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

Subject: Three Mile Island Nuclear Station, Unit 1 (TMI-1)
Operating License Nos. DPR-50 and DPR-73
Docket Nos. 50-289
Generic Letter 89-13 Revised Response

GPU Nuclear letter C311-89-2115 dated January 26, 1990, responded to Generic Letter (GL) 89-13, "Service Water System Problems Affecting Safety-Related Equipment." Two additional letters (C311-91-2055 dated August 18, 1991, and C311-91-2145 dated November 19, 1991) provided follow-up responses.

As a result of a Service Water System Operational Performance Inspection (SWSOPI) self-assessment performed during the spring of 1995, we are providing this update to our GL 89-13 response. The attachment summarizes the recommended actions of the GL and provides GPU Nuclear's revised response (changes indicated in bold print). This response replaces and supercedes all previous responses.

Sincerely,

J. Knubel

J. Knubel
Vice President and Director, TMI

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Sworn and subscribed to before me
this 6th day of June, 1996

Suzanne C. Miklosik
Notary Public

Notarial Seal
Suzanne C. Miklosik, Notary Public
Londonderry Twp., Dauphin County
My Commission Expires Nov. 22, 1999
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AWM

cc: M. G. Evans - TMI Senior Resident Inspector
J. A. Norris - TMI-1 Senior Project Manager
T. T. Martin - Administrator, Region I



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Recommended Action I to GL 89-13

"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."

GPU Nuclear Response

The open-cycle service water systems per the criteria of GL 89-13 for TMI-1 are:

- Decay Heat River Water (DR)
- Nuclear Services River Water (NR)
- Reactor Building Emergency Cooling Water Systems (RR)

Enclosure 1 (Items A-D) to GL 89-13 provides a recommended program for responding to Recommended Action 1. The following describes GPU Nuclear's program in response to the recommended actions described in Enclosure 1 to GL 89-13.

- Enclosure 1, Item A

  GPU Nuclear currently performs an annual sampling of the TMI Intake Structures for biological fouling organisms **including Asiatic Clams**. Additionally, TMI-1 Technical Specification Table 4.1-2, "Minimum Equipment Test Frequency," requires a visual inspection of silt accumulation of the Intake Pump House Floor each refueling period. Furthermore, this table requires a quarterly silt accumulation measurement of the pump house floor. **Intake bays for the service water systems are measured quarterly for silt accumulation and inspected each refueling period for silt depth visually (i.e. by scuba divers or using remote visual technology). When the silt accumulation reaches a level in excess of the procedural limit, actions are initiated to evaluate if and when desilting is necessary.**

- Enclosure 1, Item B

  The service water systems at TMI-1 are treated periodically, as necessary, to prevent biofouling. The frequency and duration of this biocidal treatment program is adjusted based on ambient river conditions and experience (e.g., results of internal component inspections, **and inspection and sampling of the river water intake structure). Present conditions typically warrant micro-biofouling treatment of injection of control chemicals up to 2 hours daily. Macro-biofouling treatment typically consists of injection of control chemicals twice a year, in the spring and fall when the river water temperature is greater than 60°F. The chemicals used for both micro-biofouling treatment and macro-biofouling treatment are in conformance with the site's NPDES permit and thus are in conformance with Federal, State and Local environmental regulations.**

• <u>Enclosure 1, Item C</u>

This item states **in part** "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", **and "...should be effectively treated to help prevent microbiologically influenced corrosion".**

**The NR system is routinely operated and normal system monitoring indicates if significant fouling is occurring**. The DR and RR systems are infrequently used. The DR system is flushed and flow tested at design flow on a quarterly basis. The RR system is flushed and flow tested at design flow during each refueling outage. The portion of the RR system that is layed up during the operating cycle is filled with chemically treated water.

Furthermore, the river water pumps are operated at least quarterly. Operating these pumps ensures that stagnant pump suction lines are not blocked and consequently limits the opportunity for undisturbed clam colonization and growth.

**The DR, RR, and NR systems contain infrequently used lines filled with stagnant water for extended periods of time. The 1995 SWSOPI self-assessment pointed out the following such lines: 1) EFP alternate suction line from the RB emergency cooling loop, 2) NR-V-52, mechanical jumper to DR, 3) DR-V-17B, fire service to DR, and 4) the emergency dump line to the river. An ongoing GPUN review identified an additional backup river water overflow point. These lines were reviewed using the GL 89-13 criteria for flow paths from safety related equipment to the ultimate heat sink. It was determined that the Emergency Feedwater alternate suction line and the backup river water system discharge points are in scope. In both cases there are constraints which make flow testing highly undesirable and the confirmation of flow capability will be done through periodic internal visual inspections. Further, those lines which contain water are included within the GPUN Microbiologically Influenced Corrosion (MIC) Monitoring Program and are subject to the inspection and remediation of that program.**

**The GPUN Microbiologically Influenced Corrosion Monitoring Program includes the NR, DR, and RR systems. The MIC Program provides a means of inspecting lines to monitor their condition and affects of potential environmental attacks due to MIC. This program encompasses two major areas of activity:**

**1) Remediation - actions taken to remedy the results of MIC attack. These comprise inspections to locate areas of degradation, to quantify the extent of degradation and physical repair/replacement to restore component integrity.**

**2) Mitigation - actions taken to alleviate the presence of aggressive microbes in plant systems. These comprise the application and monitoring of biocides to reduce microbial populations, and the application of physical cleaning methods to remove accumulated microbe colonies.**

• Enclosure 1, Item D

This item states that "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."

**TMI-1 draws its river water from the York Haven Pond. Asiatic clams populate the pond in sufficient numbers to sustain a viable growing population.** Since the presence of Asiatic clams in the TMI area has been established and an effective biocide treatment program is in place, GPUN does not perform annual pond wide sampling. Sampling of the TMI-1 intake bay will continue to track clam growth and help determine the frequency and effectiveness of the biocide treatment program. GPUN believes that this program (i.e., an effective biocide treatment program coupled with inspection and sampling of the intake structure) satisfies the recommended surveillance and control techniques provided in Enclosure 1 to GL 89-13.)

Recommended Action II to GL 89-13

"Conduct a test program to verify the heat transfer capability of all safety related heat exchangers cooled by service water."…. The need for testing of closed-cycle system heat exchangers has not been considered necessary because of the assumed high quality of existing chemistry control programs."

"A program acceptable to the NRC for heat exchanger testing is described in 'Program for Testing Heat Transfer Capability' (Enclosure 2). 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 requirement of the service water system would also be acceptable."

GPU Nuclear Response

**The heat exchangers at TMI which are included within the scope of the GL-89-13 program are:**

**1. Decay Heat Closed Cooling Water heat exchangers, DC-C-2 A/B: This is a water-to-water heat exchanger with river water from the Decay Heat River Water system on the tube side and Decay Heat Closed Cooling on the shell side. The river water systems for the Decay Heat Closed Cooling Water heat exchangers may be in service during any mode of operation, although required primarily for Cold Shutdown and Refueling operations.**

**The closed cooling side of these systems, Decay Heat Closed Cooling Water, has been maintained by a chemistry control program since the beginning of plant operation.**

For the Decay Heat Closed Cooling Water heat exchangers, typically one of the two heat exchangers will be tested on an alternating basis during refueling outages. TMI has determined that adequate testing to confirm the heat transfer capability can be done using a combination of existing instrumentation and additional temporary instrumentation. The short period of time with satisfactory system test conditions during refueling makes successful testing of both systems in a single outage unlikely. Scheduling the testing in alternate outages provides for the required testing while minimizing the risk and operator burden associated with swapping active trains early in the outage. Test results will be evaluated and trended.

2. Nuclear Services Closed Cooling Water heat exchangers, NS-C-1 A/B/C/D: This is a water-to-water heat exchanger with river water from the Nuclear River Water system on the tube side and Nuclear Services Closed Cooling on the shell side. The river water systems to the Nuclear Services Closed Cooling Water heat exchangers are in service during all modes of operation.

The closed cooling side of this system, Nuclear Services Closed Cooling Water, has been maintained by a chemistry control program since the beginning of plant operation.

The heat exchanger transfer capability will be maintained through an open and inspect program in combination with the monitoring of system conditions during normal operation. Testing to determine the heat transfer capability of the Nuclear Services heat exchangers has been unsuccessful due to the large heat transfer capability relative to the available heat loads and the accuracy of the temperature and flow measurement devices. GPUN has concluded that accident design base heat exchanger testing is not necessary because the normal heat load (during day to day steady state plant operations) on the Nuclear Services Closed Cooling Water System is actually greater than during post accident heat load. If sufficient cooling to the normal heat loads can not be maintained, action would be initiated to investigate and correct the cause in order to support power operation. This will provide confidence that the heat exchangers are capable of removing the smaller, post accident heat load and that the safety related design functions will be satisfied.

3. Reactor Building Emergency Cooling Coils RR-1 A/B/C in the Reactor Building Air Handling/Cooling Units: This is an air-to-water heat exchanger with river water from the Reactor Building Emergency Cooling Water system (RR) on the tube side and the Reactor Building atmosphere on the air side. RR is maintained in a standby mode. It is not normally placed in service except for required system testing. The water side of the Emergency Cooling Coils has been maintained by a chemistry control program which includes draining and refilling with treated water following testing.

The Emergency Cooling Coils will be subject to a combination of visual inspections and trending. Visual inspection of the air side and monitoring of air and water flows will occur each outage. Inspection of one cooler's water side will also occur each outage. This satisfies the requirements of GL 89-13, enclosure 2. The inspection, trending, and chemistry control programs provide a reliable means to verify heat transfer capability.

**GPUN has evaluated the use of performance testing to confirm the ability of the units to perform their required function and has concluded that such testing could not reliably be used to establish the heat transfer characteristics under design conditions.**

**An attempt to measure heat transfer on the water side was made in the Fall of 1995. Using installed instrumentation and with normal heat loads of 2.5 x $10^6$ BTU/hr per heat exchanger, which is small compared to accident loads of about 80 x $10^6$ BTU/hr per heat exchanger, statistically significant results could not be obtained. Upgrading of existing instrumentation has also been determined not to be practical since even a relatively small temperature measurement error would contribute a significant error relative to the normal heat load. This error would affect the developed heat transfer coefficient. (Logistical and building equipment concerns eliminate methods to increase the heat load.)**

**Additionally, with normal containment conditions the cooling coils primarily remove sensible heat from the building. During accident conditions, the coils remove a significant amount of energy by condensing steam and removing the latent heat of vaporization in addition to removing sensible heat.**

**Given the changes in heat transfer modes, as discussed above, along with a statistically questionable heat transfer coefficient, extrapolation of performance from normal conditions ( 2.5 x $10^6$ BTU/hr) to accident conditions ( 80 x $10^6$ BTU/hr) would not be meaningful.**

**In addition, TMI will apply the recommended actions of GL 89-13 to the following heat exchangers:**

**1. Control Building Chilled Water heat exchangers, AH-C-4A/B: This is a chiller with Nuclear Services Closed Cooling Water supplying the condenser and the Control Building Chilled Water system on the chiller side. The Control Building Chillers (AH-C-4A/B) are operated normally with one unit loaded in accordance with system demand and the other in standby. The Control Building Chillers are not Nuclear Safety Related by design, however we acknowledge the important function they provide; thus we feel it is prudent to monitor their performance.**

**The building cooled by this system is continually occupied. As such, degraded performance of a chiller would be detected through increased temperature in the Control Building. It should be noted that GL 89-13 allows an alternative action of frequent regular maintenance in lieu of testing for degraded performance of the heat exchanger. Both regular maintenance (bimonthly PM and annual overhaul) and performance trending will be done for the Control Building Chillers. Data for the Control Building Chillers such as temperatures, flows and pressure differential taken during the bi-monthly and annual chiller inspections will be evaluated by performance trending. Comprehensive heat transfer testing is not warranted because normal, daily**

**operation and trending provide adequate means of ensuring performance, especially since there is not a major mechanism or method of fouling either side of the chiller.**

**GPUN will continue to maintain the chemical treatment program on the closed cooling water systems as the preferred method of ensuring the capability to meet the design heat transfer requirements. The recent Service Water self assessment identified a potential heat transfer concern related to the use of NALCO, which was used as a corrosion inhibitor on systems at TMI for a period of about 15 years. The NALCO corrosion control program was performed in accordance with the chemistry controls in effect at the time. Over the last few years, NALCO has been replaced by an alternate chemistry control material. The systems were flushed prior to use of the new product.**

**An inspection of the shell side (closed cooling side) of one of the Nuclear Services Heat Exchangers was performed through a relief valve opening. The inspection identified that there is no accumulation of film or debris on the accessible tube surfaces. The tubes were bright and clearly visible. There was no residue noted on the walls or baffle plates. During the drain down of the coolers, a small amount of NALCO residue came out of the low point drain, but there was no NALCO or NALCO residue visible in the bulk water.**

**An inspection of the tube side of the Reactor Building Emergency Cooling Coils was also performed during 11R. There was no visible indication of any NALCO or NALCO residue on the tube inner surfaces, although laboratory examination of swab samples indicated traces of NALCO residue.**

**A test performed on one of the Decay Heat Closed Cooling Water heat exchangers showed excellent heat transfer capability thus indicating minimal fouling.**

**Based on the aforementioned inspections and the successful performance test of the Decay Heat Closed Cooling Water heat exchanger, there is no indication that NALCO or NALCO residue is having any adverse effect on the heat transfer of the units at TMI. NALCO has not been used in the heat exchangers for several years. There may be some accumulations of NALCO residue in low points of the systems, but it does not appear to be of any consequence.**

Recommended Action III to GL 89-13

"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."

GPU Nuclear Response

As indicated in the responses to Recommended Actions I & II, procedures currently exist for inspecting open-cycle service water systems for the presence of biofouling erosion, corrosion, coating condition and for removing accumulations of silt. Additionally, GPU Nuclear conducts a Preventive Maintenance (PM) program for the piping and components of each open-cycle system which provide the assurance that the system will perform its safety related function. **The GPUN PM** program satisfies the intent of this recommended action. Additionally, **leakage** tests are performed, in accordance with ASME Section XI, on the piping of the open-cycle service water systems to verify the integrity of these systems.

Recommended Action IV to GL 89-13

"Confirm that the service water systems will perform its intended function in accordance with the licensing bases 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."

GPU Nuclear Response

An assessment of the operational readiness of the TMI-1 open-cycle service water systems was addressed in TMI Audit Report S-TMI-87-07 dated August 25, 1987. This audit was conducted by comparing configuration; physical condition; and operating, maintenance, and surveillance procedures; to the design basis of the plant including system walkdown. The results of this audit were that the current design, operation and maintenance of the open-cycle service water systems are consistent with design basis documents.

**An audit of the Decay Heat Closed Cooling Water System (i.e., a closed-cycle system) was also performed to assess its operational readiness (Reference S-TMI-86-05). This audit report determined that the operation of the Decay Heat Closed Cooling Water System is consistent with the design basis documents. TMI Audit Report S-TMI-91-13 additionally concludes that the Nuclear Services Closed Cooling System is configured and operated consistent with the design bases in the FSAR.**

**In response to our Service Water Self-Assessment, single failure analyses of the NR/NS and the Control Building Chilled Water systems were performed and confirmed that these systems could perform their required safety functions in the event of a single active failure. Further, a review of the existing single failure analysis of the DR/DC systems was performed. This review reaffirmed the previous conclusions.**

**Revised analysis of the RR System operation shows that Reactor Building temperature and pressure requirements are satisfied during design conditions which includes a single active failure. This analysis establishes new flow requirements for the Reactor Building Emergency Cooling Water System. This system has been demonstrated to satisfy these requirements.**

**RR design descriptions (FSAR Section 6.3.2 and 9.6.1.b) state that RR system design pressure is maintained above Reactor Building design pressure to prevent leakage out of the Reactor Building from a damaged system. The RR system will not be damaged by a LOCA. However, the possibility of minor air leakage can not be excluded. A single failure which causes loss of one RR pump coincident with loss of non-safety instrument air**

**will result in loss of design pressure. Although the existing design, which ensures adequate system flow upon loss of non-safety instrument air, is consistent with the original design and licensing basis as described in the FSAR, our review has identified this vulnerability. To enhance containment integrity, a modification will be implemented consistent with the Integrated Schedule.**

Recommended Action V to GL 89-13

"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."

GPU Nuclear Response

TMI-1 procedures are reviewed on a biennial basis which provides reasonable assurance that TMI-1 procedures are current and reflect plant configuration. GPUN personnel review maintenance, operating, surveillance, emergency procedures, etc., dealing with open and closed cycle service water systems via this biennial review process. In addition to the biennial review, other procedural changes are made as the result of vendor recommendations, plant modifications, License Amendments, etc. Furthermore, QA audits similar to those discussed in the response to Recommended Action IV, also serve to confirm the adequacy of procedures related to service water systems.

The TMI Training Department program for reviewing and maintaining lesson plans ensures that equipment and procedure changes are incorporated in lesson plans and that lesson plans are maintained current. Additional training is accomplished through on-the-job training, industrial experience, meetings, etc.

**The recent Service Water System Self Assessment reviewed procedures and witnessed the use of procedures in response to a system transient at the TMI-1 simulator. This Self Assessment also reviewed training activities. The results found the procedures and training to be in good condition and operators knowledgeable of the procedures.**

Thus GPU Nuclear **has confidence** that our current procedure and training program provide assurance that the safety-related equipment**, and the Control Building chiller system**, cooled by service water systems will perform their intended function and that operators of this equipment will perform effectively.