO).

AOOs that have been evaluated in this category are control rod withdrawal errors analyzed in the UFSAR, Sections 15.4.1 and 15.4.2. Operator's actions are not required , but expected, during these events. The RPIS is not important for the Design Basis Accident (DBA)events analyzed in the UFSAR, Sections 6.3, 15.6 and 15.8 in which the automatic actions occur.

The implementation of TMR 96-0003 will not change the information used by the operators to determine control rod OPERABILITY, e.g. scram insertion times, the control rod coupling integrity, and the ability to determine the control rod position. In fact, this TMR will allow operators to use the existing RPIS design features, i.e. overtravel alarm, for its intended application, that is for determining all control rod coupling integrity in the presence of a faulty CRD 34-31 overtravel alarm input.

Therefore, the proposed change will not increase the probability or the consequences of a malfunction of equipment important to safety previously evaluated in the UFSAR.

3. Will the proposed change create the possibility of an accident of a different type than any previously evaluated in the UFSAR?

No. TMR 96-0003 will restore the operability of the common overtravel alarm annunciator. The overtravel position feature provides a positive check on the rod coupling integrity, since only an uncoupled rod can reach the overtravel position. Control rod uncoupling integrity is required to ensure compliance with analysis of the CRDA in the UFSAR, Section 15.4.9, which is the limiting design basis reactivity insertion event analyzed in the UFSAR. The proposed TMR clears the overtravel alarm circuit for the other 184 CRDs in the presence of the faulty alarm signal from CRD 34-31. The alternate method is available to make a definite determination regarding CRD 34-31 coupling status and take appropriate actions to operate with the uncoupled control rod within the constraints of the TS 3.1.3.1 requirements.

Therefore, the proposed change will not create the possibility of an accident of a different type than any previously evaluated in the UFSAR.

4. Will the proposed change create the possibility of equipment malfunction of a different type than any previously evaluated in the UFSAR?

No. As stated above, the design bases of the plant in terms of the potential for CDRA assume a worst single operator error in the control rod withdrawal sequence. In the power range, it is defined as a selection and full withdrawal of the maximum worth control rod. This could result in the potentially high reactivity addition if the specific control rod involved is uncoupled, stuck fully inserted, and, subsequently, falls to full-out position.

The implementation of TMR 96-0003 will not impact the operator's ability to make a definite determination for each rod that it is actually coupled. Moreover, the use of a second operator enhances continuous monitoring of the CRD 34-31 position indication. This operational administrative diversity ensures compliance with safe operation procedures and TS's requirements.

Therefore, the proposed change will not create the possibility of equipment malfunction of a different type than any previously evaluated in the UFSAR.

5. Will the proposed change reduce the margin of safety as defined in the bases for any technical specification?

No. The margin of safety associated with the CRDA is defined in the bases for the TS 3/4.1.4, Control Rod Program Controls in terms of peak fuel enthalpy. Damage to the fuel from the CRDA depends on the amount of energy generated within the fuel rods as a result of the rod drop. The specific energy design limit is 280 cal/gm in the event of CRDA. Surveillance requirements of control rod coupling integrity specified in the TS 4.1.3.6 ensure compliance with the analysis of a CRDA.

The Bases for the TS 3/4.1.3 stipulate that a rod is considered to be uncoupled if it reaches the overtravel position. This feature provides the positive means for determining that a rod is properly coupled. The implementation of TMR 96-0003 will not change the overtravel position feature, in fact, TMR 96-0003 will restore the operability of the common CRD overtravel alarm annunciator window 3D105.This design feature is described in the UFSAR, Section 7.7.1.1.5.2, Operator Information. CRD 34-31 coupling integrity will be temporarily determined using the alternate method during surveillance testing and normal plant operation that has been specified by General Electric (GE). This method takes credit for the operability of the control rod 48 position and Full-out rod position indication to confirm that CRD 34-31 is coupled.

Therefore, the proposed change will not reduce the margin of safety as defined in the bases for any technical specification, UFSAR or Safety Evaluation Report (SER) sections.

An unreviewed safety question does not exist based on the analysis and evaluation above.

MHL96028

March 6, 1996

To: Dan Mesaros

From: Martin H. Lim

Subject: ALTERNATE DETERMINATION OF CRD OVERTRAVEL INDICATION, GE-NE-C1100256-13, Revision 1

Dan,

Per your request, please find attached a final copy of revision 1 of a letter report, GE-NE-C1100256-13 as prepared by GE Nuclear Energy Principle Engineer, Vern Martin.

If I can provide you with any additional information, please do not hesitate to call.

Sincerely,

Martin H. Lim
GE Site Service Manager

cc: T. Dong
W. Miller
J. Thorson
A. Klemptner
D. Ockerman

(expected) behavior of the 48 and Full Out indications. The uncoupling test is incorporated into the normal rod exercise surveillance which inserts a fully withdrawn rod to 46 and then withdraws it back to 48. Proper operation of the numeric indication and the Full Out indication should be verified during this change of rod position. If the 48 and Full Out indication are verified to be operative, then both indications together may be used to confirm the rod is coupled.

Continuous Monitoring:

An uncoupled control rod may also be detected at other times when the rod is not being subjected to a surveillance to determine its coupling status. Assuming an uncoupled rod's index tube would settle to the overtravel position, an uncoupled rod would be indicated by the following:

1. Activation of the overtravel annunciator
2. Loss of (blanking of) the position 48 display
3. De-energization of the Full Out light
4. Activation of the rod drift alarm

If the overtravel indication is inoperative, three indications remain available to the operator. The rod drift alarm also serves to draw attention to the event as soon as it occurs much the same way the overtravel annunciator would. The drift alarm could occur because of conditions other than rod uncoupling. In the event a drift alarm did occur and the coupling integrity of the rod became in doubt, the operative rod position indications in combination with the surveillance activities described above provide a means of determining the rod's coupling status.

As stated above, the behavior of the 48, Full Out, and overtravel indications may all be used to reach and verify a determination regarding the coupling status of the control rod. The ability to verify the rod's coupling status is important because of the potential severity of the control rod drop event. Multiple indication failures compromise the ability to reliably verify the coupling status. Control rods whose coupling status cannot be determined should be treated as uncoupled in accordance with the plant technical specifications.

As an example, a control rod with a malfunctioning overtravel indication verified to be coupled by the method outlined in this letter and with no history of becoming uncoupled could be treated as coupled at all reactor power levels with no additional precautions or special considerations regarding its coupling status. This is because the operative position indications provide verified evidence of coupling, provide evidence that the malfunction is strictly an indication malfunction as opposed to an actual uncoupling, and the control rod's history give no reason to believe that an uncoupling has occurred or is likely to occur.

This letter provides a basis to continue use of a control rod with a malfunctioning overtravel indication. Because of the reduction of multiple methods to determine a rod's coupling status, the methods described in this letter of using alternate indications to determine a rod's coupling status should be applied on a case-by-case basis. As indicated in the above example, the

prudent action for a rod with a history of uncoupling which also has degraded indications used to identify an uncoupled condition may be to declare it inoperative even if the methods of this letter indicate it is coupled. Multiple rods with degraded position indications may require a more conservative response which, in turn, may be dependent on their mutual proximity as in cases of rod inoperability. Similarly, a single rod with multiple position indication failures may demand a more conservative response because of the compromised ability to verify a rod's status. These multiple failure conditions are beyond the scope of this letter.

Prepared by: Vernon E. Martin,
Principal Engineer

Verified by: Ed Gibo,
Principal Engineer

Approved by: Robert L. Hawk,
Electronic Systems
Mission Manager

CONTROL ROD DRIVE COUPLING

LIMITING CONDITION FOR OPERATION

3.1.3.6 All control rods shall be coupled to their drive mechanisms.

APPLICABILITY: OPERATIONAL CONDITIONS 1, 2, and 5*.

ACTION:

a. In OPERATIONAL CONDITION 1 and 2 with one control rod not coupled to its associated drive mechanism, within 2 hours:

   1. If permitted by the RWM, insert the control rod drive mechanism to accomplish recoupling and verify recoupling by withdrawing the control rod, and:

      a) Observing any indicated response of the nuclear instrumentation, and
      b) Demonstrating that the control rod will not go to the overtravel position.

   2. If recoupling is not accomplished on the first attempt or, if not permitted by the RWM, then until permitted by the RWM, declare the control rod inoperable, insert the control rod and disarm the associated directional control valves** either:

      a) Electrically, or
      b) Hydraulically by closing the drive water and exhaust water isolation valves.

   Otherwise, be in at least HOT SHUTDOWN within the next 12 hours.

b. In OPERATIONAL CONDITION 5* with a withdrawn control rod not coupled to its associated drive mechanism, within 2 hours either:

   1. Insert the control rod to accomplish recoupling and verify recoupling by withdrawing the control rod and demonstrating that the control rod will not go to the overtravel position, or

   2. If recoupling is not accomplished, insert the control rod and disarm the associated directional control valves** either:

      a) Electrically, or
      b) Hydraulically by closing the drive water and exhaust water isolation valves.

*At least each withdrawn control rod. Not applicable to control rods removed per Specification 3.9.10.1 or 3.9.10.2.

**May be rearmed intermittently, under administrative control, to permit testing associated with restoring the control rod to OPERABLE status.

SURVEILLANCE REQUIREMENTS -

4.1.3.6 Each affected control rod shall be demonstrated to be coupled to its drive mechanism by observing any indicated response of the nuclear instrumentation while withdrawing the control rod to the fully withdrawn position and then verifying that the control rod drive does not go to the overtravel position:

a. Prior to reactor criticality after completing CORE ALTERATIONS that could have affected the control rod drive coupling integrity,

b. Anytime the control rod is withdrawn to the "Full out" position in subsequent operation, and

c. Following maintenance on or modification to the control rod or control rod drive system which could have affected the control rod drive coupling integrity.