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SUBJECT: Forwards supplemental info re request for amend ECCS suction strainers.

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WASHINGTON PUBLIC POWER SUPPLY SYSTEM

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

April 28, 1998  
GO2-98-077

Docket No. 50-397

U.S. Nuclear Regulatory Commission  
Document Control Desk  
Washington, D.C. 20555

Gentlemen:

Subject: **WNP-2 OPERATING LICENSE NPF-21  
SUPPLEMENTAL INFORMATION REGARDING REQUEST FOR AMENDMENT  
EMERGENCY CORE COOLING SYSTEM SUCTION STRAINERS**

Reference: Letter GO2-98-071 dated April 16, 1998, P.R. Bemis (Supply System) to NRC Document Control Desk, WNP-2 Operating License NPF-21 Request for Amendment: Emergency Core Cooling System Suction Strainers

The referenced letter requests a change to the WNP-2 Operating License allowing the newly designed Emergency Core Cooling System (ECCS) pump suction strainers to be fabricated from cold-worked austenitic stainless steel with a surface yield strength in excess of 90,000 psi. Subsequent conversations with NRR staff C. Poslusny, J. Davis, and R. Hermann on April 20, 1998, identified three (3) areas requiring supplemental information. Each of these are discussed in Attachment 1 of this letter.

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

Respectfully,

*D.W. Coleman*

D.W. Coleman  
Acting Manager, Regulatory Affairs  
Mail Drop PE20

Attachment: Clarification - ECCS Pump Suction Strainer Operating License Amendment

cc: EW Merschoff - NRC RIV  
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**SUPPLEMENTAL INFORMATION REGARDING REQUEST FOR AMENDMENT  
EMERGENCY CORE COOLING SYSTEM SUCTION STRAINERS  
Attachment 1, Page 1 of 3**

**Clarification - ECCS Pump Suction Strainer Operating License Amendment**

**Comment:** Attachment 1 of the referenced letter on page 4 of 8 states: "Austenitic stainless steel is normally nonmagnetic due to its lattice structure with the exception of small areas of ferrite that can exist in the microstructure. The largest value that was measured using the Fisher Feritscope MP3 on the 14 GA material was 1.5% and on the 11 GA material was 0.77%." Further clarification was requested to differentiate ferrite from martensite in the magnetic structure.

**Response:** Metallography was performed on samples of the screen materials. A small amount of ferrite was observed in the less cold-worked area of the 14 GA material and a small amount of isolated martensite was observed near the surface of the punched holes. The 11 GA material also exhibited a small amount of ferrite in the less cold-worked areas and a small amount of martensite on the surface of the drilled holes.

To determine the presence of magnetic material in the core of the screen relative to that measured on the cold-worked surface of the material, additional Feritscope measurements were performed on both the 11 GA and 14 GA materials. Measurements were taken on cross sections of the screen material in the web area and on the surface of the holes. The following Feritscope average values were corrected using the maximum correction factor for either edge effects or thickness measured. The correction factor used was 1.15 times the measured value as recommended by the Feritscope manufacturer.

**PERCENT MAGNETIC MATERIAL**

	Surface	Core	Hole
14 GA	0.9%	0.2%	1.4%
11 GA	0.4%	0.4%	1.0%

The maximum amount of surface magnetic material is very small and the levels of magnetic ferrite or martensite measured are a very small part of the austenitic stainless steel microstructure. These low levels do not significantly contribute to a reduction of the overall integrity of the component. This is supported by studies on severely cold-worked type 304 material which did not fail until exposure to elevated temperatures was significantly longer than the DBA LOCA time at temperature.



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**SUPPLEMENTAL INFORMATION REGARDING REQUEST FOR AMENDMENT  
EMERGENCY CORE COOLING SYSTEM SUCTION STRAINERS**

**Attachment 1, Page 2 of 3**

**Comment:** Attachment 1 of the referenced letter on page 6 of 8 states: "Studies in BWR environments demonstrate that highly cold-worked (3/4 hard) 304 stainless steel at reactor temperatures loaded to a value of 173,000 psi in 7 ppm O<sub>2</sub> and 1.5 ppm Cl did not fail in 59 days of exposure (Ref. GE Technical Information Memorandum: "Stress Corrosion Tests on Selected Reactor Structural Steels"). The test conditions were more severe than those that would be experienced in the wetwell considering loading, temperatures and chemical species. The screen material in the new WNP-2 strainers is estimated to be approximately 1/4 to 1/2 hard. No failures were documented for the 1/4 to 1/2 hard material in the identified test environment." Additional information was requested to show that the cited study is bounding and applicable to the material used in the ECCS suction strainers.

**Response:** The referenced testing involved stainless steels with varying cold-worked conditions. The strips used in testing were 0.062" thick by 0.5" wide, cold-worked, and then loaded in 3 point bending. The hardness values and the test conditions are compared to WNP-2 screen material and water conditions:

	TEST CONDITIONS	WNP-2 ACTUAL CONDITIONS	WNP-2 ACCIDENT CONDITIONS	EPRI BWR RPV WATER GUIDELINES
TEMPERATURE	550° F	< 90° F	204° F Maximum	≤ 200° F
OXYGEN	7 PPM	0.8 PPM*	1.8 PPM	N/A
CHLORIDES	1.5 PPM	0.0011 PPM*	< 1.0 PPM	≤ 100 PPM
HARDNESS	> 3/4 Hard	< 1/2 Hard	< 1/2 Hard	N/A

\* Average values from July 1, 1997 through April 13, 1998.

One difference in the test conditions compared to the WNP-2 suppression pool post LOCA environment is the test temperature of 550° F versus the maximum post LOCA temperature of 204° F. The higher the temperature the more reactive the corrosion reaction thus the test is bounding. Another difference is greater concentrations of reactive elements were required to cause stress corrosion cracking than would exist post LOCA in the WNP-2 suppression pool using conservative assumptions. As identified in the above paragraph the test material was exposed to 7 PPM of oxygen and 1.5 PPM chloride. These conditions are worst than WNP-2 expected conditions during a DBA LOCA (max temp - 204° F) where oxygen content is expected to be 1.8 PPM and chlorides less than 1.0 PPM. Finally, the WNP-2 worst case average hardness of Rc 34 is approximated to be 1/4 hard (Rc 27) to 1/2 hard (Rc 38). Conservatively, the material used in the cited testing was 3/4 hard and still no failures occurred in testing that exceeded 59 days. Therefore, the



**SUPPLEMENTAL INFORMATION REGARDING REQUEST FOR AMENDMENT  
EMERGENCY-CORE COOLING SYSTEM SUCTION STRAINERS  
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test conditions bound the WNP-2 material and environmental conditions and indicate an acceptable margin to stress corrosion cracking for the service conditions of the strainers.

**Comment:** Attachment 1 of the referenced letter on page 6 of 8 states: "... the probability of stress corrosion cracking in the screen material is not increased in the wetwell environment of low temperature and high water quality for both normal and DBA LOCA conditions. Additionally, there will be representative screen material coupons installed in the suppression pool, available to evaluate if there is a concern for cracking as a result of a water quality excursion due to chemical ingress." Additional information was requested describing the coupon material. A commitment to scheduled testing was also suggested.

**Response:** The coupons for monitoring the material condition of the strainers were removed from actual samples of material used in the fabrication of the strainers. The coupons were sectioned from the final formed shape of the strainer rings. The rings with the tightest bend radius were used and were sectioned perpendicular to the radius of curvature. The coupons are three inches long by one inch wide. They are mounted on a seismically designed rack which will be mounted under water in the wetwell. The coupons will be removed and visually examined under low power magnification during the next outage (R-14). The strainers are currently scheduled to be visually examined each refueling outage for debris build up and structural integrity (e.g., loose bolts). The examination frequency may be reduced if inspection results indicate longer periods are appropriate. The frequency of low magnification coupon examination will be the same as the examination schedule for the strainers.





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