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SUBJECT: Forwards response 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)" - EXPEDITIOUS ACTIONS

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

Attn: T. E. Murley

January 9, 1989

Dear Dr. Murley:

This letter responds to the subject Generic Letter dated October 17, 1988, which we received November 8, 1988. Specifically, this letter responds to your staff's eight short-term recommendations designated as "expeditious actions." The detailed responses are contained in the attachment to this letter. The balance of the concerns contained in Generic Letter 88-17 will be addressed in the "programmed enhancements" response. That submittal will be provided by February 6, 1989.

This letter provides those actions and controls that will be implemented prior to operating in a reduced inventory condition with irradiated fuel in the reactor vessel. Reduced inventory is defined as an inventory that results in a reactor vessel water level lower than three feet below the reactor vessel flange.

At present, "programmed enhancements" responses are being developed in parallel with the expeditious actions described herein. These programmed enhancements may be used, as they are implemented, to replace or alter the expeditious actions described. Changing the expeditious actions would be based on a better understanding gained through further analysis or a more thorough examination of alternatives, implementing more sophisticated procedure controls, or on the basis of developing industry positions.

It should be noted that the analysis results described in this submittal are preliminary results. No explicit analytical work

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was required for this submittal, although some analytical work was performed to support equipment availability decisions. These, and other analysis results required for the programmed enhancements response, will be finalized and presented, as necessary, in the February 6, 1989 submittal.

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

MPA/eh

Attachment

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

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 forgoing Response to Generic Letter 88-17, "Loss of Decay Heat Removal (DHR)" 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 to before me this 9th

day of January, 1989.

Barbara Ann Winkler
NOTARY PUBLIC

BARBARA ANN WINKLER
NOTARY PUBLIC, STATE OF OHIO
MY COMMISSION EXPIRES MARCH 12, 1991

ATTACHMENT TO

RESPONSE TO GENERIC LETTER 88-17,

"LOSS OF DECAY HEAT REMOVAL (DHR)"

EXPEDITIOUS ACTIONS RESPONSE:

ITEM 1

Discuss the Diablo Canyon event, related events, lessons learned, and implications with appropriate plant personnel. Provide training shortly before entering a reduced inventory condition.

Response to Item 1

Formal classroom training has been provided to licensed plant personnel and to the Plant Nuclear Safety Committee on the Diablo Canyon event and other industry related case studies. Further training on the plant simulator has also been utilized to emphasize the difficulties encountered during reduced RCS level operation.

Prior to each future entry into the reduced inventory condition with irradiated fuel in the core, a briefing will be performed with each operating shift covering, but not limited to, the following topics:

- gradients that result in the indicated RCS level and the RHR suction line level due to various thermal-hydraulic phenomena,
- overall thermal-hydraulic considerations and their potential impact on half-loop operations such as time-to-boiling, RCS pressurization, the impact of vortexing on RHR pump operation, and time to core uncovery,
- short-term containment closure controls and their basis (discussed in response to Item 2),
- short-term RCS perturbation restrictions and their basis (discussed in response to Item 5),
- the make up equipment available to mitigate the consequences of and the course of action following loss of RHR cooling capability (discussed in the response to Item 6),
- proper installation sequence for nozzle dams (discussed in the response to Item 7; applies only to training for Maintenance Department personnel), and
- the potential for inventory loss through cold leg openings and the limitations of cold leg injection as a result of RCS pressurization.

ITEM 2

Implement procedures and administrative controls that reasonably assure that containment closure will be achieved prior to the time

at which a core uncovery could result from a loss of decay heat removal (DHR) coupled with an inability to initiate alternate cooling or addition of water to the reactor coolant system (RCS). Containment closure procedures should include considerations of potential steam and radioactive materials released from the RCS should closure activities extend into the time boiling takes place within the RCS. These procedures and administrative controls should be active and in use prior to entering a reduced RCS inventory condition and should apply whenever operating in those conditions.

Response to Item 2

To provide assurance that containment closure can be attained in the event that a loss of residual heat removal (RHR) resulting in core uncovery occurred, the following controls shall be established.

Prior to reducing RCS level to three feet below the reactor vessel flange with irradiated fuel in the vessel: 1) containment closure capability will be established, and 2) a procedure for closure initiation shall be in place. Each of these are described below.

1) Containment closure capability will consist of the capability to close at least one valve in each line with a pathway to atmosphere via a manual actuation of a containment isolation signal. This will ensure that at least one integral barrier to the release of radioactive material is provided. Penetrations that are not capable of being closed in this manner will be made capable of being manually isolated in the required time frame or be isolated by either an administratively closed valve, a blind flange, or installed check valve within the time frame dictated by the containment closure requirements.

   In the event that equipment is needed inside containment, for evolutions such as eddy current testing, all cabling, hoses and pressurized lines will be run through either the containment airlock or a designated penetration. If an airlock is utilized, all hoses, pressurized lines, and cabling will be clearly labelled and will be installed in such a way as to facilitate rapid separation or removal. Personnel will be available to remove hoses and other equipment and close the airlocks, if isolation is required, in less than the two hours prescribed in Enclosure 2 to the Generic Letter. If a dedicated penetration is utilized, the containment airlocks will be

capable of being placed in a closed position. The vent paths acceptable to invoke the two hour closure requirement are the hot leg steam generator and/or pressurizer manways. In addition, the two hour closure requirement is taken due to the assumption of a cold leg opening of greater than one square inch allowing for cold leg maintenance activities.

A small number of RCS maintenance activities may require a reduced inventory level for a short amount of time relative to the time required to provide, and then subsequently secure, one of the hot leg vent paths discussed above. Therefore, in order to reduce the time of operation at a reduced level, a hot leg vent may not be provided. This will be based on a careful evaluation of the activities requiring a reduced inventory level. In this situation, personnel will be available to accomplish containment closure within 30 minutes.

Adverse environmental conditions that would inhibit plant personnel's ability to effect containment closure are not anticipated. However, further analysis will be performed to ensure conditions permit personnel activity necessary to accomplish containment closure. This will be further addressed in the February 6, 1989 submittal.

To ensure containment closure capability is in place prior to lowering RCS level to three feet below the reactor vessel flange, a verification signoff of that discussed above will be added to the initial conditions of the procedure for draining the RCS.

2) To aid in mitigating the effects of a potential boiling off of reactor coolant water into the containment building, the appropriate plant procedures will be revised to ensure that the containment is closed. The following criteria will be used for initiating containment closure.

   a) The inability to remove decay heat via the RHR system pump, and

   b) Indication of RCS temperature greater than 170°F and approaching 200°F.

Response to Item 5 contains further details regarding the mitigation of a loss of RHR event.

Due to the smaller ice condenser containments of Cook Nuclear Plant Units 1 and 2, we have initiated a formal containment analysis to address containment integrity during a loss of RHR event and subsequent ore uncovery. Further details on this analysis and our conclusions will be provided in the February 6, 1989 submittal.

ITEM 3

Provide at least two independent, continuous temperature indications that are representative of the core exit conditions whenever the RCS is in a mid-loop condition and the reactor vessel head is located on top of the reactor vessel. Temperature indications should be periodically checked and recorded by an operator or automatically and continuously monitored and alarmed. Temperature monitoring should be performed either:

(a) by an operator in the control room (CR), or

(b) from a location outside of the containment building with provision for providing immediate temperature values to an operator in the CR if significant changes occur. Observations should be recorded at an interval no greater than 15 minutes during normal conditions.

Response to Item 3

In order to provide two independent and continuous core exit temperatures, sufficient core exit thermocouples will remain intact for use while in a mid loop condition with irradiated fuel in the vessel and the reactor vessel head is located on top of the reactor vessel. Since core exit thermocouples reside at or near the top of the core, the temperature indication provided will be representative of core exit RC conditions.

Prior to the next entry into a mid loop level condition, indication of RCS core exit temperature with a range from approximately 100° to 250°F will be provided. Indication will be provided either continuously in the control room or at a location outside containment with 15 minute logging. For temperature indication not provided for in the control room, continuous observation will be provided with control room communication available in the case of loss of RHR or if significant changes in RCS temperature are observed.

ITEM 4

Provide at least two independent, continuous RCS water level indications whenever the RCS is in a reduced inventory condition. Water level indications should be periodically checked and recorded by an operator or automatically and continuously monitored and alarmed. Water level monitoring should be capable of being performed either:

(a) by an operator in the CR, or

(b) from a location other than the CR with provision for providing immediate water level values to an operator in the CR if significant changes occur. Observations should be recorded at an interval no greater than 15 minutes during normal conditions.

Response to Item 4

Two indications of RCS level will be available for the operator's use. The temporary level instrument, connected to the loop 3 crossunder piping, as described in our response to Generic Letter 87-12 dated November 20, 1987, has been modified. The tygon tubing previously used has been replaced by a heavy duty rubber hose for integrity reasons. Tygon tubing does, however, connect a short span between the two sight glasses used. This system will be available and is referred to hereafter as the "visual level instrument." The range of level indication spanned by this system is approximately the reactor vessel flange to the bottom of the hot leg. Local indication of RCS inventory level inside containment, with 15 minute logging, will be maintained from 3 feet below the vessel flange to the top of the hot leg. Below the top of the hot leg level, continuous control room indication will be available via a remote TV camera.

The second level indication will be provided by a newly designed system that will be installed in parallel with the visual level instrument, thus sharing a common tap. Common mode failure concerns with use of the common tap will be minimized by a thorough installation inspection and functional testing of both instruments.

The new system is a standpipe system with venting identical to that provided for the visual level instrument. Two notable differences are (1) steel tubing or reinforced flexible tubing will be used as opposed to heavy duty rubber hose, and (2) electronic level indications and alarm will be provided by the new

instrument based on sensor admittance measurements. The range of level indication spanned by this system is approximately 17 inches, from one inch below the mid loop to 16 inches above the mid loop. This system is provided to meet the expeditious action requirement for a second and independent level indication. It is not known at this time whether this approach will be proposed for the long-term.

Several alternatives for the long-term level indication requirements are being investigated. They include providing new hot leg taps, permanent standpipe installations, and the use of incore instrument system guide tubes to measure reactor vessel level. The results of the feasibility studies on long-term solutions will be presented in the programmed enhancements submittal to be provided to the staff by February 6, 1989.

ITEM 5

Implement procedures and administrative controls that generally avoid operations that deliberately or knowingly lead to perturbations to the RCS and/or to systems that are necessary to maintain the RCS in a stable and controlled condition while the RCS is in a reduced inventory condition.

Response to Item 5

To preclude perturbations of the RCS when operating at reduced levels with irradiated fuel in the vessel, evolutions affecting RHR, the RCS, or subsystems that interface with the RCS in a manner that could result in draining of RCS water or affecting power supplies to RHR, will be deferred whenever possible. This work will be rescheduled for a time when the core is off-loaded or when the RCS has been refilled above three feet below the vessel flange level.

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. At a minimum, continuous level monitoring would be required for changes in RCS level or other evolutions that could directly impact RCS inventory and cannot be deferred.

The requirements identified above will be incorporated into the appropriate plant procedures as prerequisites or required procedure steps to ensure compliance prior to entering a reduced inventory condition.

ITEM 6

Provide at least two available or operable means of adding inventory to the RCS that are in addition to pumps that are a part of the normal DHR systems. These should include at least one high pressure injection pump. The water addition rate capable of being provided by each of the means should be at least sufficient to keep the core covered. Procedures for use of these systems during a loss of DHR events should be provided. The path of water addition must be specified to assure the flow does not bypass the reactor vessel before exiting an opening in the RCS.

Response to Item 6

To ensure RCS inventory recovery following a loss of RHR event, additional equipment will be required to be available during reduced inventory evolutions with irradiated fuel in the reactor vessel.

The equipment and flow paths that will be maintained in support of RHR operations will be:

1) One centrifugal charging pump with a flow path through either the boron injection tank and cold leg injection lines or 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

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.

Procedural guidance for use of this equipment will be provided in the operational procedure for loss of RHR. Changes to our T/Ss that restrict the use of SI pumps in a reduced inventory condition will be discussed in the February 6, 1989 submittal. As stated in the response to Item 2, the following initiating events will result in entry into the recovery procedures.

1) Inability to remove decay heat via the RHR system, and

2) Indication of RCS temperature greater than 170^{o}F and approaching 200^{o}F as indicated by core exit thermocouples.

Preliminary flow rate calculations have been completed validating that the makeup sources listed above will provide sufficient flow to exceed the boil off rate with the provision of the hot leg vents discussed in the response to Item 2. This will then allow us to restore RCS level and restart the RHR system.

Both hot and cold leg injection flow paths will be available for RCS inventory restoration. Cold leg loss of makeup water will be evident in the indicated RCS temperature as provided by the core exit thermocouples (discussed in response to Item 3). Therefore, procedural direction will be provided to the operator to initiate hot leg injection if cold leg loss of makeup water is indicated.

ITEM 7

Implement procedures and administrative controls that reasonably assure that all hot legs are not blocked simultaneously by nozzle dams unless a vent path is provided that is large enough to prevent pressurization of the upper plenum of the RV.

Response to Item 7

Prior to the use of nozzle dams, procedures containing nozzle dam installation instructions will be revised to include steps to preclude the conditions of concern in Generic Letter 88-17. Specifically, instructions will be provided for an installation sequence that lessens the probability of cold leg RCS inventory losses. In addition, RCS pressurization will be minimized by the provision of a hot leg vent prior to installing SG nozzle dams.

ITEM 8 (applicable to NSSSs with loop stop valves)

Implement procedures and administrative controls that reasonably assure that all hot legs are not blocked simultaneously by closed stop valves unless a vent path is provided that is large enough to prevent pressurization of the RV upper plenum or unless the RCS configuration prevents RV water loss if RV pressurization should occur. Closing cold legs by nozzle dams does not meet this condition.

Response to Item 8

Item 8 does not apply to Cook Nuclear Plant because neither Unit 1 or Unit 2 have loop stop valves.