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L-2017-209
10 CFR 50.55a

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington D C 20555-0001

RE: St. Lucie Units 1 and 2
Docket Nos. 50-335 and 50-389
Renewed Facility Operating Licenses DPR-67 and NPF-16
Response to Request for Additional Information Regarding Fifth 10-Year Inservice Testing (IST) Program Interval Relief Request PR-01

References:

1. Florida Power & Light Company letter L-2017-183, Fifth 10-Year Inservice Testing (IST) Program Interval Relief Requests PR-01 through PR-06, and PR-09, October 6, 2017 (ADAMS Accession No. ML17279A037)

2. NRR E-Mail Capture, Request for Additional Information, St Lucie Nuclear Plant, Units 1 And 2, Docket Nos. 50-335 and 50-389, 5th 10-Year IST Relief Request - PR-01, November 27, 2017, EPID L-2017-LLR-0113

In Reference 1, Florida Power & Light Company (FPL) submitted on behalf of St. Lucie Nuclear Plant Unit 1 and Unit 2, Relief Requests PR-01 through PR-06, and PR-09 for the Fifth Ten-Year Inservice Testing (IST) Program Interval. In Reference 2, the NRC determined that additional information is required to complete its review of Relief Request PR-01, Charging Pump Vibration Frequency Response Range.

The enclosure to this letter provides FPL's response to the request for additional information (RAI). The attachment to this enclosure provides the proposed change to Relief Request PR-01, as discussed in the enclosure.

This letter contains no new regulatory commitments.

Should you have any questions regarding this submittal, please contact Mr. Ken Frehafer, St. Lucie Licensing, at (772) 467-7748.

Sincerely,

RICHARD SCISCENTE FOR MJS

Michael J. Snyder
Licensing Manager
St. Lucie Plant

MJS/JAM

Enclosure: FPL Response to Request for Additional Information
Attachment: Relief Request PR-01 (revised)

cc: USNRC Regional Administrator, Region II
USNRC Project Manager, St. Lucie Nuclear Plant, Units 1 and 2
USNRC Senior Resident Inspector, St. Lucie Nuclear Plant, Units 1 and 2

In an email memorandum received November 27, 2017, the NRC requested additional information regarding Relief Request PR-01, Charging Pump Vibration Frequency Response Range, as indicated below. FPL's response follows:

**NRC RAI - Fifth 10-Year IST Relief Request PR-01**

By letter dated October 06, 2017 (Agencywide Documents and Access Management System (ADAMS) Accession No. ML17279A037), Florida Power & Light Company (FPL) submitted seven requests for alternatives to the NRC. Alternative request PR-01 requests an alternative for Reactor Coolant Charging Pumps (RCCPs) from the requirement of ISTB-3510(e), "Frequency Response Range," of the "American Society of Mechanical Engineers Code for Operation and Maintenance of Nuclear Power Plants," (ASME OM Code). ISTB-3510 (e), requires that the frequency response range of the vibration-measuring transducers and their readout shall be from one-third minimum pump shaft rotational speed to at least 1000 Hz.

The RCCPs are positive displacement pumps that operate at approximately 200 rpm, which equates to a rotational frequency of 3.41 Hz. The one-third minimum speed frequency response correlates to 1.13 Hz. The current instrument being used to measure frequency meets all of the ASME OM Code requirements down to 1.5 Hz, but does not meet the low end requirement of the one third minimum speed (1.13 Hz) requirement of ISTB-3510(e). In addition, vibrational calibration services utilized at St. Lucie cannot calibrate to less than 2 Hz using standards traceable to NIST. In Alternative Request PR-01, the licensee states that they are in the process of finding a qualified calibration supplier, but this process has not been completed and is not expected to be completed by the start of the Fifth 10-Year IST Interval.

In current Alternative Request PR-01, the September 25, 2008, approval of this same request for the current Fourth 10-year IST Interval is provided as the precedent. In the Alternative Request for the Fourth 10-year IST Interval, the December 7, 2000, approval of the same request for the Third 10-year IST Interval was provided as the precedent. Please provide a more specific time frame for finding a qualified calibration supplier.

**FPL Response**

After further review, FPL has determined that a success path for locating a qualified supplier capable of calibrating vibration monitoring instrumentation to 1.13 Hz, as required by ASME OM Code ISTB-3510(e) for the St. Lucie Charging Pumps, is not feasible. While the National Institute of Standards and Technology (NIST) is capable of providing a traceable calibration standard for frequencies as low as 1.0 Hz, NIST is not able to perform this calibration on the equipment used by FPL. The Computational Systems Inc. (CSI) vibration instrumentation is an industry standard utilized throughout the FPL fleet. FPL has not been able to locate a qualified vibrational calibration service capable of calibrating to less than 2 Hz using standards traceable to the NIST. The FPL Quality Assurance Program requires this instrumentation to be calibrated and traceable to NIST standards. As such, Relief Request PR-01 has been revised to reflect that the Charging Pump vibration monitoring equipment will calibrated to the lowest frequency capable of known calibration suppliers at this time, which is 2 Hz. The attachment to this enclosure provides revised Relief Request PR-01.

**Pump Relief Request - PR-01 (revised)**
**Charging Pump Vibration Frequency Response Range**
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Proposed Alternative in Accordance with 10 CFR 50.55a(z)(2)
Hardship or Unusual Difficulty without Compensating Increase in Level of Quality or Safety

## 1. ASME Code Component(s) Affected

| Pump | Description | Class | Category | Unit |
|---|---|---|---|---|
| CHG 1A | Reactor Coolant Charging Pump 1A | 2 | Group A | 1 |
| CHG 1B | Reactor Coolant Charging Pump 1B | 2 | Group A | 1 |
| CHG 1C | Reactor Coolant Charging Pump 1C | 2 | Group A | 1 |
| CHG 2A | Reactor Coolant Charging Pump 2A | 2 | Group A | 2 |
| CHG 2B | Reactor Coolant Charging Pump 2B | 2 | Group A | 2 |
| CHG 2C | Reactor Coolant Charging Pump 2C | 2 | Group A | 2 |

## 2. Applicable Code Edition and Addenda

ASME OM Code 2004 Edition through 2006 Addenda

## 3. Applicable Code Requirement

ISTB-3510(e), Frequency Response Range - 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 Hz.

## 4. Reason for Request

The Reactor Coolant Charging Pumps are positive displacement pumps that operate at approximately 205 rpm, which equates to a rotational frequency of 3.41 Hz. The one-third minimum speed frequency response required by ISTB-3510(e) for the vibration instrumentation correlates to 1.13 Hz (68 cpm).

These pumps are of a triplex reciprocating positive displacement design that are similarly designed and manufactured from two vendors. Unit 1 Charging Pumps are Type J-531 manufactured by Armco Steel Corporation and Unit 2 Charging Pumps are Model Number TX-125 manufactured by Union Pump Corporation.

The equipment currently being used to measure vibration at St. Lucie is the Computational Systems Inc. (CSI) model 2140 Machinery Health Analyzer with Emerson model A0760GP accelerometer probes. The CSI 2140 Machinery Analyzer response is flat to DC[(1)] for non-integrated and DC-coupled signals. The Emerson model A0760GP accelerometer probes meet the ASME Code ISTB-3510(a) accuracy range requirement of ± 5.0% (i.e. sensitivity) over its range from 0.5 to 10,000 Hz.

**Pump Relief Request - PR-01 (revised)**
**Charging Pump Vibration Frequency Response Range**


While NIST is capable of providing a traceable calibration standard for frequencies as low as 1.0 Hz, NIST is not able to perform this calibration on the equipment used by FPL. The CSI vibration instrumentation is an industry standard utilized throughout the FPL fleet. St. Lucie has not been able to locate a qualified provider of vibrational calibration services capable of calibrating to less than 2 Hz using standards traceable to NIST; meaning that the CSI-2140 and Emerson accelerometer cannot be calibrated to the required lower range. The FPL Quality Assurance Program requires this instrumentation to be calibrated and traceable to NIST standards.

Though the calibrated frequency response range of the Charging Pump vibration monitoring equipment does not meet the extreme low end of the readout requirements of ISTB-3510(e), the proposed range adequately envelops all potential noise contributors that could indicate degradation of the Charging Pumps. The instrumentation is fully qualified to measure all expected synchronous vibration levels. This is considered acceptable since there are virtually no mechanical degradation scenarios where only a sub-synchronous vibration component would develop on the Charging Pumps, thereby providing reasonable assurance that any Charging Pump degradation would not go undetected. The potential sub-synchronous and synchronous vibration components are evaluated as follows:

**a)** Oil whirl, which presents itself at frequencies below the rotational frequency of the pump (typically 0.38X - 0.48X, where X equals the rotational frequency of the pump) is not applicable to a horizontal, triplex, reciprocating pump.

**b)** A light rub / impact could generate a vibrational component at a frequency below the pump's rotational frequency (e.g. 0.5X or 102.5 cycles per minute), but can generate a harmonic vibrational component that would be integer and half-integer multiples of the running speed of the pump. For example, a light rub (vibrations occurring at 0.5X) could also produce a vibrational component that could be measured at integer multiples of the original frequency, i.e. 1X, 1.5X, 2X, etc., and would thus be identified in the calibrated range of the equipment.

**c)** A heavy rub generates increased integer values of multiple running speed components, as well as processing the 1X phase measurement. In either case the overall vibration level would still show an increase from both the attenuated sub-synchronous and 1X vibration components, as well as the higher harmonic vibration components.

**d)** Looseness in the power train would most likely be identified through the measurement of a vibrational component(s) found at frequencies which are multiples of the pumps rotational frequency. (i.e. 1X, 2X. etc.).

**Pump Relief Request - PR-01 (revised)**
**Charging Pump Vibration Frequency Response Range**


Relative to the Charging Pumps, the significant modes of vibration, with respect to equipment monitoring, are as follows:

1-Times Crankshaft Speed (1X) - An increase in vibration at this frequency may be an indication of rubbing between a single crankshaft cheek and rod end, or cavitation at a single valve, or coupling misalignment.

2-Times Crankshaft Speed (2X) - An increase in vibration at this frequency may be an indication of looseness at a single rod bearing or crosshead pin, a loose valve seat in the fluid cylinder, a loose plunger crosshead stub connection, or coupling misalignment.

Other Multiples of Shaft Speed - An increase in vibration at other frequencies may be an indication of cavitation at several valves, looseness at multiple locations, or bearing degradation.

Based upon the above information, there are no probable Charging Pump failure mechanisms that would be revealed by monitoring the vibration at frequencies below those related to the shaft speed (3.41 Hz). Thus, no useful information is obtained below this frequency and any indication of pump degradation will not be masked by instrumentation that is not calibrated below 2 Hz. Hence the use of Computational Systems Inc. (CSI) model 2140 Machinery Analyzer with Emerson model A0760GP accelerometer probes, or equivalent, calibrated within the frequency range of 2 to 1000 Hz will provide adequate information for evaluating Charging Pump condition and ensuring continued reliability with respect to the pumps' function. The lower calibration limit for the vibration monitoring equipment will not affect the ability to assess Charging Pump operational readiness since the pumps are not susceptible to degradation mechanisms that would only manifest themselves in the non-calibrated range (1.13 to 2 Hz) without also becoming prevalent in the monitored range (2 to 1000 Hz), and all other applicable OM Code vibration monitoring limits are being maintained. In addition, the St. Lucie Predictive Maintenance Group routinely performs spectral/waveform analysis of vibration data to ensure that no adverse trend toward mechanical degradation will go undetected. Accordingly, compliance with ISTB-3510(e) presents an unusual hardship or difficulty, due to the absence of a qualified calibration support service, without a compensating increase in the level of quality or safety.

## 5. Proposed Alternative and Basis for Use

The measurement of the vibration associated with the Reactor Coolant Charging Pumps 1A, 1B, 1C, 2A, 2B, and 2C will continue to be taken in accordance with the applicable portions of ISTB-3500 with the exception of the lower frequency response limit for the instrumentation (ISTB-3510(e)). In this case, the calibration for the vibration measuring equipment will be qualified to a minimum frequency of 2 Hz.

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**Charging Pump Vibration Frequency Response Range**
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## 6. Duration of Proposed Alternative

The proposed alternative will be utilized for the duration of the Fifth 10-Year IST Interval.

## 7. Precedents

1) NRC letter T. Boyce to J.A. Stall, St. Lucie Nuclear Plant, Units 1 and 2 - Safety Evaluation of Relief Requests for the Fourth 10-Year Pump and Valve Inservice Testing Program (TAC Nos. MD7741, MD7742, MD7743, MD7744, MD7745, MD7746, MD7747, MD7748, MD7749, MD7750, MD7751, and MD7752) September 25, 2008 (ADAMS Accession No. ML 082470089)

2) NRC letter I. Frankl to M. A. Schimmel, Monticello Nuclear Generating Plant - Relief from the Requirements of the American Society of Mechanical Engineers Code for Operation and Maintenance of Nuclear Power Plants for the Fifth 10-Year Inservice Testing Program Interval (TAC Nos. ME8067, ME8088, ME8089, ME8090, ME8091, ME8092, ME8093, ME8094, ME8095, and ME8096), September 26, 2012 (ADAMS Accession No. ML12244A272)

## 8. References

(1) DC - 'Direct Current', relates to the description of the CSI 2140 integrator frequency. When there is no vibration, there is no sinusoidal component to the generated electrical signal, which is what would be found with the measurement of direct current.