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U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

Gentlemen:

Subject: Oyster Creek Nuclear Generating Station (OCNGS)
Docket No. 50-219
Facility Operating License No. DPR-16
Request For Additional Information Concerning Generic Letter 96-06

Pursuant to your letter of June 19, 1998 and GPUN's letter of September 17, 1998, please find attached the requested information.

If there are any questions or additional information is required, please contact Mr. Joseph D. Lachenmayer of our staff at 973-316-7971.

Very truly yours,

for Michael B. Roche
Vice President and Director
Oyster Creek

Enclosure
Attachments
cc: Administrator, Region I
NRC Senior Resident Inspector
NRC Project Manager

A072 /1

REQUEST FOR ADDITIONAL INFORMATION FOR RESOLUTION OF GENERIC LETTER (GL) 96-06 ISSUES AT OYSTER CREEK NUCLEAR GENERATING STATION

GL 96-06, "Assurance of Equipment Operability and Containment Integrity During Design-Basis Accident Conditions," dated September 30, 1996, included a request for licensees to evaluate cooling water systems that serve containment air coolers to assure that they are not vulnerable to waterhammer and two-phase flow conditions. General Public Utilities Corporation (the licensee) provided its assessment of the waterhammer and two-phase flow issues for Oyster Creek in letters dated January 28, and February 26, 1997. The licensee indicated that the drywell cooling units and associated reactor building closed cooling water system are not safety related and are not required for accident mitigation. However, the Emergency Operating Procedures (EOPs) did allow operators to use the drywell cooling units following an accident if available, and the EOPs were revised to eliminate the potential for waterhammer following a loss-of-coolant accident. In order to assess the licensee's resolution of these issues, the following additional information is requested:

Issue 1

Describe the revisions that were made to the EOPs to eliminate the potential for waterhammer. Also discuss to what extent these revisions eliminate the potential for two-phase flow.

Response

GPUN revised the Emergency Operating Procedures (EOPs); specifically EMG-3200.02, Primary Containment Control instructions for "Maximizing Drywell Cooling". The revised procedure specifically prohibits the EOPs from re-establishing RBCCW flow to the Drywell. This eliminates the potential for waterhammer events described in Generic Letter 96-06.

There are, however, some Small Break LOCAs that do not cause isolation of the RBCCW system in which drywell temperature increases above the saturation temperature of the fluid in the Drywell Cooling Units (297°F). In these cases, the Drywell Cooling Units would continue to operate, however, two-phase conditions do not develop. Continued flow of RBCCW coolant through the coils and the rate of heat transfer to these units are such that the fluid within the system does not change phase. The Drywell Cooling Units and the RBCCW system are not required to mitigate these types of accidents.

Even though it is not expected that the RBCCW pumps will trip under these conditions, a spurious trip of these pumps must be considered because of it's potential impact. When this occurs, the fans will continue to operate since there is no interlock between fan and pump operation. With the pumps tripped, RBCCW fluid pressure will drop to approximately 19 psig which has a corresponding saturation temperature of 257°F. If RBCCW were lost within the first ten minutes of the accident (prior to manual initiation of containment sprays) containment conditions would likely exceed the saturation conditions for a large percentage of these break sizes. With the fans in operation significant void formation would be expected to occur. To prevent either a water hammer or two-phase condition, the EOPs will be revised to instruct the operator to isolate the RBCCW system from the drywell during a LOCA or Main Steam Line Break.

Issue 2
Implementing measures to assure that waterhammer will not occur, such as prohibiting post-accident operation of the affected system, is an acceptable approach for addressing the waterhammer concern. However, all scenarios must be considered to assure that the vulnerability to waterhammer has been eliminated. Confirm that all scenarios have been considered, including those where the affected containment penetrations are not isolated (if this is a possibility), such that the measures that have been established are adequate to prevent the occurrence of waterhammer during (and following) all postulated accident scenarios.

Response
When assessing the vulnerability of the drywell coolers to water hammer, a variety of scenarios are considered as summarized in Attachment 1. There are two basic classifications, those where RBCCW flow to the drywell coolers isolates automatically and those where automatic isolation does not occur. The case where automatic RBCCW flow isolation does occur is addressed by maintaining the RBCCW system in an isolated state. The case where the RBCCW system does not isolate automatically requires further discussion.

The RBCCW system is designed to automatically isolate on a combination of High Drywell Pressure and Low-Low Reactor Water Level, or Low-Low-Low Reactor Water Level alone. Since this issue is associated with the interaction between a hot steam filled containment atmosphere and the Drywell Cooling Units, it is reasonable to expect that the high drywell pressure condition must be present in order for this issue to be a concern. Additionally, these conditions (two phase flow) can only develop when the RBCCW flow is lost (i.e., spurious pump trip, pipe break, etc..) and the system does not isolate because reactor water level is maintained above the isolation setpoint. This may occur for breaks where offsite power is maintained such that a high-pressure injection source (i.e., feedwater) is immediately available with sufficient capacity to maintain reactor water level.

The entire evaluation of the cooling coil vulnerability to void formation is predicated on the assumption that the fan motors continue to operate in a steam atmosphere. This is not believed to be likely, however, the assumption is adopted for analysis purposes. When evaluating the failure to isolate scenarios it is necessary to determine if the resulting environment will produce boiling within the cooling units. This leads to a further division of the possible scenarios into those where containment temperature exceeds the saturation temperature of the fluid flowing to the drywell cooling units and those where it does not.

When the cooler is not isolated, fluid flows to the coils at a pressure of 50 psig having a saturation temperature of 297°F. In order for the fluid flowing through the coolers to boil the drywell atmosphere must reach temperatures that exceed the 297°F saturation temperature of the fluid. This 297°F RBCCW saturation temperature exceeds the temperature of all loss of coolant accidents within the Oyster Creek design basis. Therefore, it can easily be concluded that for all loss of coolant accidents where isolation does not occur and the RBCCW system remains operational, neither water hammer nor two-phase flow will occur in the drywell cooling units.

The same conclusion is reached regarding large main steam line breaks where containment atmosphere temperature remains saturated and below the 297°F required for boiling to occur in the RBCCW system.

However, small and intermediate size failures of the steam system inside the drywell may lead to superheated temperatures that exceed the 297°F RBCCW saturation temperature. For these breaks, the cooling coil flow and the rate of heat transfer to the coil is such that the possibility of two-phase flow does not exist. This was demonstrated by calculation using the GOTHIC (version 6.0a) computer code fan cooling coil model. Furthermore, the elevated containment temperature conditions would not persist since the EOP would have the operator trip the drywell cooling fans and initiate drywell sprays (rapidly reducing the temperature in the containment).

When containment sprays are manually initiated in drywell spray mode the drywell cooler fans are manually tripped which will significantly reduce the heat transfer to the system. First, the containment atmosphere temperature will be reduced by the drywell spray initiation. Second, the rate at which heat is transferred to the coolers is decreased substantially when the fans are tripped.

The final aspect of the evaluation is the scenarios where there is no isolation of the RBCCW system to the drywell and the RBCCW pumps trip. When this occurs, the drywell fans will continue to function since there is no interlock between fan and pump operation. In addition, the cooling fluid pressure will drop to 19 psig which has a corresponding saturation temperature of 257°F. If RBCCW were lost within the first ten minutes of the accident (prior to manual initiation of containment sprays) containment conditions would likely exceed the saturation conditions for a large percentage of the break sizes. With the fans in operation significant void formation would be expected to occur. To prevent a water hammer condition, the EOPs will be revised to have the operator isolate the RBCCW system from the drywell during a LOCA or Main Steam Line Break.

Issue 3

If the potential for two-phase flow has not been eliminated, provide the following information:

a. *Identify any computer codes that were used in the two-phase flow analyses and describe the methods used to bench mark the codes for the specific loading conditions involved (see Standard Review Plan Section 3.9.1).*

b. *Describe and justify all assumptions and input parameters (including those used in any computer codes) and explain why the values selected give conservative results. Also, provide justification for omitting any effects that may be relevant to the analysis (e.g., flow induced vibration, erosion).*

c. *Provide a detailed description of the "worst case" scenario for two-phase flow, taking into consideration the complete range of event possibilities, system configurations, parameters, and component failures. Additional examples include:*

    - *the consequences of steam formation, transport, and accumulation;*
    - *cavitation, resonance, and fatigue effects; and*
    - *erosion considerations.*

    Licensees may find NUREG/CR-6031, "Cavitation Guide for Control Valves," helpful in addressing some aspects of the two-phase flow analyses. (Note: it is important for licensees to realize that in addition to heat transfer considerations, two-phase flow also involves structural and system integrity concerns that must be addressed.)

d. *Confirm that the two-phase flow loading conditions do not exceed any design specifications or recommended service conditions for the piping system and components, including those stated by equipment vendors; and confirm that the system will continue to perform its design-basis functions as assumed in the safety analysis report for the facility, and that the containment isolation valves will remain operable.*

e. *Determine the uncertainty in the two-phase flow analyses, explain how the uncertainty was determined, and how it was accounted for in the analyses to assure conservative results.*

f. *Confirm that the two-phase flow analyses included a complete failure modes and effects analysis (FMEA) for all components (including electrical and pneumatic failures) that could impact performance of the cooling water system and confirm that the FMEA is documented and available for review, or explain why a complete and fully documented FMEA was not performed.*

g. *Explain and justify all uses of "engineering judgement."*

Response

We believe the potential for two-phase flow has been eliminated per the discussions above.

Please note that, except for the Containment Isolation feature, the Drywell Cooling Units and RBCCW system do not serve Nuclear Safety Related functions and are not required to mitigate design basis accidents. Therefore even though the revised procedure eliminates its possibility, if two-phase flow were to somehow occur, the resulting heat exchanger degradation or system flow degradation would not directly correspond to a reduction in the capability of Safety Related Systems to mitigate design basis accidents.

Issue 4
Provide a simplified diagram of the affected system, showing major components, active components, relative elevations, lengths of piping runs, and the location of any orifices and flow restrictions.

Response
A simplified diagram of the RBCCW system is provided as Attachment 2.

ATTACHMENT 1

SUMMARY OF SCENARIOS

Event	Assumptions	Fan Cooler Status	Operator Actions	Result
Large Break below core LOCA	With offsite power	Fan Coolers Trip RBCCW Isolates	Maintain the system isolated	No water hammer in the system
	Without offsite power	Fan Coolers Trip RBCCW Isolates	Maintain the system isolated	No water hammer in the system
Small Break below core LOCA	Without offsite power	Fan Coolers Trip RBCCW Isolates	Maintain the system isolated	No water hammer in the system
	With offsite power	Fan Coolers don't trip and RBCCW remains operational	Trip Fan Coolers if Drywell Sprays are required. Manually isolate RBCCW to the DW.	No water hammer in the system. No two phase flow in the system
	With offsite power and loss of RBCCW flow	Fan Coolers don't trip and RBCCW trips.	Trip Fan Coolers if Drywell Sprays are required. Manually isolate RBCCW to the DW.	No water hammer in the system.
Large Break above the core MSLB	Without offsite power	Fan Coolers Trip and RBCCW Isolates	Maintain the system isolated	No water hammer in the system. No two phase flow
	With offsite power	Fan Coolers don't trip and RBCCW remains operational	Trip Fan Coolers if Drywell Sprays are required. Manually isolate RBCCW to the DW.	No water hammer in the system. No two-phase flow.
	With offsite power and loss of RBCCW flow	Fan Coolers don't trip and RBCCW trips.	Trip Fan Coolers if Drywell Sprays are required. Manually isolate RBCCW to the DW.	No water hammer in the system.
Small Break above the core MSLB	Without offsite power	Fan Coolers Trip and RBCCW Isolates	Maintain the system isolated	No water hammer in the system.
	With offsite power	Fan Coolers don't trip and RBCCW remains operational.	Trip Fan Coolers Drywell Sprays are required. Manually isolate RBCCW to the DW.	No water hammer in the system. No Two phase flow.
	With offsite power and loss of RBCCW flow	Fan Coolers don't trip and RBCCW trips.	Trip Fan Coolers Drywell Sprays are required. Manually isolate RBCCW to the DW.	No water hammer in the system.

ATTACHMENT 2

SIMPLIFIED DIAGRAM
REACTOR CLOSED COOLING WATER SYSTEM

REACTOR BUILDING CLOSED COOLING SYSTEM SUPPLY TO DRYWELL COOLING UNITS