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SUBJECT: Requests technical assistance re plant component cooling water heat exchanger degraded mode operation. Restart of plant imminent & consideration of issues & response requested by 870730.

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JUN 29 1987

MEMORANDUM FOR: Gus C. Lainas, Assistant Director, Division of Reactor Projects, Office of Nuclear Reactor Regulation

FROM: Albert F. Gibson, Director, Division of Reactor Safety

SUBJECT: REQUEST FOR TECHNICAL ASSISTANCE - TURKEY POINT PLANT COMPONENT COOLING WATER HEAT EXCHANGER DEGRADED MODE OPERATION

Enclosure 1 addresses an NRC Region II staff concern relative to the licensee's implementation of a Technical Specification Limiting Condition for Operation (LCO) for out of service Component Cooling Water (CCW) heat exchangers. The 24-hour LCO was repeatedly entered during the summer of 1986 to allow cleaning of the three Unit 3 heat exchangers. A review of the data found in enclosure 1 indicates that one heat exchanger or another was out of service for extended periods of time on a repetitive basis. However, no single heat exchanger remained out of service in excess of 24 continuous hours. It is anticipated that the Turkey Point Unit 4 heat exchangers may require cleaning at periodicities similar in frequency and duration to those for Unit 3 which are documented in enclosure 1. Your assistance is requested in determining whether these time frames are in keeping with the intent of the LCO and are consistent with the NRC position that the repetitive entry into LCOs be minimized.

Enclosure 2 addresses an NRC Region II staff concern relative to the adequacy and prudence of a licensee safety evaluation for the operation of the CCW heat exchangers with fouled heat transfer tubes. The evaluation was originally performed to address a 10 CFR 21 issue. The licensee reached a conclusion with which the Region II staff does not take exception. Subsequently, the evaluation was revised to allow Units 3 and 4 to remain at power for a maximum of 24 hours in a 3-month period when two Intake Cooling Water (ICW) pumps were required to provide flow to two CCW heat exchangers to mitigate the consequences of the Maximum Hypothetical Accident (MHA). As itemized in enclosure 2, the FSAR and the Technical Specification bases specify that mitigation of the MHA can be accomplished using the flow from one ICW pump through two CCW heat exchangers. Consequently, the licensee's evaluation authorizes operation of the ICW system outside its design basis. The licensee's justification for allowing plant operation when the flow of an additional ICW pump is required is based on a belief that limiting the time period of operation to that specified in the evaluation creates an acceptably small vulnerability to single failure from a probabilistic risk assessment perspective. Additionally, the licensee feels that the time period is philosophically in keeping with the intent of other 24-hour Technical Specification LCOs (such as for an out of service ICW pump) which create ICW single failure potentials.

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Of particular concern to the Region II staff is that the reliance on the flow of two ICW pumps for accident mitigation creates an active single failure potential not specifically authorized by a Technical Specification LCO. The failure of the "B" emergency diesel generator during the MHA removes power from two of the three operable ICW pumps and prevents effective safety system function during the scenario of concern.

There are no established criteria for heat exchanger operability aside from being removed from service. The ability of the ICW system to perform its intended function is dependent upon heat exchanger fouling, number of operable ICW pumps and heat exchangers and the intake canal water temperature. The design basis of the ICW system requires one ICW pump providing flow to two CCW heat exchangers (see pg. 3 of JPE-L-85-38, Rev. 3). Yet the licensee has determined that under certain conditions, two ICW pumps and two heat exchangers are required. These conditions include:

1. MHA with failure of "B" EDG
2. fouling of in-service heat exchangers
3. elevated intake canal temperature

It should be noted that conditions 2 and 3 have, in fact, occurred in the past (see enclosure 2).

We are therefore requesting your assistance in resolving the operability issue of the ICW system. The following questions have been posed by the Region II staff but are by no means all inclusive.

1. Is the ICW system technically inoperable when the heat exchangers are sufficiently fouled such that more than one ICW pump is required for the system to fulfill its design function?

2. What is the proper course of action for plant management when the ICW system is found degraded?

   a. Reduce power consistent with the decay heat load that the ICW system can handle;
   b. Place time restrictions on the various parameters (water temperatures, heat exchangers outlet temperatures, etc.);
   c. Implement compensatory measures such as verification of electrical power sources, increased system surveillances, etc.; or
   d. A combination of the above or other actions.

3. Should the licensee have performed a 10 CFR 50.59 evaluation for this condition since this situation potentially involved an "unreviewed safety question"? Is 10 CFR 50.59 applicable when the licensee has not made intentional changes to the system but the system is being operated differently than that addressed in the FSAR?

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4. If a 10 CFR 50.59 is not applicable under these circumstances, then what type of evaluation, with associated NRC reporting, is appropriate?

Since the restart of Turkey Point Unit 4 is imminent, your consideration of these issues and a response is requested by July 30, 1987.

(original signed by Gibson

Albert F. Gibson

Enclosures:
1. Turkey Point Plant CCW Heat Exchanger Cleaning: Repetitive Entry Into Limiting Conditions for Operation
2. Turkey Point Plant CCW Heat Exchanger Safety Evaluation Concerns Raised by Region II Inspection Staff
3. Substantial Safety Hazards Evaluation for ICW System Design, Revision 3

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RII	RII	RII	RII
BWilson:vyg	DVerrelli	VBrownlee	LReyes
6/18/87	6/18/87	6/18/87	6/23/87

ENCLOSURE 1

TURKEY POINT PLANT CCW HEAT EXCHANGER CLEANING: REPETITIVE ENTRY INTO LIMITING CONDITIONS FOR OPERATION

The Turkey Point Intake Cooling Water (ICW) / Component Cooling Water (CCW) heat exchangers are subject to rapid fouling of the heat transfer surfaces due to a buildup of calcium carbonate from the cooling canal system. The concern was identified by the licensee during ICW system performance testing which was initiated in early 1986.

Short term corrective action, as specified in licensee evaluation JPE-L-85-38, included the development of heat exchanger performance curves which were used to determine when cleaning should be performed. Cleaning frequency was determined to be a function of heat transfer surface fouling, ICW pump flow, and canal water temperature. Cleaning is required more frequently in the summer months due to elevated canal water temperatures.

The attached data summarizes Unit 3 heat exchanger cleaning (periodicity and duration) between June and August 1986. Cleaning was required approximately three to four times each month, based on the performance guidelines of evaluation JPE-L-85-38. Cleaning was not performed when a unit was in modes 5 or 6, as was the case for Unit 3 during the last two weeks of July and Unit 4 between January and August 1986.

The cleaning effort is time consuming, due primarily to the need to remove large endbell covers to expose the heat exchanger tubes. Cleaning is performed by hydraulic water spray into each individual tube and takes, on the average, 16.5 hours per heat exchanger, including end bell removal and installation.

Each heat exchanger is returned to service within the allowable LCO time of 24 hours mandated in Technical Specification 3.4.4.b.2. However, the next heat exchanger is promptly removed from service, resulting in a total out of service time period of more than 24 hours. Consequently, on the average, a heat exchanger is out of service for 49 of the 62 hour time period used to clean all three heat exchangers. This represents a 29 percent weekly unavailability.

A concern exists that even though this out of service time does not violate the literal Technical Specification requirement it might violate the intent of the LCO. The Technical Specification does not limit the number of times during a calendar period that a component may be taken out of service (i.e., allowable cumulative unavailability). However, the intent is that out of service time be minimized.

An Amertap system is being installed on the Unit 3 heat exchangers to provide on-line cleaning. The system will be operable prior to the end of the Unit 3 refueling outage currently scheduled for completion in late June 1987. Consequently, excessive out of service time is not anticipated this summer. However, installation of an Amertap system will not begin on Unit 4 until March 1988. Consequently, each Unit 4 heat exchanger will need to be cleaned this summer on a periodicity similar to that of Unit 3 last summer.

A single Unit 4 heat exchanger will receive, on a trial basis, a chemical injection system to determine if a chemical solution can preclude the precipitation of calcium carbonate on the heat transfer surface. The vendor, Calgon, enthusiastically endorses this approach as a means to expand the time between cleanings. The actual effectiveness of the process has not been demonstrated. Testing will begin in late June 1987, subsequent to the Unit 4 reactor restart.

Please review the attached cleaning data and determine whether whether cleaning the Unit 4 ICW/CCW heat exchangers at periodicities similar in frequency and duration to those of Unit 3 (Summer 1986) is acceptable.

UNIT 3 CCW HEAT EXCHANGER CLEANING TIMEFRAMES
SUMMER 1986

Heat Exchanger	Date/Time out	Date/Time in	Time out of service	Time to Enter Next LCO
A	6/4 /86 0500	6/5 /86 0345	22hr 45min	3hr
B	6/5 /86 0645	6/5 /86 2230	15hr 45 min	2hr 5 min
C	6/6 /86 0035	6/6 /86 1450	14hr 15 min	n/a

Total out of service time: 52hr 45min

A single heat exchanger was out of service for 52hr 45min during a 57hr 50min time period.

Heat Exchanger	Date/Time out	Date/Time in	Time out of service	Time to Enter Next LCO
A	6/13/86 0530	6/14/86 0138	20hr 8min	57min
B	6/14/86 0235	6/14/86 1915	16hr 40min	24hr 25min
C	6/15/86 1940	6/16/86 1000	14hr 20min	n/a

Total out of service time: 51hr 8min

A single heat exchanger was out of service for 51hr 8min during a 76hr 30min time period.

Heat Exchanger	Date/Time out	Date/Time in	Time out of service	Time to Enter Next LCO
A	6/21/86 0630	6/21/86 2000	13hr 30min	4hr 15min
B	6/22/86 0015	6/22/86 1343	13hr 28min	13min
C	6/22/86 1356	6/23/86 0310	13hr 14min	n/a

Total out of service time: 40hr 12min

A single heat exchanger was out of service for 40hr 12min during a 44hr 40min time period.

Heat Exchanger	Date/Time out	Date/Time in	Time out of service	Time to Enter Next LCO
A	6/25/86 2130	6/26/86 2000	22hr 30 min	6hr 15 min
B	6/27/86 0215	6/27/86 1410	11hr 55min	10 min
C	6/27/86 1420	6/27/86 2115	6hr 55 min	n/a

Total out of service time: 41hr 20min

A single heat exchanger was out of service for 41hr 20 min during a 47hr 45min time period.

Heat Exchanger	Date/Time out	Date/Time in	Time out of service	Time to Enter Next LCO
C	7/1/86 0500	7/1/86 2300	18hr	1hr 30min
B	7/2/86 0030	7/2/86 1845	18hr 15min	3hr 45min
A	7/2/86 2230	7/3/86 1700	18hr 30min	n/a

Total out of service time: 41hr 20min

A single heat exchanger was out of service for 54hr 45min during a 60hr time period.

Heat Exchanger	Date/Time out	Date/Time in	Time out of service	Time to Enter Next LCO
A	7/8/86 0545	7/9/86 0035	18hr 50min	1hr 35min
B	7/9/86 0210	7/9/86 1615	14hr 5min	2hr 5min
C	7/10/86 1820	7/11/86 1615	21hr 55min	n/a

Total out of service time: 54hr 50min

A single heat exchanger was out of service for 54hr 50 min during a 82hr 30min time period.

Heat Exchanger	Date/Time out	Date/Time in	Time out of Service	Time to Enter Next LCO
A	8/8/86 0500	8/8/86 2218	17hr 18min	10hr 2min
B	8/9/86 0820	8/10/86 0120	17hr	4hr 35min
C	8/10/86 0555	8/10/86 1715	11hr 20min	n/a

Total out of service time: 45hr 38min

A single heat exchanger was out of service for 45hr 38min during a 62hr 15min time period.

Heat Exchanger	Date/Time out	Date/Time in	Time out of service	Time to Enter Next LCO
A	8/19/86 0500	8/19/86 2338	18hr 38min	42min
B	8/20/86 0020	8/20/86 2035	20hr 15min	15hr 15min
C	8/21/86 1150	8/22/86 0955	22hr 5min	n/a

Total out of service time: 60hr 58min

A single heat exchanger was out of service for 60hr 58min during a 76hr 55min time period.

Heat Exchanger	Date/Time out	Date/Time in	Time out of service	Time to Enter Next LCO
C	8/28/86 0450	8/28/86 2040	15hr 50min	5min
B	8/28/86 2045	8/29/86 0650	10hr 5min	12hr 5min
A	8/29/86 1855	8/30/86 1335	18hr 40min	n/a

Total out of service time: 44hr 35min

A single heat exchanger was out of service for 44hr 35min during a 56hr 45min time period.

ENCLOSURE 2

TURKEY POINT PLANT CCW PLANT HEAT EXCHANGER SAFETY EVALUATION CONCERNS RAISED BY REGION II INSPECTION STAFF

On February 13, 1986 the licensee determined that the Intake Cooling Water (ICW) system contained two valves which were susceptible to single active failures. The discrepancies were evaluated as not reportable under 10 CFR 21 in Substantial Safety Hazards Evaluation JPE-L-85-38, Revision 0. The licensee determined that the inability to accommodate a single failure constituted an unnecessary contribution to overall risk. Consequently, plans were implemented to evaluate and modify the ICW system to correct the condition.

It was subsequently determined that the inability for one of the valves to perform its function was inconsequential provided that certain parameters were maintained. Revision 1 to JPE-L-85-38 was issued on February 16, 1986 to promulgate graphs depicting the relationship of post accident ICW flow through the Component Cooling Water (CCW) heat exchangers, ICW system (cooling canal) temperature, and CCW heat exchanger cleanliness. Based on these parameters, the licensee was able to determine when personnel were to be stationed at a manual isolation valve to shut the valve subsequent to the occurrence of the Maximum Hypothetical Accident (MHA). The corrective actions specified in Revision 0 were expanded to include the development of a CCW heat exchanger performance monitoring program to ensure that the heat transfer capability of the heat exchangers remained sufficient for effective accident mitigation.

It was determined that the effectiveness of the heat exchangers was heavily dependent on precipitation of calcium carbonate from the canal water on the heat exchanger tubes. The high levels of calcium carbonate in the canal system rapidly degraded the heat transfer capability of the heat exchangers. Consequently, the licensee implemented a program to periodically clean them. Cleaning was required approximately weekly, during the summer months, based on the graphs contained in Revision 1.

In June 1986, it was postulated that, with one heat exchanger out of service for cleaning, canal temperatures might rise to a point where the remaining two heat exchangers could not handle the MHA heat load even after posting an operator at the manual valve. Revision 2 to JPE-L-85-38 was issued on August 5, 1986 to address this possibility.

Revision 2 states that should, during the 24 hour Limiting Condition for Operation (LCO) period for the cleaning of a CCW heat exchanger, the performance of the remaining two heat exchangers degrade to the point where the flow from two ICW pumps is necessary to remove the accident heat load (even after an operator is stationed to close the manual valve) the plant may continue to operate for a 24 hours during any three month period.

Revision 3 to the evaluation was issued on November 7, 1986. The change involved a clarification to the use of the term "operable" and did not affect the revision of concern, Revision 2.

During May 1987, NRC inspectors reviewed evaluation JPE-L-85-38 including all three revisions. It was noted that the decision to operate the Units for 24 hours in a degraded condition such that the flow of two ICW pumps was required to provide accident protection conflicted with system capability discussions found in the Final Safety Analysis Report and the Technical Specification Bases. Additionally, the evaluation did not address the requirements of 10 CFR 50.59.

The FSAR, Section 9.3 states that following a loss of coolant accident, two CCW heat exchangers accommodate the heat removal loads. If a CCW heat exchanger fails, the standby heat exchanger provides a 50 percent backup. Additionally, FSAR Table 9.3-5 specifies that two CCW heat exchangers can carry the total emergency heat load. The FSAR specifies, in Section 9.6, that only one ICW pump is required following a MHA and that the minimum operating requirements for the ICW system are met by one pump and one loop header.

The Technical Specification Bases specify, in Section B3.4.4, that one CCW pump and two CCW heat exchangers meet the requirements of the MHA analysis. Section B3.4.5 specifies that one ICW pump meets the requirements of the MHA analysis.

10 CFR 50.59, Changes, Tests and Experiments, specifies that the holder of a license may make changes in the facility as described in the safety analysis report without prior Commission approval unless the proposed change involves a change in the Technical Specifications or an unreviewed safety question. A proposed change is deemed, in part, to involve an unreviewed safety question if (1) the possibility of an accident or malfunction of a different type than any evaluated previously in the safety analysis report may be created; and (2) the margin of safety as defined in the basis for any Technical Specification is reduced.

Licensee evaluation JPE-L-86-38 may be deficient in that it does not address the requirements of 10 CFR 50.59. Operation of the CCW heat exchangers in a degraded, inefficient manner, such that the flow from two ICW pumps is required for accident mitigation could be construed as a change to the facility as described in the FSAR. Consequently, a 10 CFR 50.59 evaluation may have been required. No licensee evaluation of the issue exists other than that contained in JPE-L-85-38.

Had the required evaluation been performed, an unreviewed safety question may have been found to exist for the following reasons:

(1) The FSAR assumes that no single active failure will prevent the ICW system from performing its intended function. However, for the situation of concern, the failure of the B EDG precludes the

operation of two of the three ICW pumps. Consequently, the plant is not protected. The possible loss of ICW system function due to single failure, other than during Technical Specification authorized LCOs, has not been evaluated in the FSAR;

(2) The bases of the Technical Specifications specifically reference the ability of one ICW pump, in conjunction with two CCW heat exchangers, to handle the heat load of a MHA. The licensee's evaluation, if implemented, appeared to propose a reduction in the safety margin of a Technical Specification Basis.

For 13 hours on January 20, 1987, the licensee operated Unit 4 in a mode where two ICW pumps were needed to handle the MHA heat load. For 12 hours and 35 minutes, on January 21, 1987, the licensee operated Unit 3 in a mode where two ICW pumps were needed to handle the MHA heat load. A possibility exists that each Unit operated in the mode of concern in late November and early December 1986.

ENCLOSURE 3

SUBSTANTIAL SAFETY HAZARDS EVALUATION FOR ICW SYSTEM DESIGN, REVISION 3