

# CATEGORY 1

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 AUTH.NAME:      AUTHOR AFFILIATION  
 PARRISH, J.V.      Washington Public Power Supply System  
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SUBJECT: Forwards 90-day response to GL 97-04, "Assurance of  
 Sufficient Net Positive Suction Head For ECC & Containment  
 Heat Removal Pumps."

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WASHINGTON PUBLIC POWER SUPPLY SYSTEM

P.O. Box 968 • Richland, Washington 99352-0968

January 5, 1998  
GO2-98-002

Docket No. 50-397

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

Gentlemen:

Subject: **WNP-2, OPERATING LICENSE NPF-21,  
90-DAY RESPONSE TO GENERIC LETTER 97-04**

Reference: Generic Letter 97-04, dated October 7, 1997, "Assurance of Sufficient Net Positive Suction Head for Emergency Core Cooling and Containment Heat Removal Pumps"

In the referenced generic letter, the staff requested that we review our current design-basis analysis used to determine the available net positive suction head (NPSH) for the emergency core cooling (including core spray and decay heat removal) and containment heat removal pumps. Based on this review, the staff requested that WNP-2 submit the following information within 90 days:

1. The general methodology used to calculate the head loss associated with the emergency core cooling system (ECCS) suction strainers.
2. The required NPSH and the available NPSH for the ECCS and containment heat removal pumps.
3. A determination 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. A determination 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. If 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.

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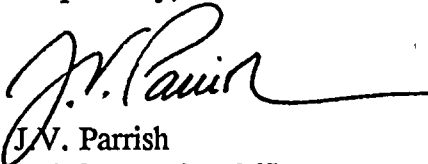
**90-DAY RESPONSE TO GENERIC LETTER 97-04**

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By this letter, and the enclosed attachment, we are providing the required 90-day response.

Should you have any questions or desire additional information regarding this matter, please call me or Mr. P.J. Inserra at (509) 377-4147.

Respectfully,



J.V. Parrish  
Chief Executive Officer  
Mail Drop 1023

REB

Attachment

cc: EW Merschoff - NRC RIV  
KE Perkins, Jr. - NRC RIV, WCFO  
C Poslusny, Jr. - NRC NRR  
NRC Sr. Resident Inspector - 927N  
DL Williams - BPA/399  
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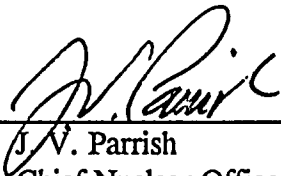
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Subject: Response to GL 97-04

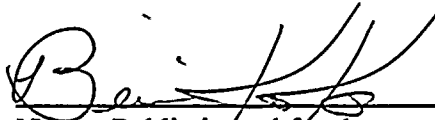
I, J. V. PARRISH, being duly sworn, subscribe to and say that I am the Chief Nuclear Officer for the WASHINGTON PUBLIC POWER SUPPLY SYSTEM, the applicant herein; that I have the full authority to execute this oath; that I have reviewed the foregoing; and that to the best of my knowledge, information, and belief the statements made in it are true.

DATE 5 January, 1998

  
\_\_\_\_\_  
J. V. Parrish  
Chief Nuclear Officer

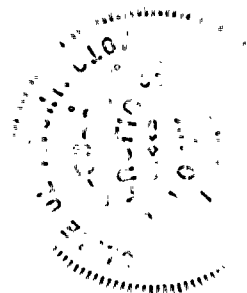
On this date personally appeared before me J. V. Parrish, to me known to be the individual who executed the foregoing instrument, and acknowledged that he signed the same as his free act and deed for the uses and purposes herein mentioned.

GIVEN under my hand and seal this 5 day of January, 1998

  
\_\_\_\_\_  
Notary Public in and for the  
STATE OF WASHINGTON

Residing at Kennebec, WA

My Commission Expires 4/28/98





## 90-DAY RESPONSE TO GENERIC LETTER 97-04

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Question 1: Specify the general methodology used to calculate the head loss associated with the emergency core cooling system (ECCS) suction strainers.

Response:

Available NPSH was calculated using the following formula:

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

where:

$\text{NPSH}_A$  = Available NPSH at the suction nozzle of the pump.

$h_a$  = Absolute pressure (in feet of water) on the surface of the suppression pool. This pressure corresponds to atmospheric conditions (14.7 psia). No credit is taken for overpressure within the wetwell following a loss of coolant accident (LOCA).

$h_{st}$  = Static head (in feet of water) between the suppression pool level and the centerline of the pump suction nozzle. The static head was developed based upon minimum allowable suppression pool level (30' - 9 3/4") per WNP-2 Technical Specifications. No credit is taken for added suppression pool volume due to LOCA discharge nor thermal expansion of the inventory due to the pool heat-up.

$h_{vpa}$  = Vapor pressure of the suppression pool water (in feet of water). For the current ECCS configuration, the vapor pressure is assumed to equal atmospheric pressure ( $h_a$ ). This approach is conservative, since the peak suppression pool temperature in WNP-2's containment analysis is 204°F, which corresponds to a lower vapor pressure than saturated conditions at 14.7 psia. (For the replacement ECCS suction strainers to be installed in response to NRC Bulletin 96-03, calculations use the vapor pressure for water at 204°F. See the response to Question 2, below, for further discussion of replacement ECCS suction strainers.)

$h_{fs}$  = All suction line losses (in feet) which include strainer losses and piping losses. The following pump flow conditions were defined for worst-case NPSH determination:

Residual Heat Removal (RHR):	7900 gpm
Low Pressure Core Spray (LPCS):	7800 gpm
High Pressure Core Spray (HPCS):	7175 gpm

These flows would occur following the complete depressurization of the reactor vessel, post-LOCA.



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### Response to Question 1 (Continued):

**Strainer losses:** Head losses across the currently installed suction strainers were developed based upon the assumed clogging of half the strainer area.

**Piping losses:** Losses across piping, fittings, and valves were developed in accordance with Crane Paper 410 for clean commercial steel pipe. RHR and LPCS suction lines are 24" nominal pipe size (NPS), standard weight, each having one 24" gate valve at the containment penetration. The HPCS suction line is also 24" NPS, standard weight, with a 18" gate valve and 24" check valve.

**Question 2:** Identify the required NPSH (ft) and the available NPSH (ft) for the ECCS and containment heat removal pumps.

### Response:

The table below, compares the available NPSH at the ECCS pump suction nozzle with the required NPSH. Note that RHR-C is excluded from the table. The RHR-C suction line is shorter than those of RHR-A and RHR-B, but with otherwise similar conditions (i.e., suction high-point elevation, valving). Also, the RHR-C pump has a slightly lower required NPSH, providing more margin than the RHR-A and RHR-B subsystems.

	<u>RHR A &amp; B</u>	<u>LPCS</u>	<u>HPCS</u>
NPSH available (ft)	≥39.9	≥39.9	≥39.9
NPSH required (ft)	14	13	24
Nominal NPSH margin at pump nozzle (ft)	≥25.90	≥26.90	≥15.90

The available NPSH values noted above are for the ECCS suction strainers that are presently installed at WNP-2. The strainers were designed for 50% blockage due to suppression pool debris, resulting in the following calculated head losses:

	<u>RHR A &amp; B</u>	<u>LPCS</u>	<u>HPCS</u>
Strainer head loss (ft)	3.62	4.09	3.46
Piping head losses (ft)	2.09	1.73	2.59
Total head losses (ft)	5.71	5.82	6.05



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The present ECCS suction strainers are to be replaced in response to NRC Bulletin 96-03. Final head loss information on the replacement strainers has not been calculated. However, acceptance criteria have been established for the replacement strainers. First, the available NPSH at the pump suction nozzles must be maintained in accordance with the manufacturer's performance curves. Also, no cavitation is allowed at any point in the ECCS pump suction lines (i.e.,  $NPSH_{min} > 0$  ft). For the latter criterion, the critical point in the suction lines are the high points, adjacent to the containment isolation valves outside the wetwell.

The values of NPSH and margin to cavitation identified below, which will be used for strainer procurement, reflect three simultaneous worse-case conditions of maximum theoretical strainer debris loading, a peak suppression pool temperature of 204°F, and ECCS pump run-out flowrates. The minimum NPSH and cavitation margins are expected to increase when actual strainer design and final head loss information is obtained from the strainer manufacturer.

	<u>RHR A &amp; B</u>	<u>LPCS</u>	<u>HPCS</u>
Minimum NPSH available (ft)	32.21	31.86	32.36
NPSH required (ft)	14	13	24
Minimum NPSH margin at pump nozzle (ft)	18.21	18.86	8.36
Allowable $NPSH_{min}$ (ft) at high point.	0	0	0
Minimum margin to cavitation at high point (ft)	0.21	0.18	0.17

Pump run-out flowrates used to procure the new strainers are as follows:

RHR: 8000 gpm  
LPCS: 7800 gpm  
HPCS: 7175 gpm

For the RHR System, the maximum design-basis flow rate is 7900 gpm, slightly less than the run-out flowrate of 8000 gpm. For sizing the new strainers a more conservative value of 8000 gpm was chosen.

The values noted above for minimum NPSH available are less than those values for the present ECCS design because greater debris loading is assumed for the new strainers that will be installed. Final NPSH and cavitation margins will be sufficient to accommodate increased head losses that may result from the age-related degradation of the inner surface of suction piping.

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Question 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:

The design-basis NPSH information approved by the NRC for which a safety evaluation exists is provided in Section 6.3.2.2 of the FSAR, and in other sections of the FSAR that answer specific NRC questions about NPSH issues.

Calculations performed since NRC approval of the FSAR, with the exception of recently approved calculations to support the installation of new ECCS suction strainers, have shown that even more margin exists for available NPSH than presently depicted in the FSAR, thus making FSAR parameters more conservative.

Recently approved calculations to support the installation of new ECCS suction strainers show greater head losses and less available NPSH than specified in the FSAR. The FSAR will be revised accordingly and a safety evaluation for the replacement strainer design modification will be performed per 10 CFR 50.59.

Question 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.

Response:

Containment overpressure was not credited in the development of available NPSH for WNP-2 ECCS pumps.

Question 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.

Response:

Not applicable based on response to Question 4 above.