



Entergy Operations, Inc.
17265 River Road
Killona, LA 70057-3093
Tel 504 739 6685
Fax 504 739 6698
jjarrel@entergy.com

John P. Jarrell III
Manager, Regulatory Assurance
Waterford 3

10 CFR 50.55a

W3F1-2016-0034

May 26, 2016

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

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

- References:
1. W3F1-2016-0022, 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, March 17, 2016 [Adams Accession Number ML16077A376].
 2. Waterford Steam Electric Station, Unit 3 - Request for Additional Information Regarding Request for Alternative to American Society of Mechanical Engineers (ASME) Operations and Maintenance (OM) Code Requirements for High-Pressure Safety Injection (HPSI) Pump Testing (CAC No. MF7485), April 26, 2016 [Adams Accession Number ML16117A045].

Dear Sir or Madam:

Per Reference 1, Entergy Operations, Inc. (Entergy) submitted Relief Request PRR-WF3-2016-1 for Waterford 3 for the Third Inservice Testing (IST) Interval of the IST Program. Per Reference 2, the NRC provided a request for additional information regarding the subject relief request.

Attachment 1 is the Entergy response to the request for additional information.

This communication 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,

 Acting for J. Jarrell, Regulatory Assurance Manager

JPJ/MMZ

A047
NRK

- Attachments:
1. Response to NRC Request for Additional Information Regarding Request for Alternative to ASME OM Code Requirements for High Pressure Safety Injection (HPSI) Pump [SI-MPMP-0002AB] Testing Requirements, PRR-WF3-2016-1.
 2. Characteristic Curve (HPSI AB Pump Curve), Ingersoll-Rand Company, Pump No. 0672176, Curve No. N-603, September 17, 1974.

cc: Mr. Marc L. Dapas, Regional Administrator
U.S. NRC, Region IV
RidsRgn4MailCenter@nrc.gov

U.S. NRC Project Manager for Waterford 3
April.Pulvirenti@nrc.gov

U.S. NRC Senior Resident Inspector for Waterford 3
Frances.Ramirez@nrc.gov
Chris.Speer@nrc.gov

**Attachment 1
to
W3F1-2016-0034**

**Response to NRC Request for Additional Information
Regarding Request for Alternative to ASME OM Code Requirements for
High Pressure Safety Injection (HPSI) Pump [SI-MPMP-0002AB]
Testing Requirements, PRR-WF3-2016-1**

**Waterford 3 Steam Electric Station
Response to NRC Request for Additional Information
Regarding Request for Alternative to ASME OM Code Requirements for
High Pressure Safety Injection (HPSI) Pump [SI-MPMP-0002AB]
Testing Requirements, PRR-WF3-2016-1**

Request for Additional Information (RAI) EPNB-1

Alternative Relief Request PRR-WF3-2016-1 states that it is submitted in accordance with 10 CFR 50.55a(a)(3)(ii). In the 10 CFR dated January 1, 2015, paragraph 50.55a(a)(3)(ii) was moved to paragraph 50.55a(z)(2). The NRC staff plans to review the alternative request under paragraph 50.55a(z)(2). Confirm that paragraph 50.55a(z)(2) of 10 CFR is the correct paragraph under which the NRC staff should conduct its review.

Entergy Response to Request RAI EPNB-1

Paragraph 50.55a(z)(2) of 10 CFR is the correct paragraph under which the NRC staff should conduct its review.

RAI EPNB-2

Confirm that Waterford 3 is currently in the third inservice test interval, that the start date of the interval was December 1, 2007, and that the end date of the interval is scheduled for November 30, 2017.

Entergy Response to Request RAI EPNB-2

Waterford 3 is currently in the Third Inservice Testing (IST) Interval. The start date of the Third IST Interval at Waterford 3 was December 1, 2007. The end date of the Third IST Interval at Waterford 3 is scheduled for November 30, 2017.

RAI EPNB-3

In the Background section of the submittal, it is stated, in part that:

A cause evaluation performed following the elevated vibration condition identified during RF20 [Refueling Outage 20] determined that the HPSI AB pump is in the beginning stages of end of life.

In the Analysis section of the submittal, it is stated, in part that:

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 [Technical Specifications] 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 [DP] acceptance criteria with no degrading trend in pump hydraulic performance.

Provide the mission time for the HPSI AB pump during a design-basis accident, and discuss why the pump is able to meet its mission time when it is in the beginning stages of end-of-life. Also define the term "longer periods of operation" that is quoted from the Analysis section.

Entergy Response to Request RAI EPNB-3

For the purpose of this response, mission time is defined as the duration of Structure, System, or Component (SSC) operation that is credited in the design basis for the SSC to perform its specified safety function. The mission time for the HPSI AB pump during a design-basis accident is conservatively taken to be 30 days.

It is a reasonable expectation that the pump is able to perform its specified safety function for its mission time when it is in the beginning stages of end-of-life because the pump continues to demonstrate through testing that there has been no change in the hydraulic performance. It continues to provide design/analyzed flow during continued quarterly testing consistent with the pump's historical performance.

During TS surveillance runs or IST comprehensive testing, flow conditions are established, allowed to stabilize for 2 minutes, and then data is collected. On November 23, 2015, after completing an alignment and additional troubleshooting/repair work, the pump was run at multiple flowrates for a total duration of approximately one hour. During this pump run, flow, pressure and various vibrations were recorded (Reference 1 provided these results). The comparative statement, "longer periods of operation" refers to an operation time approximating the time attained during the November 23, 2015 data run (1 hour).

RAI EPNB-4

In the Background section of the submittal, it is stated, in part, that:

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.

ASME OM Code ISTB-2000, "Supplemental Definitions," states that Group B pumps are "pumps in standby systems that are not operated routinely except for testing." The recommendations above imply that HPSI pump AB may not meet the definition of a Group B pump. Explain why HPSI pump AB is currently classified as a Group B pump. If the pump does meet the definition of a Group B pump, explain why the recommendations above are applicable to the pump.

Entergy Response to Request RAI EPNB-4

Waterford 3 is currently in the process of updating its IST Program for the Fourth IST Interval. As a part of this update, all pumps within the Waterford 3 IST Program are under review. The classification of HPSI Pump AB as a Group B pump has been called into question, and the issue has been entered into the Waterford 3 Corrective Action Program.

RAI EPNB-5

In Section 3 of the submittal, "Applicable Code Requirement(s)," Table ISTB-3510-1 is listed. There is no Table ISTB-3510-1 in the ASME OM Code (2001 Edition through 2003 Addenda). Provide the correct Table number.

Entergy Response to Request RAI EPNB-5

The correct table number is Table ISTB-3500-1.

RAI EPNB-6

In Section 5 of the submittal, "Proposed Alternative and Basis for Use," it is stated, in part, that:

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.

Explain how Group A vibration and DP acceptance criteria were established if the pump is classified as a Group B pump and has been tested as a Group B pump.

Entergy Response to Request RAI EPNB-6

Prior to the Third IST Interval at Waterford 3, Group A or Group B pump classifications did not exist. At this time, vibration and differential pressure acceptance criteria were established and measurements were taken accordingly.

After the Third IST Interval Update, Group B pumps no longer required vibration measurements to be taken quarterly; however, in the event an online post-maintenance test was required, the HPSI pump vibration acceptance criteria remained in the testing procedure.

RAI EPNB-7

In Section 5 of the submittal, it is stated that the proposed Group A tests will be performed at approximately 250 gallons per minute (gpm). It is also stated, in part, that:

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.

Discuss where 250 gpm and 30 gpm are located on the pump curve for HPSI Pump AB, and if they are located on a sloped portion of the curve where pump degradation can be detected. Also, provide a copy of the pump curve for HPSI Pump AB.

Entergy Response to Request RAI EPNB-7

The HPSI Pump AB curve has a maximum flow of approximately 975 gpm. 250 gpm is located at approximately 25% of the pump curve. 250 gpm is located on a sloped portion of the HPSI Pump AB curve where pump degradation can be detected.

30 gpm is the approximate flow rate while using the minimum recirculation flow line during performance of quarterly Group B IST. This flow rate is located at approximately 3% of the pump curve. The pump curve has begun to slope at this flow rate, but not significantly.

Per Table ISTB-5100-1, a Group B test requires the differential pressure acceptable range to be from 90% to 110% of the differential pressure reference value. The reference value for the HPSI AB pump is 1451.8 psid therefore the acceptable range would be 1307 to 1596 psid. However, because the quarterly Group B test is performed using the minimum recirculation line, and TS 4.5.2(f)(1) requires a differential pressure greater than or equal to 1429 psid as indicated on minimum recirculation flow, the lower differential pressure IST acceptable limit has been truncated to 1429 psid.

This truncation brings the lower IST acceptable range limit from 90% to approximately 98.4% of the current differential pressure reference value. Incorporating the Technical Specification differential pressure into IST differential pressure acceptance criteria narrows the IST differential pressure acceptable range making degradation in pump hydraulic performance detectable at 30 gpm.

The HPSI Pump AB curve is included in Attachment 2.

RAI EPNB-8

In the precedent given in Section 7 of the submittal, "Precedents," the licensee for the referenced precedent, (i.e., Palo Verde Nuclear Generating Station, Unit 3), performed a vibration frequency analysis on the subject pump. Discuss whether a vibration frequency spectrum analysis was performed during the last comprehensive pump test for HPSI pump AB at Waterford 3, and if not, why not.

Entergy Response to Request RAI EPNB-8

Waterford 3 performed a vibration frequency spectrum analysis on HPSI Pump AB during the comprehensive pump test performed during RF20 in November 2015.

**Attachment 2
to
W3F1-2016-0034
HPSI AB Pump Curve**

CURVE NO. *N-603*
DATE *17SE74*

CURVES ARE APPROXIMATE. PUMP GUARANTEED FOR ONE SET OF CONDITIONS CAPACITY, HEAD AND EFFICIENCY GUARANTEES ARE BASED ON SHORT TEST AND WHEN HANDLING CLEAR, COLD, FRESH WATER AT A TEMPERATURE OF NOT OVER 80° F. AND NOT OVER 15 FOOT SUCTION LIFT.

THIS CERTIFIES THAT THIS CURVE IS BASED ON ACTUAL TEST PERFORMANCE.

IMPELLER PATT. NO.

DIA.

DIFFUSOR PATT. NO.

Mark S. Denard
M. S. Denard

17 SE 74

6

5

4

3

2

BRAKE HORSE POWER X100

TOTAL HEAD IN FEET X100

40

35

30

25

20

15

10

5

0

PER CENT EFFICIENCY

80

70

60

50

40

30

20

10

0

GHP

NPSH

EFF

POOR ORIGINAL OR
BEST AVAILABLE COPY

GALLONS PER MINUTE X100

NPSH W.T.V.

Combustion Engineering, Inc.
Louisiana Power & Light
Waterford Generating Station
C.S.L. B. O. No. 9101519
C/S 1, Contract No. 8270
NPS 13mm
Component Code: SL 15-54-A222-00

CHARACTERISTIC CURVE

NO. *419* TYPE *C-9* STAGE PUMP
3570 R.P.M.

PUMP NO. *0672176* ORDER NO. *091-36125*

INGERSOLL RAND COMPANY

CAMERON PUMP DIVISION

DATE OF TEST *16SE74* CURVE *N-603*

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