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U.S. Nuclear Regulatory Commission
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Perry Nuclear Power Plant
Docket No. 50-440
PNPP Response to Generic Letter 89-13
"Service Water System Problems Affecting
Safety-Related Equipment"

Dear Sir:

The subject letter requested The Cleveland Electric Illuminating Company (CEI) to evaluate safety-related plant systems utilizing Lake Erie water in an open cycle configuration. Specific evaluations in each requested area are attached: (1) control of biofouling, (2) trending of heat exchanger performance, (3) periodic inspection for biological or water quality related systems degradations, (4) design review for single failure integrity and as-built configuration control, and (5) adequacy of maintenance practices, operating procedures and training.

Our commitments to implement requested programs and evaluations are provided within our attached response to each concern. Our final implementation letter confirming that all initial tests/activities have been completed and that continuing programs have been established will be submitted following the requested evaluation of 3 heat exchanger performance tests. The initial frequency for these performance tests will be at each refueling outage, therefore, the schedule for our final confirmation letter is estimated to be the fourth quarter of 1993.

If you have any questions, please feel free to call.

Very truly yours,

Al Kaplan
Vice President
Nuclear Group

AK:njc

cc: NRC Region III, Regional Administrator
P. Hiland
T. Colburn

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CEI RESPONSE TO GL 89-13 RECOMMENDED ACTIONS

I. **"For open-cycle service water systems, implement and maintain an ongoing program of surveillance and control techniques to significantly reduce the incidence of flow blockage problems as a result of biofouling. Initial activities should be completed before plant startup following the first refueling outage beginning 9 months or more after the date of this letter. All activities should be documented and all relevant documentation should be retained in appropriate plant records."**

At PNPP, the safety related open cycle cooling water system to which this Generic Letter response is directly applicable is the Emergency Service Water (ESW) System. This is the system which serves "to transfer heat from structures, systems and components important to safety to an ultimate heat sink" (Lake Erie). In response to staff concerns with other safety significant systems using raw water as a source, the fire protection system (which shares the ESW pump bay as a water source) is also discussed in this letter. For PNPP, the "first refueling outage beginning 9 months or more after the date of this [Generic] letter" is our 2nd refuel outage, scheduled to begin in September 1990.

Enclosure 1 to Generic Letter 89-13 describes recommended programs to be used to address Action Item I. Four techniques are described; two for surveillance activities and two for control activities. The techniques to be used at a plant depend on whether macroscopic biological fouling organisms (mussels or clams) have been detected at the facility. At PNPP, Asiatic Clams (Corbicula) have not yet been detected (two clams were found in June 1987 at CEI's nearby Eastlake Plant, with no subsequent occurrences found at Eastlake or PNPP), but zebra mussels <u>have</u> been identified at PNPP. Based on this history, it was decided to discuss all four of the techniques (Surveillances A and D, Controls B and C) in response to this Generic Letter:

A. **"The intake structure should be visually inspected, once per refueling cycle, for macroscopic biological fouling organisms (for example, ... Asiatic clams at freshwater plants), sediment, and corrosion. Inspections should be performed either by scuba divers or by dewatering the intake structure or by other comparable methods. Any fouling accumulations should be removed."**

<u>Response:</u>

Procedures are in place for underwater inspection of intake structures in the lake as well as on-shore pumphouses annually. Sediment buildup is removed from the ESW pump bays and forebay annually if the system engineer determines that system function could be impaired over the following inspection interval. A water treatment program is being developed to minimize accumulation of mussels and clams in pump bays, pumps and downstream system components. If mussels or clams accumulate in sufficient numbers on any inspected surface to impair pump performance, they will be physically removed. More limited accumulations that do not degrade pump performance will be left in place. At the present time, no operational problems have resulted from mussel or clam shell accumulation.

B. **"The service water system should be continuously (for example, during spawning) chlorinated (or equally effectively treated with another biocide) whenever the potential for macroscopic biological fouling exists (for example, ... Asiatic clams at freshwater plants). Chlorination or equally effective treatment is included for freshwater plants without clams because it can help prevent microbiologically influenced corrosion. However, the chlorination (or equally effective) treatment need not be as stringent for plants where the potential for macroscopic biological fouling species does not exist compared to those plants where it does. Precautions should be taken to obey Federal, State, and local environmental regulations regarding the use of biocides."**

Response:

PNPP has an ESW chlorination system that operates intermittently during time periods when the potential for a macroscopic biological fouling species exists. CEI is presently evaluating and may test several alternative biocide treatments to determine their relative effectiveness in eliminating Zebra mussels and Asiatic clams from safety-related plant systems, in compliance with federal, state and local environmental restrictions. The chosen chemical treatment system will be placed into operation before the heavy entrainment period for Zebra mussels in the summer of 1990. The injection mode selected may be intermittent or continuous.

C. **"Redundant and infrequently used cooling loops should be flushed and flow tested periodically at the maximum design flow to ensure that they are not fouled or clogged. Other components in the service water system should be tested on a regular schedule to ensure that they are not fouled or clogged. Service water cooling loops should be filled with chlorinated or equivalently treated water before layup. Systems that use raw service water as a source, such as some fire protection systems, should also be chlorinated or equally effectively treated before layup to help prevent microbiologically influenced corrosion. Precautions should be taken to obey Federal, State, and local environmental regulations regarding the use of biocides."**

Response:

Procedures are in place to flow test all ESW water-to-water heat exchanger flow paths quarterly at design flow rate to record pressure drops, and to test ESW pumps quarterly. Design flow rate through each heat exchanger is obtained by throttling the heat exchanger manual discharge valve (normally valve adjustment is not necessary). Each fire main loop is flow tested and discharge pressure trended every 3 years, and annually hydrants are flushed to verify that no rust is apparent while flow testing. The adequacy of water treatment for the ESW and fire protection systems will be confirmed for all modes of operation in conjunction with the ESW treatment system development described in (B) above. In addition, since the fire protection system is maintained greater than 100 psig by a jockey

pump, CEI is investigating whether maintaining this system pressurized will be effective in preventing Zebra mussel infestation of the fire protection system.

D. **Samples of water and substrate should be collected annually to determine if Asiatic clams have populated the water source. Water and substrate sampling is only necessary at freshwater plants that have not previously detected the presence of Asiatic clams in their source water bodies. If Asiatic clams are detected, utilities may discontinue this sampling activity if desired, and the chlorination (or equally effective) treatment program should be modified to be in agreement with paragraph B, above.**

Response:

Substrate sampling is currently performed on a quarterly basis to detect Asiatic clams at PNPP in accordance with a requirement in our Environmental Protection Plan (Appendix B to the Operating License). As noted above, Asiatic clams have not yet been detected at PNPP, however Zebra mussels have been. Since treatment programs are being instituted to control Zebra mussel growth, consideration is being given to discontinuing the complete Asiatic clam monitoring program currently being conducted. Separate correspondence on this subject will be provided to the NRC if it is determined that the current sampling program is not necessary.

II. **"Conduct a test program to verify the heat transfer capability of all safety-related heat exchangers cooled by service water. The total test program should consist of an initial test program and a periodic retest program. Both the initial test program and the periodic retest program should include heat exchangers connected to or cooled by one or more open-cycle systems as defined above. Operating experience and studies indicate that closed-cycle service water systems, such as component cooling water systems, have the potential for significant fouling as a consequence of aging-related in-leakage and erosion or corrosion. The need for testing of closed-cycle system heat exchangers has not been considered necessary because of the assumed high quality of existing chemical control programs. If the adequacy of these chemistry control programs cannot be confirmed over the total operating history of the plant, or if during the conduct of the total testing program any unexplained downward trend in heat exchanger performance is identified that cannot be remedied by maintenance of an open-cycle system, it may be necessary to selectively extend the test program and the routine inspection and maintenance program addressed in Action III, below, to the attached closed-cycle systems.**

A program acceptable to the NRC for heat exchanger testing is described in "Program for Testing Heat Transfer Capability" (Enclosure 2) [to the Generic Letter]. It should be noted that Enclosure 2 is provided as guidance for an acceptable program. An equally effective program to ensure satisfaction of the heat removal requirements of the service water system would also be acceptable.

Testing should be done with necessary and sufficient instrumentation, though the instrumentation need not be permanently installed. The relevant temperatures should be verified to be within design limits. If similar or equivalent tests have not been performed during the past year, the initial tests should be completed before plant startup following the first refueling outage beginning 9 months or more after the date of this letter.

As a part of the initial test program, a licensee or applicant may decide to take corrective action before testing. Tests should be performed for the heat exchangers after the corrective actions are taken to establish baseline data for future monitoring of heat exchanger performance. In the periodic retest program, a licensee or applicant should determine after three tests the best frequency for testing to provide assurance that the equipment will perform the intended safety functions during the intervals between tests. Therefore, in the periodic retest program, to assist that determination, tests should be performed for the heat exchangers before any corrective actions are taken. As in the initial test program, tests should be repeated after any corrective actions are taken to establish baseline data for future monitoring of heat exchanger performance.

An example of an alternative action that would be acceptable to the NRC is frequent regular maintenance of a heat exchanger in lieu of testing for degraded performance of the heat exchanger. This alternative might apply to small heat exchangers, such as lube oil coolers or pump bearing coolers or readily serviceable heat exchangers located in low radiation areas of the facility.

In implementing the continuing program for periodic retesting of safety-related heat exchangers cooled by service water in open-cycle systems, the initial frequency of testing should be at least once each fuel cycle, but after three tests, licensees and applicants should determine the best frequency for testing to provide assurance that the equipment will perform the intended safety functions during the intervals between tests and meet the requirements of GDC 44, 45 and 46.
The minimum final testing frequency should be once every 5 years. A summary of the program should be documented, including the schedule for tests, and all relevant documentation should be retained in appropriate plant records."

Response:

Performance testing of ESW water-to-water heat exchangers will be implemented with the primary objective of determining whether biofouling/corrosion has reduced the overall heat transfer coefficient sufficiently to reduce the quantity of heat that can be transferred at design conditions. Test conditions may be different than design, as long as the heat transfer coefficient can be accurately determined. Initially the schedule for ESW water-to-water heat exchangers performance testing will be each refuel outage, beginning with our second refuel outage. The retests will include both pre- and post- corrective action testing (if corrective action, e.g. cleaning, is done) in order to provide data for

determination of future schedules and to allow consistent baseline data comparisons. Test procedures/schedules will be prepared, and records retained, for the purpose of verifying the ESW water-to-water heat exchangers' capability. The best frequency for such testing/inspection will be determined after fourth refueling outage results are evaluated, but a minimum frequency of once every 5 years will be maintained. The ESW air-to-water heat exchanger (HPCS room cooler) will be inspected and cleaned at each refuel outage, fin and tube side, as an alternative to performance testing. Existing chemistry control programs for closed-cycle systems have been adequate to preclude biological fouling over PNPP's operating history. Without significant degradation in heat exchanger performance, it is concluded that extension of the test/inspection/maintenance programs beyond ESW is not warranted. In addition, established plant procedures would serve to address any degradation in the performance of interfacing closed cycle systems.

III. **"Ensure by establishing a routine inspection and maintenance program for open-cycle service water system piping and components that corrosion, erosion, protective coating failure, silting, and biofouling cannot degrade the performance of the safety-related systems supplied by service water. The maintenance program should have at least the following purposes:**

A. To remove excessive accumulations of biofouling agents, corrosion products, and silt;

B. To repair defective protective coatings and corroded service water system piping and components that could adversely affect performance of their intended safety functions.

This program should be established before plant startup following the first refueling outage beginning 9 months after the date of this letter. A description of the program and the results of these maintenance inspections should be documented. All relevant documentation should be retained in appropriate plant records."

Response:

An ongoing maintenance program has been described above for inspection and maintenance of the ESW intake structures, HPCS room cooler, and fire protection system. In addition, raw water systems are inspected for clams when open for maintenance or repair. Starting with our second refuel outage, one loop of the ESW system and a heat exchanger in that loop (three loops total) will be visually inspected, cleaned as necessary, and appropriate testing conducted for evidence of MIC or other corrosion, on a rotating basis. Consistent with heat exchangers performance testing discussed in II above, the best frequency for inspection and cleaning will be determined after the fourth refueling outage. Appropriately scheduled instructions, including records, will be prepared for this purpose. Due to the fact ESW piping is not in use during normal plant operation and operates below 200°F, the ESW system is not included in the PNPP erosion/corrosion monitoring program (described in PY-CEI/NRR-0708L, 9/8/87, PY-CEI/NRR-1034L, 7/20/89, and PY-CEI/NRR-1096L, 11/14/89).

IV. **"Confirm that the service water system will perform its intended function in accordance with the licensing basis for the plant. Reconstitution of the design basis of the system is not intended. This confirmation should include a review of the ability to perform required safety functions in the event of failure of a single active component. To ensure that the as-built system is in accordance with the appropriate licensing basis documentation, this confirmation should include recent (within the past 2 years) system walkdown inspections. This confirmation should be completed before plant startup following the first refueling outage beginning 9 months or more after the date of this letter. Results should be documented and retained in appropriate plant records."**

Response:

The Emergency Service Water System has been evaluated using Safety System Functional Inspection (SSFI) techniques by CEI staff during the first quarter of 1989. The ESW design bases, calculations, preoperational testing, plant operations, component performance and system interfaces were evaluated. Earlier the ESW System was walked down to verify its as-built configuration prior to fuel load (March, 1986). Since that time, design changes have been controlled by a formal program which reviews impacts on the design basis and verifies as-built configuration. Considering the effectiveness of this design control program, additional walkdowns are not considered necessary or justified. Our design review and followup actions have confirmed that the ESW system will perform its intended function in accordance with the PNPP licensing basis. Resolution of remaining SSFI concerns (which do not impair this function) will be documented and retained in appropriate plant records.

V. **"Confirm that maintenance practices, operating and emergency procedures, and training that involves the service water system are adequate to ensure that safety-related equipment cooled by the service water system will function as intended and that operators of this equipment will perform effectively. This confirmation should include recent (within the past 2 years) reviews of practices, procedures, and training modules. The intent of this action is to reduce human errors in the operation, repair and maintenance of the service water system. This confirmation should be completed before plant startup following the first refueling outage beginning 9 months or more after the date of this letter. Results should be documented and retained in appropriate plant records."**

Response:

The requested review has been completed, and CEI confirms that ESW maintenance practices, operating and emergency procedures, and training are adequate. The review emphasized operating and maintenance errors in

NUREG-1275, Volume 3 entitled, "Operating Experience Feedback Report - Service Water System Failures and Degradations". Operating procedures were reviewed with attention focused on system restoration following maintenance. Procedures and instructions reviewed included ESW operation, valve and electrical lineup instructions, and administrative controls for system restoration. NUREG-1275 also identifies valve locking programs as being a potential solution to mispositioning errors. The PNPP locked valve program addresses ESW throttle valves to heat exchangers and valves that cross connect Emergency Service Water to Fuel Pool Cooling, Fire Water, and RHR systems. In addition, because the Emergency Service Water System is safety related, repositioning of its components requires independent verification which is provided by PNPP administrative procedure.

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