NEXTera ENERGY SEABROOK

May 6, 2019

10 CFR 50.55a
SBK-L-19051

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

Seabrook Station
Docket No. 50-443

Subject: Relief Request PR-1, Proposed Alternative in Accordance with 10 CFR 50.55a(f)(5)(iii), CBS Pump Periodic Verification Testing on Recirculation Flow Path; and Relief Request PR-2, Proposed Alternative in Accordance with 10 CFR 50.55a(z)(1), Increase of Vibration Alert Range Absolute Limit for All CBS Pump Bearings

In accordance with the provisions of 10 CFR 50.55a(f)(5)(iii) and 10 CFR 50.55a(z)(1), NextEra Energy Seabrook, LLC (NextEra) is submitting two relief requests associated with the containment building spray (CBS pumps. Request PR-1 proposes an alternative to CBS pump periodic testing on the recirculation flow path due to impractical requirements. Request PR-2 proposes increasing the vibration limits for the CBS pumps. Enclosures 1 and 2 provide the bases for requests PR-1 and PR-2, respectively.

The current third ISI interval ends on August 18, 2020. NextEra proposes to perform the alternate methods discussed in the enclosed relief requests through the fourth testing interval. NextEra requests NRC review and approval of the proposed alternatives within a year to allow use of the alternatives in the fourth ISI interval, which begins in August 2020.

There are no commitments being made in this submittal.

If you have any questions regarding this submittal, please contact me at (603) 773-7932.

Sincerely,

NextEra Energy Seabrook, LLC

Kenneth J. Browne
Licensing Manager

Enclosure 1: Proposed Alternative for Seabrook Unit 1in Accordance with 10 CFR 50.55a(f)(5)(iii)- Relief Request PR-1 CBS Pump Periodic Verification Testing on Recirculation Flow Path

Enclosure 2: PR-1 Supporting Hydraulic Data

Enclosure 3: Proposed Alternative for Seabrook Unit 1in Accordance with 10 CFR 50.55a(z)(1) - Relief Request PR-2 Increase of Vibration Alert Range Absolute Limit for All CBS Pump Bearing to 0.400 ips

Enclosure 4: PR-2 Supporting Vibration Data

Enclosure 5: Letter from Art Washburn (Sulzer Pumps, Inc.) to Brian O'Callahan (NextEra Energy Seabrook) dated April 9, 2019.

cc:

NRC Region I Administrator
NRC Project Manager
NRC Senior Resident Inspector

Enclosure 1 to SBK-L-19051

Relief Request Number PR-1

Relief Request in Accordance with 10 CFR 50.55a(f)(5)(iii), CBS Pump Periodic Verification Testing on Recirculation Flow Path

Relief Request

in Accordance with 10 CFR 50.55a(f)(5)(iii)

--Inservice Testing Impracticality--

Relief Request PR-1, CBS Pump Periodic Verification Testing on Recirculation Flow Path

1. ASME Code Component(s) Affected

Component: Containment Building Spray (CBS) Pumps 1-CBS-P-9A & 9B

Code Class: 2

Type: Horizontal Centrifugal

Pump Group: A (ISTB-5120)

2. Applicable Code Edition and Addenda

The applicable Code of record for NextEra Energy's Seabrook Station (Seabrook) Inservice Testing (IST) Fourth Testing Interval is ASME OM-2012, Operation and Maintenance of Nuclear Power Plants.

3. Applicable Code Requirement

Test requirements specific to Seabrook are prescribed in the ASME OM-2012 Code, Subsection ISTA, General Requirements and Subsection ISTB, Inservice Testing of Pumps in Light-Water Reactor Nuclear Power Plants – Pre-2000 Plants. As discussed in ISTB-1400, the Owner shall establish a pump periodic verification test program for certain pumps tested in accordance with paragraph ISTA-1000. The requirements applicable to this request for relief in accordance with the requirements 10 CFR 55.55a include paragraph ISTB-1400 Part (d) whereas it is the responsibility of the Owner to establish "a pump periodic verification test program in accordance with Division 1, Mandatory Appendix V." The following are excerpts of the Code applicable to this request:

- ISTB-2000 states a "*comprehensive pump test flow rate*...established by the Owner that is effective for detecting mechanical and hydraulic degradation during subsequent testing"
- Division 1, Mandatory Appendix V states a "*pump periodic verification test*...verifies a pump can meet the required...pressure as applicable, at its highest design basis accident flow rate."

4. Impracticality of Compliance

Title 10 of the Code of Federal Regulations (10 CFR), Section 50.55a, requires that Inservice Testing (IST) of certain ASME pumps and valves be performed at intervals specified in accordance with ASME Code discussed herein, except

where alternatives have been authorized or relief has been requested by the licensee and granted by the Nuclear Regulatory Commission (NRC) pursuant to pertinent paragraphs contained within 10 CFR 50.55a. In accordance with 10 CFR 50.55a(f)(4)(ii), licensees are required to comply with the requirements of the latest edition and addenda of the ASME Code, incorporated by reference in the regulations, 12 months prior to the start of subsequent 10-year IST program intervals. In proposing alternatives or requesting relief, the licensee must demonstrate the proposed alternatives provide an acceptable level of quality and safety.

The CBS system is designed to remove the energy discharged to the containment following a loss-of-coolant accident (LOCA) or main steam line break (MSLB) to prevent the containment pressure from exceeding design pressure and to reduce and maintain containment temperature and pressure within acceptable limits. The CBS pumps are motor-driven, horizontal, centrifugal pumps. The subject pumps are designed to take suction from either the refueling water storage tank (RWST) in the emergency core cooling system (ECCS) injection mode or the containment recirculation sump in ECCS recirculation mode. The CBS pump discharges flow back into the containment through the containment spray nozzles. Each train of the CBS system includes one 100% capacity pump.

Full flow testing of the subject pumps would require system alignment to containment spray headers and subsequent discharge to the containment. In order to perform full flow testing without alignment to the spray headers, temporary piping is required to recirculate water to/from the Emergency Core Cooling System (ECCS) containment sumps. This was performed previously, to verify CBS pump curve data during pre-operational test PT-11, Containment Recirculation Sump Operability Demonstration. 1-PT-11 required modification of the sump by means of building a dike around the top of the sump in order to hold the volume of water required to achieve the necessary pump net positive suction head without flooding the containment. The spray header piping also required modification by means of removing the spool pieces downstream of the spray ring isolation valves and connecting temporary pipe from the 25' elevation in containment to the ECCS Sumps at –26' elevation. In 2008 (during Seabrook Refueling Outage OR12), installation of the sump modifications installed flow interceptors, further reducing the available volume of the sump for testing. Performing these temporary modifications to the CBS system or enlarging the recirculation piping and components to achieve design basis accident flow rates are not warranted since there will be no improvement in the ability to detect pump degradation.

5. Burden Caused by Compliance

Compliance with the Code will require reconfiguring the CBS recirculation line to meet design basis accident flow. A conceptual Engineering Change was completed to determine the best path for modifying the recirculation line. The preferred option interconnects the CBS heat exchanger outlet with the CBS suction from the RWST upstream of the suction check valves for each CBS pump. Installation of this system design change will require a plant shutdown

and significant expenditures without a corresponding improvement in plant safety.

CBS pumps testing is performed using an existing recirculation line achieving approximately 68% of the required design basis accident flow rate of 2808 gpm. Modifying the recirculation line to accommodate full flow for the Pump Periodic Verification Test, as required by ASME OM-2012 Mandatory Appendix V, would require an extensive hardware modification.

The CBS pumps are required to be inservice tested in accordance with Subsection ISTB of the subject Code. Subsection ISTB 1400(d) of the Code requires a pump periodic verification test program be created in accordance with Division 1, Mandatory Appendix V. This requirement was added as part of the 2012 Code revision to verify pumps can meet the required pressure at its highest design basis accident flow rate. Prior versions of the Code required demonstration of full flow performance using a comprehensive test by establishing a reference value within ±20% of a pump design flow rate. Prior NRC approved relief was granted to Seabrook for the Third Testing Interval allowing Seabrook to perform comprehensive testing via the existing recirculation line that provides 68% of design basis accident flow rate. The latest edition of the Code allows for comprehensive test flow rates to be established by the Owner at a point that is effective for detecting mechanical and hydraulic degradation during subsequent testing. The comprehensive test flow criteria changed because full flow is now demonstrated with periodic verification tests.

The flow path used to perform both the biennial comprehensive pump test and the quarterly Group A test are the same. Both CBS pumps take suction from the RWST through a series of manual valves and a suction check valve and discharge water back to the RWST. The pump discharge flow path contains a piping run to a heat exchanger (CBS-E-16-A or CBS-E- 16-B) and then continues to the containment spray ring header penetration(s) (X-14 and X-15). Upstream of this penetration is the return line to the RWST. In the return line, there is an air-operated valve specific to each train (CBS-V-31 and CBS-V-32) with no remote throttling capacity. The return lines for each train tie together into a common line that utilizes a similar type air-operated valve (CBS-V33). This common line then connects to the RWST, which is located downstream. The Safety Injection pumps also utilize this common return line to the RWST. CBS pump flow is measured utilizing a flow indicator (FI-2340) located in the common return line to the RWST. Due to the design of the valve, there is no practical method to vary the resistance of test path to adjust flow. IST testing is performed at this fixed reference condition.

During the pre-operational test period, a test was performed to verify initial CBS system performance utilizing a temporary manual throttle valve installed in a spool piece (acting as a temporary strainer) in the common RWST return line. This spool piece still exists as a bolted joint, but the manual valves and strainer have been removed. Installation of a similar temporary throttle valve with the plant online to achieve additional flow points for the subject pumps is impractical due to the use of this line by other systems such as Safety Injection

(SI). Installation of a temporary manual throttle valve during shutdown periods would require intrusive modifications and resources.

Alternative means to vary system resistance in order to provide additional test data were evaluated. The local manual throttling of CBS-V-31, CBS-V-32, or CBS-V-33 was eliminated as an option due to the potential for valve damage since these valves incorporate a soft seat type design. Additionally, local manipulation of these valves at power would override the automatic signals that these valves receive to close to protect the spray flow path to containment.

The potential to vary system resistance utilizing a manual valve located in the pump suction lines was also evaluated. This option was eliminated due to the potential to cavitate the pumps and reduce net positive suction head margin for the pumps. As a result, the CBS pumps can only be tested on a recirculation flow path which is sized for approximately 63% (1920 GPM) of the Best Efficiency Point (BEP) Flow of 3010 GPM and approximately 68% of the required design basis accident flow rate of 2808 GPM.

6. Proposed Alternative and Basis for Use

Testing of the CBS pumps utilizing the existing recirculation flow path provides for substantial flow testing in a stable region of the pump curve, well above the minimum continuous flow rate of 1230 GPM specified by the original equipment manufacturer (Sulzer Pumps). Testing the CBS pumps at reference values established in the region of 1920 GPM has been validated for stable flow. Testing over the last ten years has shown consistent performance with both pumps and, compared to performance data in the first two intervals, no signs of mechanical or hydraulic degradation. The manufacturer reviewed historical performance data of both pumps, along with the original pre-service tests, and determined testing in this range is sufficient to identify potential pump performance degradation.

Both CBS pumps were included as IST Group A pumps prior to the Third Testing Interval as a result of the pumps use in the Silica Removal Program. Group A pumps are required to have vibration monitoring performed during the quarterly surveillance runs. This resulted in a significantly larger pool of test data for monitoring and analyzing pump performance.

In order to compensate for the inability to test the pumps at design flow as required by Mandatory Appendix V, the CBS pumps are included in the Predictive Maintenance (PdM) Monitored Equipment program. This program includes thermography, enhanced vibration monitoring and analysis of the pump, and periodic sampling and analysis of the lube oil. Station personnel also perform Static Motor Testing using the Baker Advanced Winding Analyzer Series IV (AWAIV) equipment and Dynamic Motor Monitoring utilizing the Baker EXP3000 equipment. Online testing using the EXP3000 utilizes a multitude of tests to determine power quality, motor operating conditions, motor performance, and load originated issues. The enhanced PdM program has been in place since the last Code update and has yielded satisfactory results for both pumps.

Continued testing in a stable recirculation flow range combined with the enhanced PdM program provides reliable performance monitoring beyond those requirements prescribe in the Code that reliably validates the ability of each pump to meet the design basis accident flow rates. The testing is effective for detecting mechanical and hydraulic degradation as required by Subsection ISTB.

7. Duration of Proposed Alternative

The provisions of this relief are applicable for the duration of the Fourth 10-Year Inservice Testing (IST) program applicable to the CBS pumps for Seabrook Station, which will commence on August 18th, 2020.

8. Precendents

This is the first Relief Request for periodic verification testing to design basis accident flow rates in accordance with ASME OM-2012 Mandatory Appendix V. The following precedents, while not specific to ASME OM-2012 Code, are similar in that the Nuclear Regulatory Committee (NRC) found acceptable the use of reduced flow rates to verify Seabrook 1-CBS-P-9-A & 9-B pump performance.

1. NRC letter, "Seabrook Station, Unit No.1 – Relief Request for Containment Building Spray Pump Testing on Recirculation Flow Path, Third 10-Year Interval (TAC No. ME2412), June 11, 2010 (ML101380192)

2. NRC letter "Seabrook Station, Unit No.1 - Relief from ASME Code Operations and Maintenance Code ISTB 4.3(e)(1) Ten-Year Interval Inservice Test for Containment Spray Pumps CBS-P9A and CBS-P9B (TAC MB6676)," May 30, 2003 (ML031070510)

9. References

1. U.S. Code of Federal Regulations, "Domestic Licensing of Production and Utilization Facilities," Part 50, Chapter I, Title 10, "Energy," Section 50.55a, Codes and standards.

2. U.S. Nuclear Regulatory Commission, "Guidance on Developing Acceptable Inservice Testing Program," Generic Letter 89-04, through Supplement 1, April 4, 1995.

3. U.S. Nuclear Regulatory Commission, "Guidance for Inservice Testing at Nuclear Power Plants," NUREG-1482, October 2013.

4. NextEra Energy Seabrook UFSAR, Rev. 19

5. ASME OM-2012, Operation and Maintenance of Nuclear Power Plants

6. NRC letter, "Seabrook Station, Unit No.1 – Relief Request for Containment Building Spray Pump Testing on Recirculation Flow Path, Third 10-Year Interval (TAC No. ME2412), June 11, 2010 (ML101380192)

7. NRC letter "Seabrook Station, Unit No.1 - Relief from ASME Code Operations and Maintenance Code ISTB 4.3(e)(1) Ten-Year Interval Inservice Test for Containment Spray Pumps CBS-P9A and CBS-P9B (TAC MB6676)," May 30, 2003 (ML031070510)

Enclosure 2 to SBK-L-19051

Relief Request Number PR-1

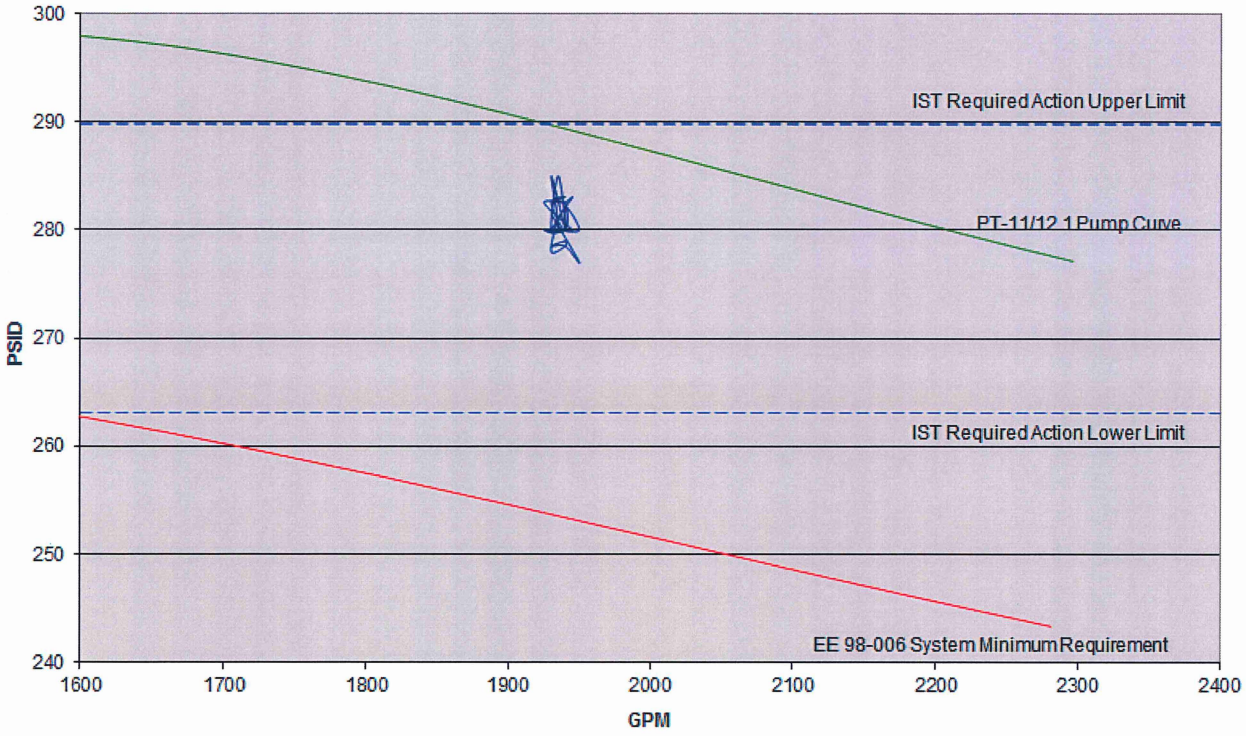
PR-1 Supporting Hydraulic Data

Table 1
Hydraulic Performance Data

CBS-P-9A			CBS-P-9B		
date	flow	psid	date	flow	psid
1/14/2019	1930	280	11/26/2018	1920	283
10/21/2018	1940	282	5/30/2018	1920	282
7/9/2018	1940	280	3/9/2018	1920	283
4/11/2018	1925	280	11/28/2017	1915	284.4
1/15/2018	1940	280	8/28/2017	1920	283
10/11/2017	1940	280	5/30/2017	1920	283
7/10/2017	1935	280	3/1/2017	1930	283
5/4/2017	1950	280	11/28/2016	1920	283
1/20/2017	1940	282.2	8/29/2016	1925	282.5
10/10/2016	1940	280	5/23/2016	1910	282.5
10/10/2016	1940	280	2/29/2016	1910	282.5
7/11/2016	1930	285	11/24/2015	1920	282
4/11/2016	1935	280	9/29/2015	1905	283
1/11/2016	1925	280	8/31/2015	1920	283
9/22/2015	1940	280	6/29/2015	1910	281
7/16/2015	1940	282.5	5/27/2015	1920	283
4/13/2015	1930	282.5	4/10/2015	1920	281.5
1/12/2015	1940	283.05	2/23/2015	1920	281.5
10/17/2014	1930	282.5	11/25/2014	1915	283
7/11/2014	1940	280	8/25/2014	1925	282
3/21/2014	1935	285	5/28/2014	1920	282
1/13/2014	1930	280	2/24/2014	1925	282.5
10/14/2013	1940	280	11/25/2013	1910	280
7/15/2013	1945	280	8/27/2013	1920	285
4/15/2013	1925	282.5	5/27/2013	1920	283
1/14/2013	1940	282.5	2/25/2013	1920	285.5
10/31/2012	1940	282.5	11/26/2012	1925	283
7/11/2012	1945	283	8/28/2012	1920	282
4/12/2012	1935	281	5/28/2012	1920	282.5
1/9/2012	1930	278	2/27/2012	1915	282
10/23/2011	1940	278.5	11/28/2011	1920	283
7/14/2011	1940	279	8/29/2011	1915	283
3/23/2011	1940	279	5/25/2011	AR 1667371	
1/10/2011	1930	278.5	2/28/2011	1915	282.5
10/11/2010	1940	278.5	11/29/2010	1910	285
7/16/2010	1950	277	8/24/2010	1930	283
4/12/2010	1930	281.5	5/24/2010	1920	280
4/23/2009	1930	281.5	5/29/2009	1920	283
1/12/2009	1940	282	2/23/2009	1910	285.5
10/20/2008	1940	284	12/1/2008	1915	283
7/28/2008	1940	279	9/8/2008	1920	283
5/9/2008	1940	279	6/16/2008	1910	283
2/11/2008	1940	281.5	3/27/2008	1920	286
11/19/2007	1940	280	12/31/2007	1910	286
8/27/2007	1940	279	10/8/2007	1920	283

6/4/2007	1940	279		7/16/2007	1925	283.5
3/12/2007	1940	281.3		4/23/2007	1910	286
12/18/2006	1940	281.5		1/30/2007	1920	283
9/26/2006	1950	279		12/4/2006	1910	283.5
7/4/2006	1945	281		8/14/2006	1930	283.5
4/10/2006	1940	281		5/22/2006	1915	285
1/16/2006	1940	284		12/5/2005	1920	283.5
10/24/2005	1940	282		9/12/2005	1930	284
5/9/2005	1940	283.5		6/21/2005	1910	283.5
2/15/2005	1940	281.5		3/29/2005	1915	284.5
11/22/2004	1940	281		1/4/2005	1920	285
8/29/2004	1940	280		10/11/2004	1920	286.5
6/7/2004	1935	281		7/21/2004	1915	285
3/17/2004	1930	282		4/26/2004	1915	286.5
12/22/2003	1940	279		2/5/2004	1920	285.5
9/29/2003	1940	281		11/10/2003	1930	285.6
7/10/2003	1940	280		8/19/2003	1920	283
4/17/2003	1945	281		5/27/2003	1910	285.5
1/20/2003	1940	281		3/3/2003	1920	285
11/1/2002	1940	281		12/9/2002	1920	285.5
8/9/2002	1940	279		9/16/2002	1915	285
6/13/2002	1940	279		6/24/2002	1920	287
5/18/2002	1950	281		5/18/2002	1910	284
2/22/2002	1950	281		4/3/2002	1900	288.5
11/30/2001	1950	283		1/9/2002	1910	286
9/7/2001	1950	281		10/17/2001	1920	288.5
6/15/2001	1940	282.3		7/25/2001	1915	286.9
3/23/2001	1940	280		5/2/2001	1920	285
12/30/2000	1930	281.5		2/7/2001	1920	286.5
10/5/2000	1940	282		11/25/2000	1920	287

CBS-P-9A Performance Data
4/12/2010 to11/14/2019



CBS-P-9B Performance Data
5/24/2010 to 11/26/2018

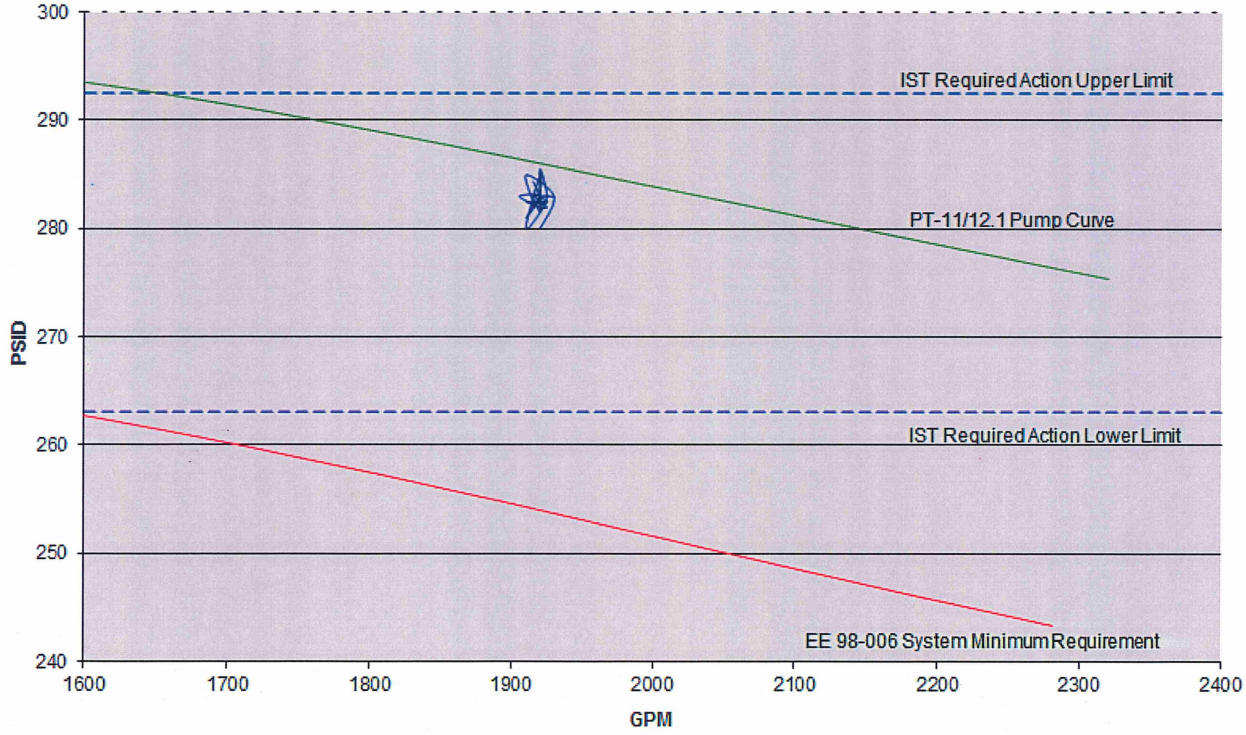


Table 2
Preservice Test PT-11 Full Flow Test

CBS-P-9A		
DP	**Flow**	**Head**
268	2296	640
258	2569	622
248.5	2792	604
239	3000	586
229	3211	567
219.5	3393	548
210	3573	530
201.5	3726	514
CBS-P-9B		
DP	**Flow**	**Head**
287	1688	674
266.5	2320	636
257.5	2478	617
247.8	2679	599
238	2856	579
228.5	3012	560
219	3197	542
209	3340	522

Table 3
Preservice Test PT-12.1 Recirculation to/from RWST

CBS-P-9A						
Hydraulic		**Vibration (ips)**				
DP	**Flow**	**Pump 9**	**Motor 3**	**Pump 7**	**Motor 5**	**Pump 8**
290	1670	0.27	0.08	0.35	0.24	0.24
295	1150					
304	800					
304	390					
CBS-P-9B						
Hydraulic		**Vibration (ips)**				
DP	**Flow**	**Pump 9**	**Motor 3**	**Pump 7**	**Motor 5**	**Pump 8**
285.5	1660	0.29	0.10	0.38	0.24	0.24
294.5	1210					
299	800					

Enclosure 3 to SBK-L-19051

Relief Request Number PR-2

Proposed Alternative in Accordance with 10 CFR 50.55a(z)(1), Increase in Vibration Alert Range Absolute Limit for All CBS Pump Bearings to .0400 ips

Proposed Alternative
In Accordance with 10 CFR 50.55a(z)(1)

--Alternative Provides Acceptable Level of Quality and Safety--

Relief Request PR-2, Increase of Vibration Alert Range Absolute Limit for All CBS Pump Bearings to 0.400 ips

1. ASME Code Component(s) Affected

Component: Containment Building Spray (CBS) Pumps 1-CBS-P-9A & 9B

Code Class: 2

Type: Horizontal Centrifugal

Pump Group: A (ISTB-5120)

2. Applicable Code Edition and Addenda

The applicable Code of record for NextEra Energy's Seabrook Station (Seabrook) for the Inservice Testing (IST) Fourth Testing Interval is ASME OM-2012, Operation and Maintenance of Nuclear Power Plants.

3. Applicable Code Requirement

Test requirements specific to Seabrook are prescribed in the ASME OM-2012 Code, Subsection ISTA, General Requirements and Subsection ISTB, Inservice Testing of Pumps in Light-Water Reactor Nuclear Power Plants – Pre-2000 Plants. As discussed in paragraph ISTB-5121, Group A Test Procedure, pump tests shall be conducted with vibration (displacement or velocity) determined and compared with the reference value. Paragraphs ISTB-5121(e) and ISTB-5123(e) require all deviations from the reference value shall be compared with the ranges of Table ISTB-5121-1 and corrective action taken as specified in paragraph ISTB-6200.

This request is for a proposed change to the Alert Range for the CBS pumps listed in Table ISTB 5121-1, Centrifugal Pump Tests Acceptance Criteria.

4. Reason for Request

- CBS-P-9-B pump bearing vibrations exceed the ISTB Table 5121-1, Centrifugal Pump Tests Acceptance Criteria Alert Range absolute limit.
- CBS-P-9-A pump bearing vibration approaches the ISTB Table 5121-1, Centrifugal Pump Tests Acceptance Criteria Alert Range absolute limit leaving little room for test repeatability.

The ASME Code provides both a relative multiplier on the reference value and 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 will be applied to all of the bearings. The alert limit of 0.325 inches per second (ips) was increased to 0.350 ips after NRC acceptance of PR-2 of the Seabrook Station Inservice Testing (IST) Program Update for the Third Testing Interval [ML101380166].

The manufacturer (Sulzer Pumps) reviewed the historical hydraulic and vibration monitoring data for both pumps, including the pre-service testing. The discrete peaks found at 1X, 4X, and 8X were found to exhibit normal energy for this design of pump. Energy in the form of a raised floor is also present, which combines with the discrete frequencies and causes the overall vibration to exceed 0.325 ips. No indication of material degradation was identified in the review. This is supported by the surveillance data over the past 28 years, where the pumps have maintained stable vibration levels and hydraulic performance.

The pump design contributes to the discrete frequencies identified in the vibration spectral analysis. Both pumps have two volutes, offset 180 degrees to balance flow, and four impeller vanes. This combination increases the risk of amplification at 1X, 4X, and 8X, which explains the discrete frequencies present. These discrete frequencies are low and acceptable.

The raised floor has existed since original installation. The energy was analyzed by the manufacturer and found to be acceptable for continued operation of the pumps. This is additionally supported by the manufacturer's internal guidance document that recommends 0.43 ips as the alert level for this pump type.

Internal recirculation leakage across wear parts was assessed and is acceptable. If the wear part clearance was to increase, the degrading performance would be indicated as a declining hydraulic trend during IST testing. The historical hydraulic performance data has been analyzed and does not indicate degradation.

Both pumps vibration levels result in testing challenges due to the lack of any margin between the reference value and the ISTB Table 5121-1, Centrifugal Pump Tests Acceptance Criteria Alert Range absolute limit. Exceedance of the Alert limit results in additional testing. 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 200 hours for an 18 month cycle.

The manufacturer determined that both CBS pumps can operate with vibrations up to 0.430 ips and support a mission time of 30 days. Anything below this limit is considered acceptable vibration for continued operation. Increasing the ISTB Table 5121-1 Alert Range Absolute Limit from 0.325 ips to 0.400 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 and will be within the manufacturers recommended limit.

As part of the Third Ten Year Interval PR-2 alternative testing, additional testing, trending, and diagnostic analysis were added to the Seabrook Station Predictive Maintenance Program. This includes Static Motor Testing using the Baker Advanced Winding Analyzer Series IV (AWAIV) equipment, Dynamic Motor Monitoring utilizing the Baker EXP3000 equipment, thermography

inspections, and lube oil sampling and analysis. This enhanced Predictive Maintenance Program goes beyond the vibration monitoring and analysis required by ISTB. Performance of these tests during the past testing interval yielded satisfactory results.

The Silica Removal Program periodically uses the CBS pumps to recirculate the RWST for the removal of silica. Because of this, the CBS pumps were re-classified from Group B to Group A pumps for the Third Testing Interval, resulting in vibration analysis performance during quarterly pump runs. The increased frequency of testing provided a larger sample of trend data that has been used to better monitor component performance.

Based on test history and review of pumps performance by the manufacturer an ISTB 5121-1 Alert Range Absolute Limit increase of the lower vibration limit from 0.325 ips to 0.400 ips for the pump vibration readings is warranted.

5. Proposed Alternative and Basis for Use

Increasing the ISTB Table 5121-1 Alert Range Absolute Limit from 0.325 ips to 0.400 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 and will be within the manufacturers recommended limit.

The CBS Pumps will continue to be monitored using 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. If measured parameters are found to be outside the normal operating range or determined to be trending toward an unacceptable degraded state, then appropriate actions will 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.

The past 28 years of surveillance data, along with PDM program results, supports stable and acceptable pump performance at the current vibration levels. This is supported by the manufacturer's review and analysis of pump operation.

6. Duration of Proposed Alternative

The provisions of this relief are applicable for the duration of the Fourth 10-Year Inservice Testing (IST) program applicable to the CBS pumps for Seabrook Station, which will commence on August 18th, 2020.

7. Precedents

Previous relief has been granted to Seabrook Station for the last two 10-year Intervals, allowing the Alert Range Limit in Table ISTB 5121-1 to be increased to 0.350 ips.

1. NRC letter "Seabrook Station, Unit No. 1 - Relief Request for Containment Building Spray Pump Bearing Vibration Alert Range Limit, THIRD 10-Year Interval (TAC No. ME2416)," June 3, 2010 (ML101380166)

2. NRC letter "Seabrook Station, Unit No. 1 - Inservice Testing Program Relief Request PR-3 (TAC No. MB8941)," February 4, 2004 (ML033440009)

8. References

1. U.S. Code of Federal Regulations, "Domestic Licensing of Production and Utilization Facilities," Part 50, Chapter I, Title 10, "Energy," Section 50.55a, Codes and standards.

2. U.S. Nuclear Regulatory Commission, "Guidance on Developing Acceptable Inservice Testing Program," Generic Letter 89-04, through Supplement 1, April 4, 1995.

3. U.S. Nuclear Regulatory Commission, "Guidance for Inservice Testing at Nuclear Power Plants," NUREG-1482, October 2013.

4. NextEra Energy Seabrook UFSAR, Rev. 19

5. ASME OM-2012, Operation and Maintenance of Nuclear Power Plants

6. NRC letter "Seabrook Station, Unit No. 1 - Relief Request for Containment Building Spray Pump Bearing Vibration Alert Range Limit, THIRD 10-Year Interval (TAC No. ME2416)," June 3, 2010 (ML101380166)

7. NRC letter "Seabrook Station, Unit No. 1 - Inservice Testing Program Relief Request PR-3 (TAC No. MB8941)," February 4, 2004 (ML033440009)

Enclosure 4 to SBK-L-19051

Relief Request Number PR-2

PR-2 Supporting Vibration Data

CBS Pump Relief Request PR-2 Supporting Information

CBS-P-9-A and CBS-P-9-B have had stable since original installation and testing in 1985. During the Preoperational Test, PT-12.1 vibrations were 0.35 ips and 0.38 ips on CBS-P-9-A and CBS-P-9-B, respectively. A review of data from 1991 to 2018 shows stable trends in the overall vibration magnitudes. Vibration spectrums on these pumps have been collected and archived since 1999. A review of the data from 1999 to 2018 shows similar vibration signatures. The predominant peaks in the spectrums are 1-times vane pass (4-times running speed of pump), 2-times vane pass (8-times running speed of pump) and 1-times running speed of the pump. This was validated by review from the manufacturer.

Seabrook Station was licensed to the OM Code 1983 Edition, Summer 1983 Addenda for its First Interval. The vibration limitations listed in that revision addressed vibration in displacement and had a larger acceptable range. Seabrook Station voluntarily upgraded to a later version of the code (OM Code 1995 Edition, 1996 Addenda) at the start of the Second Interval which incorporated a more stringent acceptance criteria for vibration. Vibration limits were established in velocity and absolute limits were assigned for the Alert and Required Action Limits. Seabrook Station requested and received relief from the 0.325 ips Alert Limit at that time [ML033440009].

Seabrook submitted the original Relief Request for vibrations on March 21, 2000 with later revisions on May 9, 2003 and September 23, 2003[ML033440009].

The last Relief Request [ML101380166]was submitted on August 19, 2009 and increased the Alert Range Absolute Limit to 0.350 ips. This proved to be insufficient as CBS-P-9-B had already exceeded this value during previous testing intervals and did so one time during the Third Testing Interval.

We have reviewed the referenced information as well as data from 2010 to 2018. The vibrations have been stable for over 30 years. Additionally, the enhanced PdM program has yielded satisfactory results during the last testing interval. To significantly reduce vibrations would likely require the installation of a new pump design or structural modifications to the pump or connected piping. A trend of the vibrations magnitudes from 2010 to 2018 CBS-P-9-A and CBS-P-9-B are provided below.

Table 1
1-CBS-P-9-A Vibration Historical Data (readings in ips)

Date	POH	POV	POA	PIH	PIV
10/21/2018	0.28	0.27	0.19	0.24	0.21
7/9/2018	0.27	0.27	0.17	0.23	0.24
4/11/2018	0.27	0.22	0.17	0.24	0.25
1/15/2018	0.25	0.26	0.17	0.22	0.22
10/11/2017	0.27	0.20	0.16	0.23	0.22
7/10/2017	0.26	0.25	0.17	0.24	0.23
5/4/2017	0.28	0.24	0.18	0.23	0.24
1/20/2017	0.29	0.25	0.17	0.25	0.24
10/10/2016	0.29	0.21	0.18	0.25	0.25
10/10/2016	0.29	0.21	0.18	0.25	0.25
7/11/2016	0.28	0.23	0.18	0.26	0.25
4/11/2016	0.28	0.26	0.19	0.24	0.25
1/11/2016	0.29	0.25	0.17	0.25	0.24
9/22/2015	0.28	0.22	0.17	0.25	0.26
7/16/2015	0.28	0.33	0.28	0.24	0.24
4/13/2015	0.29	0.30	0.18	0.24	0.26
1/12/2015	0.26	0.33	0.18	0.23	0.26
10/17/2014	0.28	0.33	0.17	0.22	0.25
7/11/2014	0.25	0.22	0.19	0.22	0.22
3/21/2014	0.30	0.34	0.20	0.27	0.25
1/13/2014	0.28	0.31	0.18	0.22	0.23
10/14/2013	0.27	0.32	0.18	0.22	0.24
7/15/2013	0.29	0.31	0.18	0.23	0.24
4/15/2013	0.28	0.31	0.18	0.22	0.26
1/14/2013	0.27	0.30	0.19	0.21	0.25
10/31/2012	0.28	0.31	0.19	0.21	0.22
7/11/2012	0.27	0.25	0.17	0.21	0.23
4/12/2012	0.27	0.30	0.18	0.22	0.25
1/9/2012	0.26	0.32	0.16	0.21	0.23
10/23/2011	0.26	0.24	0.16	0.22	0.24
7/14/2011	0.26	0.30	0.18	0.20	0.23
3/23/2011	0.26	0.30	0.17	0.20	0.24
1/10/2011	0.25	0.28	0.18	0.21	0.24
10/11/2010	0.26	0.30	0.18	0.23	0.24
7/16/2010	0.25	0.28	0.18	0.22	0.24
4/12/2010	0.26	0.30	0.19	0.21	0.24
5/14/2009	0.267	0.300	0.183	0.211	0.235
1/12/2009	0.280	0.284	0.194	0.216	0.231
2/22/2008	0.276	0.287	0.179	0.218	0.259
2/14/2008	0.276	0.295	0.180	0.221	0.233
3/12/2007	0.286	0.317	0.183	0.212	0.259
9/26/2006	0.296	0.282	0.188	0.244	0.222
5/9/2005	0.301	0.307	0.185	0.243	0.266
2/14/2005	0.287	0.333	0.190	0.222	0.256
7/9/2003	0.288	0.322	0.185	0.228	0.254
8/9/2002	0.277	0.300	0.177	0.223	0.233
5/18/2002	0.312	0.315	0.189	0.273	0.253
9/7/2001	0.284	0.319	0.185	0.233	0.261

7/13/2000	0.290	0.315	0.189	0.236	0.293
11/5/1999	0.272	0.322	0.155	0.234	0.305
11/4/1999	0.332	0.332	0.178	0.324	0.338
8/12/1999	0.277	0.330	0.175	0.251	0.296
5/20/1999	0.294	0.315	0.150	0.239	0.297
2/25/1999	0.257	0.304	0.155	0.224	0.302
12/3/1998		0.309	0.213	0.224	0.310
9/10/1998	0.253	0.270	0.190	0.232	0.290
6/22/1998	0.253	0.284	0.144	0.215	0.288
4/20/1998	0.324	0.350	0.178	0.214	0.310
1/7/1998	0.286	0.327	0.188	0.233	0.302
11/4/1997	0.240	0.310	0.330	0.270	0.320
5/1/1997	0.270	0.320	0.230	0.260	0.300
2/24/1997	0.220	0.300	0.210	0.240	0.280
12/2/1996	0.280	0.330	0.220	0.300	0.260
9/9/1996	0.280	0.350	0.220	0.240	0.250
6/17/1996	0.280	0.330	0.210	0.250	0.320
3/25/1996	0.300	0.400	0.200	0.300	0.300
1/2/1996	0.290	0.310	0.200	0.240	0.290
10/10/1995	0.300	0.320	0.230	0.260	0.320
7/17/1995	0.270	0.310	0.200	0.240	0.280
6/4/1995	0.280	0.350	0.220	0.260	0.280
4/24/1995	0.280	0.320	0.260	0.260	0.320
1/30/1995	0.300	0.370	0.220	0.320	0.300
11/7/1994	0.300	0.300	0.200	0.250	0.340
8/15/1994	0.280	0.310	0.190	0.250	0.310
7/23/1994	0.280	0.320	0.190	0.270	0.270
2/28/1994	0.290	0.320	0.190	0.250	0.310
12/6/1993	0.280	0.320	0.180	0.260	0.320
9/13/1993	0.310	0.280	0.020	0.280	0.330
6/21/1993	0.280	0.300	0.200	0.280	0.300
3/29/1993	0.300	0.280	0.200	0.300	0.290
1/4/1993	0.240	0.320	0.200	0.270	0.300
10/31/1992	0.290	0.380	0.240	0.300	0.300
9/1/1992	0.280	0.330	0.220	0.280	0.350
7/31/1992	0.300	0.300	0.220	0.270	0.280
4/27/1992	0.300	0.300	0.220	0.250	0.300
2/4/1992	0.280	0.340	0.220	0.270	0.290
11/11/1991	0.300	0.300	0.200	0.270	0.250
9/30/1991	0.300	0.300	0.200	0.280	0.250
5/27/1991	0.320	0.360	0.280	0.260	0.360

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 Vibration Historical Data (readings in ips)

Date	POH	POV	POA	PIH	PIV
11/26/2018	0.21	0.24	0.18	0.20	0.25
5/30/2018	0.33	0.31	0.21	0.21	0.32
3/9/2018	0.33	0.30	0.19	0.26	0.32
11/28/2017	0.35	0.28	0.18	0.25	0.30
8/28/2017	0.35	0.31	0.20	0.25	0.31
5/30/2017	0.31	0.29	0.17	0.24	0.30
3/1/2017	0.32	0.31	0.20	0.24	0.35
11/28/2016	0.33	0.31	0.20	0.27	0.30
8/29/2016	0.33	0.28	0.20	0.25	0.30
5/23/2016	0.33	0.29	0.18	0.25	0.31
2/29/2016	0.33	0.28	0.19	0.25	0.28
11/24/2015	0.33	0.31	0.22	0.27	0.28
9/29/2015	0.32	0.31	0.19	0.24	0.30
8/31/2015	0.34	0.31	0.19	0.25	0.29
6/29/2015	0.34	0.29	0.19	0.25	0.32
5/27/2015	0.34	0.30	0.17	0.25	0.30
4/10/2015	0.33	0.31	0.18	0.27	0.28
2/23/2015	0.35	0.31	0.18	0.26	0.32
11/25/2014	0.34	0.31	0.20	0.25	0.32
8/25/2014	0.32	0.31	0.20	0.23	0.29
5/28/2014	0.32	0.30	0.21	0.26	0.32
2/24/2014	0.34	0.32	0.21	0.25	0.32
11/25/2013	0.33	0.29	0.21	0.26	0.31
8/27/2013	0.33	0.30	0.19	0.24	0.31
5/27/2013	0.33	0.32	0.19	0.25	0.29
2/25/2013	0.31	0.29	0.19	0.26	0.29
11/26/2012	0.23	0.30	0.22	0.19	0.31
8/28/2012	0.31	0.29	0.19	0.25	0.30
5/28/2012	0.33	0.33	0.18	0.22	0.30
2/27/2012	0.31	0.31	0.18	0.23	0.31
11/28/2011	0.31	0.31	0.18	0.24	0.30
8/29/2011	0.31	0.30	0.18	0.25	0.30
5/25/2011	DATA missing from work package AR 1667371				
2/28/2011	0.33	0.30	0.19	0.22	0.28
11/29/2010	0.31	0.29	0.19	0.23	0.29
8/24/2010	0.33	0.32	0.18	0.25	0.31
5/24/2010	0.31	0.34	0.18	0.25	0.32
2/27/2010	0.30	0.32	0.19	0.26	0.31
8/6/2009	0.318	0.315	0.184	0.285	0.301
7/7/2009	0.321	0.302	0.189	0.254	0.323
5/28/2009	0.324	0.318	0.196	0.259	0.322
2/23/2009	0.303	0.278	0.185	0.237	0.329
12/1/2008	0.322	0.281	0.197	0.243	0.350
3/27/2008	0.348	0.307	0.217	0.263	0.273
12/31/2007	0.331	0.268	0.195	0.244	0.328
4/23/2007	0.307	0.294	0.181	0.220	0.300
1/29/2007	0.318	0.268	0.196	0.242	0.320
2/27/2006	0.318	0.287	0.188	0.248	0.322
3/29/2005	0.323	0.278	0.201	0.244	0.323

4/26/2004	0.333	0.303	0.212	0.245	0.315
5/27/2003	0.335	0.300	0.198	0.238	0.343
6/24/2002	0.311	0.304	0.190	0.248	0.322
5/18/2002	0.334	0.324	0.206	0.245	0.321
1/9/2002	0.352	0.275	0.236	0.248	0.250
7/25/2001	0.347	0.280	0.196	0.248	0.274
7/25/2001	0.337	0.275	0.192	0.265	0.256
12/1/2000	0.331	0.296	0.211	0.257	0.284
5/31/2000	0.340	0.281	0.212	0.279	0.337
6/30/1999	0.318	0.314	0.193	0.224	0.383
3/19/1999	0.304	0.287	0.180	0.230	0.345
10/20/1998	0.273	0.253	0.212	0.215	0.333
7/29/1998	0.335	0.289	0.192	0.250	0.366
3/13/1998	0.318	0.302	0.197	0.245	0.371
12/23/1997	0.380	0.320	0.250	0.280	0.360
9/22/1997	0.310	0.330	0.240	0.280	0.320
6/30/1997	0.350	0.300	0.250	0.260	0.350
4/7/1997	0.300	0.300	0.220	0.300	0.320
1/13/1997	0.290	0.290	0.220	0.240	0.340
10/21/1996	0.340	0.340	0.210	0.270	0.370
7/29/1996	0.300	0.300	0.200	0.300	0.400
5/7/1996	0.290	0.340	0.200	0.250	0.340
2/13/1996	0.350	0.350	0.240	0.300	0.370
12/6/1995	0.350	0.210	0.210	0.320	0.350
8/28/1995	0.340	0.280	0.220	0.260	0.340
6/5/1995	0.300	0.270	0.210	0.260	0.380
3/13/1995	0.300	0.290	0.240	0.280	0.340
12/19/1994	0.290	0.290	0.240	0.260	0.380
9/26/1994	0.310	0.270	0.220	0.260	0.320
8/1/1994	0.300	0.220	0.200	0.280	0.280
1/18/1994	0.300	0.300	0.220	0.250	0.370
10/15/1993	0.350	0.160	0.200	0.250	0.320
8/2/1993	0.300	0.320	0.220	0.290	0.400
5/13/1993	0.310	0.300	0.220	0.240	0.390
2/15/1993	0.300	0.320	0.200	0.260	0.400
11/23/1992	0.320	0.340	0.250	0.270	0.400
11/5/1992	0.310	0.320	0.230	0.270	0.400
8/31/1992	0.300	0.300	0.250	0.260	0.400
6/8/1992	0.320	0.300	0.230	0.260	0.380
3/17/1992	0.340	0.320	0.250	0.300	0.400
1/28/1992	0.310	0.310	0.240	0.270	0.390
12/20/1991	0.330	0.310	0.200	0.240	0.380
9/15/1991	0.300	0.320	0.240	0.280	0.400
7/7/1991	0.300	0.350	0.250	0.270	0.400

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

Table 3
CBS-P-9-A and CBS-P-9-B PDM Results for Third Testing Interval

CBS-P-9-A		
Baker Testing (Dynamic) PMID 76219		
Work Order	**Date Completed**	**Result**
40207365-01	4/15/2013	SAT
40396252-01	4/11/2016	SAT
01185833-04	4/12/2010	SAT
Baker Testing (Static) PMID 76208		
Work Order	**Date Completed**	**Result**
01185833-02	4/12/2010	SAT
40207444-01	4/16/2013	SAT
40396251-01	4/16/2016	SAT
4.16kV Motor Inspection PMID 1959		
Work Order	**Date Completed**	**Result**
01185833-01	4/12/2010	SAT
40185640-01	4/15/2013	SAT
40396247-01	4/11/2016	SAT
Thermographic Inspection PMID 1960		
Work Order	**Date Completed**	**Result**
01211113-01	1/11/2011	SAT
40170918-01	1/17/2013	SAT
40302131-01	1/14/2015	SAT
40454598-01	7/11/2017	SAT

CBS-P-9-B		
Baker Testing (Dynamic) PMID 76221		
Work Order	**Date Completed**	**Result**
40120134-01	2/29/2012	SAT
40316947-01	11/26/2015	SAT
40568825-01	01 6/4/2018	SAT
Baker Testing (Static) PMID 76220		
Work Order	**Date Completed**	**Result**
40120133-01	2/28/2012	SAT
40316946-01	2/29/2016	SAT
40585539-01	5/30/2018	SAT
4.16kV Motor Inspection PMID 1970		
Work Order	**Date Completed**	**Result**
40102139-01	2/28/2012	SAT
40328569-01	2/25/2016	SAT
40552939-01	6/1/2018	SAT
Thermographic Inspection PMID 1971		
Work Order	**Date Completed**	**Result**
01186244-01	8/30/2010	SAT
40144148-01	2/28/2012	SAT
40276768-01	8/26/2014	SAT
40422377-01	2/1/2017	SAT
40567871-01	12/27/2018	SAT

Enclosure 5 to SBK-L-19051

Letter from Art Washburn (Sulzer Pumps, Inc.) to Brian O'Callahan (NextEra Energy Seabrook) dated April 9, 2019

SULZER
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Brian O'Callahan
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Seabrook Station

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April 9, 2019
No. Pages - 1

Revision 1

Subject: ***Sulzer Review of CBS Pump IST Relief Requests to NRC, PR-1 and PR-2***
Containment Building Spray Pumps
Sulzer 6 x 10 x 14B CD 1 Stage Horizontal Pump (s/n 14210477, 14210478)
NextEra Contract 02391473, Sulzer S.O. 100337440
Sulzer FEAR E-068-05593

Revision 1: Added Ref. 3 and review of Relief Request PR-1 for testing on recirculation flow path.

References:

1. Sulzer Memo, Revision 1, Washburn to O'Callahan dated February 4, 2019, CBS Pump IST Relief Request Vibration and Hydraulic Analysis
2. NextEra Proposed Alternative in accordance with 10CFR50.55a(z)(1), Relief Request PR-2, Increase of Vibration Alert Range Absolute Limit for All CBS Pump Bearings to 0.400 ips, provided in email, O'Callahan to Washburn dated March 21, 2019
3. *NextEra Proposed Alternative in accordance with 10CFR50.55a(f)(5)(iii), Relief Request PR-1, CBS Pump Periodic Verification Testing on Recirculation Flow Path, provided in email, O'Callahan to Washburn dated April 4, 2019*

Sulzer Engineering reviewed the proposed Relief Requests < ref. 2, 3 >, and concurs with the following:

a. *Recommendations on proposed vibration limits for the Alert Range associated with the CBS pumps at Seabrook Station.*
b. *Recommendations on proposed reduced flow rate where past performance has been consistent and acceptable. Potential hydraulic performance degradation can be identified in this range of the pump curve.*

If there are further questions, please contact Mike Davis (your Nuclear Sales Representative) at 717-813-0104 or myself.

Regards,

Art Washburn P.E.

Attachment

xc: Jim Bohlman, P.E.
Mike Davis
Julie Duryee, P.E.
Eric Jenkins
Clarence Payton
Don Spencer, P.E.