FPL Energy
Seabrook Station

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SEP 23 2003

Docket No. 50-443

NYN-03080

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

Seabrook Station
Revision to Inservice Test Program Relief Request PR-3

References:

1. NYN-03039, "Inservice Test Program Relief Request PR-3," dated May 9, 2003

Provided within the enclosed is a revision to Inservice Test (IST) Program Relief Request PR-3. This IST Program relief request was originally submitted to the Nuclear Regulatory Commission on May 9, 2003 (Reference 1). Seabrook Station performs IST in accordance with the 1995 Edition (including the 1996 Addenda) of the American Society of Mechanical Engineers (ASME) Code for Operation and Maintenance of Nuclear Power Plants (OM Code).

The original relief request proposed to increase the alert range absolute limit identified in ISTB Table 5.2.1-1 of the OM Code from 0.325 inches per second (ips) to 0.350 ips for the outboard bearing of the Containment Building Spray Pumps (CBS) in the horizontal and vertical directions. Based upon an additional engineering review of pump test data taken during the previous refueling outage, FPL Energy Seabrook, LLC has determined that the scope of the subject relief request should be expanded to apply an absolute limit of 0.350 ips for both bearings of the CBS pumps.

The NRC approved a similar relief request for the Sequoyah Nuclear Plant, Units 1 and 2 by letter dated July 16, 2002 (TAC Nos. MB4930 and MB4931). FPLE Seabrook requests the NRC to review and approve the subject relief request by February 1, 2004.

A047

Should you have any questions concerning this response, please contact Mr. James M. Peschel, Regulatory Programs Manager, at (603) 773-7194.

Very truly yours,
FPL Energy Seabrook, LLC

Mark E. Warner
Site Vice President

cc: H. J. Miller, NRC Region I Administrator
V. Nerses, NRC Project Manager, Project Directorate I-2
G. T. Dentel, NRC Senior Resident Inspector

ENCLOSURE TO NYN-03080

Relief request: PR-3

Pumps: CBS-P-9-A, CBS-P-9-B

Code Class: 2

Function: Pumps required to perform a function in shutting down the reactor or in mitigating the consequences of an accident, and are provided with an emergency power source.

Test Requirements: ISTB Table 5.2.1-1 requires an Alert Range of >2.5Vr to 6 Vr, or > 0.325 to 0.7 in./sec for centrifugal pumps that operate at ≥ 600 RPM.

Basis For Relief:

1. Pump casing resonance amplification causes the CBS-P-9-B pump bearing vibration to exceed the ISTB Table 5.2.1-1 Alert Range absolute limit.
2. Pump casing resonance amplification causes the CBS-P-9-A pump bearing vibration to approach the ISTB Table 5.2.1-1 Alert Range absolute limit leaving very little room for test repeatability.

The ASME Code provides both a relative multiplier on the reference value, or an absolute limit. The lower of the relative multiplier or the absolute limit is used to define test acceptance criteria. The Code established that the absolute limit for the ALERT limit be applied to all of the bearings. Based on the forcing function (e.g. pump casing resonance caused by the four vane impeller) being the same on both CBS-P-9-A and CBS-P-9-B, the absolute limit of 0.325 ips needs to be increased to 0.350 ips to provide test margin.

The cause of the vibration is well understood and is a result of our original pump design and the sizing of our re-circulation line. It is not the result of any material degradation from the original installation. An impeller design change would be required to obtain vibration test margin; however, this design change would not fix any material degradation or restore lost margin.

The pump casing resonance amplification issue impacts both pumps, although only the CBS-P-9-B pump has gone into the ALERT condition. The corresponding vibration levels on Containment Spray Pump CBS-P-9-A have not reached the Alert Range, but are very close to the limit (the most recent reference value, V_r is 0.319 in/sec at the outboard pump bearing, vertical).

Pump bearing housing resonance amplification results in a testing hardship due to the lack of any margin between our reference value and the ISTB Table 5.2.1-1 Alert Range absolute limit. Reduced interval testing does not provide any compensating increase in the level of quality and safety. The pumps are infrequently run, on the order of 20 hours per

year. Implementing a design change solely for the purposes of establishing some test repeatability margin subjects Seabrook Station to an undue burden to comply with the regulation.

Increasing the ISTB Table 5.2.1-1 ALERT Range Absolute limit from 0.325 ips to 0.350 ips for all of the PUMP BEARING limits on both 1-CBS-P-9-A and 1-CBS-P-9-B, will provide adequate margin for test repeatability.

Seabrook Station has always monitored the CBS Pump vibration as part of the Predictive Maintenance Monitored Equipment Program.

Containment Spray Pump (CBS) CBS-P-9-B outboard pump bearing overall vibration amplitude exceeds the ASME OM Code IST ALERT limit of >0.325 in/sec. The initial outboard pump bearing, horizontal reference value, V_r, is 0.347 in/sec. Since July 2001, the readings at this point have been between 0.311 and 0.347 in/sec. The pump inboard vertical bearing has just recently (e.g., post OR08 pump disassembly) increased from 0.274 ips to 0.343 ips. A review of the historical data shows that this inboard bearing for CBS-P-9B has repeatedly been over 0.325 ips limit. CBS-P-9-A is of the same pump design as the CBS-P-9B pump. Vibrations on all bearings are higher than expected although we have had only one occurrence of a bearings exceeding the 0.325 inches/second limit. This occurrence was on 11/04/99, which pre-dated our adoption of the ASME OM Code. Some of the other bearings vibrations have approached the 0.325 inches per second limit.

Additional vibration data collection and analysis identified high pump vane pass spectral responses. Pump casing resonance testing identified that the pump has a resonance frequency similar to that of pump vane pass. This condition results in vibration amplitude amplification that is responsible for most of the vibration magnitude. A review of past pump history, including plant pre-operational test data identified similar pump vane pass vibration amplification.

CBS pump design uses a wide, four-vane impeller that is susceptible to elevated vane pass vibration. This induced vibration amplitude, along with casing resonance near vane pass frequency, results in elevated overall vibration levels. There are no corrective actions to minimize this condition without replacing the pump impeller, or to modify the stiffness of the pump bearing housings. Either of these design changes would require undue burden to comply with the regulation.

Recent pump bearing resonance test results are consistent with tests performed during initial plant startup (1986). These results identify that the casing resonance contributes to the overall vibration amplitude. Continued pump operation at these levels is acceptable. Additionally, high resolution vibration data analysis has not found any indications of

bearing wear or degradation.

During Refueling Outage 08 (OR08), Seabrook Station performed a disassembly and inspection of CBS-P-9-B. This inspection indicated that the pump did not have to be refurbished to restore any lost margin. Inspections of the wearing ring clearances were found to be satisfactory. The clearance acceptance criterion is 0.017 inches to 0.025 inches. The inboard clearances were 0.021 to 0.023 inches and outboard clearances were 0.022 to 0.023 inches. This disassembly validated our performance monitoring programs.

Based on this test history, the OR08 CBS-P-9-B disassembly, and the current vibration values, an ISTB 5.2.1-1 ALERT RANGE increase of the lower vibration limit from 0.325 inches per second to 0.350 inches per second for the pump outboard bearing vibration readings is warranted. The bases for the 0.350 inches per second is to simply provide some margin for test repeatability and to define a limit for additional actions.

Alternate Testing:

- Using the 0.350 ips as the absolute limit for all pump bearings will provide adequate indication of pump performance.

- The CBS Pumps will be subject to additional testing, trending, and diagnostic analysis as required by the Seabrook Station Predictive Maintenance Program. This program employs predictive monitoring techniques that go beyond the vibration monitoring and analysis required by ISTB. These techniques also now include oil sampling and analysis. If the measured parameters were found to be outside the normal operating range or were determined to be trending toward an unacceptable degraded state, then appropriate actions would be taken. These actions include monitoring additional parameters, review of specific information to identify cause, and potential removal of the pump from service to perform necessary maintenance.

- Increase the ISTB Table 5.2.1-1 ALERT Range Absolute limit from 0.325 ips to 0.350 ips for all pump bearing absolute limits on both 1-CBS-P-9-A and 1-CBS-P-9-B.

CBS Pump Relief Request Supporting Details

Problem Statement

Containment Building Spray Pump bearing housing vibration amplitude levels fluctuate above and below the ASME OM-Code, ISTB, Table 5.2.1-1, Alert limit of 0.325 inches/second Peak. This limit is the absolute limit for pumps speeds greater or equal to 600 revolutions per minute (RPMs). This results in unnecessarily placing the CBS-P-9-B in an Alert status and has the potential for placing CBS-P-9-A also in Alert status.

Discussion

Containment Building Spray (CBS) pumps supply the containment spray headers during a design based accident when containment building pressure exceeds the Containment Pressure-HI-3 setpoint. During normal operation, the pumps are tested using an alternate mini-flow path which is capable of 1915 to 1955 gallons per minute (gpm) flow. This is adequate to allow pump performance flow and differential pressure testing, however; this flow rate increases pump internal recirculation flow that increases pump impeller vane pass vibration response. Pump vibration is measured at the bearing housings. Vibrations on all bearings are higher than expected although not all bearings have exceeded the 0.325 inches/second limit. A review of Tables 1 and 2 data indicates that this has been consistent. On July 3, 1985, during the performance of pre-operational test, PT-12.1, pump vibration amplitude values were above acceptable levels. Additional data collection and analysis was performed and identified the major spectral vibration component of 14,300 cpm. As a result of this information no additional work was performed to reduce vibration levels and the elevated vibration condition was accepted.

The ASME Code provides both a relative multiplier on the reference value, or an absolute limit. The lower of the relative multiplier or the absolute limit is used to define test acceptance criteria. The Code established that the absolute limit for the ALERT limit be applied to all of the bearings.

On CBS-P-9B, the pump vibration amplitude levels fluctuate above and below the ASME OM-Code, ISTB, Table 5.2.1-1, Alert limit of 0.325 inches/second Peak. This limit is the absolute limit for pump speeds greater than or equal to 600 revolutions per minute (RPM). This results in unnecessarily placing the CBS pump into an Alert status. This action is inconsistent with the IST program intent. The intent is the additional monitoring that is required to determine a degrading condition. In this case, the equipment will continue to function normally at these elevated vibration levels during surveillance testing. It is expected that during a design basis condition where pump flow rates are approximately 3030 gpm that pump bearing vibration amplitudes would be less than 0.325 ips Peak. This is based upon reduced pump internal recirculation resulting in less resonance amplification.

Analysis

NUREG/CP-0152 "Proceedings of the Fourth NRC/ASME Symposium on Valve and Pump Testing," (1996) Article on "Nuclear Power Plant Safety Related Pump Issues," (pages 4-32 and 4-33) identifies four components that should be considered for NRC staff review when changing Code Absolute Vibration Limits. These are:

1 Pump vibration history
2 Information from the pump manufacturer,
3 Discussion of owner attempts to lower vibration, and
4 Spectral analysis of the pump-driver system.

The following addresses each of these four components.

1. Pump vibration has been programmatically recorded since 1991. Attachment 1, Table 1, provides nearly 12 years of CBS-P-9-A pump bearing housing vibration history and Table 2, provides nearly 12 years of CBS-P-9-B pump bearing housing vibration history.

2. Information from the pump manufacturer. The original pump vendor, Bingham-Willamette Company is now part of Sulzer Pumps (US) Inc. Mr. Simon H. Daou, a Rotating Equipment Engineer and Mr. John F. Murry, National Sales Manager – Power both from Sulzer visited Seabrook Station to discuss the elevated pump vibration levels. Mr. Daou stated that Sulzer no longer supplies the single exit vane impeller style and now supplies a split exit vane impeller to reduce the induced vane pass energy.

   Additional pump modal response vibration data was forwarded to Sulzer for their evaluation. The results of this effort is a new vendor recommended pump bearing limit of 0.35 ips Peak. See Attachment 2 Sulzer Pump vendor correspondence.

3. Discussion of owner attempts to lower vibration.

   CBS-P-9-A is of the same pump design as the CBS-P-9-B pump. Vibrations on all bearings are higher than expected. See Attachmeng 1, Table 1.

   The CBS pumps are a Bingham-Willamette Company Type CD, dwg. B-33844. The pump style is a double suction single discharge, single stage pump having a flooded suction. Normal suction pressure is approximately 55 psig during surveillance testing.

   The pump impeller is configured with a wide flat discharge vane exiting to the discharge diffuser. This pump impeller design is prone to vane pass induced vibration. The pump vendor was contacted regarding this design issue. The vendor stated that the present impeller design is no longer manufactured and their current replacement impeller has a modified vane exit passages to reduce vane pass excitation.

During refueling outage eight (OR08), CBS-P-9-B was disassembled to repair several bearing oil leaks and perform an internal pump inspection. The pump internal inspection did not identify any unusual conditions and the pump was returned to service.

Both pumps, CBS-P-9-A and CBS-P-9-B are of the same design. Pump bearing housing modal testing (bump testing) was performed to determine the structure's resonance frequencies. The results identified that the pump outboard housing has broad frequency response amplification at the vane pass frequency and at two times vane pass. This means that any vibration stimulus at these frequencies will result in resonance amplification causing increased vibration responses at all monitored location. See additional information in Attachment 1, Advanced Diagnostic Report.

There are no acceptable methods to reduce pump vibration without implementing a design change solely to address the Code administrative limit. The pump casing resonance issue affects both pumps. This relief request is being requested for both pumps even though the CBS-P-9B is the only pump currently in the ALERT status.

4. Spectral Analysis of the pump-driver system.

CBS-P-9-B

During routine pump surveillance testing both vibration amplitude and spectral data are collected. Pump and motor spectral data are reviewed and trended over a frequency range of 5 to 1000 Hz. This data indicates that there are no pump rolling element bearing or motor bearing degrading trends. The pump vibration spectrum does contain several upper energy spectral peaks at four and eight times running speed. See Figure 1 CBS-P-9B Pump Outboard Bearing Horizontal Vibration Spectra below.

Pump bearing housing modal testing identified broad resonance amplification peaks at the pump 1x and 2x vane pass frequencies. Vibration spectral analysis shows that the pump outboard bearing horizontal location has a 1x amplitude peak of 0.05 ips, while the vane pass amplitude peak is 0.065 ips and the two time vane pass amplitude is 0.084 ips. This data supports that the elevated vibration amplitudes at the pump outboard bearing are the result of vane pass excitation energy due to resonance amplified. Data analysis has not identified any bearing distress frequencies or indications of improper rotor balance or shaft rubs.

Pump bearing housing resonance amplification problem is also present on CBS-P-9-A, but to a lesser degree. See Figure 2, CBS-P-9A Pump Outboard Bearing Horizontal Vibration Spectra. Pump outboard vibration amplitudes are averaging 0.31 ips.

Figure 1
CBS-P-9-B Pump Outboard Bearing Horizontal Vibration Spectra

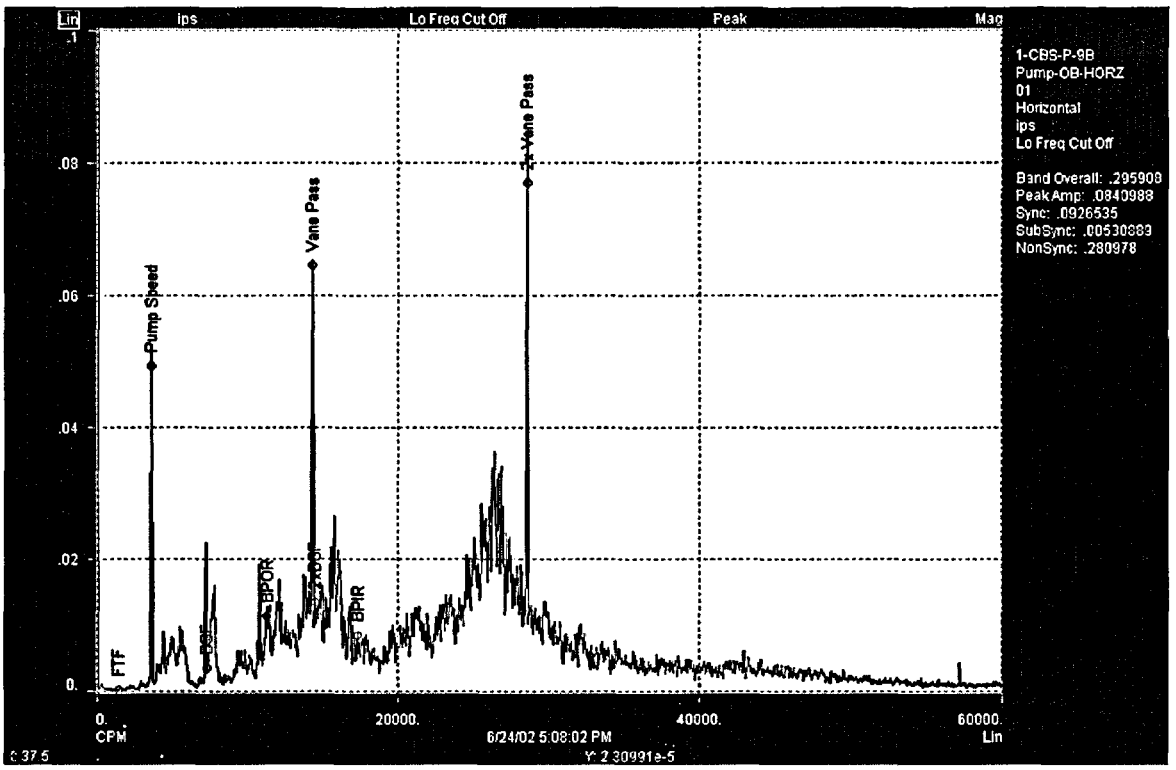
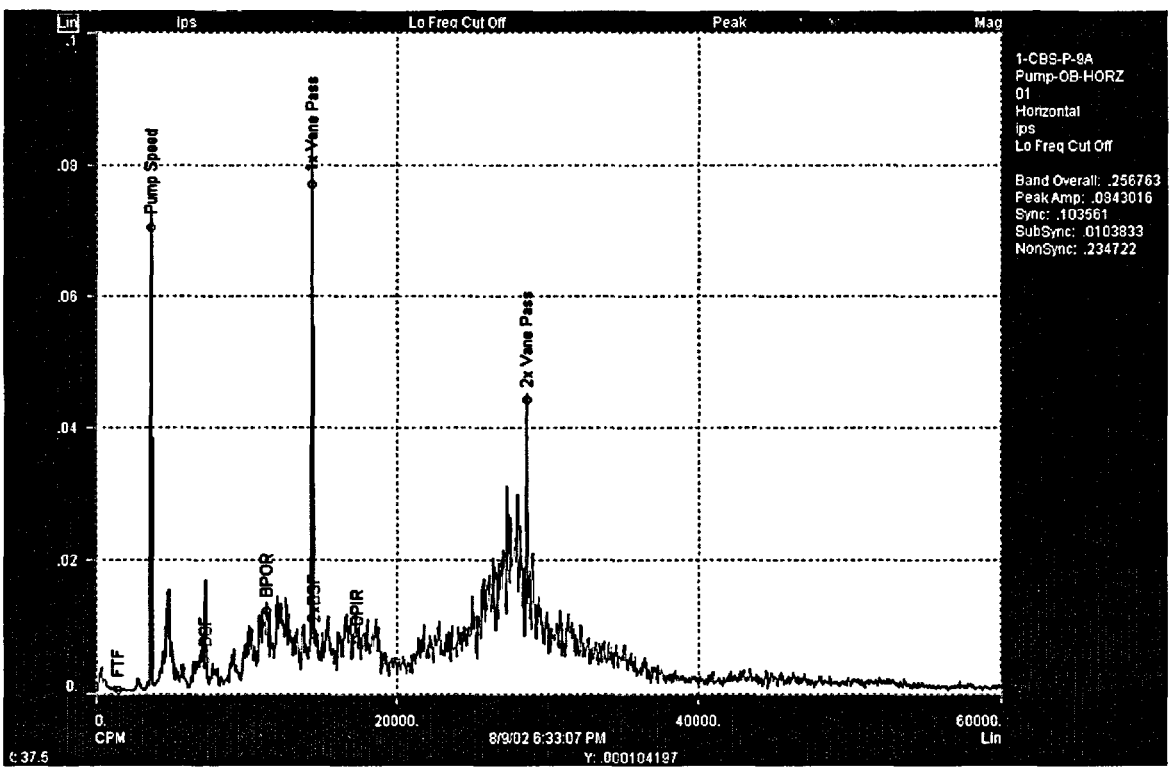


Figure 2
CBS-P-9-A Pump Outboard Bearing Horizontal Vibration Spectra



CBS-P-9-A & CBS-P-9-B

During accident conditions, the CBS pumps would operate in response to a containment high pressure signal. Pump operation would not be limited by the recirculation line size. In this condition, pump vibration amplitudes would be reduced since internal pump recirculation would be reduced and pump forcing frequencies would also be subsequently reduced. Although full flow vibration data has not been collected it is reasonable to expect overall vibration amplitudes would be reduced as observed on other single stage double suction pumps. Consequently, based on these modes of operation for both normal and accident conditions, the CBS pumps would only experience elevated vibration from vane pass during IST Comprehensive and other routine surveillance testing.

The pump manufacturer has been involved evaluating the pump vibration data and agrees with increasing pump bearing vibration limits due to vane pass frequency phenomena. The pump manufacturer agrees that quarterly ISTB Table 5.2.1-1 pump tests on mini-flow recirculation flow does not reduce pump bearing life. These tests are short duration (15-30 minutes) and bearing life is considerable based on the actual pump run time. Pump run time for both CBS pumps is approximately 400 hours.

ISTB Section 6.2.1 states "If the measured test parameter values fall within the Alert range of Table ISTB 5.2.1-1, Table 5.2.1-2, or Table 5.2.3-1, as applicable, the frequency of testing specified in para. ISTB5.1 shall be doubled until the cause of the deviation is determined and the condition is corrected." In this case, the CBS-P-9-B pump outboard bearing horizontal vibration often exceeds the Alert range causing the test frequency to be increased. The cause of the pump bearing vibration amplitude deviation has been attributed to vane pass frequency amplification. The elevated vibration amplitude is not indicative of pump degradation and is not predicted to result in degraded pump performance or failure. The correction for this condition would result in replacing the pump impeller requiring head verification and/or replacing pump discharge recirculation piping. Implementing either of these two options would require substantial costs and equipment unavailability. In this circumstance, doubling the frequency unnecessarily operates a component to perform a test that does not provide any additional information and provides no additional assurance on information as to the condition of the pump or its ability to perform its safety function.

Conclusion

The cause of the vibration is well understood, and is a result of the vendor's original pump design and of recirculation line size.

The issue impacts both containment spray pumps, 1-CBS-P-9-A & 1-CBS-P-9-B. Vibration amplitudes on Containment Spray Pump 1-CBS-P-9-A have not reached the Alert Range, but are very close to the limit (the most recent reference value, V_r is 0.319 in/sec at the outboard pump bearing, vertical).

Casing resonance amplification results in a testing hardship due to the lack of any margin between our reference value and the ISTB Table 5.2.1-1 Alert Range absolute limit. Additional testing does not provide any compensating level of quality or safety.

Increasing the ISTB Table 5.2.1-1 ALERT Range Absolute limit from 0.325 ips to 0.350 ips for both 1-CBS-P-9-A and 1-CBS-P-9-B, will provide adequate margin for test repeatability without placing the pump in an Alert condition.

Attachment 1

Form A: Advanced Diagnostics Report

Unit	1	System	CBS	ID	CBS-P-9A/B	Status	Operable	CBM File #	01-001
Machine Name	1-CBS-P-9-A & -B			Tracking Mechanism				CR 01-07360-01	

Overall Condition: Operable

Containment Building Spray Pump Outboard Bearing

CBS-P-9B pump bearing overall radial vibration amplitude often exceeds IST limit of 0.325 ips during the comprehensive IST pump test. Actual POH bearing radial vibration is 0.347 ips. Additional vibration data collection and modal analysis has identified pump vane pass spectral responses resulting in amplitude amplification. Pump casing resonance testing identified that the pump design has a resonance frequency similar to that of pump vane pass frequency of 14,250 cpm. This impacts both pumps even though the CBS-P-P9A is not currently in ALERT status. See Figures 1 and 2 below. This condition results in vibration amplitude amplification. A review of past pump history identified similar pump vane pass vibration amplification. No corrective actions are recommended at this time. Vibration levels for CBS-P-9-B have been routinely above 0.325 ips and the vibration levels for CBS-P-9-A are very close to the ALERT limit of 0.325 inches per second.. See Tables 1 and 2. ☒ Continuation Sheet

Suspected Cause(s): Casing Resonance with Pump Vane Pass Amplification

CBS pump design uses a wide, four-vane impeller that is susceptible to elevated vane pass vibration. This induced vibration amplitude, along with casing resonance near vane pass frequency, results in elevated overall vibration levels. There are no corrective actions to minimize this condition without replacing the pump impeller. This design change to update the impeller design would be required to obtain vibration test margin, however this design change would not fix any material degradation or restore lost margin. ☒ Continuation Sheet

Diagnostic Recommendation(s): None

Recent pump bearing resonance test results confirm tests performed during initial plant startup (1986). These results identify that the casing resonance contributes to the overall vibration amplitude. Continued pump operation at these levels is acceptable given that spectral vibration data is being collected and reviewed for bearin degradation. Additional, high resolution vibration data analysis has not found any indications of bearing wear or degradation. ☐ Continuation Sheet

Maintenance Recommendation(s): None

There are no maintenance actions that can improve this condition. Impeller replacement with an improved design, e.g. split vane, would reduce pump vibration. This design change to update the impeller design would be required to obtain vibration test margin, however this design change would not fix any material degradation or restore lost margin. This would involve a design change and would require addition pre-service testing that would be very difficult to accomplish.

☐ Continuation Sheet

Monitoring Summary:

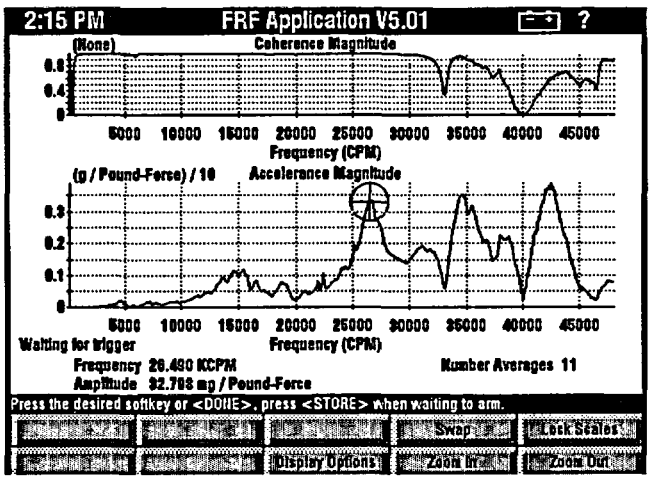
PdM Technologies	Vibration	Lube Oil	Thermography	Other
Last Date Monitored:	07/09/03	07/09/03	07/09/03	
Current Condition:	Alert	Monitor	Normal	
Monitoring Frequency:	98 weeks	24 weeks	96 weeks	
Post Mntc Test Req'd:	N/A	N/A	N/A	

Analyzed By:	Robert A. Gwinn	Signature: Robert A. Gwinn	Date: 9-12-03
Reviewed By:	Robert I. PARRY	Signature: R I Parry	Date: 9/12/03
Approved By:	MICHAEL J. MAHONEY	Signature: M J Mahoney	Date: 9/12/03

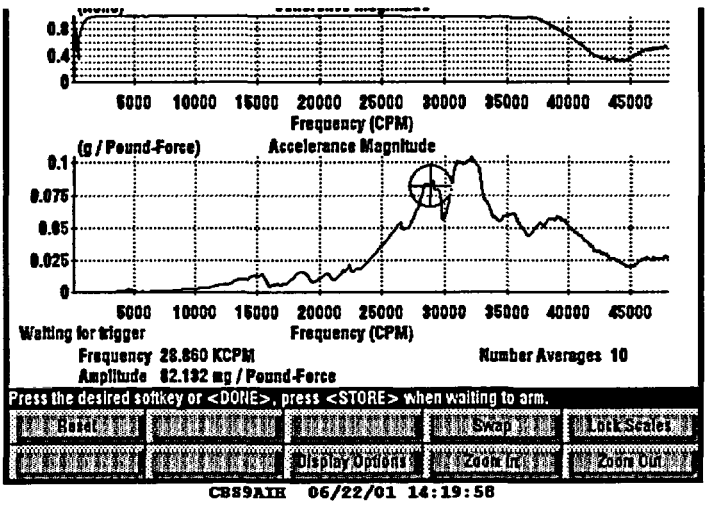
Figure 1

1-CBS-P-9-A Pump Bearing Housing Resonance Test Results

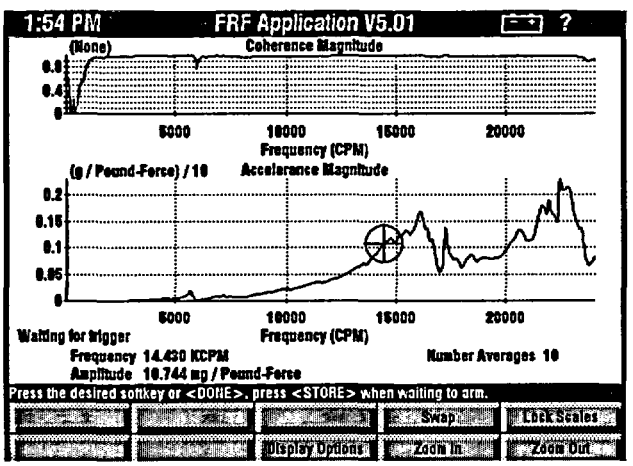
Pump Outboard Bearing Horizontal



Pump Inboard Bearing Horizontal



Pump Outboard Bearing Vertical



Pump Inboard Bearing Vertical

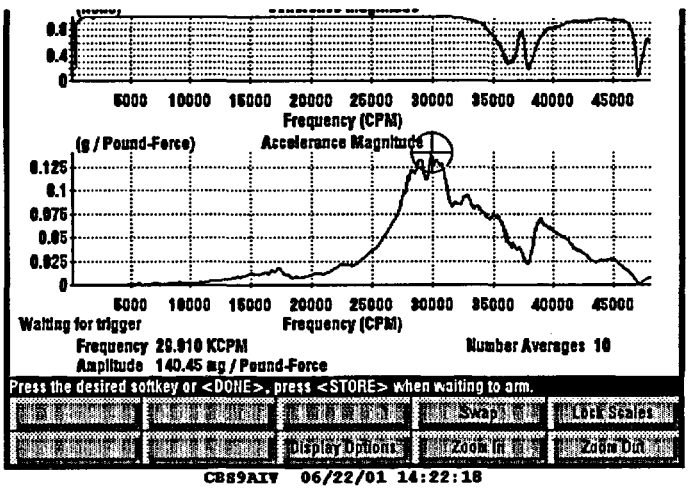
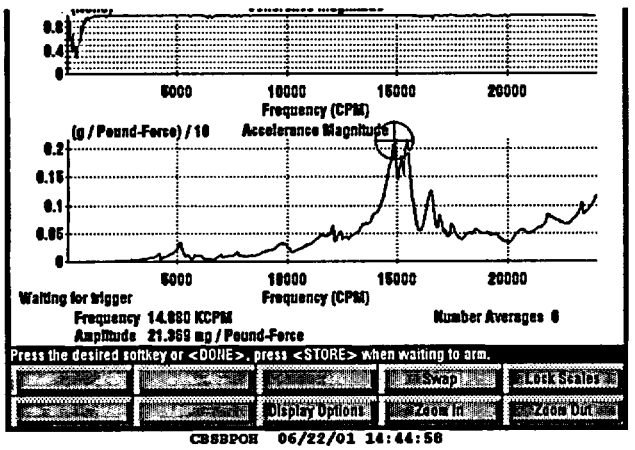


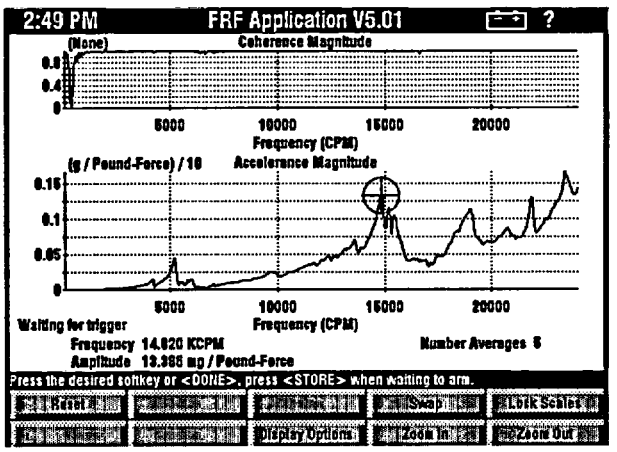
Figure 2

1-CBS-P-9-B Pump Bearing Housing Resonance Test Results

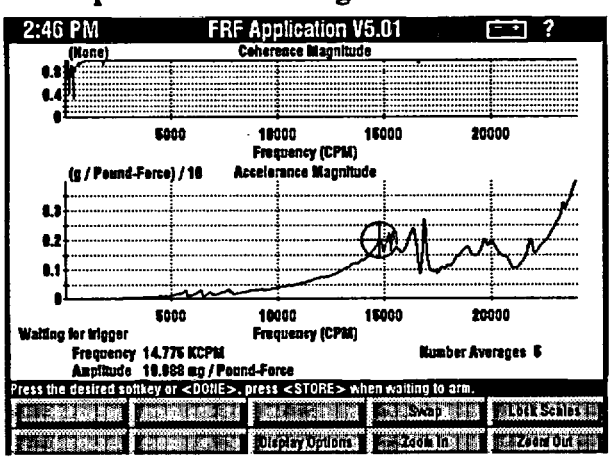
Pump Outboard Bearing Horizontal



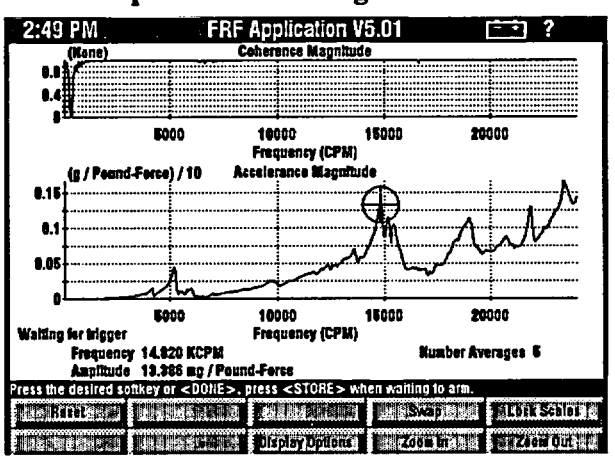
Pump Inboard Bearing Horizontal



Pump Outboard Bearing Vertical



Pump Inboard Bearing Vertical



Suspected Causes

Data Review

A comparison between the spectral and analog overall vibration amplitudes for CBS-P-9-B indicates that the majority of vibration energy is due to synchronous speed and pump vane pass excitation. This comparison indicates a slight difference between the vibration energy in the spectral range of 300 to 60,000 cpm (5 to 1000 Hz) and the overall range of 300 to 4,500,000 cpm (5 to 75,000 Hz). As expected, the larger spectral band provides a higher number. Indicated below under the column of Change is the difference in percent between these two spectral bands. The broad band energy as compared to the spectrum overall is insignificant and indicates that most of the energy is below 60,000 cpm (1,000 Hz) due to pump vane pass vibration resonance amplification. There are no indications of rolling element bearing distress frequencies, e.g. ball pass, ball pass inner/outer race, or fundamental train frequencies.

Location Position	300 to 60,000 cpm	300 to 4,500,000 cpm	Change (%)
1 (POH)	0.317 ips	0.346 ips	0.029 (8.38%)
2 (POV)	0.255 ips	0.275 ips	0.02 (7.27%)
3 (POA)	0.165 ips	0.191 ips	0.026 (13.61%)
4 (PIH)	0.237 ips	0.265 ips	0.028 (10.56%)
5 (PIV)	0.231 ips	0.256 ips	0.025 (9.7%)

The elevated vibration levels observed on the pump bearing housings is due to resonance amplification with the excitation energy being produced by pump vane pass and increased internal pump recirculation due to the system recirculation line.

The issue impact both pumps although currently only the CBS-P-9-B is in ALERT status. Based on this information, both CBS pumps will continue to perform without degraded performance based on the pump vane pass resonance amplification. There is no justification at this time that would require pump impeller replacement or pump bearing housing stiffening.

Table 1

1-CBS-P-9-A Pump Vibration Historical Data

(Some of this data was collected by the Predictive Maintenance Programs)

Date	POH	POV	POA	PIH	PIV
5/27/91	0.32	**0.36**	0.28	0.26	**0.36**
9/30/91	0.3	0.30	0.20	0.28	0.25
11/11/91	0.3	0.30	0.20	0.27	0.25
2/04/92	0.28	0.34	0.22	0.27	0.29
4/27/92	0.3	0.30	0.22	0.25	0.30
7/31/92	0.3	0.30	0.22	0.27	0.28
9/01/92	0.28	0.33	0.22	0.28	**0.35**
10/31/92	0.29	**0.38**	0.24	0.30	0.30
1/04/93	0.24	0.32	0.20	0.27	0.30
3/29/93	0.3	0.28	0.20	0.30	0.29
6/21/93	0.28	0.30	0.20	0.28	0.30
9/13/93	0.31	0.28	0.20	0.28	**0.33**
12/06/93	0.28	0.32	0.18	0.26	0.32
2/28/94	0.29	0.32	0.19	0.25	0.31
7/23/94	0.28	0.32	0.19	0.27	0.27
8/15/94	0.28	0.31	0.19	0.25	0.31
11/07/94	0.30	0.30	0.20	0.25	**0.34**
1/30/95	0.30	**0.37**	0.22	0.32	0.30
4/24/95	0.28	0.32	0.26	0.26	0.32
6/04/95	0.28	**0.35**	0.22	0.26	0.28
7/17/95	0.27	0.31	0.20	0.24	0.28
10/10/95	0.30	0.32	0.23	0.26	0.32
1/02/96	0.29	0.31	0.20	0.24	0.29
3/25/96	0.30	**0.40**	0.20	0.30	0.30
6/17/96	0.28	**0.33**	0.21	0.25	0.32
9/09/96	0.28	**0.35**	0.22	0.24	0.25
12/02/96	0.28	**0.33**	0.22	0.30	0.26
2/24/97	0.22	0.30	0.21	0.24	0.28
5/01/97	0.27	0.32	0.23	0.26	0.30
11/04/97	0.24	0.31	**0.33**	0.27	0.32
1/07/98	0.286	**0.33**	0.18	0.23	0.30
4/20/98	0.324	**0.35**	0.178	0.214	0.31
6/22/98	0.253	0.284	0.144	0.215	0.288
9/10/98	0.253	0.270	0.190	0.232	0.290
12/03/98	N/A	0.309	0.213	0.224	0.310
2/25/99	0.257	0.304	0.155	0.224	0.302
5/20/99	0.294	0.315	0.150	0.239	0.297
8/12/99	0.277	**0.330**	0.175	0.251	0.296
11/04/99	**0.332**	**0.332**	0.178	0.324	**0.338**
11/05/99	0.272	0.322	0.155	0.234	0.305
7/13/00	0.290	0.315	0.189	0.236	0.293
9/07/01	0.284	0.319	0.185	0.233	0.261
5/18/02	0.312	0.315	0.189	0.273	0.253
8/09/02	0.277	0.300	0.177	0.223	0.233
07/09/03	0.288	0.322	0.185	0.228	0.254

Notes: **POH** – Pump Outboard Horizontal; **POV** Pump Outboard Vertical; **POA** – Pump Outboard Axial; **PIH** – Pump Inboard Horizontal; & **PIV** – Pump Inboard Vertical

Table 2

1-CBS-P-9-B Pump Vibration Historical Data

(Some of this data was collected by the Predictive Maintenance Programs)

Date	POH	POV	POA	PIH	PIV
07/07/91	0.30	0.35	0.25	0.27	0.40
09/15/91	0.30	0.32	0.24	0.28	0.40
12/20/91	0.33	0.31	0.20	0.24	0.38
01/28/92	0.31	0.31	0.24	0.27	0.39
03/17/92	0.34	0.32	0.25	0.30	0.40
06/08/92	0.32	0.30	0.23	0.26	0.38
08/31/92	0.30	0.30	0.25	0.26	0.40
11/05/92	0.31	0.32	0.23	0.27	0.40
11/23/92	0.32	0.34	0.25	0.27	0.40
02/15/93	0.30	0.32	0.20	0.26	0.40
05/13/93	0.31	0.30	0.22	0.24	0.39
08/02/93	0.30	0.32	0.22	0.29	0.40
10/15/93	0.35	0.16	0.20	0.25	0.32
01/18/94	0.30	0.30	0.22	0.25	0.37
08/01/94	0.30	0.22	0.20	0.28	0.28
09/26/94	0.31	0.27	0.22	0.26	0.32
12/19/94	0.29	0.29	0.24	0.26	0.38
03/13/95	0.30	0.29	0.24	0.28	0.34
06/05/95	0.30	0.27	0.21	0.26	0.38
08/28/95	0.34	0.28	0.22	0.26	0.34
12/06/95	0.35	0.21	0.21	0.32	0.35
02/13/96	0.35	0.35	0.24	0.30	0.37
05/07/96	0.29	0.34	0.20	0.25	0.34
07/29/96	0.30	0.30	0.20	0.30	0.40
10/21/96	0.34	0.34	0.21	0.27	0.37
01/13/97	0.29	0.29	0.22	0.24	0.34
04/07/97	0.30	0.30	0.22	0.30	0.32
06/30/97	0.35	0.30	0.25	0.26	0.35
09/22/97	0.31	0.33	0.24	0.28	0.32
12/23/97	0.38	0.32	0.25	0.28	0.36
03/13/98	0.318	0.302	0.197	0.245	0.371
07/29/98	0.335	0.289	0.192	0.250	0.366
10/20/98	0.273	0.253	0.212	0.215	0.333
03/19/99	0.304	0.287	0.180	0.230	0.345
06/30/99	0.318	0.314	0.193	0.224	0.383
05/31/00	0.34	0.281	0.212	0.279	0.337
12/01/00	0.331	0.296	0.211	0.257	0.284
07/25/01	0.337	0.275	0.192	0.265	0.256
07/25/01	0.347	0.280	0.196	0.248	0.274
01/09/02	0.352	0.275	0.236	0.248	0.250
05/18/02	0.334	0.324	0.206	0.245	0.321
06/24/02	0.311	0.304	0.190	0.248	0.322
05/27/03	0.335	0.300	0.198	0.238	0.343

Notes: **POH** – Pump Outboard Horizontal; **POV** Pump Outboard Vertical; **POA** – Pump Outboard Axial; **PIH** – Pump Inboard Horizontal; & **PIV** – Pump Inboard Vertical

Attachment 2

Sulzer Pumps

Good day Mr. Gwinn,

Further to you email below, and following a review please note "The vibration alert limit is not to exceed .35 ips".

Please advise should you require additional information.

Best regards,
Simon Daou, P.E.
Rotating Equipment Engineer, Eastern Service Center
Sulzer Pumps (US) Inc.
106 Iberville Street
Dollard-des-Ormeaux, Quebec H9B 3A9
Tel. +1 514-685-8520
Mobile phone +1 514-234-3838
Fax +1 514-684-3545
E-mail mailto:simon.daou@sulzerpumps.com
Internet http://www.sulzerpumps.com

-----Original Message-----
From: robert_gwinn@fpl.com [mailto:robert_gwinn@fpl.com]
Sent: 13 janvier, 2003 16:58
To: john.murry@sulzerpumps.com; Daou, Simon
Cc: robert_mccormack@fpl.com; robert_parry@fpl.com; sean_doody@fpl.com
Subject: Upper Pump Bearing Housing Vibration Limit Requested

Dear John and Simon,

Seabrook Station is in the process of requesting NRC regulatory relief for our containment building spray pumps. Currently, we are proposing to increase the pump vibration Alert limit to 0.4 ips Peak from the current program limit of 0.325 ips Peak. This would provide an effective pump Alert limit and still implement the intent of the In-service Test Code.

Historically, containment building spray (CBS) pumps (Bingham model "CD" Fig. B-33844, a double suction, single discharge, four vane impeller and operating at 3565 rpm) have exhibited elevated vibration levels. Vibration analysis shows that part of the elevated vibration is due the pump vane pass response and outboard bearing housing resonance. Since there can is no cost effective means to reduce this physical condition, it is recommended to establish a vendor supported upper vibration limit for the pump bearing housing vibration Alert limits.

The following graphic illustrates a typical pump outboard bearing housing horizontal vibration spectrum.

Figure 1 1-CBS-P-9-B Pump Outboard Bearing

Spectrum
(Embedded image moved to file: pic05002.pcx)

Based on the graphic above you can clearly observe vane and 2 time vane pass frequency amplitudes. Additionally, there are raised floor vibration responses near these amplitudes that contribute to the overall vibration amplitudes. Resonance test (bump test) results show elevated response amplification at both the vane and two time vane pass frequencies. This forced vibration and the resonance testing clearly indicate that if the vane pass responses were removed, the pump bearing housing vibration levels would be well below the administrative limit of 0.325 ips Peak.

What I need close this regulatory relief request, is a document from the Vendor, you, stating that increasing the outboard bearing vibration amplitude Alert limit to 0.4 ips Peak is acceptable. This would be based on the current pump impeller vane pass response and outboard bearing resonance test results.

If you have any questions regarding this subject or need addition information please contact me at (603) 773-7056, by email

Sincerely,

Robert A. Gwinn.