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10 CFR 50.55a

W3F1-2016-0022

March 17, 2016

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
11555 Rockville Pike
Rockville, MD 20852

Subject: Relief Request from ASME Code Requirements for High Pressure Safety Injection (HPSI) Pump AB [SI-MPMP-0002AB] Testing Requirements, Relief Request PRR-WF3-2016-1
Waterford Steam Electric Station, Unit 3 (Waterford 3)
Docket No. 50-382
License No. NPF-38

Dear Sir or Madam:

Pursuant to 10 CFR 50.55a, "Codes and Standards," paragraph (a)(3)(ii), Entergy Operations, Inc. (Entergy) hereby requests NRC approval of the attached relief request associated with the Third Inservice Testing (IST) Interval of the IST Program for Waterford 3.

Entergy is requesting relief from ASME OM Code Section ISTB-6200 to double the frequency of testing if a parameter value falls within the Alert range. During the performance of an IST Comprehensive Test of High Pressure Safety Injection (HPSI) Pump AB, bearing vibration values were recorded in the Alert range. Compliance with ISTB-6200 would require a mid-cycle shutdown and removal of the reactor pressure vessel head. Entergy is proposing to perform IST Group A quarterly tests on HPSI Pump AB until corrective actions can be performed. The details of the relief request are provided within the Attachment.

Entergy requests approval by August 03, 2016 to ensure that relief is obtained prior to the time that testing would need to be performed, which is 39 weeks following the previous test due to the increased testing frequency requirement.

This report contains no new commitments.

If you have any questions or require additional information, please contact the Regulatory Assurance Manager, John P. Jarrell, at (504) 739-6685.

Sincerely,

JPJ/MMZ

Attachments: 1. Relief Request PRR-WF3-2016-1

cc: Mr. Marc L. Dapas, Regional Administrator
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Attachment 1

to

W3F1-2016-0022

Relief Request PRR-WF3-2016-1

Waterford 3 Steam Electric Station
10 CFR 50.55a Request No. PRR-WF3-2016-1

Proposed Alternative in Accordance with 10 CFR 50.55a(a)(3)(ii)
Hardship or Unusual Difficulty without
Compensating Increase in Level of Quality or Safety

Entergy is requesting relief from the requirement of ASME OM Code Section ISTB-6200 to double the frequency of testing if a measured test parameter value falls within the Alert range until the condition is corrected. During the performance of an Inservice Testing (IST) Comprehensive Test of High Pressure Safety Injection (HPSI) Pump AB during the twentieth refueling outage (RF20), pump bearing vibration values were recorded in the Alert range. The IST Comprehensive Test for HPSI Pump AB can only be performed during an outage (Mode 6). The requirement to double the frequency of the IST Comprehensive Test for HPSI Pump AB would require a mid-cycle shutdown and removal of the reactor pressure vessel head. Entergy is proposing to perform IST Group A quarterly tests on HPSI Pump AB until corrective actions can be performed.

Background

HPSI Pump AB is subject to pump flow rate and differential pressure (DP) requirements in accordance with Technical Specifications (TS) Section 4.5.2 and IST vibration and DP requirements in accordance with ASME OM Code 2001 Edition with 2003 Addenda, Subsection ISTB.

TS 4.5.2(f)(1) requires that each HPSI pump required to be operable be verified to perform with a DP greater than or equal to 1429 psid on recirculation flow (≥ 25 gpm). TS 4.5.2(h) requires that during flow balance surveillance in Cold Leg injection mode, the sum of injection line flow rates of each pump, excluding the highest flow rate, shall be greater than or equal to 675 gpm. Also, during the same flow balance surveillance and while operating in Hot/Cold Leg injection mode, each pump must perform with a flow rate greater than or equal to 436 gpm and within ±10% of cold leg flow.

ASME OM Code 2001 Edition with 2003 Addenda Section ISTB-3400 requires an IST Comprehensive Test be performed on a biennial frequency and a Group B test on a quarterly frequency. Waterford 3 complies with this requirement by performing the Comprehensive Test on an eighteen (18) month frequency along with the TS flow balance surveillance during refueling outages. The Group B test is performed quarterly and in conjunction with the TS 4.5.2(f)(1) surveillance.

During a refueling outage, the IST Comprehensive Test is performed with flow established at approximately 405 gpm and inboard and outboard pump bearing vibration and pump DP data recorded and verified to be within IST Comprehensive Test acceptance criteria as stated in Table ISTB-5100-1. The flow balance surveillance is then performed to verify the HPSI pump achieves the flow requirements of TS 4.5.2(h).

During RF20, the HPSI AB vibration monitoring values obtained as part of Comprehensive pump testing were determined to be low in the alert range ($0.325 < V \leq 0.700$) (inches/second) at vibration points 3H (inboard bearing) and 4H (outboard bearing). RF20 Comprehensive Test data along with historical Comprehensive Test data is provided in Table 1.

Table 1. HPSI Pump AB Comprehensive Test Data (Historical)

Date	Outage	Flow Rate (gpm)	DP (psid)	Pump Bearing Vibrations				
				3H	3V	4H	4V	4A
10/28/2009	RF16	404	1202	0.267	0.191	0.252	0.266	0.050
04/16/2011	RF17	422.8	1184.2	0.235	0.161	0.241	0.250	0.058
12/18/2012	RF18	411	1215	0.249	0.166	0.226	0.234	0.049
04/19/2014	RF19	411.2	1190.7	0.090	0.083	0.070	0.072	0.058
11/03/2015	RF20	406	1194.5	***0.332***	0.191	***0.336***	0.230	0.088
11/23/2015	RF20	408.5	1202.2	***0.397***	0.225	***0.399***	0.179	0.078

It should be noted that the pump bearing vibration data taken in RF19 is suspect because the recorded vibration data is considerably lower than previously recorded vibration data, and no maintenance had been performed on HPSI Pump AB which could have lowered vibration readings. This unrelated condition has been entered into the corrective action program.

Following the initial RF20 testing, the current pump vendor, Flowserve, was contacted to discuss the higher vibrations. Flowserve suggested that the pump was most likely out of alignment. It was also suggested that the vibration could be occurring due to voids in the grout. The pump foundation consists of a steel box that is filled with grout through several pouring iterations. If this is done improperly, it is possible that the upper foundation plate can loosen from the grout and cause pump instability. An as-found alignment inspection found the pump/motor out of alignment. Pump alignment was completed on November 17, 2015. Inspection of the pump foundation for voids found it to be satisfactory.

During the post-maintenance Comprehensive retest on November 23, 2015, elevated vibration at points 3H and 4H was recorded as shown in Table 1.

A cause evaluation performed following the elevated vibration condition identified during RF20 determined that the HPSI AB pump is in the beginning stages of end of life. Recommendations regarding operation of this pump to avoid further wear are being utilized to the extent practical. These consist of avoidance of using the pump for non-accident, non-surveillance scenarios/tasks that can be accomplished with other pumps, use of HPSI Pump A (which has an upgraded rotating assembly) as the preferred pump, minimizing the pump stop/start cycles as much as possible, and minimizing operation above 120% of the best efficiency point. Actions to complete refurbishment of the HPSI AB pump during RF21 are being tracked in the corrective action program.

Analysis

The information provided below demonstrates the HPSI AB pump is capable of performing its safety function because of the following:

- Bearing vibrations do not improve or worsen with higher flow rates and longer periods of operation;
- Pump discharge flow has consistently achieved TS 4.5.2(h) flow requirements during each refueling outage;
- Pump differential pressure has achieved TS 4.5.2(f)(1) DP requirements during each quarterly surveillance during Operating Cycle 20 prior to RF20;
- The pump has been within IST Comprehensive test differential pressure acceptance criteria with no degrading trend in pump hydraulic performance.

The data substantiating the evidence consists of a multiple-flow test performed after the post-maintenance test performed on November 23, 2015, historical IST Comprehensive test differential pressure, and historical TS 4.5.2(h) and TS 4.5.2(f)(1) surveillance data.

After the IST Comprehensive retest data was recorded, the pump was run at several different flow rates to obtain additional vibration data. The data suggests that the pump runs more efficiently in the 600-750 gpm range and that running the pump for longer periods of time does not necessarily improve or worsen the elevated vibration condition. This data and comparison data from the November 3, 2015 Comprehensive test is provided in Table 2.

Table 2. HPSI Pump AB RF20 Comprehensive Test Data and Additional Data at Multiple Flow Rates

Date	Time	Flow Rate (gpm)	Location									
			Motor					Pump				
			1H	1V	2H	2V	2A	3H	3V	4H	4V	4A
11/03/2015	0855	406	0.1184	0.0653	0.1379	0.0586	0.0485	***0.3315***	0.1910	***0.3359***	0.2295	0.0877
11/23/2015	0810	408.5	0.2524	0.0865	0.1891	0.1853	0.2076	***0.3971***	0.2250	***0.3996***	0.1787	0.0776
Multiple Flow Rate Data 11/23/2015	0849	900	0.2145	0.0964	0.1674	0.1902	0.1517	0.3131	0.1559	0.2518	0.1571	0.0667
	0901	680	0.2284	0.0513	0.1843	0.1885	0.1392	0.2951	0.1707	0.2806	0.1289	0.0634
	0910	580	0.2203	0.0655	0.1601	0.1746	0.1400	0.2830	0.1734	0.2871	0.1440	0.0902
	0918	390	0.2214	0.0548	0.1629	0.2152	0.1324	0.3138	0.1813	***0.3414***	0.2376	0.0871
	0924	250	0.2153	0.0588	0.1598	0.2116	0.1288	0.2320	0.2005	0.2807	0.2367	0.2043

Initial Comprehensive Test data was taken in RF16. It was identified and documented in a condition report in October 2015 that the DP acceptance criteria in the IST Comprehensive Testing procedure is not in compliance with ASME OM Code Table ISTB-5100-1; rather, the acceptance criteria reflects the pump curve provided by the original pump manufacturer. Corrective action for this condition includes performing a reference run following pump repair (scheduled for RF21) and incorporation of the new reference values into the procedure.

Table 3 provides historical recorded differential pressures taken during IST Comprehensive Tests since RF16. Also provided in the table are Acceptable, Alert, and Required Action Ranges that have been calculated based on the multipliers listed in Table ISTB-5100-1 using the RF16 DP as the reference value. The differential pressure data for pump performance shows the pump was within the IST acceptable range with steady performance and no evidence of a degrading trend on pump hydraulic performance and is capable of performing its safety function.

Table 3. HPSI Pump AB IST Comprehensive Test Differential Pressure Data and Acceptance Criteria

Date	Outage	DP (psid)	Acceptance Range (psid)	Alert Range (psid)	Required Action Range (psid)	
					Low	High
10/28/2009	RF16	1202	1117.9 ≤ DP ≤ 1238.0	1081.8 ≤ DP < 1117.9	DP < 1081.8	DP > 1238.0
04/16/2011	RF17	1184.2	1117.9 ≤ DP ≤ 1238.0	1081.8 ≤ DP < 1117.9	DP < 1081.8	DP > 1238.0
12/18/2012	RF18	1215	1117.9 ≤ DP ≤ 1238.0	1081.8 ≤ DP < 1117.9	DP < 1081.8	DP > 1238.0
04/19/2014	RF19	1190.7	1117.9 ≤ DP ≤ 1238.0	1081.8 ≤ DP < 1117.9	DP < 1081.8	DP > 1238.0
11/03/2015	RF20	1194.5	1117.9 ≤ DP ≤ 1238.0	1081.8 ≤ DP < 1117.9	DP < 1081.8	DP > 1238.0
11/23/2015	RF20	1202.2	1117.9 ≤ DP ≤ 1238.0	1081.8 ≤ DP < 1117.9	DP < 1081.8	DP > 1238.0

During each TS full flow balance surveillance since RF16, the pump achieved hot leg/cold leg injection flow rates per TS 4.5.2(h). During Operating Cycle 20, the pump achieved DP requirements per TS 4.5.2(f)(1). TS 4.5.2(h) data compiled since RF16 of all TS flow rate tests performed on HPSI pump AB is provided in Table 4, and TS 4.5.2(f)(1) data for HPSI Pump AB during Operating Cycle 20 is provided in Table 5. This TS surveillance data demonstrates that the HPSI AB pump has consistently been capable of performing its safety function.

Table 4. HPSI Pump AB TS 4.5.2(h) Surveillance Data (Historical)

Date	Outage	TS 4.5.2(h) Cold Leg Flow (gpm)	Cold Leg Flow (gpm)	TS 4.5.2(h)(2) Hot/Cold Leg Flow (gpm)		
				90% Cold Leg Flow	Hot Leg Flow	110% Cold Leg Flow
10/28/2009	RF16	687	441	396.9	463.7	485.1
04/16/2011	RF17	695	466	419.4	455	512.6
12/18/2012	RF18	706	451	405	458	496
04/19/2014	RF19 (Header B)	708	422	379.8	455.2	464.2
05/06/2014	RF19 (Header A)	689	459	413	441	505
11/03/2015	RF20 (Header A)	680	454	408.6	445	499.4
11/23/2015	RF20 (Header B)	694	442	397.8	462	486.2

Table 5. HPSI Pump AB TS 4.5.2(f)(1) Operating Cycle 20 Differential Pressure Data

Date	Differential Pressure (psid)
06/10/2014	1491
09/09/2014	1462
12/12/2014	1491.5
03/05/2015	1466.5
06/02/2015	1471.6
09/04/2015	1497

The preceding information demonstrates the HPSI AB pump is capable of performing its safety function because the pump bearing vibrations do not improve or worsen with higher flow rates and longer periods of operation, the pump has consistently achieved TS 4.5.2(h) flow requirements during each refueling outage, has achieved TS 4.5.2(f)(1) differential pressure during each quarterly surveillance during Operating Cycle 20 prior to RF20, and has been within IST Comprehensive test differential pressure acceptance criteria with no degrading trend in pump hydraulic performance.

1. ASME Code Component(s) Affected

Pump SI-MPMP-0002AB is the installed spare (may be aligned to either train) HPSI Pump AB. This is a safety-related, horizontally mounted, nine stage, centrifugal pump. The pump manufacturer is Ingersoll Rand (Model 4X9C9). The pump is rated for 405 gpm with 2830 feet of head at 3570 rpm.

2. Applicable Code Edition and Addenda

ASME OM Code 2001 Edition, 2003 Addenda

3. Applicable Code Requirement(s)

- ISTB-3300, "Reference Value," states, in part, that "Reference values shall be established within ± 20% of pump design flow rate for the Comprehensive Test," and "Reference values shall be established within ± 20% of pump design flow for the Group A and Group B tests, if practicable. If not practicable, the reference point flow rate shall be at the highest practical flow rate."

- ISTB-3400, "Frequency of Inservice Tests," states that an inservice test shall be run on each pump as specified in Table ISTB-3400-1.

- Table ISTB-3400-1 Requires Group A and Group B tests to be performed quarterly and a Comprehensive Test to be performed biennially.

- Table ISTB-3510-1, "Required Instrument Accuracy," specifies the instrument accuracies for Group A, Group B, Comprehensive, and Preservice Tests.

- Table ISTB-5100-1, "Centrifugal Pump Test Acceptance Criteria," defines the required acceptance criteria for Group A, Group B, and Comprehensive Tests for centrifugal pumps.

- ISTB-6200, "Corrective Action," requires that if the measured test parameter values fall within the alert range of the applicable table [Table ISTB-5121-1], the frequency of testing specified in ISTB-3400 shall be doubled until the cause of the deviation is determined and the condition is corrected.

4. Reason for Request

Vibration monitoring is a component of the Comprehensive Test that is performed every refueling outage based on the frequency of every refueling outage (78 weeks) as required by ISTB-3400. Per ISTB-6200, since the vibration measurement falls within the alert range, Comprehensive Testing would be required to be every 39 weeks until the condition is corrected. This test is normally performed with the reactor in the defueled state with the reactor head removed. The Comprehensive Test flow rate can only be achieved by injecting into the reactor cavity. This test cannot be performed during normal power operations.

The proposed relief would permit the alternative use of the HPSI pump flow path using the pre-October 2013 quarterly test flow rate/path [250 gpm/Hot Leg Injection line to route the flow back to the Refueling Water Storage Pool (RWSP)] to perform Group A tests which require vibration monitoring during the upcoming cycle. This test can be performed safely while online and would eliminate the need to enter into an unnecessary outage reaching Mode 6 in order to perform the additional vibration monitoring.

5. Proposed Alternative and Basis for Use

Prior to October 2013, the quarterly IST pump test was routinely run at a flow rate of approximately 250 gpm using the Hot Leg Injection line to route the flow back to the Refueling Water Storage Pool (RWSP). The quarterly pump test was changed in October 2013 such that only the minimum recirculation line is utilized with flow rates of approximately 30 gpm. This change was to minimize the impact on the hot leg injection and Safety Injection Tank valve leakage by reducing the frequency of flowing water through the path.

Entergy is proposing to perform Group A tests using the pre-October 2013 HPSI Pump quarterly test flow rate/path in order to facilitate pump performance monitoring during Operating Cycle 21 as an alternative to entering an outage reaching Mode 6 to perform a Comprehensive Test as required by ISTB-6200(a). Test data will be compared to the Group A vibration and DP acceptance criteria which were established when the pump was known to be operating acceptably. The data obtained will be analyzed to ensure there are no indications of unacceptable pump performance and to ensure that the performance data is in the expected range. This will provide assurance that the equipment will continue to be operationally ready for the duration of the fuel cycle. ISTB-6200 shall remain applicable to Group A quarterly testing.

The purpose of performing the Comprehensive Test at double the normal test frequency while in the Alert range is to monitor for additional pump performance degradation until the condition is corrected. This pump performance monitoring can be tracked and trended from the results of testing at flow rates other than that of the Comprehensive Test. Per ISTB-3300, the reference values shall be established within ±20% of pump design flow for the Comprehensive Test. The design flow for the HPSI AB pump is 405 gpm. The flow rate during the performance of this alternative is expected to be approximately 250 gpm, which would be greater than 60% of the Comprehensive Test point, and is the highest practicable flow rate for online testing. Performing the alternative testing at flow rates that are 60% of the Comprehensive Test point provides sufficient vibration data to assess HPSI pump operation. The vibration, flow, and pressure instrumentation used during the Group A Test shall meet the instrumentation accuracy requirements as stated in Table ISTB-3500-1.

The performance of the Group A quarterly test at approximately 250 gpm will provide assurance of acceptable HPSI AB pump operation and sufficient pump degradation monitoring until the pump can be repaired during RF21 to meet the requirements of ASME OM Code ISTB-6200. During the quarterly tests, data will be collected to provide assurance of continued pump operability.

6. Duration of Proposed Alternative

This is a one-time request until pump refurbishment is performed during RF21. The duration of the proposed alternative will be for Operating Cycle 21.

7. Precedents

A similar Relief Request was submitted to the U.S. Nuclear Regulatory Commission for Palo Verde Nuclear Generating Station, Unit 3, Relief Request PRR-08 (ADAMS Accession No. ML091900274), dated August 3, 2009.

8. References

None