

June 26, 2000

MEMORANDUM TO: Gary M. Holahan, Director  
Division of Systems Safety and Analysis  
Office of Nuclear Reactor Regulation

THRU: John N. Hannon, Chief **/RA/**  
Plant Systems Branch  
Division of Systems Safety and Analysis  
Office of Nuclear Reactor Regulation

George T. Hubbard, Chief **/RA/**  
Balance of Plant and Containment Systems Section  
Plant Systems Branch  
Division of Systems Safety and Analysis  
Office of Nuclear Reactor Regulation

FROM: Kerri A. Kavanagh, Reactor Systems Engineer **/RA/**  
Balance of Plant and Containment Systems Section  
Plant Systems Branch  
Division of Systems Safety and Analysis  
Office of Nuclear Reactor Regulation

SUBJECT: REPORT ON RESULTS OF STAFF REVIEW OF NRC GENERIC  
LETTER 97-04, "ASSURANCE OF SUFFICIENT NET POSITIVE  
SUCTION HEAD FOR EMERGENCY CORE COOLING AND  
CONTAINMENT HEAT REMOVAL PUMPS" (TAC NUMBER MA0698)

The purpose of this memorandum is to document the closure of generic TAC Number MA0698 associated with our review of Generic Letter 97-04, "Assurance of Sufficient Net Positive Suction Head for Emergency Core Cooling and Containment Heat Removal Pumps." On October 7, 1997, we issued NRC Generic Letter 97-04 (GL 97-04) to all holders of operating licenses or construction permits. The purpose of GL 97-04 was to confirm the adequacy of the net positive suction head (NPSH) available for the emergency core cooling (including core spray and residual heat removal) and containment heat removal pumps under all design-basis accident scenarios. Specifically, we requested that licensees provide the following information for their facilities:

1. *Specify the general methodology used to calculate the head loss associated with the emergency core cooling system (ECCS) suction strainers.*
2. *Identify the required NPSH and the available NPSH.*
3. *Specify whether the current design-basis NPSH analysis differs from the most recent*

*analysis reviewed and approved by the NRC for which a safety evaluation was issued.*

4. *Specify whether containment overpressure (i.e., containment pressure above the vapor pressure of the sump or suppression pool fluid) was credited in the calculation of available NPSH. Specify the amount of overpressure needed and the minimum overpressure available.*
5. *When containment overpressure is credited in the calculation of available NPSH, confirm that an appropriate containment pressure analysis was done to establish the minimum containment pressure.*

The generic letter applied only to ECCS and containment heat removal pumps that met the following criteria:

- 1) pumps that take suction from the containment sump or suppression pool following a design-basis loss-of-coolant accident (LOCA) or secondary line break, or
- 2) pumps used in 'piggyback' operation that are necessary for recirculation cooling of the reactor core and containment.

We requested that the licensees respond to the generic letter within 90 days from the date of the generic letter, i.e., January 7, 1998. We received responses for 103 operating units. We also received responses from Browns Ferry Unit 1 (defueled and on administrative hold with no established restart date), Millstone Unit 1, and Zion Units 1 and 2. Since the issuance of the generic letter, the licensees for Millstone Unit 1 and Zion Units 1 and 2 decided to decommission their facilities. As such, we did not perform a review of their GL 97-04 responses. The licensee for Maine Yankee did not respond to the generic letter request.

During our review, we discovered that a significant number of licensees had not reviewed their net positive suction head calculations since the initial licensing of the facility. As a result, many licensees had to re-evaluate the NPSH requirements for the safety related pumps due to discrepancies, errors and/or inconsistencies in the analyses, inadequate design, or unavailability of the documentation. We also discovered that several plants appeared to be outside their licensing basis for their ECCS pumps, while other facilities could not locate their NPSH calculations. Additionally, some utilities were in the middle of revising their calculations due to forthcoming ECCS strainer modifications/replacements. A few of these licensees provided the NPSH information for their 'old' strainers and the NPSH information for their soon to be 'new' strainers. In order to resolve these issues, the responses were categorized into four groups using a risk-informed approach. These groups included responses that could be closed, responses that needed additional information, responses that needed to be resubmitted in their entirety, and responses that needed management's attention.

Since the purpose of the generic letter was to gather a snapshot of the licensees' current NPSH analyses, detailed safety evaluations were not performed on most of the licensee's responses. For the responses that could be closed, closeout letters were sent to the respective licensees. For the responses that needed additional information or needed to be resubmitted in their entirety, requests for additional information (RAIs) were sent and the responses evaluated. The responses to our RAIs were sufficient to closeout the generic letter for those licensees. For those responses that required management's attention, the combination of tele-conferences and meetings with the

utilities led to the completion of our review. As a result of our interactions with the specific utilities, sixteen operating units received safety evaluation reports documenting our review.

Based on our efforts, we found that all licensees had adequately responded to the requests of GL 97-04. All licensees are within their licensing basis with respect to their ECCS and containment heat removal pump NPSH calculations for the recirculation phase following a LOCA. All licensees have satisfied the requests of GL 97-04.

In addition to the above determination, we observed the following from the responses to GL 97-04.

a. For the calculation of available NPSH, a majority of pressurized water reactor (PWR) licensees assume 50 percent blockage of their ECCS sump screens, which is within their current licensing basis. The BWR licensees have performed plant specific debris blockage analyses, rather than assuming 50 percent blockage, due to the requested actions of NRC Bulletin 96-03, "Potential Plugging of Emergency Core Cooling Suction Strainers by Debris in Boiling-Water Reactors."

b. With regard to question 4 of the generic letter, twenty four operating units take credit for containment overpressure (containment pressure above atmospheric pressure, normally 14.7 psia) or subcooling (the difference between the containment pressure and the vapor pressure of the sump water) to ensure adequate NPSH for the ECCS and containment heat removal pumps. Nine PWRs take credit for subcooling in their NPSH calculations and fifteen boiling water reactors (BWRs) take credit for containment overpressure. For the 24 reactors that credit some form of containment overpressure, these facilities were either licensed with or have safety evaluation reports approving their use of containment overpressure or subcooling. The remaining seventy nine units responded stating that their NPSH analyses do not credit containment overpressure or subcooling.

As a result of efforts described above, all but one of the generic letter responses were closed by August 19, 1999. The remaining response, Fort Calhoun, was closed February 3, 2000. We have concluded that all licensees have sufficiently responded to the requests of Generic Letter 97-04. As such, the generic and plant specific activities associated with the review of Generic Letter 97-04 are complete. This concludes our efforts on generic TAC Number MA0698.

