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November 7, 2002

Mr. Fred Cayia
Nuclear Management Company, LLC
6590 Nuclear Road
Two Rivers, WI 54241

Subject: Preliminary Analysis of Auxiliary Feed Water Reduced Flow and Scope of Final Analysis

Dear Fred Cayia:

Per your request, I am writing this letter to provide a preliminary analysis of the auxiliary feed water flow reduction problem related to pumps AFP-38A and 38B. Also, per your request for a thorough failure mode and effects analysis, I state the scope of this analysis. The full scope analysis may take one month to complete.

INFORMATION COLLECTION & OBSERVATION

Dan Lyons, my PII director, and I have reviewed all available flow data, visually examined the particles obtained from the orifice downstream of AFP-38A and AFP-38B, and particles samples obtained from bottom of the condensate storage tank, interviewed system engineers and mechanics who took apart the orifice downstream of the AFP-38A pump, and witnessed the draining and removal of the orifice downstream of the AFP-38B pump. Moreover, we walked down the system and did a debris source analysis.

PRELIMINARY ANALYSIS

Based on what Dan Lyons and I observed to date, there are six possible failure modes that could account for the degradation of the auxiliary feedwater flow rate. These six failure modes are:

- Scaling of the holes in the orifice
- Debris blockage of the holes in the orifice
- Piston hanging of check valves AF-0015 and AF-0016
- Limit switch failure or stem separation of AOV AF-4007 and AF-4014
- Valve failure of manual valves downstream of the orifice, AF 27 and AF 40
- Pump degradation
- Flow instrumentation accuracy

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Even though we have formally not ruled out any failure modes, and conditions and information is constantly changing we felt that debris blockage, piston hanging of the check valves, or air binding of the pumps are the most likely failure modes.

IMPACT ON SAFETY

We realize that we have not performed a full scope analysis. However, using engineering judgment, we believe this issue poses little risk to the flow rate requirements of the auxiliary feed water system. Our judgment is based on the following considerations:

- Piston hanging requires a high friction coefficient (commonly encountered with a dry surface between the piston and its guide) between the metal surface. This condition occurs only after draining the line, which occurs infrequently. As such, this failure mode is not a common failure mode for all four pumps.
- The debris at the bottom of the CST is in forms of small piece of rust and resin. As they pass through the auxiliary feed pumps, they would be pulverized/powderized. The powders won't stick onto the orifice holes because of the high velocity through the orifice holes.
- The debris in the service water may be in forms of algae, silt, and organic pieces. As they go through the service water pump and the auxiliary feed water pump, they will also be powderized. Again, the high velocity in the orifice holes will probably prevent them from sticking onto the orifice wall.
- Corrosion products downstream of the auxiliary feed water pump are the only source that may transport into the orifice without being powderized by the pump. However, it is our judgment, these corrosion products developed when the system was opened to the atmosphere. This failure mode is not a common failure mode.
- For air binding of the pumps they would have to be opened for maintenance or other work. This failure mode is not a common failure mode. Also, the pumps are multi-staged pumps that are designed to operate effectively with only the initial stages primed. Therefore, the configuration of the flow instrumentation may preclude adequate venting of the instrumentation, which is not a common failure mode of the pumps.

Based on the above discussion, it is our judgment at this time that the auxiliary feed water flow cooling capability will not be compromised through a common failure mode.

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FINAL ANALYSIS

Of course, we have to complete the final analysis to support our preliminary judgment. We will perform particle size and structure analysis, shear force analysis, scaling analysis, and pump degradation analysis to determine the bounding conditions that would render the pump unable to meet its design function. We can then compare that to the conditions that exist at the plant and include these analyses in the final report.

If you have any questions please do not hesitate to call me at 949-361-5476.

Sincerely,

Chong Chiu

Dr. Chong Chiu
President
Performance Improvement International, LLC