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FPL Energy.

Duane Arnold Energy Center

May 8, 2006

NG-06-0355
10 CFR 50.55a

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

Duane Arnold Energy Center
Docket No: 50-331
Op. License No: DPR-49

Fourth Ten-Year Interval Inservice Testing Program Relief Requests

References: 1. NG-05-0427, dated August 1, 2005, Inservice Testing Program, Fourth Ten-Year Interval Update
2. NG-06-0005, dated January 4, 2006, Fourth Ten-Year Interval Inservice Testing Program Relief Requests
3. Letter dated March 2, 2006, Request for Additional Information related to Three Relief Requests associated with the Inservice Testing Program Fourth 10-Year Interval (TAC NOS. MC8713, MC8784 and MC8785)

The Duane Arnold Energy Center (DAEC) Inservice Testing (IST) Program update for the fourth ten-year interval was submitted by letter dated August 1, 2005 (Reference 1). This update included relief requests PR-01, PR-02 and VR-01. Following discussions with the Staff, the relief requests were revised to provide additional information (Reference 2).

By letter dated March 2, 2006, the Staff issued a request for additional information regarding the three requests (Reference 3). Information regarding VR-01 and PR-02 is provided in Enclosure 1. Additional information concerning VR-01 will be provided by May 19, 2006.

After further consideration, FPL Energy Duane Arnold has determined that PR-01 is not required, and hereby withdraws that request.

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In addition, FPL Energy Duane Arnold has identified the need for relief concerning flow measurement for the Standby Liquid Control pumps. As discussed in NUREG 1482, Revision 1, Section 3.3.3, Implementation of Updated Programs, when licensees identify impractical test provisions throughout the interval, the licensee may test the applicable components using the method proposed in the relief request during the time from identification until the Staff completes their evaluation. FPL Energy Duane Arnold has therefore implemented the method of flow measurement described in relief request PR-03 (Enclosure 2). Approval of PR-03 is requested by May 15, 2007.

This letter contains the following new commitment.

> Provide additional information regarding the six instrument lines containing excess flow check valves in the steam tunnel. This information will be provided by May 19, 2006.

Should you have any questions regarding this matter, please contact Steve Catron at (319) 851-7234.

Gary Van Middlesworth
Vice President, Duane Arnold Energy Center
FPL Energy Duane Arnold, LLC

Enclosures: 1. Response to Request for Additional Information Related to Three Relief Requests Associated with the Duane Arnold Energy Center Inservice Testing Program
2. PR-03 Standby Liquid Control Pump Flow Rate Measurement, Relief Request in accordance with 10 CFR 50.55a(f)(5)(iii)

cc: Administrator, Region III, USNRC
Project Manager, DAEC, USNRC
Senior Resident Inspector, DAEC, USNRC

Response to Request for Additional Information Related to Three Relief Requests Associated with the Duane Arnold Energy Center Inservice Testing Program

NRC Question 1 Regarding Relief Request VR-01

1. Section 4.1 of NEDO-32977-A speculates that most excess flow check valves (EFCVs) fail to close due to sticking and Attachment A testing data identifies 21 failures on Browns Ferry Nuclear (BFN) Plant, Unit 2, and 5 failures on BFN, Unit 3, due to crud buildup and sticking after extended outages. Table 4-1 of NEDO-32977-A shows that both BFN and Duane Arnold Energy Center (DAEC) use the same make of EFCV. Considering that NEDO-32977-A indicates DAEC has included the EFCVs as a subset within the Maintenance Rule, please clarify the type of preventive maintenance, if any, performed on the EFCVs to prevent sticking and, if no maintenance is performed, please explain why such failures reported with similar make valves are not expected in the future when the valves are not exercised as frequently.

Please indicate if there is any preventive maintenance performed to preclude sticking or why failures with similar valves are not expected when the valves are not exercised as frequently.

FPL Energy Duane Arnold Response to Question 1 Regarding Relief Request VR-01

Topical Report B21-00658-01 "Excess Flow Check Valve Testing Relaxation" was completed by GE Nuclear Energy for the Boiling Water Reactor Owners' Group (BWROG) in November of 1998. The DAEC acted as the lead plant and included the Topical Report in its 1999 submittal to the NRC for relaxed testing of Excess Flow Check Valves. The NRC-approved Licensing Topical Report has been assigned as NEDO-32977-A, Excess Flow Check Valve Testing Relaxation.

As discussed in the NRC Safety Evaluation for the Topical Report, in 1999, the DAEC requested a license amendment which would allow relaxation of the frequency of surveillance testing of excess flow check valves in reactor instrumentation lines. The basis for the request was a high degree of reliability with the EFCVs and the low consequences of an EFCV failure. The analysis to support this conclusion was based on the GE Topical Report B21-00658-01, which was submitted as part of the license amendment request for the DAEC. The NRC SE states that as part of the action granting the DAEC amendment, the Staff accepted the topical report insofar as it was applied to the DAEC case.

As discussed in NG-99-1383, DAEC Response to Request for Additional Information on Technical Specification Change Request (TSCR) Regarding Excess Flow Check Valve Surveillance Requirements, dated October 8, 1999, the EFCV vendor manual, "Technical Manual For Excess Flow Check Valve Model No. FVL16F Part No. 280837 Revision G," states "Under normal operating conditions, the valve does not require

maintenance of any kind." The DAEC concurs with the vendor that preventive maintenance is not needed.

NRC Question 2 Regarding Relief Request VR-01

2. Attachment B to NEDO-32977-A includes the radiological analysis of the consequences of an unisolable instrument line break. The consequences of several EFCVs sticking open following potential damage to multiple instrument lines caused by postulated high-energy line breaks outside containment have not been evaluated in the relief request. Please discuss the consequences of such postulated failures on multiple instrument lines that depend upon closure of excess flow check valves for isolation.

Please discuss the consequences of a common mode failure of several valves to close caused by sticking, in the event of a postulated high-energy line break outside containment. Please clarify if postulated high-energy line breaks outside containment do not impact these instrument lines.

FPL Energy Duane Arnold Response to Question 2 Regarding Relief Request VR-01

The analysis for high energy line breaks (HELBs) outside of containment considered the main steam, feedwater, high pressure coolant injection (HPCI) steam, reactor core isolation cooling (RCIC) steam, reactor water cleanup (RWCU) and high-energy sampling and instrument sensing lines. HELB areas outside containment are the steam tunnel, turbine building, HPCI room, RCIC room, and RWCU heat exchanger room. A review of these areas identified only six instrument lines containing excess flow check valves. These six lines are in the steam tunnel. Additional information will be provided regarding these six instrument lines by May 19, 2006.

NRC Questions Regarding Relief Request PR-01

1. The relief request does not identify an industry consensus standard as a technical basis for deviating from the acceptance criteria identified in Table ISTB-5100-1 for this pump. NUREG-1482, Revision 1, identifies that the acceptance criteria identified in the Operations & Maintenance (O&M) Code is based on an evaluation of empirical data and various acceptance criteria for pump vibration velocity established by U.S. industries, academia, international industry and foreign agencies. Please identify if an industry consensus standard exists that includes a technical basis for applying a relaxation in acceptance criteria from the O&M Code (industry standards such as the Hydraulics Institute, the International Standardization Organization (ISO), or manufacturer's recommendations, vibration analysis, Electric Power Research Institute (EPRI)).

Please address acceptance criteria in other industry standards which support an alternative technical basis. If other industry standards do not support alternative acceptance criteria, then please confirm and clarify that the technical basis relies on other sources such as manufacturer's evaluation, vibration analysis or EPRI.

2. The information included with the basis for relief identifies that DAEC has many years of inservice test data showing that baseline vibrations of 0.4 in/sec represent acceptable pump operation and that vibration levels have not trended upward. The licensee states that DAEC has had these vibration levels analyzed by an engineering consultant that specialized in vibration analysis and their analysis shows that this pump can operate at vibration levels up to 0.700 in/sec. Please identify the details of this vibration analysis and test data trends from when the pump was new or reference values, including the basis for the acceptance criteria. Please clarify if spectral analysis has been applied and if the vibration analysis has been reviewed and accepted by the pump manufacturer as an alternative to recommended modifications.

Please provide sufficient details of the vibration analysis. Although mention is made of the spectral/waveform analysis, the information does not include sufficient details of the analyses, including the evaluation criteria and pump manufacturer's evaluation.

3. No compensatory actions have been identified to justify accepting a higher level of vibration. Please explain how potential degradation in components will be detected. For example, please clarify if an oil analysis or inspections will be performed to detect degradation in bearings.

Please discuss any compensatory actions and discuss how bearing degradation will be detected.

4. Based on a review of manufacturer's information and other licensee relief requests, it appears that high vibration levels are common to this type of pump. Please identify the results of any industry technical inquiries with the American Society of Mechanical Engineers Code Committee on vibration acceptance criteria and please clarify why a code case is not more appropriate to evaluate a generic deviation from the O&M Code acceptance criteria. For example, complex configurations may require special guidance.

5. The licensee has not demonstrated that compliance would result in hardship or unusual difficulty. Please identify specific alternatives considered to lower the vibration level and their estimated costs. For example, the pump manufacturer has recommended that the most cost-effective solution is to replace the impeller if the alert limits are exceeded. Please address the results of any industry experience where other licensees have performed such modifications or other corrective actions should be addressed.

6. If other techniques, such as displacement monitoring, acceleration monitoring or acoustic detection, have been applied to monitor vibration levels, please submit the results of such monitoring.

7. To completely understand the nature of the vibration levels and the impact on operational readiness of the high-pressure coolant injection pump, please provide information regarding the pump operating history, bearing analysis, root cause analysis, wear rates, water temperature effects, fatigue considerations, maintenance practices and planned activities to reduce vibration levels within the Code acceptance criteria.

FPL Energy Duane Arnold Response Regarding Relief Request PR-01

After further consideration, FPL Energy Duane Arnold has determined that PR-01 is not required; PR-01 is therefore withdrawn.

NRC Question Regarding Relief Request PR-02

1. In the section entitled Basis for Relief, the licensee states that meeting the procurement and calibration requirements for these instruments to cover the range to the lower extreme (1.3 Hz) is impractical due to the limited number of vendors supplying such equipment and the level of sophistication and cost of the equipment. The availability of these instruments might have been impractical a decade ago. However, it appears that these instruments are readily available from several vendors today at reasonable cost. Please discuss your reasons for determining the impracticality of meeting this Code requirement today.

FPL Energy Duane Arnold Response Regarding Relief Request PR-02

NUREG/CP-0152, Volume 5, NRC/ASME Symposium on Valve and Pump Testing, on page 4A:20, provides information regarding requests associated with pump vibration measuring instruments (transducers). The NUREG states:

> The NRC has received relief requests from various licensees for relief from the provisions of ISTB 4.7.1(f) of the ASME OM Code for pumps with low pump shaft rotational speeds. Paragraph ISTB 4.7.1(f), "Frequency Response Range," requires that the frequency response range of the vibration-measuring transducers and their readout system shall be from one-third minimum pump shaft rotational speed to at least 1000 hertz (Hz).
>
> Most of the licensees stated that procurement and calibration of instruments to cover the lower end of the Code-specified range was impractical due to the limited number of vendors supplying such equipment, the level of equipment sophistication required, and the equipment cost. ...
>
> The NRC has learned that, due to technology advancement and research work performed in the field of instrumentation, vibration-measuring transducers meeting the Code requirements can be easily procured from various suppliers at a reasonably low cost.
>
> Therefore, licensees are requested to carefully examine the availability, procurement, and related cost of the Code-required instruments (vibration-measuring transducers) before submitting a relief request to the NRC.
>
> Recently, a similar relief request was received from the licensee of the Pilgrim Nuclear Power Station. After review, requests for additional information, and

followup discussion by the NRC, the licensee withdrew the relief request and decided to install a new transducer, that met the Code requirements.

The relief request referenced in the NUREG was reviewed. Pilgrim's submittal indicates that the station was able to obtain a transducer capable of achieving the Code lower limit of 1/3 turning speed, however, their Standby Liquid Control (SBLC) pumps run at higher turning speeds. (One-third turning speed stated in the Pilgrim request is 2.3 Hz; for the DAEC's SBLC pumps, one-third turning speed is 1.33 Hz.) Discussion with Pilgrim staff indicated that the instrumentation they utilize would not meet the Code-required accuracy for the DAEC's lower value of 1.33 Hz.

Discussion with the DAEC's instrument vendor also indicates that technology is not readily available that can achieve the Code-required accuracy for the DAEC's 1/3 turning speed frequency of 1.33 Hz. On the low end of the range, the signal is integrated from acceleration to obtain velocity. The instrument manufacturer indicated that even with additional signal filtering the integration from acceleration to velocity will create a slope that would prevent obtaining reliable data at frequencies this low. The integration creates a "ski slope" on the low end, so that at the Code-required low-end frequencies for the DAEC, the data is corrupted by the ski slope and the data would be unreliable.

PR-03 Standby Liquid Control Pump Flow Rate Measurement
Relief Request in accordance with 10 CFR 50.55a(f)(5)(iii)

ASME Code Component(s) Affected

Systems: Standby Liquid Control (SBLC)
Pump: 1P230A and 1P230B Standby Liquid Control Injection Pumps
Class: 2
Function: To inject liquid poison into the reactor.

Applicable Code Edition and Addenda

ASME Code for Operation and Maintenance of Nuclear Power Plants, 2001 Edition through 2003 Addenda.

Applicable Code Requirement

ISTB 3550 Flow Rate: When measuring flow rate, a rate or quantity meter shall be installed in the pump test circuit.

ISTB-5300(a)(1): For the comprehensive test, after pump conditions are as stable as the system permits, each pump shall be run at least 2 min. At the end of this time at least one measurement or determination of each of the quantities required by Table ISTB-3000-1 shall be made and recorded.

Impracticality of Compliance

The positive displacement SBLC pumps are designed to pump a constant flow rate regardless of system resistance. The SBLC system was not designed with a flow meter in the flow loop. The system was designed with a test tank, where the change in level can be measured over time and a flow rate calculated. As part of the modifications made to the SBLC system for the ATWS Rule (10 CFR 50.62), the DAEC installed instrumentation to measure the SBLC flow. The ultrasonic flow meter that was installed, however, was not intended to meet the accuracy requirements of the ASME OM Code, and has not proven to be capable of meeting Code accuracy requirements. The accuracy performance of the flow meter is attributed to the lack of adequate straight length of pipe to establish fully developed flow.

In March, 2006, portable ultra-sonic flow meters were installed on the common SBLC pump discharge piping to determine the practicality of using later-technology ultra-sonic flow meters to measure flow per ASME OM Code requirements. The flow meter transducers were installed at three different locations on the discharge piping. A vendor representative was on-site to facilitate proper installation and setup of the transducers and flow meters. Each location resulted in significantly different measured flow rates compared to the other locations and the test tank level method.

NUREG 1482, Revision 1 recognizes that plants may have difficulties with flow instrumentation. In Section 2.5.1, Justifications for Relief, the NUREG states that compliance with the Code may be impractical because of design limitations. "Imposition of the Code requirements would require significant system redesign and modifications. For example, a flow meter does not meet the accuracy requirements of ISTB 3510 [4.7.1] and Table ISTB 3500-1 [4.7.1-1] because the present system configuration does not have a straight section of pipe of sufficient length in which to measure flow accurately ... ."

Burden Caused by Compliance

Flow measurement can not be achieved to the required accuracy using a flow meter. In addition, the SBLC test tank is not large enough to provide two minutes of flow prior to recording flow data. As discussed in NUREG 1482, Revision 1, Section 5.5.2, requiring installation of a flow meter to measure the flow rate, and to guarantee the test tank size, such that the pump flow rate will stabilize in 2 minutes before recording data would be a burden because of the design and installation changes to be made to the existing system.

Proposed Alternative and Basis for Use

Flow rate for the SBLC pumps will be determined by measuring the change in test tank level over time. The pump will be started with suction from the test tank and will discharge to storage barrels. The test tank level will be approximately the same at the beginning of each test to ensure repeatability. After at least two minutes of pump operation and a change of tank level of at least 20 inches, the time and level are recorded and the pump stopped. The change in level over the measured time will be converted to flow rate by the following formula:

$$Q\ (GPM) = \Psi \Delta L\ (inch) / \Delta t\ (Second)$$

Where: Q is flow rate
Ψ is a constant which reflects tank dimensions and unit conversions
ΔL is the measured change in level in the tank in time Δt.

Pump discharge pressure will match system pressure up to the shutoff head of the positive displacement pump. Because of the characteristics of a positive displacement pump, there should be virtually no change in pump discharge flow rate as a result of the rising level in the temporary storage barrels. Therefore, increasing level will not have an impact on test results. By having approximately the same level in the tank at the beginning of each test, repeatable results can be achieved.

Per NUREG 1482, Revision 1, Section 5.5.2, Use of Tank Level to Calculate Flow Rate for Positive Displacement Pumps, when "flow meters are not installed in the flow loop of a system with a positive displacement pump, it is impractical to directly measure flow rate for the pump. The staff has determined that, if the licensee uses the tank level to calculate the flow rate as described in Subsection ISTB 3550 [4.7.5], the implementing

procedure must include the calculational method and any test conditions needed to achieve the required accuracy. ... If the meter does not directly indicate the flow rate, the record of the test shall identify the method used to reduce the flow data." The test tank level will be measured in accordance with the accuracy requirements of OM Table ISTB-3500-1. The calculational method and test conditions required to achieve this accuracy are documented in the implementing procedures.

Relief is requested in accordance with 10 CFR 50.55a(f)(5)(iii) from the requirement to use a flow meter and run the pump for two minutes prior to recording data.

Duration of Relief

Relief is requested for the Fourth Ten-Year Interval.

Precedent

Monticello Nuclear Generating Plant, Docket No. 50-263, Relief Request PR-01, authorized by letter from L. Raghavan (NRC) to D. Wilson (NMC), dated July 17, 2003 (TAC NO. MB6807).