UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

January 23, 2018

Vice President, Operations
Entergy Operations, Inc.
Grand Gulf Nuclear Station
P.O. Box 756
Port Gibson, MS 39150

SUBJECT: GRAND GULF NUCLEAR STATION, UNIT 1 – RELIEF REQUESTS PRR-GGNS-2017-1, PRR-GGNS-2017-2, AND PRR-GGNS-2017-3 PROPOSING AN ALTERNATIVE FOR THE FOURTH 10-YEAR INSERVICE TESTING REQUIREMENTS OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS CODE FOR OPERATION AND MAINTENANCE OF NUCLEAR POWER PLANTS (CAC NOS. MF9749, MF9750 AND MF9751; EPID L-2017-LLR-0039, L-2017-LLR-0040 AND L-2017-LLR-0041)

Dear Sir or Madam:

By letter dated May 15, 2017 (Agencywide Documents Access and Management System Accession No. ML17145A310), Entergy Operations, Inc. (the licensee) requested an alternative for Grand Gulf Nuclear Station, Unit 1 (GGNS) inservice testing (IST) program. In these relief requests, the licensee proposed to continuously monitor the jockey pumps discharge header pressure by means of low pressure annunciators in the control room, and the pumps flow through technical specification surveillance requirements in lieu of the requirements of the American Society of Mechanical Engineers (ASME) Code for Operation and Maintenance of Nuclear Power Plants (OM Code).

The U.S. Nuclear Regulatory Commission (NRC) staff reviewed the licensee's submittals and concluded, as set forth in the enclosed safety evaluation, that the licensee has adequately addressed all of the regulatory requirements set forth in Title 10 of the *Code of Federal Regulations*, paragraph 50.55a(z)(2). Therefore, the NRC authorizes the licensee's proposed alternative for reasonable assurance of the operational readiness of Residual Heat Removal System Jockey Pumps A, B, and C, Low Pressure Core Spray System Jockey Pump, and High Pressure Core Spray System Jockey Pump for GGNS for the fourth IST interval, which began December 1, 2017, and is scheduled to end on November 30, 2027.

All other ASME OM Code requirements for which relief was not specifically requested and approved by the NRC staff remain applicable.

If you have any questions, please contact the Project Manager, Siva P. Lingam, at 301-415-1564 or via e-mail at Siva.Lingam@nrc.gov.

Sincerely,

Robert J. Pascarelli, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-416

Enclosure:
Safety Evaluation

cc: Listserv

UNITED STATES
NUCLEAR REGULATORY COMMISSION
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUESTS PRR-GGNS-2017-1, PRR-GGNS-2017-2, AND PRR-GGNS-2017-3

PROPOSING AN ALTERNATIVE FOR THE FOURTH 10-YEAR INSERVICE INSPECTION

TESTING REQUIREMENTS OF THE ASME OM CODE

ENTERGY OPERATIONS, INC.

GRAND GULF NUCLEAR STATION, UNIT 1

DOCKET NO. 50-416

1.0 INTRODUCTION

By letter dated May 25, 2017 (Agencywide Documents Access Management System (ADAMS) Accession No. ML17145A310), Entergy Operations, Inc. (Entergy, the licensee) submitted relief requests PRR-GGNS-2017-1, PRR-GGNS-2017-2, and PRR-GGNS-2017-3 requesting an alternative to the requirements of the American Society of Mechanical Engineers (ASME) Code for Operation and Maintenance of Nuclear Power Plants (OM Code), 2004 Edition through 2006 Addenda, regarding inservice testing (IST) of the Residual Heat Removal (RHR) System Jockey Pumps A, B, and C, Low Pressure Core Spray (LPCS) System Jockey Pump, and High Pressure Core Spray (HPCS) System Jockey Pump (hereby called as jockey pumps) at the Grand Gulf Nuclear Station, Unit 1 (GGNS). In these relief requests, the licensee proposed to continuously monitor the jockey pumps discharge header pressure by means of low pressure annunciators in the control room, and the pumps flow through technical specification (TS) surveillance requirements (SRs) in lieu of the requirements of the ASME OM Code. The intention of the licensee's proposed alternative is to ensure reasonable assurance of the operational readiness of these jockey pumps for GGNS for the fourth IST interval, which began December 1, 2017 and is scheduled to end on November 30, 2027.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) paragraph 50.55a(z)(2), Entergy requested to use the proposed alternative on the basis that compliance with the code requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

It should be noted that Entergy's alternative requests PRR-GGNS-2017-1, PRR-GGNS-2017-2, and PRR-GGNS-2017-3 are related to GGNS. In these alternative requests, there is inconsistency of the prefix of the various referenced components' identification (ID). Sometimes, these components' IDs are prefixed with "1" and sometimes without prefix "1." The U.S. Nuclear Regulatory Commission (NRC) staff has used the GGNS components' IDs as provided by the licensee in these alternative requests.

2.0 REGULATORY EVALUATION

The regulations in 10 CFR 50.55a(f), "Preservice and inservice testing requirements," require, in part, that IST of certain ASME Code Class 1, 2, and 3 components must meet the requirements of the applicable ASME OM Code and addenda, except where alternatives have been authorized, pursuant to 10 CFR 50.55a(z)(1) or 10 CFR 50.55a(z)(2).

In proposing alternatives, a licensee must demonstrate that the proposed alternatives provide an acceptable level of quality and safety as outlined in 10 CFR 50.55a(z)(1), or compliance would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety as outlined in 10 CFR 50.55a(z)(2). Section 50.55a allows the NRC to authorize alternatives and to grant relief from ASME Code requirements upon making the necessary findings.

Based on the above, the NRC staff finds regulatory authority exists for the licensee to request, and the NRC to authorize the proposed alternatives to the ASME OM Code requested by the licensee.

3.0 TECHNICAL EVALUATION

The GGNS fourth 10-year IST program interval began on December 1, 2017. The applicable ASME OM Code edition and addenda for the GGNS fourth 10-year IST program interval is the 2004 Edition through the 2006 Addenda.

3.1 Applicable Code Requirements

The licensee requested an alternative for the jockey pumps to the following IST requirements of the 2004 Edition through 2006 Addenda of the ASME OM Code:

1. Paragraph ISTB-3300, "Reference Values:"

    (a) Initial reference values shall be determined from the results of testing meeting the requirements of ISTB-3100, Preservice Testing, or from the results of the first inservice test.

    (b) New or additional reference values shall be established as required by ISTB-3310, ISTB-3320, or ISTB-6200(c).

    (c) Reference values shall be established only when the pump is known to be operating acceptably.

    (d) Reference values shall be established at a point(s) of operation (reference point) readily duplicated during subsequent tests.

    (e) Reference values shall be established in a region(s) of relatively stable pump flow.

        (1) Reference values shall be established within ±20% of pump design flow rate for the comprehensive test.

(2) 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 established at the highest practical flow rate.

(f) All subsequent test results shall be compared to these initial reference values or to new reference values established in accordance with ISTB-3310, ISTB-3320, or ISTB-6200(c).

(g) Related conditions that can significantly influence the measurement or determination of the reference value shall be analyzed in accordance with ISTB-6400.

2. Paragraph ISTB-3510, "General," (b) "Range," (1), states, "The full-scale range of each analog instrument shall be not greater than three times the reference value."

3. Paragraph ISTB-3510(c), "Instrument Location," states, "The sensor location shall be established by the Owner, documented in the plant records (see ISTB-9000), and shall be appropriate for the parameter being measured. The same location shall be used for subsequent tests. Instruments that are position sensitive shall be either permanently mounted, or provision shall be made to duplicate their position during each test."

4. Paragraph ISTB-5121, "Group A Test Procedure," states, "Group A tests shall be conducted with the pump operating at a specified reference point. The test parameters shown in Table ISTB-3000-1 shall be determined and recorded as required by this paragraph."

5. Paragraph ISTB-5121(b) states, "The resistance of the system shall be varied until the flow rate equals the reference point. The differential pressure shall then be determined and compared to its reference value. Alternatively, the flow rate shall be varied until the differential pressure equals the reference point and the flow rate determined and compared to the reference flow rate value."

6. Table ISTB-3000-1, "Inservice Test Parameters," lists flow rate as a required parameter for the Group A and comprehensive pump tests.

7. Table ISTB-5121-1, "Centrifugal Pump Test Acceptance Criteria," provides Alert and Required Action Range limits at 2.5 times and 6 times, respectively.

3.2 ASME Code Components Affected

Relief is requested for the following jockey pumps:

Pump ID	Function	Category	Class
E12C003A	Residual Heat Removal System Jockey Pump A	Group A	2
E12C003B	Residual Heat Removal System Jockey Pump B	Group A	2
E12C003C	Residual Heat Removal System Jockey Pump C	Group A	2
E21C002	Low Pressure Core Spray System Jockey Pump	Group A	2
E22C003	High Pressure Core Spray System Jockey Pump	Group A	2

3.3 Licensee's Reason for Request

In its letter dated May 25, 2017, the licensee stated, in part:

> These jockey pumps operate whenever their respective...trains are in the operable condition. As such, the pumps perform continuous duty on a recirculation line and provide makeup as needed.
>
> Pressure taps exist in the jockey [pumps'] suction and discharge piping where pump[s] suction and discharge pressures can be measured for calculation of differential pressure, and throttle valves exist, which can be used to set differential pressure equal to the pumps' reference value. However, the pumps differential pressure information provided is of little use for analyzing the hydraulic condition of the jockey pumps without being able to measure flow rate or set flow rate at a known reference value, as required by ASME OM Code-2004 Edition with addenda through OMb Code-2006, subparagraph ISTB-5121(b).
>
> There is no practical means of measuring the flow rate of these jockey pumps since no flow rate meters, orifices or other measurement devices are installed in the [systems] for measurement of jockey pump flow rate. The installed main [systems] process flow measurement instrumentation loops, which are discussed below, cannot be used for jockey pumps flow measurement. Attempts have been made to use portable ultrasonic flow instruments to measure jockey pumps flow rate, however the results have been inconsistent and not repeatable.
>
> Flow orifices 1E12-FE-N014A, B, and C, [and 1E21-FE-N002,] which are installed in the system to measure flow rate of the main LPCI [low pressure coolant injection]/RHR pumps 1E12C002A, B, and C, each have a rated maximum flow rate in excess of 8,000 gpm [gallons per minute] ([Entergy's] System Design Criteria SDC-E12). Each flow instrument loop, which consists of the flow orifice, flow transmitter, flow indicator and signal processing electronics, has an overall loop accuracy of between one and two percent of the maximum measurable flow rate. Even at the lower, more accurate point, one percent accuracy is approximately 90 gpm, which is over twice the jockey pumps' rated

flow rate of 40 gpm at 50 psid [pounds per square inch differential] (UFSAR [Updated Final Safety Analysis Report] Section 6.3.2.2.5).

Flow orifice 1E21-FE-N002, which is installed in the system to measure the flow rate of the main LPCS Pump 1E21C001, has a rated maximum flow rate of 12,000 gpm (GE [General Electric] LPCS System Design Specification 22A3125AC). The flow instrument loop, which consists of the flow orifice, flow transmitter, flow indicator and signal processing electronics, has an overall loop accuracy of between one and two percent of the maximum measurable flow rate. Even at the lower, more accurate point, one percent accuracy is equivalent to 120 gpm, which is over 3 times the jockey pumps' rated flow rate of 40 gpm at 45 psid (UFSAR Section 6.3.2.2.5).

Flow orifice 1E22-FE-N007, which is installed in the system to measure the flow rate of the main HPCS Pump 1E22C001, has a rated maximum flow rate of 10,000 gpm (GE HPCS System Design Specification 22A3131AC). The flow instrument loop, which consists of the flow orifice, flow transmitter, flow indicator and signal processing electronics, has an overall loop accuracy of between one and two percent of the maximum measurable flow rate. Even at the lower, more accurate, point, one percent accuracy is equivalent to 100 gpm, which is over 2-1/2 times the jockey pump's rated flow rate of 40 gpm at 45 psid (UFSAR Section 6.3.2.2.5).

The flow orifices for the LPCI/RHR Pumps are installed in 18-inch NPS [nominal pipe size] piping. [The flow orifices for the LPCS and HPCS Pumps are installed in 16-inch NPS piping.] Even if the typical operational jockey pump differential flow rate of 40 gpm registered on this flow instrumentation, it would not meet the requirements of ASME OM Code-2004 Edition with addenda through OMb Code-2006, subparagraphs ISTB-3510(b)(1) and ISTB-3510(c), since the full-scale ranges of these instruments are more than 200 times the probable reference values for these jockey pumps. Under ideal conditions, the jockey pump flows would be just barely detectable at the lower end of the instrument scales, and accurate measurement would be masked by instrument noise and other conditions.

Additionally, the licensee stated that the flow path for each of the RHR jockey pumps in standby operation is through a minimum-flow return line with a flow-limiting orifice plate (1E12-RO-D002A, B or C), which is sized to hold flow rate reasonably constant at about 40 gpm (UFSAR Figure 5.4-19), while providing adequate margin in jockey pump capacity to make up for any leakage from the main LPCI/RHR pump discharge header. The flow path for the LPCS jockey pump in standby operation is through a minimum-flow return line with a flow-limiting orifice plate (1E21-RO-D003), which is sized to hold flow rate reasonably constant at about 10 gpm (UFSAR Figure 6.3-5), while providing adequate margin in jockey pump capacity to make up for any leakage from the main LPCS pump discharge header. The flow path for the HPCS jockey pump in standby operation is through a minimum-flow return line with a flow-restricting orifice plate (1E22-RO-D003), which is sized to hold flow rate reasonably constant at about 40 gpm, while providing adequate margin in jockey pump capacity to make up for any leakage from the main HPCS pump discharge header. Flow rate through these orifice plates cannot be measured, as discussed above, since there are flow rate through these orifice plates cannot be measured, as discussed above, since there are no installed measurement points and portable flow rate instrumentation has not proven adequate. These flow rates also cannot be considered constant

and repeatable enough to meet the requirements of ASME OM Code-2004 Edition with addenda through OMb Code-2006, subparagraph ISTB-3300(d), due to the potential for changes in the main LPCI/RHR, LPCS, and HPCS discharge headers leakage from test to test.

3.4 Licensee's Proposed Alternative and Basis for Use

In its letter dated May 25, 2017, the licensee stated in part:

> Jockey pump discharge header pressure is continuously monitored, and the RHR PMP A DISCH PRESS [PUMP A Discharge Pressure] ABNORMAL, RHR PMP B DISCH PRESS ABNORMAL or the RHR PMP C DISCH PRESS ABNORMAL annunciators alarm in the Control Room if the discharge header pressure drops below a preset value of 40 psig [pounds per square inch gauge] for the Loop A and B jockey pumps, and 28 psig for the Loop C jockey pump. Based on the pumps' rated capacities (40 gpm at 50 psid, per UFSAR Section 6.3.2.2.5) and the required suppression pool level during power operation (greater than, or equal to, 18 feet 4-1/12 inches and less than or equal to 18 feet 9-3/4 inches per [TS] LCO [Limited Condition for Operation] 3.6.2.2), these low header pressure annunciators will activate at approximately 100 percent of the Loop A and B jockey pumps' operating differential pressure, and at approximately 65 percent of the Loop C jockey pump's operating differential pressure.
>
> Jockey pump discharge header pressure is continuously monitored, and the LPCS PMP DISCH PRESS ABNORMAL annunciator is activated in the Control Room if the main LPCS discharge header pressure drops below 32 psig. Based on the jockey pumps' rated capacity (40 gpm at 45 psid, per UFSAR Section 6.3.2.2.5) and the required suppression pool level during power operation (greater than or equal to 18 feet 4-1/12 inches and less than or equal to 18 feet 9-3/4 inches per [TS] LCO 3.6.2.2), this low header pressure annunciator will activate at approximately 70 percent of the jockey pumps' operating differential pressure.

The licensee also stated that the Jockey pump discharge header pressure is continuously monitored, and the HPCS jockey pump discharge pressure low annunciator is activated (alarms) in the Control Room if the discharge header pressure drops below a preset value (currently 19 psig). Based on the pump's rated capacity (40 gpm at 45 psid) and the required suppression pool level during power operation (greater than, or equal to, 18 feet 4-1/12 inches and less than, or equal to, 18 feet 9-3/4 inches per TS LCO 3.6.2.2), this low header pressure annunciator will alarm at approximately 55 percent of the jockey pump's operating differential pressure.

Further, the licensee stated, in part, in its letter dated May 25, 2017:

> Hydraulic condition of the jockey pump[s] will be considered acceptable by continuous monitoring of pump discharge header pressures and verifying adequate header pressures as indicated by the absence of low pressure alarms. Corrective action will be taken if a header low pressure alarm sounds, indicating low header pressure.
>
> Also, GGNS Technical Specification SR 3.5.1.1 requires verification every 31 days that [the respective LPCI/RHR] headers are filled with water by venting

the piping at the high point vents. Such continuous monitoring and monthly venting will provide timely warning if a jockey pump has failed, or that system leakage has exceeded the capacity of the jockey pump.

In addition, vibration will continue to be measured on [these] pumps as required by ASME OM Code-2004 Edition with addenda through OMb Code-2006. If a measured vibration velocity exceeds an Alert or Required Action Range limit according to ASME OM Code-2004 Edition with addenda through OMb Code-2006, Table ISTB-5121-1, "Centrifugal Pump Test Acceptance Criteria," the required actions of ASME OM Code-2004 Edition with addenda through OMb Code-2006, paragraph ISTB-6200, "Corrective Action," will be taken.

3.5 NRC Staff Evaluation

Paragraph ISTB-5121 requires that a Group A test be conducted with the pump operating at a specified reference point. The resistance of the system shall be varied until the flow rate equals the reference point. The differential pressure shall then be determined and compared to its reference value. Alternatively, the flow rate shall be varied until the differential pressure equals the reference point, and the flow rate determined and compared to the reference flow rate value.

There are no current means of accurately measuring the flow rates of the RHR jockey pumps, E12C003A, B, and C, LPCS jockey pump E21C002, and HPCS jockey pump E22C003 because no flow rate meters, orifices or other measurement devices are installed in the RHR, LPCS, and HPCS systems for the measurement of these flow rates. The installed main LPCI/RHR, LPCS, and HPCS process flow measurement instrumentation loops cannot be used for jockey pump flow measurement because the full-scale ranges of these flow instruments are too large to accurately measure the small flow rates of the RHR, LPCS and HPCS jockey pumps. As shown by the licensee, the jockey pump flow rates would be just barely detectable at the lower end of the instrument scales, and accurate measurement would be masked by instrument noise and other conditions. The licensee stated that it has attempted to use ultrasonic flow instruments to measure the jockey pumps' flow rate, but the results have been variable and non-repeatable. Therefore, the NRC staff concludes that the jockey pump flow rates cannot be meaningfully measured due to the lack of flow instrumentation in the jockey pump minimum flow return lines. Therefore, imposing the ASME OM Code requirements would result in a hardship for the licensee because it would require system modification and installation of flow devices.

The RHR, LPCS, and HPCS jockey pumps are continuously operating pumps. Their safety function is to keep the RHR, LPCS, and HPCS discharge headers piping in a filled condition to prevent a water hammer upon the start of a main RHR, LPCS, and HPCS pumps. The actual output and hydraulic performance of the RHR jockey pumps are not critical to the safety function, as long as the pumps are capable of maintaining the piping full of water.

In lieu of an ASME OM Code-required Group A test and flow measurement, the licensee has proposed to continuously monitor the pump discharge header pressures by means of low pressure annunciators in the control room. The low pressure alarms will provide an early detection of a low header pressure and insufficient flow from the jockey pumps. Also, GGNS TS SR 3.5.1.1 requires verification every 31 days that the respective LPCI/RHR, LPCS, and HPCS headers are filled with water by venting the piping at the high-point vents, which would be an indication of insufficient jockey pump flow. The continuous monitoring of discharge header pressure in the control room and the monthly (more frequent than quarterly) venting surveillance at high points will provide reasonable assurance that the jockey pumps are operable and have

sufficient flow, or that the system leakage has not exceeded the capacity of the jockey pumps. In addition, the proposed vibration measurement meets the ASME OM Code requirements and will provide the required test results reflecting the mechanical condition of the pumps.

Based on the above discussion, the NRC staff concludes that the proposed alternative would provide reasonable assurance of the operational readiness of RHR jockey pumps E12C003A, B, and C, LPCS jockey pump E21C002, and HPCS jockey pump E22C003 and their capability to perform their safety function of keeping the RHR, LPCS, and HPCS headers piping in a filled condition.

4.0 CONCLUSION

As set forth above, the NRC staff determined that for alternative requests PRR-GGNS-2017-1, PRR-GGNS-2017-2, and PRR-GGNS-2017-3 for GGNS the proposed alternative provides reasonable assurance that the affected pumps E12C003A, B, and C (PRR-GGNS-2017-1), E21C002 (PRR-GGNS-2017-2), and E22C003 (PRR-GGNS-2017-3) are operationally ready. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(2) for requests PRR-GGNS-2017-1, PRR-GGNS-2017-2, and PRR-GGNS-2017-3. Therefore, the NRC staff authorizes the use of alternative requests PRR-GGNS-2017-1, PRR-GGNS-2017-2, and PRR-GGNS-2017-3 for GGNS for the fourth 10-year IST program interval, which began on December 1, 2017, and is scheduled to end on November 30, 2027.

All other ASME OM Code requirements for which relief was not specifically requested and approved remain applicable.

Principal Contributors: John Billerbeck, NRR/DE/EMIB
Gurjendra Bedi, NRR/DE/EMIB

Date: January 23, 2018

SUBJECT: GRAND GULF NUCLEAR STATION, UNIT 1 – RELIEF REQUESTS PRR-GGNS-2017-1, PRR-GGNS-2017-2, AND PRR-GGNS-2017-3 PROPOSING AN ALTERNATIVE FOR THE FOURTH 10-YEAR INSERVICE TESTING REQUIREMENTS OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS CODE FOR OPERATION AND MAINTENANCE OF NUCLEAR POWER PLANTS (CAC NOS. MF9749, MF9750 AND MF9751; EPID L-2017-LLR-0039, L-2017-LLR-0040 AND L-2017-LLR-0041) DATED JANUARY 23, 2018

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