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SUBJECT: Forwards 90-day response to GL 97-04, "Assurance of
Sufficient NPSH for ECC & Containment Heat Removal Pumps."

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Robinson File No: 13510
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United States Nuclear Regulatory Commission
Attn: Document Control Desk
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H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261/LICENSE NO. DPR-23

SUBMITTAL OF INFORMATION REQUESTED BY GENERIC LETTER 97-04,
"ASSURANCE OF SUFFICIENT NET POSITIVE SUCTION HEAD FOR EMERGENCY
CORE COOLING AND CONTAINMENT HEAT REMOVAL PUMPS"

Dear Sir or Madam:

NRC Generic Letter 97-04, "Assurance of Sufficient Net Positive Suction Head For Emergency Core Cooling and Containment Heat Removal Pumps," dated October 7, 1997, requested that certain information be submitted to the NRC within 90 days of the date of the Generic Letter. By letter dated November 6, 1997, Carolina Power & Light (CP&L) Company committed to submit the requested information, attached.

If you have any questions concerning this matter, you may contact me or Mr. H. K. Chernoff of my staff.

Very truly yours,

T. M. Wilkerson

T. M. Wilkerson
Manager - Regulatory Affairs

A076 1/1

Attachment
JSK/jk

c: Mr. B. B. Desai, USNRC Senior Resident Inspector, HBRSEP
Mr. J. W. Shea, USNRC Project Manager, HBRSEP
Mr. L. A. Reyes, Regional Administrator, USNRC, Region II

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H. B. Robinson Steam Electric Plant, Unit No. 2
Submittal of Information Requested by Generic Letter 97-04, "Assurance of
Sufficient Net Positive Suction Head for Emergency Core Cooling and
Containment Heat Removal Pumps"

Generic Letter 97-04 requested the following information:

"Requested Information"

On the basis of the preceding discussion and examples, addressees are requested to review, for each of their respective reactor facilities, the current design-basis analyses used to determine the available NPSH for the emergency core cooling (including core spray and decay heat removal) and containment heat removal pumps that meet either of the following criteria:

- (1) pumps that take suction from the containment sump or suppression pool following a design-basis LOCA or secondary line break, or
- (2) pumps used in "piggyback" operation that are necessary for recirculation cooling of the reactor core and containment (that is, pumps that are supplied by pumps which take suction directly from the sump or suppression pool).

Based on this review, within 90 days from the date of this generic letter, addressees are requested to provide the information outlined below for each of their facilities. New NPSH analyses are neither requested nor required.

1. Specify the general methodology used to calculate the head loss associated with the 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."

Carolina Power & Light (CP&L) Company has reviewed the current design-basis analyses used to determine the available NPSH for the Emergency Core Cooling System (ECCS) and containment heat removal pumps that meet either of the following criteria:

- (1) pumps that take suction from the containment sump or suppression pool following a design-basis LOCA or secondary line break, or
- (2) pumps used in "piggyback" operation that are necessary for recirculation cooling of the reactor core and containment (that is, pumps that are supplied by pumps which take suction directly from the sump or suppression pool).

As a result of this review, CP&L has determined that the pumps applicable to this Generic Letter include the Residual Heat Removal (RHR) pumps, which take suction from the containment sump during the post-LOCA recirculation mode, and the Containment Spray (CS) and Safety Injection (SI) pumps that operate in the "piggyback" mode when used during the recirculation mode. As a result of the review the requested information for H. B. Robinson Steam Electric Plant (HBRSEP), Unit No. 2 is provided below.

Request 1

Specify the general methodology used to calculate the head loss associated with the ECCS suction strainers.

Response 1

The general methodology used at HBRSEP, Unit No. 2 to calculate the head loss associated with the ECCS suction strainer/containment sump is as follows:

The basic equations for calculating NPSH are:

$$NPSH = h_a - h_{vpa} + h_{st} - h_{fs}$$

or

$$NPSH = h_{static} - h_{vpa} + v^2 / 2g_c$$

where:

h_a = absolute pressure at the surface of the liquid supply level in feet. This term is the higher of atmospheric pressure or saturation pressure for the sump fluid.

h_{vpa} = head corresponding to the vapor pressure of the liquid being pumped in feet.

h_{st} = static height that the liquid supply level is above or below the pump impeller centerline in feet.

h_{fs} = suction line losses including entrance losses and friction losses in feet.

Recent calculations show, that for either a blockage of 80% of the strainer holes or 80% of each hole in the strainer, head losses across the strainer are negligible (i.e., approximately 0.06 psi using a square edge orifice model).

h_{static} = static head (absolute) at the pump inlet in feet.

v = velocity of liquid at pump suction in feet/second.

g_c = 32.2 feet lb_m/lb_f second².

lb_m = pound mass.

lb_f = pound force.

Request 2

Identify the required Net Positive Suction Head ($NPSH_R$) and the available Net Positive Suction Head ($NPSH_A$).

Response 2

The RHR pumps are the ECCS pumps designed to draw suction from the Containment Sump. The SI pumps and CS pumps, if used, draw suction from the output of the RHR pumps during recirculation. No specific evaluation has been performed for the SI and CS pumps in the piggyback mode. However, during evaluation of the RHR NPSH, pressures were calculated at the inlet of the SI and CS pumps and these indicated that the $NPSH_A$ was several multiples of the $NPSH_R$. The limiting case occurs when the RHR pump draws saturated liquid from the sump with the sump at minimum level. This case was analyzed in November 1997 and showed 19.2 feet of $NPSH_A$ and 15 feet of $NPSH_R$ for a margin of 4.2 feet.

Request 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.

Response 3

Carolina Power & Light (CP&L) Company can find no explicit record that the NRC reviewed an NPSH analysis for these pumps in the recirculation mode. The original Final Safety Analysis Report and Safety Evaluation Report address NPSH only in general terms. A recent problem related to NPSH was discovered in 1997 as a result of the NRC Design Inspection and is documented in HBRSEP Licensee Event Report No. 97-08-00. As a result of this issue, flow modeling and calculations have been performed to document the capability of the SI pumps to perform their design functions.

Request 4

Specify whether containment overpressure (i.e., containment pressure above the vapor pressure of the sump fluid) was credited in the calculation of available NPSH. Specify the amount of overpressure needed and minimum overpressure available.

Response 4

As noted in Response 1, no credit for containment pressure in excess of the sump fluid vapor pressure was used.

Request 5

When containment overpressure is credited in the calculation of NPSH, confirm that an appropriate containment pressure analysis was done to establish the minimum containment pressure.

Response 5

Not applicable based on the response to Request 4.