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AUTH.NAME AUTHOR AFFILIATION
ALEXICH,M.P. Indiana Michigan Power Co. (formerly Indiana & Michigan Ele
RECIP.NAME RECIPIENT AFFILIATION
MURLEY,T.E. Office of Nuclear Reactor Regulation, Director (Post 870411R

SUBJECT: Responds to Generic Ltr 88-17, "Loss of DHR."

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Donald C. Cook Nuclear Plant Units 1 and 2
Docket Nos. 50-315 and 50-316
License Nos. DPR-58 and DPR-74
RESPONSE TO GENERIC LETTER 88-17, "LOSS OF DECAY HEAT REMOVAL (DHR)" - PROGRAMMED ENHANCEMENTS

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

Attn: T. E. Murley

February 6, 1989

Dear Dr. Murley:

This letter responds to the six "programmed enhancement" recommendations contained in the subject Generic Letter dated October 17, 1988. These responses are found in the attachment to this letter. This letter follows letter AEP:NRC:1033B dated January 9, 1989, which provided our responses to the "expeditious actions" specified in Generic Letter 88-17. Reference should be made to AEP:NRC:1033B for further details regarding our overall response to the issues and concerns addressed in Generic Letter 88-17.

Programmed enhancements that consist of or are dependent on hardware installations or modifications will be implemented within the time required by Generic Letter 88-17. Further, programmed enhancements that do not depend upon hardware changes or modifications will be implemented within 18 months of receipt of the Generic Letter.

Analyses results described in the expeditious actions response letter have been finalized. Descriptions of the analyses performed are found in the response to Item 4 that is contained in the attachment to this letter.

With regard to your December 2, 1988, letter to our Chairman and Chief Executive Officer, Mr. W. S. White, Jr., we appreciate and share your concerns.

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This letter is submitted pursuant to 10 CFR 50.54(f) and as such an oath of affirmation is enclosed.

Sincerely,

M. P. Alexich
Vice President

ldp

Attachment

cc: D. H. Williams, Jr.
W. G. Smith, Jr. - Bridgman
R. C. Callen
G. Charnoff
A. B. Davis
NRC Resident Inspector - Bridgman
G. Bruchmann

Item 1 - Instrumentation

Provide reliable indication of parameters that describe the state of the RCS and the performance of systems normally used to cool the RCS for both normal and accident conditions. At a minimum, provide the following in the control room:

(a) two independent RCS level indications

(b) at least two independent temperature measurements representative of the core exit whenever the RV head is located on top of the RV (We suggest that temperature indications be provided at all times.)

(c) the capability of continuously monitoring DHR system performance whenever a DHR system is being used for cooling the RCS

(d) visible and audible indications of abnormal conditions in temperature, level, and DHR system performance.

Response to Item 1

(a) Two independent electronic level monitoring systems will monitor RCS level during reduced inventory operation. One of these electronic level monitoring systems, which we will denote as the narrow range level instrument, will connect to the RCS on the same hot leg to which the residual heat removal (RHR) pump suction line is connected. The narrow range level instrument will span approximately from below half loop to the top of the hot leg to which the instrument is connected. This instrument will provide the operator primary level information for the purpose of RHR pump operation.

The second electronic level monitoring system, which we will denote as the wide range level instrument, will monitor RCS level from approximately the reactor vessel flange down to the bottom of a hot leg. The wide range level instrument will connect to a cross-under leg.

The output of these level monitoring systems will be recorded in the control room. Each system will have an associated low half loop level alarm setpoint and will alarm in the control room.

In addition to the above, the visual level indication system, also connected to a cross-under leg, will continue to be used. As was discussed in the expeditious actions response, this system has a range of indication from approximately the vessel flange to the bottom of the hot leg.

The system phenomena and instrument behavior concerns discussed in Section 3.1.2.1 of Enclosure 2 to Generic Letter 88-17 will be addressed for the RCS level monitoring systems during the detailed design process.

(b) Two incore thermocouples will provide sufficient core exit temperatures with the range of approximately 100°F to 500°F whenever the RV head is located on top of the RV, irradiated fuel is in the RV, and the RCS is being operated at reduced inventory level. A change in the range of temperature indication, from the 100°F to 250°F given in the expeditious actions response letter, was deemed prudent due to possible RCS temperatures with the assumptions of worst-case core conditions and insufficient hot leg venting capability. These signals will be recorded in the control room and alarm with a setpoint of 170°F increasing. By administrative procedure, the disconnection of this temperature monitoring system will be permitted only when the RCS is not at reduced inventory.

(c) Two independent control room recorders with alarm capability will continuously monitor the following parameters whenever the RHR system is being used for cooling the RCS during reduced inventory operation with irradiated fuel in the core: the RCS level, RCS temperature, RHR pump suction pressure, RHR heat exchanger outlet flow, RHR motor current, and RHR heat exchanger exit temperature. As is discussed in the generic letter, signal recording, instead of just instantaneous indication, provides more useful information to the operator regarding the above parameters through the capability to trend.

(d) All of the parameters discussed in (c) above will be visible on control room recorders. The recorders will indicate the channel/parameter that is in alarm. The recorders' alarm relays will initiate control room alarms that provide visible and audible indication of abnormal conditions.

Item 2 - Procedures

Develop and implement procedures that cover reduced inventory operation and that provide an adequate basis for entry into a reduced inventory condition. These include:

(a) procedures that cover normal operation of the NSSS, the containment, and supporting systems under conditions for which cooling would normally be provided by DHR systems.

(b) procedures that cover emergency, abnormal, off-normal, or the equivalent operation of the NSSS, the containment, and supporting systems if an off-normal condition occurs while operating under conditions for which cooling would normally be provided by DHR systems.

(c) administrative controls that support and supplement the procedures in items (a), (b), and all other actions identified in this communication, as appropriate.

Response to Item 2

(a) Procedures which govern the operation of the RHR system and RCS drain down evolutions during normal plant operations will be revised to address additional equipment and procedural guidelines for operation while at reduced RCS inventories. These procedures will ensure that containment closure capability, independent instrumentation, and support systems are in place, prior to entry into a reduced inventory condition with irradiated fuel in the vessel. In addition, they will provide guidance for the operation of the RHR system at varying loop levels to preclude air entrainment and subsequent loss of the RHR system.

(b) Operator guidance for off-normal conditions is or will be provided via two separate mechanisms. Annunciator response procedures are provided for high, low and low-low level transients which occur while at a reduced inventory. These procedures direct the operator to verify and trend loop activity (i.e., level and RHR system parameters). If indications point to an imminent loss of RHR, the operator is directed to the Emergency Operating Procedure. The Emergency Operating Procedure will provide direction for impending losses of RHR as well as a total loss of RHR. The entry conditions for this procedure will be the alarms identified previously or, in the case of a total loss of RHR, (1) the inability to start either RHR pump and, (2) indication of RCS temperature greater than $170^{\circ}F$ and approaching $200^{\circ}F$ as indicated by core exit thermocouples.

The emergency procedures discussed above will be considered an interim measure. A permanent procedure for loss of RHR will be developed following the receipt of the Emergency Response Guidelines and Background Document from the Westinghouse Owners Group. The WOG guidance is scheduled for issuance in the fall of 1989.

The permanent procedure for use at Cook Nuclear Plant will be issued within three months of receipt of WOG guidelines (estimated issue date - mid-February 1990).

(c) A top tier plant procedure is being developed which delineates the administrative requirements associated with reduced inventory operation. In addition, guidelines for containment closure capability, loss of RHR mitigation criteria, instrumentation, nozzle dam usage and general surveillance requirements will also be contained in this instruction or other appropriate plant procedures. Implementation is scheduled for April 1989.

Item 3 - Equipment

(a) assure that adequate operating, operable, and/or available equipment of high reliability* is provided for cooling the RCS and for avoiding a loss of RCS cooling.

(b) maintain sufficient existing equipment in an operable or available status so as to mitigate loss of DHR or loss of RCS inventory should they occur. This should include at least one high pressure injection pump and one other system. The water addition rate capable of being provided by each equipment item should be at least sufficient to keep the core covered.

(c) provide adequate equipment for personnel communications that involve activities related to the RCS or systems necessary to maintain the RCS in a stable and controlled condition.

Response to Item 3

As previously discussed in the response to Item 6 of the expeditious actions, the following equipment will be maintained in an operable and/or available status in support of RHR operation with irradiated fuel in the core.

(1) One centrifugal charging pump with a flow path either through the boron injection lines, or through the normal charging header to either loop 1 or 4 cold legs, and an intermediate head safety injection pump with a flow path through the hot leg injection line to two loops, or

(2) Two SI pumps with flow paths available for both cold and hot leg injection, or

*Reliable equipment is equipment that can be reasonably expected to perform the intended function. See Enclosure 2 (of Generic Letter 88-17) for additional information.

(3) RWST gravity feed capability via either the RHR suction flow path or the safety injection flow path and an SI pump with flow paths available for both cold and hot leg injection with a hot leg vent provided.

As was discussed in the response to Item 2, a procedure will be developed on the basis of forthcoming Westinghouse guidance. This procedure may employ equipment differing from that above. It will be ensured, however, that if changes in this respect are made, an equivalent level of protection is provided.

In response to concerns raised regarding unplanned activation of the RHR suction valve auto close interlock, plant procedures currently require this system to be deenergized during RHR operation. Control power is removed from the two, in series, RHR suction isolation valves (IMO-128 and ICM-129) when RHR is placed in service. Power is not restored to the valves until the RHR system is placed in standby readiness for emergency core cooling considerations (i.e., no longer in a reduced inventory condition) or during periods of core offload.

RHR support system requirements as well as RHR system operating parameters will be clearly delineated in plant procedures. Support systems which will be maintained available in support of RHR include service water utilized for pump and heat exchanger cooling and backup electrical power (i.e., available emergency diesel generator). RHR system operating flow rates will be specified for various loop levels in order to preclude air entrainment. Additionally, the required T/S flow rate is being reduced to aid in preventing a possible loss of RHR, as is further discussed in the response to Item 5.

See response to Item 6 for a discussion of personnel communications.

Item 4 - Analyses

Conduct analyses to supplement existing information and develop a basis for procedures, instrumentation installation and response, and equipment/NSSS interactions and response. The analyses should encompass thermodynamic and physical (configuration) states to which the hardware can be subjected and should provide sufficient depth that the basis is developed. Emphasis should be placed upon obtaining a complete understanding of NSSS behavior under non-power operation.

Response to Item 4

The Westinghouse Owners Group sponsored an analysis program to address generic issues stemming from concerns about operation at a reduced inventory level (reference WCAP-11916, Revision 0 dated July 1988). Several results from this work have been applied to

Cook Nuclear Plant to produce plant-specific values for heat-up rate, time to boiling, and time to core uncovery. These results will be incorporated into plant procedures and/or operator training as appropriate.

Calculations have been performed to determine plant-specific maximum RCS pressures expected with a pressurizer or steam generator hot leg manway removed. RCS pressure response without a hot leg vent has also been determined. These results were utilized in validating both gravity feed and forced make-up source flow rates and flow paths to ensure that core coverage is maintained. Appropriate operator response actions that depend on RCS configuration will be incorporated into the procedure and training for operation at a reduced inventory level.

Correlations between RCS hot leg water level and RHR intake flow rates were developed for the purpose of limiting air entrainment within the guidelines for RHR pump operation. RHR pump operating and test data from actual operating plants show that the correlations developed are reasonable and conservative. The administrative levels defined in the operating procedures for reduced RCS inventory will correspond with the RCS water level requirements provided by the WCAP for the Cook Nuclear Plant configuration.

As discussed in the response to Item 1, instrumentation behavior and system response will be addressed in the process of engineering and installing the new level instrumentation. This will include, at a minimum, the eight items discussed in Section 3.1.2.1 of Enclosure 2 to Generic Letter 88-17. Prior to the operator employing these new level instruments, the engineering evaluation of instrumentation behavior and system response will be reviewed for impact on operator training and plant operating procedures.

Calculations were performed to address the following issues, as was discussed in the expeditious actions response letter: (1) worst-case containment pressure and (2) containment environment for closure activities. In both calculations, it was determined that no further concerns or equipment considerations are necessary for the purpose of providing heat removal capability in containment. However, in order to provide additional justification for our analytical methods, we will maintain available a minimum of two fans from the lower containment ventilation system and one in the upper containment ventilation system while operating in a reduced inventory condition with irradiated fuel in the reactor vessel. This is necessary in order to allow additional air circulation within the compartments to better utilize the structural heat sinks that exist within containment.

Item 5 - Technical Specifications

Technical Specifications (T/Ss) that restrict or limit the safety benefit of the actions identified in this letter should be identified and appropriate changes should be submitted.

Response to Item 5

It is understood from a member of your staff that a T/S amendment for Cook Nuclear Plant Units 1 and 2 regarding a reduction of the minimum RHR flow rate from 3000 gpm to 2000 gpm has been approved by your staff. This reduced flow rate will be employed at or near a half loop level.

Concerns regarding inadvertent automatic closure of the RHR System suction/isolation valves due to automatic closure interlocks have been minimized by removing power from these valves in the open position while in a reduced inventory condition (discussed in the response to Item 3). The removal of power from these valves in the open position is imposed by administrative procedures. This is considered sufficient in lieu of deleting the auto closure interlock and associated T/Ss.

With the procedural instructions provided to the operator regarding use of SI pumps, a T/S change may be desirable. Specifically, low temperature overpressure protection (LTOP) concerns prevent use of (or even providing power to) an SI pump below a cold leg temperature of 170°F. As was discussed in Item 2, entry into emergency procedures, and thus possibly using an SI pump, occurs only when the core exit temperature reaches 170°F and is increasing. An investigation will be made into a possible T/S change regarding the availability of an SI pump during operation at a reduced inventory.

Requirements for availability and operation of equipment and instrumentation provided for operation in a reduced inventory condition, as discussed throughout this letter, will be contained in appropriate plant procedures. These requirements will be specified as prerequisites to or required procedure steps while operating in a reduced inventory condition. These controls are considered sufficient in lieu of any related T/S changes.

Item 6 - RCS Perturbations

Item (5) of the expeditious actions should be reexamined and operations refined as necessary to reasonably minimize the likelihood of loss of DHR.

Response to Item 6

In review of the RCS perturbations expeditious actions response, the process defined for deferral of activities which could result

in RCS perturbations will be continued. For evolutions that cannot be deferred, a management review of the proposed work will be conducted, and authorization given only when necessary controls and any required compensatory measures are in place.

As discussed in our response to Item 3, the auto closure interlock associated with the RHR suction valves will not cause inadvertent closure of the valves during testing due to the deenergized status of the valves. Additionally, the review process identified previously would be utilized to determine whether or not testing could be performed on the RCS while irradiated fuel is in the reactor vessel and RCS inventory is at reduced levels.

To enhance the existing communications capability, extensive work has been performed to improve the reliability of the present plant communications systems. Additionally, work has been started on upgrading plant communications in response to NUREG 0700 (DCRDR). Verification that the necessary communications systems are available will be required prior to commencing any evolutions which could result in a RCS or support system perturbation.

To prevent perturbations in instrumentation used to monitor RCS level and temperature while at reduced inventory, the new instrumentation identified in the response to Item 1 will be hard piped where practical. Additionally, the current visual level indication system will be upgraded to prevent inadvertent failure.

When upgrading instrumentation used during normal system operation, the root isolation valve off the RCS or support system will be used to prevent inadvertent draining of the RCS. Additionally, the root valve position will be administratively controlled to prevent unanticipated manipulation.

As a means of maintaining control of the activities addressed with respect to RCS perturbations, the aforementioned administrative controls will be incorporated into the top tier procedure discussed in response to Item 2.

STATE OF OHIO)
COUNTY OF FRANKLIN)

Milton P. Alexich, being duly sworn, deposes and says that he is the Vice President of licensee Indiana Michigan Power Company, that he has read the foregoing response to Generic Letter 88-17, "Loss of Decay Heat Removal (DHR) - Programmed Enhancements," and knows the contents thereof; and that said contents are true to the best of his knowledge and belief.

M P Alexich

Subscribed and sworn before me this 6th day of February, 1989.

Marsha A. Applegarth
NOTARY PUBLIC

MARSHA A. APPLEGARTH
NOTARY PUBLIC - STATE OF OHIO
MY COMMISSION EXPIRES JAN. 16, 1990

(Applegarth)