MAR 16 1983

Docket No. 50-263

Mr. D. M. Musolf
Nuclear Support Services Department
Northern States Power Company
414 Nicollet Mall - 8th Floor
Minneapolis, Minnesota 55401

Dear Mr. Musolf:

SUBJECT: NUREG-0737, ITEM II.K.3.13, "RCIC AUTOMATIC RESTART"

Re: Monticello Nuclear Generating Plant

Item II.K.3.13 of NUREG-0737 required: (1) separation of high pressure coolant injection (HPCI) and reactor core isolation cooling (RCIC) system initiation levels, and (2) modification of the RCIC initiation logic to cause automatic RCIC restart on low reactor vessel water level.

In a letter to D. G. Eisenhut, NRC from R. H. Buchholz, GE, dated October 1, 1980, General Electric, on behalf of the BWR Owners Group, transmitted an evaluation regarding the separation of the HPCI and RCIC initiation levels. The staff has reviewed and concurs with the conclusion of the General Electric analysis that no significant benefit is gained by the separation of the initiation levels. Enclosure (1) is the staff's Safety Evaluation for RCIC and HPCI initiation level separation. Therefore, this item is considered complete and no action is required by you with regard to this aspect of Item II.K.3.13.

In a letter to D. G. Eisenhut, NRC from D. B. Waters, Chairman of the BWR Owners Group, dated December 29, 1980, the Owners Group provided an evaluation of a proposed modification for the RCIC system to allow automatic restart following a trip of the system on high reactor vessel water level. The recommended modification would relocate the existing high water level trip from the RCIC turbine trip valve to the steam supply valve. The staff has reviewed this proposal and finds it acceptable on a generic basis. Enclosure (2) is the staff's generic Safety Evaluation for RCIC system automatic restart.

The staff's Safety Evaluation (Enclosure 2) included a number of considerations to be addressed during the development of plant specific changes to logic circuits when implementing this proposed modification. Therefore, the staff has developed plant specific acceptance criteria (Enclosure 3) to be used as guidance when developing specific changes for your facility. You are requested to verify that the acceptance criteria delineated in Enclosure (3) will be satisfied when this change is implemented. If the criteria will be satisfied, so state. Should any of the criteria not be met, you are requested

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to provide appropriate justification for non-compliance or to describe how your design satisfies the intent of the criteria. Also, you are requested either to confirm that the modification has already been made or to provide a schedule for the implementation of this modification. Your response is requested within 30 days of receipt of this letter.

This request for information was approved by the Office of Management and Budget under clearance number 3150-0065 which expires May 31, 1983.

Sincerely,

Original signed by
V. Rooney for

Domenic B. Vassallo, Chief
Operating Reactors Branch #2
Division of Licensing

Enclosures:
(1) Safety Evaluation, "Separation of RCIC and HPCI Initiation Levels."
(2) Safety Evaluation, "Generic Evaluation of BWR Owners' Group Proposed Change for RCIC Automatic Restart."
(3) Plant Specific Acceptance Criteria for RCIC Automatic Restart.

cc w/enclosures
See next page

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Mr. D. M. Musolf
Northern States Power Company

cc:

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Enclosure (1)

SAFETY EVALUATION

BWR OWNERS GROUP GENERIC RESPONSE "SEPARATION OF HIGH-PRESSURE COOLANT INJECTION AND REACTOR CORE ISOLATION COOLING (RCIC) SYSTEM INITIATION LEVELS"

Position

Currently, the reactor core isolation cooling (RCIC) system and the high-pressure coolant injection (HPCI) system both initiate on the same low-water-level signal and both isolate on the same high-water-level signal. The HPCI system will restart on low water level but the RCIC system will not. The RCIC system is a low-flow system when compared to the HPCI system. The initiation levels of the HPCI and RCIC system should be separated so that the RCIC system initiates at a higher water level than the HPCI system. Further, the initiation logic of the RCIC system should be modified so that the RCIC system will restart on low water level. These changes have the potential to reduce the number of challenges to the HPCI system and could result in less stress on the vessel from cold water injection. Analyses should be performed to evaluate these changes. The analyses should be submitted to the NRC staff and changes should be implemented if justified by the analyses.

Staff Position

The staff position given in NUREG-0737, Item II.K.3.13 is in two parts. The first, which is addressed in this Safety Evaluation, deals with separation of initiation levels for HPCI and RCIC. The second, which is addressed in a separate Safety Evaluation, deals with restart of RCIC on low water level after automatic shut-off on high water level.

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The reason for considering separating the HPCI and RCIC initiation levels is to reduce the number of thermal cycles on the reactor vessel and internals resulting from HPCI operation. The reason for considering automatic restart of RCIC on low water level is increased reliability and reduced required operator action.

In a letter to D. G. Eisenhut, NRC from R. H. Buchholz, GE dated October 1, 1980, General Electric, on behalf of the BWR Owners Group, transmitted an evaluation regarding the separation of the HPCI and RCIC initiation levels. This letter concluded that separation of the initiation levels would be of negligible benefit.

Two classes of transients can cause RCIC and HPCI initiation:

1) Initiation of HPCI and RCIC on low water level after feedwater is tripped on high reactor water level. For these transients, the inventory is slowly lost due to decay heat steam generation.

2) Initiation of HPCI and RCIC following a sudden loss of feedwater. For these transients, inventory loss is rapid with HPCI and RCIC initiation occurring approximately 20 seconds after event initiation.

In the first category, the level decrease is slow for most events because of the low power condition at the time the feedwater is tripped. A small amount of makeup water is needed and if feedwater cannot be restored, sufficient time is usually available such that RCIC would be started manually as the water level slowly decreases below the normal operating range. Since such manual action has been demonstrated to be successful for avoidance of HPCI actuation, it is considered sufficient and more desirable than an increase of the RCIC setpoint close to the normal operating water level.

In the second class of events, loss of feedwater is accompanied by a large and rapid drop in water level. Low level scram is initiated in approximately 5 seconds, with RCIC and HPCI actuation occurring shortly thereafter. With both systems operating, water level is quickly restored. Due to the rapidity of the transient, HPCI initiation cannot be avoided even if the RCIC setpoint is raised to the normal operating level.

For both types of events, automatic RCIC operation could avoid HPCI initiation if the HPCI setpoint were lowered; however, no significant benefit is realized unless the HPCI setpoint is lowered to the low-low water level (level 1). Since such a drastic lowering of the HPCI setpoint lessens the existing margin for assurance of adequate core cooling, lowering of the HPCI setpoint is not warranted.

Conclusion

We agree with the conclusion of the General Electric analysis of the separation of HPCI and RCIC setpoints. No significant safety benefit is gained by separating the HPCI and RCIC initiation setpoints.

Principal Contributor: P. J. Polk
M. W. Hodges

Dated: MAR 16 1983

GENERIC

SAFETY EVALUATION

BWR OWNERS GROUP PROPOSED CHANGE FOR REACTOR CORE ISOLATION COOLING (RCIC) SYSTEM "AUTOMATIC RESTART"

BACKGROUND:

Item II.K.3.13 of NUREG-0737, addressed two items related to the RCIC system. The first item is related to the separation of the initiation levels for RCIC and high pressure coolant injection (HPCI) based on low reactor water level. The staff has concluded that this change is not necessary based on the review of an analysis provided by the BWR Owners Group. The second item is related to the modification of the initiation logic for the RCIC system to permit automatic restart on low water level following a trip of RCIC on high water level. By letter dated December 29, 1980, from D. B. Waters, Chairman, BWR Owners Group, to D. G. Eisenhut, NRR, an evaluation of RCIC automatic restart conducted by the General Electric Company was provided. The evaluation included a conceptual design change which is generic to all BWR RCIC systems.

EVALUATION:

The General Electric generic evaluation of RCIC automatic restart considered various means to implement this change. Based on this review it was determined that the closure of steam supply valves in lieu of the RCIC turbine trip valve on high water level offered a simple, reliable and direct way to implement this change.

The evaluation provided a typical elementary diagram in order to indicate the changes which would be required. The present design uses a turbine trip

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relay energized by parallel contacts which energize the trip relay for the various conditions to initiate a trip of the RCIC turbine. One of these contacts closes on sensing high reactor water level. This contact is removed from the trip relay circuit and is used to energize an auxiliary relay which is used to close the steam supply valve and activate a new annunciator window. The new alarm point is provided since the existing alarm on a high water level trip is derived from the turbine trip valve position and this valve will not be closed on the high water level condition. In the present design the high water level trip contact is wired in series with a steam supply valve full open limit switch. In the proposed change this contact is eliminated since this interlock is no longer necessary. For plants with solid state logic, the same functions would be incorporated using solid state devices.

The closure of the motor operated steam supply valve occurs over a period of 15 seconds or less in contrast to the fast closure of the spring loaded trip valve. A conservative estimate was made to determine the additional water which could be added to the reactor vessel following a high water level trip and this was found to be insignificant, 200 gallons or less. Based on a review of Licensee Event Report (LER) data it was concluded that the reliability of the steam supply valve is comparable to that of the turbine trip valve and therefore this change does not reduce the reliability of termination of RCIC flow on high water level. Further, in that the turbine trip valve does not have to be manually reset and reopened following a high water level trip, overall reliability of RCIC restart is improved.

The initiation of the RCIC system includes the following functions which are not reset by the high water level trip and specific considerations which were included in the evaluation of RCIC automatic restart:

1. Gland seal system starts.
2. Turbine lube oil cooler cooling water supply valve opens.

Other functions which occur on initiation of the RCIC system are either not reset by the high water level trip or are performed automatically on restart of RCIC. An example of the former is the interlock which opens the condensate suction to the RCIC pump, if it were closed, when the system is initiated. Since it is opened on initiation of the RCIC system, no additional action would be required for automatic restart. Examples of the latter are the reopening of the steam supply valve and actions which are performed as a consequence of the closure of the steam supply valve. These include the reset of the ramp generator function to control acceleration of the RCIC turbine on start-up, closure of the vessel injection and minimum flow valves and opening of appropriate drain valves. For those functions which are not reset on the high water level trip, the gland seal system can continue to operate. Termination of the cooling water supply to the lube oil cooler is only performed manually for all system trips. The cooling water source is the condensate storage tank and is discharged to the clean radioactive waste system. General Electric notes that plant unique considerations may require that this valve be reclosed prior to system restart. In this case the logic should close the lube oil cooler cooling water supply valve following a high water level shutdown of the RCIC system.

Another plant specific consideration applies to those plants that do not have an electrical trip solenoid on the turbine trip valve. For these plants a shutdown of the turbine by the closure of the steam supply valve would eventually result in a loss of oil pressure and closure of the trip valve. This is due to the design of the oil dash pot system used for engaging and releasing the trip mechanism. These plants must replace the dash pot trip mechanism with an electrical solenoid similar to that mechanism used on later plants. The RCIC pump minimum flow recirculation valve is closed when the discharge flow is above a set limit and during standby operation it is closed when the steam supply valve is closed or when the turbine trip and throttle valves are closed. General Electric notes that each plant should verify these interlocks are a part of the RCIC system logic.

General Electric notes that some additional functions may be involved which are associated with the operation of the RCIC system. An example noted is the operation of a room cooler based on the system logic, such as steam supply valve position. For the proposed change, it may be appropriate to maintain such systems in operation during periods when the automatic restart could occur.

CONCLUSION:

The proposed change to the logic circuits of the RCIC system removes the high water level trip signal from the RCIC turbine trip valve circuit and initiates closure of the steam supply valve. A new alarm point is provided to indicate shutdown of the RCIC turbine on high water level. This change retains the same basic functions provided by the original design. Therefore we find the proposed generic logic change to be acceptable.

The evaluation included considerations of valve stroke times and hardware reliability related to RCIC turbine shutdown with the steam supply valve vs. the turbine trip valve. Also plant specific modifications for those plants having oil dash pot trip mechanisms have been identified in order to be compatible with the proposed change. Therefore we find that adequate consideration has been given to the reliability and operability of the RCIC shutdown with the steam supply valve in lieu of the turbine trip valve on high water level.

The evaluations included consideration of actions which are not reset by the high water level trip as well as those which are. Each has been analyzed and plant specific considerations have been identified along with recommendations to assure overall systems operability. We find that functional requirements for system restart have been adequately addressed from the systems operation standpoint.

Since the proposed changes provide a generic resolution for RCIC automatic restart with guidance to develop plant specific modifications, the staff concludes that an independent design review of plant specific changes and a functional system test following implementation will provide adequate assurance of the adequacy and operability of the modified system. Plant specific acceptance criteria have been developed and are provided in enclosure (3).

Principal Contributor: P. J. Polk
M. Wigdor

Dated: MAR 1 6 1983

PLANT SPECIFIC ACCEPTANCE CRITERIA FOR REACTOR CORE ISOLATION COOLING (RCIC) "AUTOMATIC RESTART"

1. The RCIC system shall be modified to relocate the existing logic for the high reactor vessel water level trip from the RCIC turbine trip valve to the steam supply valve to permit subsequent auto restart of the RCIC system on low water level. This change will be consistent with actions identified in the BWR Owners Group proposed modification, noted above, for RCIC automatic restart, including plant specific considerations.

2. The modifications to the RCIC system shall be designed and implemented to standards consistent with the original system design.

3. For those plants for which the RCIC system is classified as a safety-related system, the quality assurance requirements of Appendix B to 10 CFR Part 50 apply. In order to provide assurance that the modifications of the RCIC system are implemented to standards commensurate with the systems importance to safety for those plants for which the RCIC system is not classified as a safety-related system, the following requirements are applicable.
   a) Design control measures shall provide for verifying the adequacy of the design, such as by the performance of an independent design review of the changes, consistent with the intent of Section III "Design Control", of Appendix B to 10 CFR Part 50.*

*Reference to Appendix B is to provide guidance rather than to establish specific requirements.

b) A system function test shall be conducted to verify the adequacy of the design to satisfy its functional performance requirements consistent with the intent of Section XI, Test Control of Appendix B to 10 CFR Part 50.*