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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO INSERVICE TESTING PROGRAM RELIEF REQUESTS FOR

ENTERGY OPERATIONS, INC.

GRAND GULF NUCLEAR STATION

DOCKET NUMBER 50-416

1.0 INTRODUCTION

Title 10 of the Code of Federal Regulations (10 CFR), Section 50.55a, requires that inservice testing (IST) of certain American Society of Mechanical Engineers (ASME) Code Class 1, 2, and 3 pumps and valves are performed in accordance with Section XI of the ASME *Boiler and Pressure Vessel Code* (the Code) and applicable addenda, except where alternatives have been authorized or relief has been requested by the licensee and granted by the Commission pursuant to Sections (a)(3)(i), (a)(3)(ii), or (f)(6)(i) of 10 CFR 50.55a. In proposing alternatives or requesting relief, the licensee must demonstrate that (1) the proposed alternatives provide an acceptable level of quality and safety, (2) compliance would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety, or (3) conformance is impractical for its facility. Section 50.55a authorizes the Commission to approve alternatives and to grant relief from ASME Code requirements upon making the necessary findings. Guidance related to the development and implementation of IST programs is given in Generic Letter (GL) 89-04, "Guidance on Developing Acceptable Inservice Testing Programs," issued April 3, 1989, and its Supplement 1 issued April 4, 1995. Also, see NUREG-1482, "Guidelines for Inservice Testing at Nuclear Power Plants," and NUREG/CR-6396, "Examples, Clarifications, and Guidance on Preparing Requests for Relief from Pump and Valve Inservice Testing Requirements."

The 1989 Edition of the ASME Code is the latest edition incorporated by reference in Paragraph (b) of Section 50.55a. Subsection IWV of the 1989 Edition, which gives the requirements for IST of valves, references Part 10 of the American National Standards Institute/ASME *Operations and Maintenance Standards* (OM-10) as the rules for IST of valves. OM-10 replaces specific requirements in previous editions of Section XI, Subsection IWV, of the ASME Code. Subsection IWP of the 1989 Edition, which gives the requirements for IST of pumps, references Part 6 of the American National Standards Institute/ASME *Operations and Maintenance Standards* (OM-6) as the rules for IST of pumps. OM-6 replaces specific requirements in previous editions of Section XI, Subsection IWP, of the ASME Code.

Entergy Operations, Inc.'s (EOI's, or the licensee's) IST program submitted in a letter dated November 26, 1997, covers the second 10-year IST interval for the Grand Gulf Nuclear Station (GGNS), which began on December 1, 1997. In the updated program, EOI submitted two valve

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relief requests and five pump relief requests. The staff and EOI discussed these relief requests on April 17, May 1, June 18, and December 15, 1998. In response to staff's questions and comments, EOI revised previous relief requests, divided the general valve relief request VRR-GEN-01 into two specific valve relief requests, and resubmitted them with a new valve relief request in a letter dated February 18, 1999. The staff's evaluation is provided below.

2.0 PUMP RELIEF REQUESTS

2.1 Pump Relief Request PRR-E12-01

PRR-E12-01 requests relief for Residual Heat Removal System (RHR) pumps, E12C003A, E12C003B, and E12C003C from the specific requirements of flow measurement during a pump test as required in OMa-1988, Part 6 (OM-6), Paragraph 5.2. Pump vibration will be measured in accordance with Paragraph 4.6.4 of OM-6 at a reference differential pressure. These are jockey pumps that operate continuously during normal operation to keep their respective main Low Pressure Core Injection (LPCI)/RHR pump discharge piping full of water.

2.1.1 Basis for Relief

The licensee states:

> These jockey pumps are required to operate whenever their respective LPCI/RHR 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 pump suction and discharge piping where pump suction and discharge pressure can be measured for calculation of differential pressure, and throttle valves exist which can be used to set differential pressure equal to the pump's reference value. However, the pump differential-pressure information provided is of little use for analyzing the hydraulic condition of the jockey pump without being able to measure flow rate or set flow rate at a known reference value, as required by ASME/ANSI OMa-1988 Part 6, Para. 5.2(b).
>
> There are no practical means of measuring the flow rate of these jockey pumps. No flow rate meters, orifices or other measurement devices are installed in the system for measurement of jockey pump flow rate. The installed main LPCI/RHR process flow measurement instrumentation loops, which are discussed below, cannot be used for jockey pump flow measurement. Attempts have been made to use portable ultrasonic flow instruments to measure jockey pump flow rate, but the results have been too variable to be repeatable.
>
> Flow orifices 1E12-FE-N014A, B, and C, which are installed in the system to measure flow rate of the main LPCI/RHR Pumps 1E12C002A, B, and C, have a rated maximum flow rate of 10,000 gpm. 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 equivalent to 100 gpm, which is over 2-1/2 times the jockey

pumps' rated flow rate of 40 gpm at 50 psid (SAR Section 6.3.2.2.5). The flow orifices are installed in 18-inch NPS piping. Even if the typical operational jockey pump flow rate of 30 to 50 gpm registered on this flow instrumentation, it would not meet the requirements of ASME/ANSI OMa-1988, Part 6, Para. 4.6.1.2 and 4.6.1.3, since the full-scale ranges of these analog 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 flow path for each of the jockey pumps in standby operation is through a minimum-flow return line with a flow-limiting orifice plate (E12-RO-D002A, B or C) which is sized to hold flow rate reasonably constant at about 40 gpm (SAR 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. Flow rate through this orifice plate cannot be measured, as discussed above, since there are no installed measurement points and portable flow rate instrumentation has not proven adequate. This flow rate also cannot be considered constant and repeatable enough to meet the requirements of ASME/ANSI OMa-1988 Part 6, Para. 4.3, due to the potential for changes in the main LPCI/RHR discharge header leakage from test to test.

Additionally, jockey pump discharge header pressure is continuously monitored, and an annunciator alarms in the Control Room if the discharge header pressure drops below a preset value, currently 40 psig for the Loop A and B jockey pumps and 28 psig for the Loop C jockey pump. Based on the pump's rated capacities (40 gpm at 50 psid, per SAR Section 6.3.2.2.5) and the required suppression pool level during power operation ($\geq$ 18 feet 4-1/12 inches and $\leq$ 18 feet 9-3/4 inches per Tech Spec LCO 3.6.2.2), these low header pressure annunciators will alarm at approximately 70 percent of the Loop A and B jockey pumps' operating differential pressure, and at approximately 50 percent of the Loop C jockey pump's operating differential 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, these pumps are currently being monitored at least once a quarter under the GGNS Vibration Monitoring Program, which is currently not required by any Federal, state or industry requirements. Because rotating equipment faults that can be detected by vibration monitoring will show up any time the equipment is operating, returning these pumps to a fixed set of operating conditions is not necessary to detect such faults. The faults themselves, however, are affected by the equipment operating parameters. For example, if the equipment is heavily loaded, fault growth will typically be escalated.

These jockey pumps may be categorized as "smooth running," that is, they are typically running with very low vibration velocities. Each pump's flow rate is normally at or only slightly higher than the flow through the pump's minimum flow return piping. Any additional flow is typically only to make up for leakage from the main LPCI/RHR pump's discharge piping. Under these conditions, these pumps' reference values of vibration velocity are normally less than 0.05 inches per second (IPS).

Limits established in the GGNS Vibration Monitoring Program are not only based on vendor and industry data but also on changes in vibration levels and in the spectral content of the vibration signals. Unlike ASME/ANSI OMa-1988, Part 6, Table 3a, which has fixed Alert and Required Action limits at 2.5 times and 6 times, respectively, of the reference values, the GGNS Vibration Monitoring Program analyzes changes in vibration spectrum or spectral content over time, looks for trends in the changes, and attempts to determine the reasons for the changes. If changes are determined to be from an equipment problem, rather than changes in operating parameters, increased monitoring is established to determine the rate of the trend and equipment maintenance is scheduled to correct the problem before any vendor or industry recommendations or limits of ASME/ANSI OMa-1988, Part 6 are expected to be exceeded.

2.1.2 Proposed Alternative Testing

The licensee states:

Hydraulic condition of the jockey pumps will be considered acceptable by continuing to monitor the pump discharge header pressures and verifying adequate header pressures, as indicated by the absence of low pressure alarms. Corrective action will be taken if header low pressure alarm sounds, indicating low header pressure.

Vibration will continue to be measured on these pumps as required by ASME/ANSI OMa-1988, Part 6. Differential pressure will be set equal to its reference value prior to the measurements. (Reference values of vibration were taken with the jockey pumps in normal operation with header pressure alarm cleared and flow rate through the jockey pump minimum flow return orifice plate.) If a measured vibration velocity exceeds an Alert or Required Action limit of ASME/ANSI OMa-1988, Part 6, Table 3a, the required actions of ASME/ANSI OMa-1988, Part 6, Para. 6.1, Acceptance Criteria," will be taken.

2.1.3 Evaluation and Conclusion

OM-6, Paragraph 5.2 requires that an inservice test be conducted with the pump operating at specific test reference conditions. The resistance of the system shall be varied until the flow rate equals the reference value. The pressure shall then be determined and compared to its reference value. Alternatively, the flow rate can be varied until the pressure equals the reference value and the flow rate shall be determined and compared to the reference flow rate value.

There are no practical means of accurately measuring the flow of the affected jockey pump because no flow meters, orifices or other measurement devices are installed in the jockey pump system for directly measuring the flow rate. The installed main LPCI/RHR 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 for the jockey pumps. As such, the jockey pump flow rate 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. Attempts have been made by the licensee to use portable ultrasonic flow instruments to measure jockey pump flow rate, but the results have been too variable to be repeatable. Therefore, flow rate cannot be meaningfully measured due to the lack of on-line flow instrumentation in the jockey pump minimum flow return line. Imposing the Code requirements would result in a hardship for the licensee because it would require system modification and installation of on-line flow devices.

In lieu of a Code-required hydraulic test and flow measurement, the licensee proposes to monitor the pump discharge header pressures continuously by a low pressure annunciator in the control room. The low pressure alarm will provide an early detection of a low header pressure. The licensee also indicates that GGNS Technical Specification SR 3.5.1.1 requires verification every 31 days that the respective LPCI/RHR headers are filled with water at the high point vents. The continuous monitoring of discharge header pressure in the control room and monthly (more frequent than quarterly) venting surveillance at high points will provide reasonable assurance that the jockey pump is operable, or that the system leakage has not exceeded the capacity of the jockey pump. In addition, the proposed vibration measurement meets the Code requirements and will provide the required test results reflecting the mechanical condition of the pump. The proposed alternative previously described would therefore provide reasonable assurance of operational readiness for the affected pumps.

Pursuant to 10 CFR 50.55a(a)(3)(ii), the proposed alternative is authorized on the basis that imposing the Code requirements would result in hardship without a compensating increase in the level of quality and safety. The licensee's proposed alternative testing provides reasonable assurance of pump operability.

2.2 Pump Relief Request PRR-E21-01

PRR-E21-01 requests relief for the Low Pressure Core Spray (LPCS) pump E21C002 from the specific requirements of flow measurement during a pump test as required in OM-6, Paragraph 5.2. Pump vibration will be measured in accordance with Paragraph 4.6.4 of OM-6 at a reference differential pressure. This jockey pump operates continuously during normal operation to keep the discharge piping full of water.

2.2.1 Basis for Relief

The licensee states:

> This jockey pump is required to operate whenever the LPCS system is in the operable condition. As such, the pump performs continuous duty on a recirculation line and provides makeup as needed.

Pressure taps exist in the jockey pump suction and discharge piping where pump suction and discharge pressure can be measured for calculation of differential pressure, and a throttle valve exists which can be used to set differential pressure equal to the pump's reference value. However, the pump differential-pressure information provided is of little use for analyzing the hydraulic condition of the jockey pump without being able to measure flow rate or set flow rate at a known reference value, as required by ASME/ANSI OMa-1988 Part 6, Para. 5.2(b).

There are no practical means of measuring the flow rate of this pump. No flow rate meters, orifices or other measurement devices are installed in the system for measurement of jockey pump flow rate. The installed main process flow measurement instrumentation loop, which is discussed below, cannot be used for jockey pump flow measurement. Attempts have been made to use ultrasonic flow instruments to measure jockey pump flow rate, but the results have been too variable to be repeatable.

Flow orifice 1E21-FE-N002, which is installed in the system to measure flow rate of the main LPCS Pump 1E12C001, has a rated maximum flow rate of 10,000 gpm. 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 pump's rated flow rate of 40 gpm at 45 psid (SAR Section 6.3.2.2.5). The flow orifice is installed in 16-inch NPS piping. Even if the typical operational jockey pump flow rate of 30 to 50 gpm registered on this flow instrumentation, it would not meet the requirements of ASME/ANSI OMa-1988, Part 6, Para. 4.6.1.2 and 4.6.1.3, since the full-scale range of this analog instrument is more than 200 times the probable reference values for this jockey pump. Under ideal conditions, the jockey pump flow would be just barely detectable at the lower end of the instrument scale, and accurate measurement would be masked by instrument noise and other conditions.

Additionally, the flow path for the jockey pump in standby operation is through a minimum-flow return line with a flow restricting orifice plate (1E21-RO-D003) which is sized to hold flow rate reasonably constant at about 40 gpm (SAR Figure 5.4-19), while providing adequate margin in jockey pump capacity to make up for any leakage from the main LPCS pump discharge header. Flow rate through this orifice plate cannot be measured, as discussed above, since there are no installed measurement points and portable flow rate instrumentation has not proven adequate. This flow rate also cannot be considered constant and repeatable enough to meet the requirements of ASME/ANSI OMa-1988 Part 6, Para. 4.3, due to the potential for changes in the main LPCS discharge header leakage from test to test.

Additionally, jockey pump discharge header pressure is continuously monitored, and an annunciator alarms in the Control Room if the main LPCS discharge header pressure drops below a preset value, currently 32 psig. Based on the jockey pump's rated capacity (40 gpm at 45 psid, per SAR Section 6.3.2.2.5) and the required suppression pool level during power operation ($\geq$18 feet 4-1/12 inches and $\leq$18 feet 9-3/4 inches per Tech Spec LCO 3.6.2.2), this low header pressure annunciator will alarm at approximately 60 percent of the jockey pump's operating differential pressure.

Also, GGNS Technical Specification SR 3.5.1.1 requires verification every 31 days that the main LPCS discharge header is filled with water by venting the piping at the high point vent. Such continuous monitoring and monthly venting will provide timely warning if the jockey pump has failed, or that system leakage has exceeded the capacity of the jockey pump. In addition, the pump is currently being monitored at least once a quarter under the GGNS Vibration Monitoring Program, which is currently not required by any Federal, state or industry requirements. Because rotating equipment faults that can be detected by vibration monitoring will show up any time the equipment is operating, returning the pump to a fixed set of operating conditions is not necessary to detect such faults. The faults themselves, however, are affected by the equipment operating parameters. For example, if the equipment is heavily loaded, fault growth will typically be escalated.

This jockey pump may be categorized as "smooth running," that is, it is typically running with very low vibration velocities. The pump's flow rate is normally at or only slightly higher than the flow through the pump's minimum flow return piping. Any additional flow is typically only to make up for leakage from the main LPCS pump's discharge piping. Under these conditions, the pump's reference values of vibration velocity are normally less than 0.05 inches per second (IPS).

Limits established in the GGNS Vibration Monitoring Program are not only based on vendor and industry data but also on changes in vibration levels and in the spectral content of the vibration signals. Unlike ASME/ANSI OMa-1988, Part 6, Table 3a, which has fixed Alert and Required Action limits at 2.5 times and 6 times, respectively, of the reference values, the GGNS Vibration Monitoring Program analyzes changes in vibration spectrum or spectral content over time, looks for trends in the changes, and attempts to determine the reasons for the changes. If changes are determined to be from an equipment problem, rather than changes in operating parameters, increased monitoring is established to determine the rate of the trend and equipment maintenance is scheduled to correct the problem before any vendor or industry recommendations or limits of ASME/ANSI OMa-1988, Part 6 are expected to be exceeded.

2.2.2 Alternative Testing

The licensee states:

Hydraulic condition of the jockey pump will be considered acceptable by continuing to monitor the pump discharge header pressure and verifying adequate header pressures as indicated by the absence of low pressure alarm. Corrective action will be taken if header low pressure alarm sounds, indicating low header pressure.

Vibration will continue to be measured on this pump as required by ASME/ANSI OMa1988, Part 6. Differential pressure will be set equal to its reference value prior to the measurements. (Reference values of vibration were taken with the jockey pump in normal operation with header pressure alarm cleared and flow rate through the jockey pump minimum flow return orifice plate.) If a measured vibration velocity exceeds an Alert or Required Action limit of ASME/ANSI OMa-1988, Part 6, Table 3a, the required actions of ASME/ANSI OMa-1988, Part 6, Para. 6.1, "Acceptance Criteria," will be taken.

2.2.3 Evaluation and Conclusion

OM-6, Paragraph 5.2 requires that an inservice test be conducted with the pump operating at specific test reference conditions. The resistance of the system shall be varied until the flow rate equals the reference value. The pressure shall then be determined and compared to its reference value. Alternatively, the flow rate can be varied until the pressure equals the reference value and the flow rate shall be determined and compared to the reference flow rate value.

There are no practical means of accurately measuring the flow of the affected jockey pump because no flow meters, orifices, or other measurement devices are installed in the jockey pump system for directly measuring the flow rate. The installed main process flow measurement instrumentation loop cannot be used for jockey pump flow measurement because the full-scale ranges of these flow instruments are too large for the jockey pump. As such, the jockey pump flow rate would be just barely detectable at the lower end of the instrument scales, and accurate measurement would be masked by instrument noise and other flow conditions. Attempts have been made by the licensee to use portable ultrasonic flow instruments to measure jockey pump flow rate, but the results have been too variable to be repeatable. Therefore, flow rate cannot be meaningfully measured due to the lack of on-line flow instrumentation in the jockey pump minimum flow return line. Imposing the Code requirements would result in a hardship for the licensee because it would require system modification and installation of on-line flow devices.

In lieu of a Code-required hydraulic test and flow measurement, the licensee proposes to monitor the pump discharge header pressures continuously by a low pressure annunciator in the control room. The low pressure alarm will provide an early detection of a low header pressure. The licensee also indicates that GGNS Technical Specification SR 3.5.1.1 requires verification every 31 days that the main LPCS discharge header is filled with water at the high point vent. The continuous monitoring of discharge header pressure in the control room and monthly (more frequent than quarterly) venting surveillance will provide reasonable assurance that the jockey pump is operable, or that the system leakage has not exceeded the capacity of the jockey pump. In addition, the proposed vibration measurement meets the Code requirements and will provide the required test results reflecting the mechanical condition of the pump. The proposed alternative previously described would therefore provide reasonable assurance of operational readiness for the affected pump.

Pursuant to 10 CFR 50.55a(a)(3)(ii), the proposed alternative is authorized on the basis that imposing the Code requirements would result in hardship without a compensating increase in the level of quality and safety. The licensee's proposed alternative testing provides reasonable assurance of pump operability.

2.3 Relief Request PRR-E22-01

PRR-E22-01 requests relief for the High Pressure Core Spray (HPCS) pump E22 C003 from the specific requirements of flow measurement during a pump test as required in OM-6, Paragraph 5.2. Pump vibration will be measured in accordance with Paragraph 4.6.4 of OM-6 at a reference differential pressure. This jockey pump operates continuously during normal operation to keep the discharge piping full of water.

2.3.1 Basis for Relief

The licensee states:

> This jockey pump is required to operate whenever the HPCS system is in the operable condition. As such, the pump performs continuous duty on a recirculation line and provides makeup as needed.
>
> Pressure taps exist in the jockey pump suction and discharge piping where pump suction and discharge pressure can be measured for calculation of differential pressure, and a throttle valve exists which can be used to set differential pressure equal to the pump's reference value. However, the pump differential-pressure information provided is of little use for analyzing the hydraulic condition of the jockey pump without being able to measure flow rate or set flow rate at a known reference value, as required by ASME/ANSI OMa-1988 Part 6, Para. 5.2(b).
>
> There are no practical means of measuring the flow rate of this pump. No flow rate meters, orifices or other measurement devices are installed in the system for measurement of jockey pump flow rate. The installed main process flow measurement instrumentation loop, which is discussed below, cannot be used for jockey pump flow measurement. Attempts have been made to use ultrasonic flow instruments to measure jockey pump flow rate, but the results have been too variable to be repeatable.
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> Flow orifice 1E22-FE-N007, which is installed in the system to measure flow rate of the main HPCS Pump 1E22C001, has a rated maximum flow rate of 10,000 gpm. 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 (SAR Section 6.3.2.2.5). The flow orifice is installed in 16-inch NPS piping. Even if the typical operational jockey pump flow rate of 30 to 50 gpm registered on this flow instrumentation, it would not meet the requirements of ASME/ANSI OMa-1988, Part 6, Para. 4.6.1.2 and 4.6.1.3, since the full-scale range of this analog instrument is more than 200 times the probable reference value for this jockey pump. Under ideal conditions, the jockey pump flow would be just barely

detectable at the lower end of the instrument scale, and accurate measurement would be masked by instrument noise and other conditions.

Additionally, the flow path for the 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 (SAR Figure 5.4-19), while providing adequate margin in jockey pump capacity to make up for any leakage from the main HPCS pump discharge header. Flow rate through this orifice plate cannot be measured, as discussed above, since there are no installed measurement points and portable flow rate instrumentation has not proven adequate. This flow rate also cannot be considered constant and repeatable enough to meet the requirements of ASME/ANSI OMa-1988 Part 6, Para. 4.3, due to the potential for changes in the main HPCS discharge header leakage from test to test.

Additionally, jockey pump discharge header pressure is continuously monitored, and an annunciator alarms in the Control Room if the discharge header pressure drops below a preset value, currently 28 psig. Based on the pump's rated capacity (40 gpm at 45 psid, per SAR Section 6.3.2.2.5) and the required suppression pool level during power operation ($\geq$18 feet 4-1/12 inches and $\leq$18 feet 9-3/4 inches per Tech Spec LCO 3.6.2.2), this low header pressure annunciator will alarm at approximately 55 percent of the jockey pump's operating differential pressure.

Also, GGNS Technical Specification SR 3.5.1.1 requires verification every 31 days that the respective header is filled with water by venting the piping at the high point vents. Such continuous monitoring and monthly venting will provide timely warning if the jockey pump has failed, or that system leakage has exceeded the capacity of the jockey pump.

In addition, the jockey pump is currently being monitored at least once a quarter under the GGNS Vibration Monitoring Program, which is currently not required by any Federal, state or industry requirements. Because rotating equipment faults that can be detected by vibration monitoring will show up any time the equipment is operating, returning the pump to a fixed set of operating conditions is not necessary to detect such faults. The faults themselves, however, are affected by the equipment operating parameters. For example, if the equipment is heavily loaded, fault growth will typically be escalated.

This jockey pump may be categorized as "smooth running," that is, it is typically running with very low vibration velocities. The pump's flow rate is normally at or only slightly higher than the flow through the pump's minimum flow return piping. Any additional flow is typically only to make up for leakage from the main HPCS pump's discharge piping. Under these conditions, the pump's reference values of vibration velocity are normally less than 0.05 inches per second (IPS).

Limits established in the GGNS Vibration Monitoring Program are not only based on vendor and industry data but also on changes in vibration levels and in the spectral content of the vibration signals. Unlike ASME/ANSI OMa-1988, Part 6,

Table 3a, which has fixed Alert and Required Action limits at 2.5 times and 6 times, respectively, of the reference values, the GGNS Vibration Monitoring Program analyzes changes in vibration spectrum or spectral content over time, looks for trends in the changes, and attempts to determine the reasons for the changes. If changes are determined to be from an equipment problem, rather than changes in operating parameters, increased monitoring is established to determine the rate of the trend and equipment maintenance is scheduled to correct the problem before any vendor or industry recommendations or limits of ASME/ANSI OMa-1988, Part 6 are expected to be exceeded.

2.3.2 Alternative Testing

The licensee states:

> Hydraulic condition of the jockey pump will be considered acceptable by continuing to monitor the pump discharge header pressures and verifying adequate header pressures, as indicated by the absence of low pressure alarms. Corrective action will be taken if header low pressure alarm sounds, indicating low header pressure.
>
> Vibration will continue to be measured on this pump as required by ASME/ANSI OMa-1988, Part 6. Differential pressure will be set equal to its reference value prior to the measurements. (Reference values of vibration were taken with the jockey pump in normal operation with header pressure alarm cleared and flow rate through the jockey pump minimum flow return orifice plate.) If a measured vibration velocity exceeds an Alert or Required Action limit of ASME/ANSI OMa-1988, Part 6, Table 3a, the required actions of ASME/ANSI Oma-1988, Part 6, Para. 6.1, Acceptance Criteria," will be taken.

2.3.3 Evaluation and Conclusion

OM-6, Paragraph 5.2 requires that an inservice test be conducted with the pump operating at specific test reference conditions. The resistance of the system shall be varied until the flow rate equals the reference value. The pressure shall then be determined and compared to its reference value. Alternatively, the flow rate can be varied until the pressure equals the reference value and the flow rate shall be determined and compared to the reference flow rate value.

There are no practical means of accurately measuring the flow of the affected jockey pump because no flow meters, orifices or other measurement devices are installed in the jockey pump system for directly measuring the flow rate. The installed main process flow measurement instrumentation loop cannot be used for jockey pump flow measurement because the full-scale ranges of these flow instruments are too large for the jockey pump. As such, the jockey pump flow rate 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. Attempts have been made by the licensee to use portable ultrasonic flow instruments to measure jockey pump flow rate, but the results have been too variable to be repeatable. Therefore, flow rate cannot be meaningfully measured due to the lack of on-line flow instrumentation in the jockey pump minimum flow return line. Imposing the Code requirements would result in a hardship for the licensee because it would require system modification and installation of on-line flow devices.

In lieu of a Code-required hydraulic test and flow measurement, the licensee proposes to monitor the pump discharge header pressures continuously by a low pressure annunciator in the control room. The low pressure alarm will provide an early detection of a low header pressure. The licensee also indicates that GGNS Technical Specification SR 3.5.1.1 requires verification every 31 days that the main HPCS discharge header is filled with water at the high point vent. The continuous monitoring of discharge header pressure in the control room and monthly (more frequent than quarterly) venting surveillance will provide reasonable assurance that the jockey pump is operable, or that the system leakage has not exceeded the capacity of the jockey pump. In addition, the proposed vibration measurement meets the Code requirements and will provide the required test results reflecting the mechanical condition of the pump. The proposed alternative previously described would therefore provide reasonable assurance of operational readiness for the affected pump.

Pursuant to 10 CFR 50.55a(a)(3)(ii), the proposed alternative is authorized on the basis that imposing the Code requirements would result in hardship without a compensating increase in the level of quality and safety. The licensee's proposed alternative testing provides reasonable assurance of pump operability.

2.4 Relief request PRR-P75-01

PRR-P75-01 requests relief for the Standby Diesel Generator (SDG) system pumps P75C002A and P75C002B from the specific requirements of flow and pressure measurement during a pump test as required in OM-6, Paragraph 5.2. These pumps transfer fuel oil from the storage tank to the day tank for the SDGs.

2.4.1 Basis for Relief

The licensee states:

> The physical locations of the SDG fuel oil transfer pumps are at the bottoms of the respective-SDG fuel oil storage tanks, which are buried in the ground outside the diesel generator bays. The pump design specifies each pump to be submerged in the fuel oil with the 3/4-inch discharge piping rising from the pump, through the fuel oil, and out to the top of the tank approximately 13 feet above the pump discharge. Approximately 1 foot above the tank, the 3/4-inch piping widens to 2-inch diameter pipe. A 2-inch check valve near the expansion fitting prevents fuel oil in the transfer piping from draining back into the storage tank. The 2-inch piping rises approximately 15 to 16 inches, elbows twice during the next 29-inch run, and then flanges 20 inches later prior to entering the ground. Since good engineering design requires a minimum of 5 pipe diameters both upstream and downstream for source pressure measurement, the only adequate location for a pressure instrument tap within this exposed piping between the top of the storage tank and the ground entry point is the 29 inch run. However, as the following justification will identify, locating a pressure tap in this exposed pipe run will not provide a

significant increase in the usefulness of a discharge pressure measurement in this location.

The 2-inch piping then runs underground to the respective SDG rooms, and rises above ground level enroute to the day tank. Shortly after the 2-inch piping exits the ground in the respective SDG room, but prior to the SDG fuel oil strainer, is the pressure instrument tap used to measure the transfer pump discharge pressure. This pressure instrument tap is the current location for measurement of the pump discharge pressure, and is located approximately 12 feet above the 3/4-to-2-inch expansion fitting (24-feet above the actual pump discharge), and approximately 10 feet below the highest piping elevation in the run to the day tank. As noted above, the 3/4-inch diameter discharge piping run and elevation rise are both approximately 13 feet. The 2-inch diameter fuel oil transfer piping run is approximately 295 feet (SDG "B") and 360 feet (SDG "A"), with a total rise of 22 feet before entering the top of the respective SDG day tank.

For both trains of the SDG fuel oil transfer piping, the only isolation valve is a manual globe valve which is located in the highest elevation run of the 2-inch piping shortly upstream of where the pipe enters the day tank.

Between August 1994 and July 1997, 15 inservice tests were performed and documented for trending purposes for the 1 P75C002A pump. [For brevity, only test data from the "A" pump is given. The "B" pump exhibits similar results.] For these 15 tests, the pressure readings at the current instrument location ranged from 3.96 to 5.51 psig, which obviously does not reflect the true discharge pressure of the pump. The suction pressure, which is calculated utilizing the level of the the level in the storage tank, has ranged from 3.43 to 3.67 psig during these tests. The calculated differential pressure utilizing only the discharge pressure instrument and suction pressure has ranged from 0.34 to 2.04 psid. This calculated differential pressure is clearly not representative of the actual pump differential pressure.

Based on a system resistance calculation, these pumps experience approximately 68% to 70% of the total head loss in the 3/4-inch piping. Thus, only approximately 30% of the actual pump discharge pressure is measurable at the 3/4-to-2-inch reducer. From the reducer to the pressure instrument tap location, another 5 psi drop is experienced due to the elevation difference alone. Although the actual pressure readings documented during the test period analyzed have been in the range expected, the information has provided very little value as a pump degradation tool. The average measured discharge pressure over the analyzed tests is approximately 5.30 psig, with the average suction pressure being approximately 3.57 psig, thus the average differential pressure has been around 1.73 psid. As an attempt to make the differential pressure measurement a more practical pump performance indicator, a correction factor was calculated based on the respective SDG fuel oil system resistances. However, testing experience has indicated that even the use of a correction factor has not increased the usefulness of the differential-pressure determinations for these pumps, as the following discussion will establish.

The system resistance is based on the flow rate, and therefore the correction factor utilized would need to be based on the system flow rate during the test. This would necessitate setting the flow rate at a fixed value (32.75 gpm being the current reference value), and determining the pump differential pressure, or setting the differential pressure and determining the flow rate. Both of these test methods are considered to be impractical for the following reasons:

(1) Flow rate is determined by measuring the day tank level change from the low-level alarm to the pump shutoff level, and dividing the change by the pump run time. As such, instantaneous flow measurement is not available to allow simple adjustment to establish a fixed flow rate. There are no installed flow meters or taps for measuring flow rate directly. Ultrasonic flow measurement attempts using a portable instrument have proven to be inconsistent when compared to the level change method. The current method for determination of flow rate meets the loop accuracy requirements mandated per Table 1 of ASME/ANSI OMa-1988 Part 6. Modification to install a flow meter solely for the purpose of providing instantaneous flow indication to allow establishment of a fixed flow rate is not necessary for evaluating the hydraulic condition of these pumps for the reasons specified in this relief request.

(2) Differential pressure is determined by a calculation of the measured discharge pressure plus the correction factor minus the suction pressure. The suction pressure is from a real-time calculation based on the storage tank level measurement during the pump run. To ensure full loop accuracy, a Barton tube gauge (0-200 inches of water) is utilized to measure the discharge pressure, and thus requires a real-time calculation to convert inches of water to psi. Thus, three calculations would be required for each valve adjustment to establish a differential pressure. To utilize differential pressure as the fixed parameter, each system adjustment to set the differential pressure to the reference value would necessitate the performance of these three calculations. Each performance of these calculations adds time to the pump run duration and unnecessarily increases the potential for calculational error.

(3) The pump run is typically 8-10 minutes which, as noted above, will not allow for a fixed parameter adjustment during the pump run. Thus, the day tank would need to be drained to the low level for another pump run once the differential pressure is correctly adjusted. The breaker for the pump must be opened in order to drain the day tank to the low level alarm. Unnecessary cycling of component breakers solely for the purpose of performance testing is not desirable.

(4) The globe valve is the only available means of adjusting the system resistance to set either flow rate or differential pressure equal to its reference value; however, adjusting the globe valve will change the system resistance upon which the differential pressure correction factor is based. The corresponding resistance factor for the position of the globe valve would need to be determined to re-perform the system resistance calculation, and could necessitate the performance of the system resistance calculation during each pump test depending upon the sensitivity of the valve's resistance factor versus valve position. In either case,

valve adjustment would add additional uncertainty to the correction factor applied to the differential pressure measurements, which would further reduce the usefulness of the differential pressure as a pump performance parameter.

(5) Evaluation of the IST results for these pumps has shown that differential pressure measurement is not providing any substantial benefit as a diagnostic tool for pump hydraulic performance.

The current differential pressure reference values for these pumps are 28.11 ("A") and 28.29 ("B") psid. These reference values are based on correction factors from the system resistances at an average flow rate of 33.0 gpm. Even though a different reference flow rate (32.75 gpm) has been established since the original differential pressure reference values were determined, there has been absolutely no change in the average differential pressure results for the tests at the new flow reference value. If a new reference value is established based on a correction factor at 32.75 gpm, the same test results would be averaged around the new correction factor because of the very little variation between the measured suction and discharge pressures. However, establishing new correction factors or reference values would provide no additional benefit as noted below.

Per Table 3b of ASME/ANSI OMa-1988, Part 6, the acceptance criteria can deviate from the reference value by as much as 10% (2.8 psi) before corrective action is necessary. In order to achieve a 2.8 psi drop in differential pressure, the measured discharge pressure would have to drop to approximately 1.2 to 2.4 psig since suction pressure remains fairly constant. The pressure drop due solely to the elevation difference between the pressure instrument location and the maximum elevation experienced enroute to the day tank is approximately 4 psi. As such, flow would have to drop dramatically, and even cease, before the differential pressure ever came close to the lower required action value. Therefore, it has become clear that the only parameter which is currently providing any true representation of the pump hydraulic condition is the flow rate.

To make the measurement of the pump differential pressure a useful parameter for pump performance evaluation, it would be necessary to perform a modification to install the pump discharge pressure gage closer to the pump discharge. Such a modification is considered to represent an unusual hardship without a compensating increase in the level of quality and safety for the following reasons:

(a) Any modification would require removal of the fuel oil transfer pump from the associated fuel oil storage tank to make the necessary modification.

(b) A direct sensing instrument at the pump's discharge flange or the beginning of the discharge pipe would be submerged in the fuel oil with the pump. For this application, a pressure transducer would be required in lieu of a pressure gage. Such an arrangement would necessitate the removal of the pump assembly from the storage tank every time the pressure transducer requires calibration.

(c) If a pressure gage option were used with the tap location at the discharge of the pump and the transducer located elsewhere, the least impact would be caused by routing the gage sensing line along with the fuel discharge piping. However, this option would require an additional modification to the existing discharge flange arrangement at the top of the storage tank to allow the sensing line to penetrate the tank (any other penetration location would necessitate an entry into the tank to disconnect the sensing line whenever the pump is required to be pulled for planned or corrective maintenance.) Once this modification was performed, a correction factor will still need to be calculated to account for the elevation difference between the gage and the pump.

(d) The current test configuration allows the fuel oil transfer system to be treated as a fixed-resistance system due to the negligible head loss between the current discharge measurement location and the day tank. If a modification were performed to allow for more practical discharge pressure measurement, the system may no longer qualify as a fixed-resistance system depending upon the modification performed. If such were the case, resistance adjustment would necessitate at least two pump runs per quarter as discussed above. The option does exist to keep the drain open on the day tank while the adjustment is made, and then the drain would be shut for the level measurement. This option, however, could significantly reduce the accuracy of the flow rate measurement due to the shorter pump run time and due to the need to measure the initial tank level while the pump is actually filling the tank, instead of during a stable, no-flow condition.

(e) Safety-related maintenance activities, such as the removal of this pump for any reason, are expensive undertakings and involve risks associated with the disassembly of any piping system. Performance of a modification requiring such activities will significantly increase the cost burden.

(f) Working with fuel oil systems involves additional personnel and equipment safety hazards, which should be minimized whenever possible.

(g) If the transducer option were installed, removal and reinstallation of the pump assembly would be necessary for calibration purposes. This would require additional testing to be performed on the system to ensure that the maintenance activity did not impact the hydraulic performance capability of the fuel oil transfer system. Such testing would require verification that the reference values of the pump hydraulic parameters were not affected. If a transducer arrangement were used, then revalidation of the reference values would be required at the same periodicity as the instrument calibration.

(h) Finally, diesel-generator operability and availability could be adversely affected by an installation of any modification that would require multiple test runs of the fuel oil transfer pump or frequent storage tank entries for calibration purposes should such instrumentation be installed.

2.4.2 Alternative Testing

The licensee states:

As noted in the preceding discussion, the existing means of measuring pump differential pressure does not provide any useful information regarding the pump hydraulic condition that would not be readily apparent by a corresponding decrease in pump flow. For the fuel oil transfer system pumps, the measurement of flow rate alone, with the following additional requirements, will provide an acceptable level of quality and safety while having minimal negative impact on diesel-generator operability and availability. Before starting the pumps, adequate storage tank level will be ensured for pump net positive suction head (NPSH) requirements. The systems will be left in their normal alignment with no valves throttled. The day tanks will be drained to a low level and then refilled using the associated fuel oil transfer pump. An average flow rate will be calculated and compared to its reference value in order to determine if any pump degradation is occurring. A lower "alert value" (not presently required per Table 3b of OMa-1988, Part 6 for centrifugal pumps) of 93% of the reference flow rate value will be established for each of the pumps. If the measured flow rate falls below this "alert value," then the analyses and evaluation actions required by Section 6 of OMa-1988, Part 6 for pump performance in the alert range will be performed.

Although not specifically provided as alternative testing requirements for these pumps, the following summarizes alternative means and supplies for providing fuel oil to the SDGs in the event that a fuel oil transfer pump is inoperable. Some of these supplies are more fully described in SAR 9.5.4.

The SDG day tanks are equipped with low level switches that alarm in the Control Room. Various portable electric-, gasoline-, and diesel-driven pumps are available on-site that could be used in an emergency to refill the day tanks by pumping from the storage tanks. Each SDG installation includes provisions for manually refilling the day tanks from outside the Diesel-Generator Building.

Entergy Corp. maintains supplies of diesel fuel at power plants in Vicksburg, MS (approximately 25 miles from Grand Gulf Nuclear Station, GGNS) and in Natchez, MS (approximately 40 miles from GGNS). GGNS also maintains a contract with a fuel oil supply company in the surrounding area for resupply of SDG fuel oil as part of emergency planning, and the trucks from this company have pumps which could also resupply the SDG day tanks.

Finally, a fuel oil truck is maintained on-site at GGNS which is normally used for refueling portable diesel engines around the site (e.g., portable pumps, generators, compressors, etc.) The truck has 1,100 gal capacity and can be refilled from an on-site storage tank. The truck could be used in an emergency to refill the fuel oil day tank, even though neither the quantity nor the quality (purity and chemical analysis) of the fuel oil in either the truck or the storage tank is controlled for emergency purposes.

2.4.3 Evaluation and Conclusion

OM-6, Paragaph 5.2 requires that an inservice test be conducted with the pump operating at specific test reference conditions. The resistance of the system shall be varied until the flow rate equals the reference value. The pressure shall then be determined and compared to its reference value. Alternatively, the flow rate can be varied until the pressure equals the reference value and the flow rate shall be determined and compared to the reference flow rate value.

The SDG fuel oil transfer pumps are located at the bottom of the respective SDG fuel oil storage tanks, which are buried in the ground outside the diesel generator bay. By design, the pumps are submerged in the fuel oil. The current locations of pressure instrument taps for measurement of the pump discharge pressure are approximately 24 feet above the actual pump discharge and approximately 10 feet below the highest piping elevation in the piping run to the day tank. The pressure readings from current pressure instrument tap vary from test to test and provide very little value for monitoring pump performance. There are no installed flow meters or taps for measuring flow rate directly. Ultrasonic flow measurement attempts using a portable instrument have proven to be inconsistent. Therefore, flow rate as well as differential pressure cannot be meaningfully measured due to the lack of on-line flow instrumentation and improper location of the pressure tap. Imposing the Code requirements would require major system modifications including installation of on-line flow instrument, and a pressure transducer or tap at the discharge of the pump that is submerged in the fuel oil.

In lieu of the Code-required test, the licensee proposes to measure the average flow rate using the day tank. The day tank will be drained to a low level and then refilled using the associated fuel oil transfer pump. An average flow rate will be calculated and compared to its reference value to determine if pump degradation is occurring. A lower "alert value" of 93 percent of the reference flow rate value will be established for each pump. If the measured flow rate falls below this "alert value," then the analyses and evaluation actions required by Section 6 of OM-6 for pump performance in the alert range will be performed. Although the proposal will not provide the Code-required test results, the change of average flow rate can provide useful information to determine if pump degradation is occurring.

In addition, the SDG day tanks are equipped with low level switches that alarm in the control room. Various portable electric-, gasoline-, and diesel-driven pumps are available on-site that could be used in an emergency to refill the day tanks by pumping from the storage tanks. Each SDG installation includes provisions for manually refilling the day tank from outside the Diesel-Generator Building.

GGNS also maintains a contract with a fuel oil supply company in the surrounding area for resupply of SDG fuel oil as part of emergency planning, and the trucks from this company have pumps which could also resupply the SDG day tanks. Furthermore, a fuel oil truck is maintained on-site at GGNS which is normally used for refueling portable diesel engines around the site (e.g., portable pumps, generators, compressors, etc.). The truck has 1,100-gallon capacity and can be refilled from an on-site storage tank. The truck could be also used in an emergency to refill the fuel oil day tank.

The staff finds that monitoring the average flow rate for the affected pump and various alternative means of refilling the day tanks in the event of any emergency provide reasonable assurance of operational readiness for the pumps and day tanks.

Pursuant to 10 CFR 50.55a(a)(3)(ii), the proposed alternative is authorized on the basis that imposing the Code requirements would result in hardship without a compensating increase in the level of quality and safety. The licensee's proposed alternative testing provides reasonable assurance of operational readiness for the pumps and day tanks.

2.5 Relief Request PRR-P81-01

PRR-P81-01 requests relief for the HPCS Diesel Generator System pump P81C002 from the specific requirements of flow and pressure measurement during a pump test as required by OM-6, Paragraph 5.2. This pump transfers fuel oil from the storage tank to the day tank for the HPCS Diesel Generator System.

2.5.1 Basis for Relief

The licensee states:

> The physical location of the HPCS Diesel Generator (DG) fuel oil transfer pump is at the bottom of the fuel oil storage tank, which is buried in the ground outside the diesel generator bay. The pump design specifies the pump to be submerged in the fuel oil with the 3/4-inch discharge piping rising from the pump, through the fuel oil, and out to the top of the tank approximately 11 feet above the pump discharge. Less than 1 foot above the tank, the 3/4-inch piping widens to 2-inch diameter pipe. A 2-inch check valve near the expansion fitting prevents fuel oil in the transfer piping from draining back into the storage tank. The 2-inch piping rises approximately 4 inches, elbows twice during the next 14-inch run, and then flanges 9 inches later prior to entering the ground. Since good engineering design requires a minimum of 5 pipe diameters both upstream and downstream for source pressure measurement, there is no adequate location for a pressure instrument tap within this exposed piping between the top of the storage tank and the ground entry point.
>
> The 2 inch piping then runs underground to the HPCS DG room, and rises above ground level enroute to the day tank. Shortly after the 2-inch piping exits the ground in the HPCS DG room, but prior to the DG fuel oil strainer, is the pressure instrument tap used to measure the transfer pump discharge pressure. This pressure instrument tap is the closest practical location for measurement of the pump discharge pressure, and is located approximately 11.5 feet above the 3/4-to-2-inch expansion fitting (23.5 feet above the actual pump discharge), and 6.5 feet below the highest piping elevation in the run to the day tank.
>
> As noted above, the 3/4-inch diameter discharge piping run and elevation rise are both approximately 11 feet. The 2-inch diameter fuel oil transfer piping run is approximately 177.5 feet with a total rise of 19 feet before entering the top of the HPCS DG day tank.

The only isolation valve in the HPCS DG fuel oil transfer piping is a manual globe valve which is located in the highest elevation run of the 2-inch piping shortly upstream of where the pipe enters the day tank.

Between August 1994 and July 1997, 20 inservice tests were performed and documented for trending purposes. For these 20 tests, the pressure readings at the discharge pressure instrument location ranged from 2.95 to 3.80 psig, which obviously does not reflect the true discharge pressure of the pump. The suction pressure, which is calculated utilizing the level of the storage tank, has ranged from 3.51 to 3.80 psig during these tests. The calculated differential pressure utilizing only the discharge pressure instrument and suction pressure has ranged from -0.71 to +0.17 psid. This calculated differential pressure is clearly not representative of the actual pump differential pressure.

Based on a system resistance calculation for the HPCS DG fuel oil transfer system, the expected pump discharge pressure for the current reference flow rate (36.7 gpm) is 35.4 psig. Also, based on the same resistance calculation, the pump experiences approximately 75% of the total head loss in the 3/4-inch piping. This would yield an approximate pressure measurement of 8.8 psig at the 3/4-to-2-inch reducer. From the reducer to the pressure instrument tap location, another 5 psi drop is experienced due to the elevation difference alone.

Although the actual pressure readings documented during the test period analyzed have been in the range expected, the information has provided very little value as a pump degradation tool. The average measured discharge pressure over the analyzed tests is approximately 3.65 psig, with the average suction pressure being approximately 3.68 psig, thus the average differential pressure has been around-0.03 psid. As an attempt to make the differential pressure measurement a more practical pump performance indicator, a correction factor was calculated based on the HPCS DG fuel oil system resistance. However, testing experience has indicated that even the use of a correction factor has not increased the usefulness of the differential-pressure determinations for this pump, as the following discussion will establish.

The system resistance is based on the flow rate, and therefore the correction factor utilized would need to be based on the system flow rate during the test. This would necessitate setting the flow rate at a fixed value (36.7 gpm being the current reference value), and determining the pump differential pressure, or setting the differential pressure and determining the flow rate. Both of these test methods are considered to be impractical for the following reasons:

(1) Flow rate is determined by measuring the day tank level change from the low level alarm to the pump shutoff level and dividing the change by the pump run time. As such, instantaneous flow measurement is not available to allow simple adjustment to establish a fixed flow rate. There are no installed flow meters or taps for measuring flow rate directly. Ultrasonic flow measurement attempts using a portable instrument have proven to be inconsistent when compared to the level change method. The current method for determination of flow rate meets the loop

accuracy requirements mandated per Table 1 of ASME/ANSI OMa-1988 Part 6. Modification to install a flow meter solely for the purpose of providing instantaneous flow indication to allow establishment of a fixed flow rate is not necessary for evaluating the hydraulic condition of this pump for the reasons specified in this relief request.

(2) Differential pressure is determined by a calculation of the measured discharge pressure plus the correction factor minus the suction pressure. The suction pressure is from a real-time calculation based on the storage tank level measurement during the pump run. To ensure full loop accuracy, a Barton tube gauge (0-200 inches of water) is utilized to measure the discharge pressure, and thus requires a real-time calculation to convert inches of water to psi. Thus, three calculations would be required for each valve adjustment to establish a differential pressure. To utilize differential pressure as the fixed parameter, each system adjustment to set the differential pressure to the reference value would necessitate the performance of these three calculations. Each performance of these calculations adds time to the pump run duration and unnecessarily increases the potential for calculational error.

(3) The pump run is typically 9-10 minutes which, as noted above, will not allow for a fixed parameter adjustment during the pump run. Thus, the day tank would need to be drained to the low level for another pump run once the differential pressure is correctly adjusted. The breaker for the pump must be opened in order to drain the day tank to the low level alarm. Unnecessary cycling of component breakers solely for the purpose of performance testing is not desirable.

(4) The globe valve is the only available means of adjusting the system resistance to set either flow rate or differential pressure equal to its reference value; however, adjusting the globe valve will change the system resistance upon which the differential pressure correction factor is based. The corresponding resistance factor for the position of the globe valve would need to be determined to re-perform the system resistance calculation, and could necessitate the performance of the system resistance calculation during each pump test depending upon the sensitivity of the valve's resistance factor versus valve position. In either case, valve adjustment would add additional uncertainty to the correction factor applied to the differential pressure measurements, which would further reduce the usefulness of the differential pressure as a pump performance parameter.

(5) Evaluation of the IST results for this pump has shown that differential pressure measurement is not providing any substantial benefit as a diagnostic tool for pump hydraulic performance.

The current differential pressure reference value for this pump is 33.7 psid, which was based on a system resistance at the old reference flow rate of approximately 35 gpm. Even though a different reference flow rate (36.7 gpm) has been established since the original differential pressure reference value was determined, there has been absolutely no change in the average differential pressure results for the tests at the new flow reference value. If a new reference value is established based on a correction factor at 36.7 gpm, the same test results would be averaged around the new correction factor because of the very little variation between the measured suction and discharge pressures. However, establishing new correction factors or reference values would provide no additional benefit as noted below.

Per Table 3b of ASME/ANSI OMa-1988, Part 6, the acceptance criteria can deviate from the reference value by as much as 10% (3.3 psi) before corrective action is necessary. In order to achieve a 3.3 psi drop in differential pressure, the measured discharge pressure would have to drop to approximately 0.4 to 0.5 psig since suction pressure remains fairly constant. The pressure drop due solely to the elevation difference between the pressure instrument location and the maximum elevation experienced enroute to the day tank is approximately 2.5 psi. As such, flow would have to drop dramatically, and even cease, before the differential pressure ever came close to the lower required action value. Therefore, it has become clear that the only parameter which is currently providing any true representation of the pump hydraulic condition is the flow rate.

To make the measurement of the pump differential pressure a useful parameter for pump performance evaluation, it would be necessary to perform a modification to install the pump discharge pressure gage closer to the pump discharge. Such a modification is considered to represent an unusual hardship without a compensating increase in the level of quality and safety for the following reasons:

(a) Any modification would require removal of the fuel oil transfer pump from the associated fuel oil storage tank to make the necessary modification.

(b) A direct sensing instrument at the pump's discharge flange or the beginning of the discharge pipe would be submerged in the fuel oil with the pump. For this application, a pressure transducer would be required in lieu of a pressure gage. Such an arrangement would necessitate the removal of the pump assembly from the storage tank every time the pressure transducer required calibration.

(c) If a pressure gage option were used with the tap location at the discharge of the pump and the transducer located elsewhere, the least impact would be caused by routing the gage sensing line along with the fuel discharge piping. However, this option would require an additional modification to the existing discharge flange arrangement at the top of the storage tank to allow the sensing line to penetrate the tank (any other penetration location would necessitate an entry into the tank to disconnect the sensing line whenever the pump is required to be pulled for planned or corrective maintenance.) Once this modification was performed, a correction factor will still need to be calculated to account for the elevation difference between the gage and the pump.

(d) The current test configuration allows the fuel oil transfer system to be treated as a fixed-resistance system due to the negligible head loss between the current discharge measurement location and the day tank. If a modification were performed to allow for more practical discharge pressure measurement, the system may no longer qualify as a fixed-resistance system depending upon the modification performed. If such were the case, resistance adjustment would necessitate at least two pump runs per quarter as discussed above. The option does exist to keep the drain open on the day tank while the adjustment is made, and then the drain would be shut for the level measurement. This option, however, could significantly reduce the accuracy of the flow rate measurement due to the shorter pump run time and due to the need to measure the initial tank level while the pump is actually filling the tank, instead of during a stable, no-flow condition.

(e) Safety-related maintenance activities, such as the removal of this pump for any reason, are expensive undertakings and involve risks associated with the disassembly of any piping system. Performance of a modification requiring such activities will significantly increase the cost burden.

(f) Working with fuel oil systems involves additional personnel and equipment safety hazards, which should be minimized whenever possible.

(g) If the transducer option were installed, removal and reinstallation of the pump assembly would be necessary for calibration purposes. This would require additional testing to be performed on the system to ensure that the maintenance activity did not impact the hydraulic performance capability of the fuel oil transfer system. Such testing would require verification that the reference values of the pump hydraulic parameters were not affected. If a transducer arrangement were used, then revalidation of the reference values would be required at the same periodicity as the instrument calibration.

(h) Finally, diesel-generator operability and availability could be adversely affected by an installation of any modification that would require multiple test runs of the fuel oil transfer pump or frequent storage tank entries for calibration purposes should such instrumentation be installed.

2.5.2 Alternative Testing

The licensee states:

As noted in the preceding discussion, the existing means of measuring pump differential pressure does not provide any useful information regarding the pump hydraulic condition that would not be readily apparent by a corresponding decrease in pump flow. For the fuel oil transfer system pump, the measurement of flow rate alone, with the following additional requirements, will provide an acceptable level of quality and safety while having minimal negative impact on diesel-generator operability and availability.

Before starting the pump, adequate storage tank level will be ensured for pump net positive suction head (NPSH) requirements. The system will be left in its normal alignment with no valves throttled. The day tank will be drained to a low level and then refilled using the fuel oil transfer pump. An average flow rate will be calculated and compared to its reference value in order to determine if any pump degradation is occurring. A lower "alert value" (not presently required per Table 3b of OMa-1988, Part 6 for centrifugal pumps) of 93 percent of the reference flow rate value will be established for the pump. If the measured flow rate falls below this "alert value," then the analyses and evaluation actions required by Section 6 of OMa-1988, Part 6 for pump performance in the alert range will be performed.

Although not specifically provided as alternative testing requirements for this pump, the following summarizes alternative means and supplies for providing fuel oil to the HPCS DG in the event that the fuel oil transfer pump is inoperable. Some of these supplies are more fully described in SAR 9.5.4.

The HPCS DG day tank is equipped with a low level switch that alarms in the Control Room. Various portable electric-, gasoline-, and diesel-driven pumps are available on site that could be used in an emergency to refill the day tank by pumping from the storage tank. The HPCS DG installation includes provisions for manually refilling the day tank from outside the Diesel-Generator Building.

Entergy Corp. maintains supplies of diesel fuel at power plants in Vicksburg, MS (approximately 25 miles from Grand Gulf Nuclear Station, GGNS) and in Natchez, MS (approximately 40 miles from GGNS). GGNS also maintains a contract with a fuel oil supply company in the surrounding area for resupply of HPCS DG fuel oil as part of emergency planning, and the trucks from this company have pumps which could also resupply the HPCS DG day tank.

Finally, a fuel oil truck is maintained on-site at GGNS which is normally used for refueling portable diesel engines around the site (e.g., portable pumps, generators, compressors, etc.) The truck has 1,100 gal capacity and can be refilled from an on-site storage tank. The truck could be used in an emergency to refill the fuel oil day tank, even though neither the quantity nor the quality (purity and chemical analysis) of the fuel oil in either the truck or the storage tank is controlled for emergency purposes.

2.5.3 Evaluation and Conclusion

OM-6, Paragraph 5.2 requires that an inservice test be conducted with the pump operating at specific test reference conditions. The resistance of the system shall be varied until the flow rate equals the reference value. The pressure shall then be determined and compared to its reference value. Alternatively, the flow rate can be varied until the pressure equals the reference value and the flow rate shall be determined and compared to the reference flow rate value.

The HPCS DG fuel oil transfer pump is located at the bottom of the fuel oil storage tank, which is buried in the ground outside the diesel generator bay. By design, the pump is submerged in the fuel oil. The current locations of pressure instrument taps for measurement of the pump discharge pressure are approximately 23.5 feet above the actual pump discharge and approximately 6.5 feet below the highest piping elevation in the piping run to the day tank. The pressure readings from current pressure instrument tap vary from test to test and do not provide meaningful data for monitoring pump performance. There are no installed flow meters or taps for measuring flow rate directly. Ultrasonic flow measurement attempts using a portable instrument have proven to be inconsistent. Therefore, flow rate as well as differential pressure cannot be meaningfully measured due to the lack of on-line flow instrumentation and an ineffective location of the pressure tap. Imposing the Code requirements would require major system modifications including installation of on-line flow instrument and a pressure transducer or tap at the discharge of the pump.

In lieu of the Code-required test, the licensee proposes to measure the average flow rate using the day tank. The day tank will be drained to a low level and then refilled using the associated fuel oil transfer pump. An average flow rate will be calculated and compared to its reference value to determine if pump degradation is occurring. A lower "alert value" of 93 percent of the reference flow rate value will be established for the pump. If the measured flow rate falls below this "alert value," then the analyses and evaluation actions required by Section 6 of OM-6 for pump performance in the alert range will be performed. Although the proposal will not provide the Code-required test results, the change of average flow rate can provide sufficient information to determine if pump degradation is occurring.

In addition, the HPCS DG day tank is equipped with a low level switch that alarms in the control room. Various portable electric-, gasoline-, and diesel-driven pumps are available on-site that could be used in an emergency to refill the day tank by pumping from the storage tanks. The HPCS DG installation includes provisions for manually refilling the day tank from outside the Diesel-Generator Building.

GGNS also maintains a contract with a fuel oil supply company in the surrounding area for resupply of HPCS DG fuel oil as part of emergency planning, and the trucks from this company have pumps which could also resupply the HPCS DG day tank. Furthermore, a fuel oil truck is maintained on-site at GGNS which is normally used for refueling portable diesel engines around the site (e.g., portable pumps, generators, compressors, etc.). The truck has a 1,100-gallon capacity and can be refilled from an on-site storage tank. The truck could also be used in an emergency to refill the fuel oil day tank. The staff finds that monitoring the average flow rate for the affected pump and various alternative means of refilling the day tank in the event of any emergency provide reasonable assurance of operational readiness for the pump and day tank.

Pursuant to 10 CFR 50.55a(a)(3)(ii), the proposed alternative is authorized on the basis that imposing the Code requirements would result in hardship without a compensating increase in the level of quality and safety. The licensee's proposed alternative testing provides reasonable assurance of operational readiness for the pump and day tank.

3.0 VALVE RELIEF REQUESTS

3.1 Valve Relief Request VRR-B21-01

VRR-B21-01 requests relief from the stroke time test requirements of OM-10, Paragraph 4.2, and the post installation stroke tests requirements of OM-1987, Part 1 (OM-1), Paragraph 3.4.1.1(d) for the following main steam safety/relief valves (MSRVs) and Automatic Depressurization System (ADS) valves.

B21F041A	B21F047A	B21F051A
B21F041B	B21F047C	B21F051B
B21F041C	B21F047D	B21F051C
B21F041D	B21F047G	B21F051D
B21F041E	B21F047H	B21F051F
B21F041F	B21F047L	B21F051K
B21F041G		B21F041K

3.1.1 Basis For Relief

The licensee states:

> Opening these valves during power operation would cause unnecessary transients in the reactor coolant system and require needless operation of the suppression pool cooling system. Cycling of these valves during power operation significantly increases the risk of creating undesired seat leakage and/or escalating deterioration of valve seating surfaces due to such leakage. The initiation and continuation of MSRV seat leakage increases the amount of valve contamination and may necessitate extensive decontamination efforts on the valve prior to testing. The creation of extensive seat leakage would also require unnecessary operation of the suppression pool cooling system. In addition to the potential seat leakage issues, there is the possibility of an MSRV sticking open during testing at power thereby creating a LOCA [loss-of-coolant accident]. Although an inadvertently stuck open MSRV is an analyzed event in the UFSAR, it is not the intent for testing to increase the risk of initiating such a casualty.
>
> In NUREG-1482, Guidelines for Inservice Testing at Nuclear Power Plants (April, 1995) Section 4.3.4, the NRC Staff recommended reducing the number of challenges to the dual function ADS valves in order to reduce their failure rate. Since both ADS and non-ADS MSRVs perform dual function service, the same recommendation for reduction in the number of challenges to dual function operation is implied by inference for the non-ADS MSRVs. The Staff also noted that the ASME OM Committee was reviewing the categorization of safety and relief valves as Category C, rather than Category B, C, and stated that if the OM Committee determines these valves are Category C only, meeting the code requirements for Category A or B will not be necessary.
>
> The ASME OM Committee and Board on Nuclear Codes and Standards approved a change to the ASME Operation and Maintenance (OM) Code, Section ISTC 1.2, which adds the following statement:
>
>> Category A and B safety and relief valves are excluded from the requirements of ISTC 4.1, "Valve Position Verification" and ISTC 4.2, "Inservice Exercising Test."
>
> This change was incorporated into the ASME OM Code in the OMa-1996 Addenda.

Although this approval does not address the categorization of safety and relief valves noted in NUREG-1482, it accomplishes the same objective, which is to limit inservice exercising of the valves when they are installed in the plant. By excluding the safety and relief valves from Sections ISTC 4.1 and ISTC 4.2, the OM Committee has in fact determined that these valves are only subject to Category C testing. Although this approval is to OM Code-1995, it addresses concerns which have existed since Section XI to the ASME Boiler and Pressure Vessel Code was originally issued. The 1995 OM Code requires safety and relief valves to meet the testing requirements of Appendix I. Similarly, OMa-1988 requires safety and relief valves to meet the testing requirements of OM-1987, Part 1. Thus, it is reasonable to apply the OM Committee's determination (which was approved in NUREG-1482) to OMa-1988. Therefore, Category B testing and valve position verification is not required.

Per OM-1987, Part 1, Para. 3.4.1(d), the MSRVs are required to be stroked at reduced system pressure to verify open and close capability. As noted above, valve stroking on live steam is not desirable. Additionally, it is GGNS's opinion that the purpose of this Part 1 requirement is to verify correct installation of the air and electrical systems associated with the relief mode operation of the MSRV. Such confirmation can be accomplished without physically lifting the valve disk from the nozzle seat. Thus, GGNS believes that a de-coupled actuator test, as described in the Alternative Testing section below, is sufficient to perform this installation verification and will provide an acceptable level of quality and safety.

3.1.2 Alternative Testing

The licensee proposes:

The MSRVs will be exercised to the open position by manual actuation of the valve control system during setpoint testing and certification activities on the test bench. The response time of MSRV actuation is measured and recorded during certification activities. This response time is well below 1 second, and corrective actions are required should the response time be exceeded.

During installation in the plant following setpoint testing and certification, the valve stems will be uncoupled from their actuators. The air actuators will be exercised (without lifting the valve stems) to verify control signal continuity and proper air system configuration, following which the actuators will be re-coupled to the valve stems.

3.1.3 Evaluation and Conclusion

Paragraph 4.2 of OM-10 requires quarterly stroke time test of power-operated valves, and Paragraph 3.4.1.1(d) of OM-1 requires the post-installation stroke test of safety/relief valves. In lieu of the quarterly stroke time test, the licensee proposes to measure the response time during setpoint testing and valve certification activities. In lieu of actual stroke of the valve following reinstallation, the licensee proposes that only air actuators be exercised (without lifting the valve stems) to verify control signal continuity and proper air system configuration, following the actuators, which will be re-coupled to the valve stems.

The MSRVs are normally closed for reactor coolant system boundary. They are designed to open infrequently for overpressure protection and for automatic depressurization function. Frequent cycling of these valves using live steam would increase the risk of damaging valve seating surfaces and cause the valve to leak. In addition to the potential seat leakage, there is the possibility of the failure of an MSRV to reclose during testing at power thereby creating a LOCA. Furthermore, opening these valves, when not required, could cause an undesirable transient in the reactor coolant system and require needless operation of the suppression pool cooling system. These MSRVs are fast acting valves, and without the installation of additional instrumentation, the stroke time of the valves cannot be measured. Therefore, it is impractical to stroke test and measure the stroke time of the affected valves during power, at cold shutdown, and refueling outage.

The alternative testing provides for actual stroking of the valve disks after performing the Code setpoint testing. The response time of MSRV actuation is measured and recorded during certification activities. The proposed post installation test of air actuator would verify the correct installation of the air and electrical systems associated with the MSRVs. Therefore, the alternative testing provides reasonable assurance of the operational readiness of the valve because the only portion of the Code-required testing that is not incorporated into the proposed alternative is the verification that the stem is properly coupled to actuator. The staff also notes that these valves are primarily safety/relief valves. More recent editions of the OM Code provide for valve stroking of safety/relief valves only when setpoint tests, or maintenance or repair activities, are performed. Therefore, the licensee's proposal meets the more recent Code for these testing requirements.

Based on the consideration that it is impractical to stroke test of the affected valves during operation, at cold shutdown and at refueling outage and that the proposed alternative provides reasonable assurance of valve operability, the proposed alternative is authorized pursuant to 10 CFR 50.55a(a)(3)(ii), because imposition of the Code requirements would result in hardship without a compensating increase in the level of quality and safety. A similar relief request for the same valves was authorized for GGNS in an NRC safety evaluation dated November 18, 1996.

3.2 Valve Relief Request VRR-B21-02

OM-10, Paragraph 4.3.2.4(c) allows disassembly and inspection of certain check valves on a refueling outage basis. VRR-B21-02 applies to valves B21F010A and B21F010B, and requests relief from disassembling each check valve every refueling outage. The licensee proposes to disassemble one of these valves each refueling outage in accordance with the Position 2 of GL 89-04.

3.2.1 Basis for Relief

The licensee states:

Testing of check valves requires knowledge of the position of the disk. However, for these check valves the disk position cannot be ascertained during operation. These valves are Y-pattern plug check valves, which close on reverse flow. There are no provisions in the system for inserting a large enough back flow against the valves to ensure that the disks close fully. Check valves (B21-F032A and F032B) in the feedwater piping upstream of these valves prevent rapid depressurization of the upstream piping, which would be needed to build up a meaningful differential pressure across these valves.

Disassembly testing may be used to determine that a valve's disk will full-stroke exercise open or to verify closure capability, as allowed by OMa-1988, Part 10, Para. 4.3.2.4(c). Due to the scope of disassembly testing, the personnel hazards involved, foreign material exclusion (FME) concerns, planned maintenance activities and other operating restrictions, disassembly and inspection of both valves is not justified during each reactor refueling outage. Generic Letter 89-04 provides approval of Code deviations that are consistent with the NRC positions of the Generic Letter, Attachment 1.

This relief request meets the guidelines of Position 2 of the Generic Letter for implementation of a check valve sample disassembly and inspection program, as follows:

(a) Both valves are 24-inch Y-pattern plug check valves of the same design (same manufacturer, size, model number, and materials of construction).

(b) Disassembly of such large valves is inherently hazardous to personnel safety and poses risks of damaging the valves or their component parts during the disassembly and reassembly. In addition, even with foreign material exclusion (FME) practices in effect, there is a finite probability of introducing foreign material into the feedwater piping and, eventually, into the reactor vessel through the open check valve bonnet.

(c) Both valves are installed in feedwater piping, in the A and B feedwater lines, at essentially the same place in the system and in the plant, and are in the same orientation. They experience essentially the same service and atmospheric conditions.

(d) Both valves are located in the Drywell, which is inaccessible during power operation due to high radiation and is a high radiation area and a high contamination area during outages. The area they are in is difficult to access, is congested, and contains a number of obstacles to prevent efficiently disassembling and reassembling the valves.

(e) Based on information from past inspections, it takes an estimated 300 man-hours to perform an inspection of the internals of each of these check valves. These manhours include only the time required for disassembly, inspection and reassembly of the valve. The cost to perform each inspection is estimated at $9000. Additional manhours required for document preparation, review and approval, work preparation, dressing in protective clothing, depressurizing and draining the system piping, Health Physics and Quality Control support, removal of protective clothing, system restoration, and completion of documentation are not included and incur additional costs. In addition, an estimated dose of 1 man-rem would be received during each inspection activity.

3.2.2 Alternative Testing:

The licensee proposes:

Where it is determined that it is burdensome to disassemble and inspect all applicable valves each refueling outage, the following Sample Disassembly and Inspection Plan for groups of identical valves in similar applications is employed. The requirements for grouping in accordance with this plan are explained below:

The Sample Disassembly and Inspection Plan involves grouping valves of similar design, application and service conditions, and testing one valve in each group during each refueling outage. The grouping technique requires that, for each valve in a group, the following, as a minimum, be considered: Design, manufacturer, size, model number, service, orientation, and materials of construction. Valve group size is limited to four valves, maximum. These valves are a disassembly group of two valves.

One valve of this group will be disassembled and the internals inspected every refueling outage. When disassembly testing is performed, valves shall be tested as follows:

(a) At each disassembly it must be verified that the disassembled valve is capable of full-stroking and that the internals of the valve are structurally sound (no loose, corroded, worn, or failed parts).

(b) A different valve of each group is required to be disassembled, inspected, and manually full-stroke exercised at each successive refueling outage, until the entire group has been tested. At least one valve from each group is to be disassembled and examined at each refueling outage. Once this is completed, the sequence of disassembly must be repeated. All valves in each group are to be disassembled and examined at least once every six years. Each of these two valves will be disassembled and examined at least once every second refueling outage.

(c) Before return to service, valves that were disassembled for examination or that received maintenance that could affect their performance, are to be exercised full- or part-stroke, with flow, if practicable. Both of these valves are verified to be opened to the partially-open position quarterly and will be exercised prior to starting the plant after an outage during which one of the valves was disassembled for inspection.

(d) If the disassembled valve is not capable of being full-stroke exercised or there is binding or failure of valve internals, the remaining valves in that group must also be disassembled, inspected, and manually full-stroke exercised during the same outage.

3.2.3 Evaluation and Conclusion

Paragraph 4.3.2.2(e) of OM-10 requires that if valve exercising is not practicable during plant operation or cold shutdowns, full-stroke exercising is to be performed during refueling outages. As an alternative, Paragraph 4.3.2.4(c) allows disassembly and inspection every refueling outage to verify operability of check valves. However, the licensee proposes to test these valves on sampling basis in accordance with the guidance of Position 2 of GL 89-04. Accordingly, one of the these valves will be disassembled and manually full-stroke exercised at each refueling outage on a staggered basis.

Position 2 of GL 89-04 states that valve disassembly and inspection can be used as a positive means of determining that a valve's disk will full-stroke exercise open or of verifying closure capability. It further states that where the licensee determines that it is burdensome to disassemble and inspect all applicable valves each refueling outage, a sample disassembly and inspection plan for groups of identical valves in a similar applications may be employed. Guidance for grouping of the valves is provided such that each valve is disassembled and inspected once every 6 years, with a minimum of one valve disassembled and inspected each refueling outage.

As indicated by the licensee, there are no system design provisions to verify full closure of the affected valves quarterly, at cold shutdown or refueling outage, because of the check valves (B21-F032A and -F032B) located in the feedwater piping upstream of these valves. As such, it is impractical to exercise the valve to close and that imposing the Code requirements would require major system modifications. Position 2 of GL 89-04 allows disassembly as an acceptable means of inspecting check valves at each refueling outage, and extension of test intervals up to 6 years where the licensee can determine that it is burdensome to test all applicable valves each refueling outage. The licensee has documented that an estimated 300 man-hours is required to perform an inspection of the internals of each of these check valves. Additional man-hours and cost are required for document preparation, review and approval, work preparation, dressing in protective clothing, depressurizing and draining the system piping, Health Physics and Quality Control support, removal of protective clothing, and system restoration. In addition, an estimated dose of 1 man-rem would be received during each inspection activity. For a group of two valves in the relief request, the proposal to test one valve at each refueling outage would extend the test interval to no more than 4 years, and meets the guidance of Position 2 of GL 89-04.

Based on the consideration that closure test of the affected valves cannot be accomplished during operation, at cold shutdown, and at refueling outage and that the proposed alternative meets the guidance of GL 89-04, and provides reasonable assurance of valve operability, the proposed alternative is authorized pursuant to 10 CFR 50.55a(a)(3)(ii), on the basis that imposition of the Code requirements would result in hardship without a compensating increase in the level of quality and safety.

3.3 Valve Relief Request VRR-E38-01

OM-10, Paragraph 4.3.2.4(c) allows disassembly and inspection of certain check valves on a refueling outage basis. VRR-B38-01 applies to valves E38F002A, E38F002B, E38F003A, and E38F003B, and requests relief from disassembling each check valve every refueling outage. The licensee proposes to disassemble one of these valves each refueling outage in accordance with Position 2 of GL 89-04 on a staggered basis.

3.3.1 Basis for Relief:

The licensee states:

> Testing of check valves generally requires knowledge of the position of the disk or verification of the amount of flow passing through the valve. However, for these check valves the disk position or required flow values cannot be ascertained.
>
> During power operation, these valves are held closed by feedwater pressure on the downstream side, making full-stroke or part-stroke open exercising impracticable. These valves are located in the Auxiliary Building Steam Tunnel, which is a high radiation area and is inaccessible during power operation. Testing these valves in the closed direction requires personnel access and can be performed only during shutdown conditions. The valves are capable of being exercised closed and partially open during cold shutdowns, when the feedwater system is depressurized and the valve location is accessible.
>
> Verifying that these valves full-stroke open cannot be accomplished without knowledge of the flow rate through the valves. System design does not provide adequate instrumentation or test connections for measuring flow through the valves, even during cold shutdowns. There are no provisions in the system for measuring the flow rate through the feedwater leakage control (FWLC) lines. Ultrasonic flow measurement instrumentation has been used to verify that the check valves open to the partially-open position, but the instrumentation has not been determined to be capable of verifying fully-open function. In addition, these valves do not have any external indications of the disk position, except that the disk can be forced onto its seat by closing the handwheel.
>
> Disassembly testing may be used to determine that a valve's disk will full-stroke exercise open or to verify closure capability, as allowed by OMa-1988, Part 10, Para. 4.3.2.4(c). Due to the scope of disassembly testing, the personnel hazards involved, planned maintenance activities and system operating restrictions, all valves requiring disassembly and inspection may not be available for such testing during each reactor refueling outage. Generic Letter 89-04 provides approval of Code deviations that are consistent with the NRC positions of the Generic Letter, Attachment 1.

This relief request meets the guidelines of Position 2 of the Generic Letter for implementation of a check valve sample disassembly and inspection program, as follows:

(a) All four valves are 1 1/2-inch Y-pattern stop-check valves of the same design (same manufacturer, size, model number, and materials of construction).

(b) Disassembly of even small valves poses risks of damaging the valves or their component parts during the disassembly and reassembly. In addition, even with foreign material exclusion (FME) practices in effect, there is a finite probability of introducing foreign material into the feedwater leakage control piping and, eventually, into the reactor vessel through the open check valve bonnet.

(c) All four valves are installed in FWLC lines leading to the Loop A and B feedwater piping, both upstream (E38F003A and F003B) and downstream (E38F002A and F002B) of the outboard check valve (B21F032A and F032B), and are in the same orientation (upright in horizontal pipe runs). They experience essentially the same service and atmospheric conditions.

(d) All four valves are located in the Auxiliary Building Steam Tunnel, which is inaccessible during power operation due to high radiation and is a high radiation area and a contamination area during outages. In addition, the area is generally hot (above 100 F), even during cold shutdowns and refueling outages.

(e) Based on information from past inspections, it takes an estimated 24 man-hours to perform an inspection of the internals of each of these check valves. These manhours include only the time required for disassembly, inspection and reassembly of the valve. The cost to perform each inspection is estimated at $720. Additional man-hours required for document preparation, review and approval, work preparation, dressing in protective clothing, depressurizing and draining the system piping, Health Physics and Quality Control support, removal of protective clothing, system restoration, and completion of documentation are not included and incur additional costs. In addition, an estimated dose of 0.48 to 0.96 man-rem would be received during each inspection activity, based on a general area dose rate of 20 to 40 millirem per hour.

(f) Previous experience with disassembling and inspecting the internals of these four check valves during the first 10-year interval has not revealed any problems with any of the valves that would prevent any valve from performing its safety functions.

3.3.2 Alternative Testing

The licensee proposes:

Relief is requested to disassemble one sample valve out of this sample group of four valves every refueling outage, instead of disassembling all four valves every refueling outage.

Where it is determined that it is burdensome to disassemble and inspect all applicable valves each refueling outage, the following Sample Disassembly and Inspection Plan for groups of identical valves in similar applications is employed. The requirements for grouping in accordance with this plan are explained below:

The Sample Disassembly and Inspection Plan involves grouping valves of similar design, application and service conditions, and testing one valve in each group during each refueling outage. The grouping technique requires that, for each valve in a group, the following, as a minimum, be considered: Design, manufacturer, size, model number, service, orientation, and materials of construction. Valve group size is limited to four valves, maximum. These valves are a disassembly group of four valves.

One valve of this group will be disassembled and the internals inspected every refueling outage. When disassembly testing is performed, valves shall be tested as follows:

(a) At each disassembly it must be verified that the disassembled valve is capable of full-stroking and that the internals of the valve are structurally sound (no loose, corroded, worm, or failed parts). If the disassembly is to verify the full-stroke capability of the valve, the disk is to be manually full-stroke exercised. Full-stroke motion of the obturator is to be re-verified immediately prior to completing reassembly. Check valves (e.g., spring loaded lift check valves, or check valves with the obturator supported from the bonnet) that have their obturator disturbed before full stroke motion is verified, are to be examined to determine if a condition exists that could prevent full opening or re-closure of the obturator.

(b) A different valve of each group is required to be disassembled, inspected, and manually full-stroke exercised at each successive refueling outage, until the entire group has been tested. At least one valve from each group is to be disassembled and examined at each refueling outage. Once this is completed, the sequence of disassembly must be repeated. All valves in each group are to be disassembled and examined at least once every six years.

(c) Before return to service, valves that were disassembled for examination or that received maintenance that could affect their performance, are to be exercised full- or part-stroke, with flow, if practicable. All four of these valves are exercised to the partially-open position and to the closed position in accordance with the cold shutdown testing frequency described in the Valve Program section of this program plan.

(d) If disassembly is the only means of verifying the valves full stroke, the check valve should be partially stroked quarterly or during cold shutdown, if practicable. All four of these valves are exercised to the partially-open position and to the closed position in accordance with the cold shutdown testing frequency described in the Valve Program section of this program plan.

(e) If the disassembled valve is not capable of being full-stroke exercised or there is binding or failure of valve internals, the remaining valves in that group must also be disassembled, inspected, and manually full-stroke exercised during the same outage.

3.3.3 Evaluation and Conclusion

Paragraph 4.3.2.2(e) of OM-10 requires that if valve exercising is not practicable during plant operation or cold shutdowns, full-stroke exercising is to be performed during refueling outages. As an alternative, Paragraph 4.3.2.4(c) allows disassembly and inspection every refueling outage to verify operability of check valves. However, the licensee proposes to test these valves on a sampling basis in accordance with the guidance of Position 2 of GL 89-04. Accordingly, one of the these valves will be disassembled and manually full-stroke exercised at each refueling outage on a staggered basis.

Position 2 of GL 89-04 states that valve disassembly and inspection can be used as a positive means of determining that a valve's disk will full-stroke exercise open or of verifying closure capability. It further states that where the licensee determines that it is burdensome to disassemble and inspect all applicable valves each refueling outage, a sample disassembly and inspection plan for groups of identical valves in a similar applications may be employed. Guidance for grouping of the valves is provided such that the group size is no more than four, with a minimum of one valve disassembled and inspected each refueling outage.

The licensee indicates that verifying these valves full-stroke open cannot be accomplished because system design does not provide adequate instrumentation or test connections for measuring flow through the valves, even during cold shutdowns. Ultrasonic flow measurement instrumentation has been used to verify that the check valves open to the partially-open position, but the instrumentation has not been determined to be capable of verifying fully-open position. In addition, these valves do not have any external indications of the disk position. As such, it is impractical to full-stroke open these valves and that imposing the Code requirements would require major system modifications. Position 2 of GL 89-04 allows disassembly as an acceptable means of inspecting check valves at each refueling outage with a sample group of up to four valves if the licensee can determine that it is burdensome to test all applicable valves each refueling outage. The licensee has documented that an estimated 24 man-hours is required to perform an inspection of the internals of each of these check valves. Additional man-hours and cost are required for document preparation, review and approval, work preparation, dressing in protective clothing, depressurizing and draining the system piping, Health Physics and Quality Control support, removal of protective clothing, and system restoration. In addition, an estimated dose of 0.48 to 0.96 man-rem would be received during each inspection activity. For a group of four valves in the relief request, the proposal meets the guidance of Position 2 of GL 89-04.

Based on the consideration that full-stroke opening of the affected valves cannot be accomplished during operation, at cold shutdown, and at refueling outage and that the proposed alternative meets the guidance of GL 89-04, and provides reasonable assurance of valve operability, the proposed alternative is authorized pursuant to 10 CFR 50.55a(a)(3)(ii), on the basis that imposition of the Code requirements would result in hardship without a compensating increase in the level of quality and safety.

3.4 Valve Relief Request VRR-E51-01

OM-10, Paragraph 4.3.2.4(c) allows disassembly and inspection of certain check valves on a refueling outage basis. VRR-E51-01 applies to valves E51F079 and E51F081, and requests relief from disassembling each check valve every refueling outage. The licensee proposes to disassemble one of these valves each refueling outage in accordance with the Position 2 of GL 89-04.

3.4.1 Basis for Relief

The licensee states:

> These valves are check valves (vacuum breakers) attached to the RCIC turbine exhaust line. Testing of check valves generally requires knowledge of the position of the disk or verification of the amount of flow passing through the valve. There are no installed flow measuring devices in the line and no flow path exists that can be used to pass flow through the valves for testing purposes. In addition, these valves do not have any external indications of the disk position.
>
> Disassembly testing may be used to determine that a valve's disk will full-stroke exercise open or to verify closure capability, as allowed by OMa-1988, Part 10, Para. 4.3.2.4(c). Due to the scope of disassembly testing, the personnel hazards involved, planned maintenance activities and system operating restrictions, all valves requiring disassembly and inspection may not be available for such testing during each reactor refueling outage. GL 89-04 provides approval of Code deviations that are consistent with the NRC positions of the Generic Letter, Attachment 1.
>
> This relief request meets the guidelines of Position 2 of the Generic Letter for implementation of a check valve sample disassembly and inspection program, as follows:
>
> (a) Both valves are 2 1/2-inch swing check valves of the same design (same manufacturer, size, model number, and materials of construction.)
>
> (b) Disassembly of small valves poses risks of damaging the valves or their component parts during the disassembly and reassembly. In addition, even with FME practices in effect, there is a finite probability of introducing foreign material into the RCIC piping through the open check valve bonnet.
>
> (c) Both valves are installed in the same vacuum relief line, in series approximately one foot apart, and are in the same orientation (upright in a horizontal run of pipe). They experience essentially the same service and atmospheric conditions.
>
> (d) The valves are located in the Auxiliary Building, in the overhead approximately 15 feet above the grating in the Low Pressure Core Injection/Residual Heat Removal Loop A Pump room, in a high radiation area. A ladder or scaffolding is required for access to the valves.

(e) Based on information from past inspections, it takes an estimated 47 man-hours to perform an inspection of the internals of each of these check valves. These man-hours include only the time required for disassembly, inspection and reassembly of the valve and construction and removal of the scaffold. Most of the man-hours are expended in constructing the scaffold. The cost to perform each inspection is estimated at $1410. Additional man-hours required for document preparation, review and approval, work preparation, dressing in protective clothing, depressurizing and draining the system piping, Health Physics and Quality Control support, removal of protective clothing, system restoration, and completion of documentation are not included and incur additional costs. In addition, an estimated dose of 0.47 to 0.94 man-rem would be received during each inspection activity, based on a general area dose rate of 10 to 20 millirem per hour.

(f) Previous experience with disassembling and inspecting the internals of these two check valves during the first 10-year interval has not revealed any problems with either valve that would prevent either valve from performing its safety functions.

3.4.2 Alternative Testing

The licensee proposes:

Where it is determined that it is burdensome to disassemble and inspect both valves each refueling outage, the following Sample Disassembly and Inspection Plan for groups of identical valves in similar applications is employed. The requirements for grouping in accordance with this plan are explained below:

The Sample Disassembly and Inspection Plan involves grouping valves of similar design, application and service conditions, and testing one valve in each group during each refueling outage. The grouping technique requires that, for each valve in a group, the following, as a minimum, be considered: Design, manufacturer, size, model number, service, orientation, and materials of construction. Valve group size is limited to four valves, maximum. These valves are a disassembly group of two valves.

One valve of this group will be disassembled and the internals inspected every refueling outage. When disassembly testing is performed, valves shall be tested as follows:

(a) At each disassembly it must be verified that the disassembled valve is capable of full-stroking and that the internals of the valve are structurally sound (no loose, corroded, worm, or failed parts). If the disassembly is to verify the full-stroke capability of the valve, the disk is to be manually full-stroke exercised. Full-stroke motion of the obturator is to be re-verified immediately prior to completing reassembly. Check valves (e.g., spring loaded lift check valves, or check valves with the obturator supported from the bonnet) that have their obturator disturbed before full stroke motion is verified, are to be examined to determine if a condition exists that could prevent full opening or re-closure of the obturator.

(b) A different valve of each group is required to be disassembled, inspected, and manually full-stroke exercised at each successive refueling outage, until the entire group has been tested. At least one valve from each group is to be disassembled and examined at each refueling outage. Once this is completed, the sequence of disassembly must be repeated. All valves in each group are to be disassembled and examined at least once every six years. Each of these two valves will be disassembled and examined at least once every second refueling outage.

(c) Before return to service, valves that were disassembled for examination or that received maintenance that could affect their performance, are to be exercised full- or part-stroke, with flow, if practicable. Both of these valves are exercised to the partially-open position and to the closed position quarterly and after maintenance, including disassembly for inspection.

(d) If disassembly is the only means of verifying the valves full stroke, the check valve should be partially stroked quarterly or during cold shutdown, if practicable. Both of these valves are exercised to the partially-open position and to the closed positions quarterly and after maintenance, including disassembly for inspection.

(e) If the disassembled valve is not capable of being full-stroke exercised or there is binding or failure of valve internals, the remaining valves in that group must also be disassembled, inspected, and manually full-stroke exercised during the same outage.

3.4.3 Evaluation and Conclusion

Paragraph 4.3.2.2(e) of OM-10 requires that if valve exercising is not practicable during plant operation or cold shutdowns, full-stroke exercising is to be performed during refueling outages. As an alternative, Paragraph 4.3.2.4(c) allows disassembly and inspection every refueling outage to verify operability of check valves. However, the licensee proposes to test these valves on a sampling basis in accordance with the guidance of Position 2 of GL 89-04, i.e., one of the these valves will be disassembled and manually full-stroke exercised at each refueling outage on a staggered basis.

Position 2 of GL 89-04 states that valve disassembly and inspection can be used as a positive means of determining that a valve's disk will full-stroke exercise open or of verifying closure capability. It further states that where the licensee determines that it is burdensome to disassemble and inspect all applicable valves each refueling outage, a sample disassembly and inspection plan for groups of identical valves in a similar applications may be employed. Guidance for grouping of the valves is provided such that each valve is disassembled and inspected once every 6 years, with a minimum of one valve disassembled and inspected each refueling outage.

The licensee indicates that verifying these valves full-stroke open cannot be accomplished because there are no installed flow measuring devices in the line and no flow path exists that can be used to pass flow through the affected valves for testing purposes. In addition, these valves do not have any external indications of the disk position. As such, it is impractical to full-stroke open these valves and that imposing the Code requirements would require major system modifications. Position 2 of GL 89-04 allows disassembly as an acceptable means of inspecting check valves at each refueling outage, and extension of up to 6 years where the licensee can determine that it is burdensome to test all applicable valves each refueling outage. The licensee has documented that an estimated 47 man-hours is required to perform an inspection of the internals of each of these check valves. Additional man-hours and cost are required for document preparation, review and approval, work preparation, dressing in protective clothing, depressurizing and draining the system piping, Health Physics and Quality Control support, removal of protective clothing, and system restoration. In addition, an estimated dose of 0.47 to 0.94 man-rem would be received during each inspection activity. For a group of two valves in the relief request, the proposal to test one valve at each refueling outage would extend the test interval to no more than 4 years, and meets the guidance of Position 2 of GL 89-04.

Based on the consideration that full-stroke opening of the affected valves cannot be accomplished during operation, at cold shutdown, and at refueling outage and that the proposed alternative meets the guidance of GL 89-04, and provides reasonable assurance of valve operability, the proposed alternative is authorized pursuant to 10 CFR 50.55a(a)(3)(ii), on the basis that imposition of the Code requirements would result in hardship without a compensating increase in the level of quality and safety.

4.0 CONCLUSION

The staff concludes that relief requests PRR-E12-01, PRR-E21-01, PRR-E22-01, PRR-P75-01, PRR-P81-01, VRR-B21-01, VRR-B21-02, VR-E38-01, and VRR-E51-01 are authorized pursuant to 10 CFR 50.55a(a)(3)(ii), on the basis that imposition of the Code requirements would result in hardship without a compensating increase in the level of quality and safety. The staff further concludes that EOI's proposed alternatives provide reasonable assurance of operational readiness for the affected pumps and valves.

Principal Contributor: Y. S. Huang

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