CP&L

Carolina Power & Light Company
PO Box 10429
Southport, NC 28461-0429

DEC 08 1997

SERIAL: BSEP 97-0504 10 CFR 50.55a(a)(3)(ii)

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

BRUNSWICK STEAM ELECTRIC PLANT, UNIT NOS. 1 AND 2
DOCKET NOS. 50-325 AND 50-324/LICENSE NOS. DPR-71 AND DPR-62
REQUEST FOR ALTERNATIVE TO ASME CODE, SECTION XI - PUMP VIBRATION MONITORING

Gentlemen:

In accordance with 10 CFR 50.55a(a)(3)(ii), Carolina Power & Light (CP&L) Company requests approval for the Brunswick Steam Electric Plant, Unit Nos. 1 and 2, to use an alternative to the vibration testing requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, and ASME/American National Standards Institute (ANSI) Operations and Maintenance Standards, Part 6 (ASME 1988a), "Inservice Testing of Pumps in Light-Water Reactor Power Plants." The bases for this request is enclosed. CP&L proposes to use the alternative vibration monitoring for the identified pumps for the remainder of the second 10-year inservice inspection interval, which will end on May 10, 1998.

Please refer any questions regarding this submittal to Mr. Warren J. Dorman, Supervisor - Licensing at (910) 457-2068.

Sincerely,

Dwin M. Berry for
Keith R. Jury

Keith R. Jury
Manager – Regulatory Affairs
Brunswick Steam Electric Plant

WRM/wrm 180020

A047

Enclosure:
Request For Alternative to ASME Code Section XI - Pump Vibration Monitoring

cc (with enclosure):

U. S. Nuclear Regulatory Commission, Region II
ATTN: Mr. Luis A. Reyes, Regional Administrator
Atlanta Federal Center
61 Forsyth Street, SW, Suite 23T85
Atlanta, GA 30303

U. S. Nuclear Regulatory Commission
ATTN: Mr. Charles A. Patterson, NRC Senior Resident Inspector
8470 River Road
Southport, NC 28461

U. S. Nuclear Regulatory Commission
ATTN: Mr. David C. Trimble, Jr. (Mail Stop OWFN 14H22)
11555 Rockville Pike
Rockville, MD 20852-2738

The Honorable Jo A. Sanford
Chairman - North Carolina Utilities Commission
PO Box 29510
Raleigh, NC 27626-0510

Division of Boiler and Pressure Vessel
North Carolina Department of Labor
ATTN: Mr. Jack Given, Assistant Director of Boiler & Pressure Vessels
4 West Edenton Street
Raleigh, NC 27601-1092

ENCLOSURE

BRUNSWICK STEAM ELECTRIC PLANT, UNIT NOS. 1 AND 2
DOCKET NOS. 50-325 AND 50-324/LICENSE NOS. DPR-71 AND DPR-62
REQUEST FOR ALTERNATIVE TO ASME CODE, SECTION XI -
PUMP VIBRATION MONITORING

Introduction

Technical Specification 4.0.5 for the Brunswick Steam Electric Plant (BSEP), Unit Nos. 1 and 2, requires that the inservice inspection and testing of American Society of Mechanical Engineers (ASME) Code Class 1, 2, and 3 components be performed in accordance with Section XI of the ASME Boiler and Pressure Vessel Code and applicable addenda as required by 10 CFR 50.55a(g), except where alternatives have been granted or relief has been granted by the NRC pursuant to 10 CFR 50.55a(a)(3)(i), 10 CFR 50.55a(a)(3)(ii), or 10 CFR 50.55a(f)(6)(ii). 10 CFR 50.55a(a)(3) allows alternatives to the requirements of paragraph (g) to be used, when authorized by the NRC, if (1) the proposed alternatives would provide an acceptable level of quality and safety, or (2) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

The 1989 Edition of the ASME Code, Section XI was incorporated by reference into 10 CFR 50.55a(b) by rulemaking that became effective September 8, 1992. The 1989 edition specifies that the rules for the inservice testing of pumps are stated in the ASME/American National Standards Institute (ANSI) Operations and Maintenance (OM) Standards, Part 6 (ASME 1988a), "Inservice Testing of Pumps in Light-Water Reactor Power Plants."

10 CFR 50.55a(f)(4)(iv) specifies that inservice tests of pumps and valves may meet the requirements in subsequent editions and addenda that are incorporated by reference in paragraph (b) of 10 CFR 50.55a, subject to the limitations and modifications listed in paragraph (b), and subject to NRC approval. Portions of editions or addenda may be used if all related requirements are met.

NRC guidance contained in Generic Letter 89-04, "Guidance on Developing Acceptable Inservice Testing Programs," provides alternatives to the ASME Code requirements determined to be acceptable to the NRC. Alternatives that conform with the guidance in Generic Letter 89-04 may be implemented without additional NRC approval, but are subject to review during inspections. Generic Letter 89-04, Supplement 1, and NUREG-1482, "Guidelines for Inservice Testing at Nuclear Power Plants," give further guidance.

In accordance with 10 CFR 50.55a(a)(3)(ii), Carolina Power & Light (CP&L) Company is requesting approval for implementing alternative monitoring requirements for vibration monitoring of the Standby Liquid Control system pumps, and the Conventional and Nuclear Service Water system pumps.

Component Identification:

Standby Liquid Control System Pumps:
1-SLC-P-1A and 1-SLC-P-1B
2-SLC-P-1A and 2-SLC-P-1B

Service Water System Pumps:
1-SW-C-P-1A, 1-SW-C-P-1B, 1-SW-C-P-1C, 1-SW-N-P-1A, and 1-SW-N-P-1B
2-SW-C-P-1A, 2-SW-C-P-1B, 2-SW-C-P-1C, 2-SW-N-P-1A, and 2-SW-N-P-1B

ASME Code, Section XI Requirement:

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 (Reference: OM Part 6, Paragraph 4.6.1.6).

Proposed Alternative:

Vibration levels of the Standby Liquid Control and Service Water system pumps will be measured in accordance with the applicable portions of OM Part 6, Paragraph 4.6, with the exception of the lower frequency response limit for the vibration measuring equipment (Paragraph 4.6.1.6). In this case, the lower response limit of the vibration measuring equipment will be 5 Hertz or less, based on the capability of the existing plant vibration measuring equipment, and the upper frequency response limit will be a minimum of 1000 Hertz.

Basis For Relief:

By letter dated January 4, 1990, the NRC approved the inservice testing program for the second 10-year interval. Technical Evaluation Report EGG-NTA-8420, "Technical Evaluation Report Pump and Valve Testing Program Brunswick Steam Electric Plant, Units 1 and 2," was included as part of the NRC safety evaluation accompanying the NRC approval. Section 3.1 of the Technical Evaluation Report, "Pump Bearing Temperature Measurement," discussed a relief request under which CP&L proposed to perform vibration monitoring for certain pumps rather than pump bearing temperature measurements required by the ASME Code, Section XI, Article IWP 3100. Among the pumps included in this relief request were the Standby Liquid Control system pumps, the Nuclear Service Water system pumps, and the Conventional Service Water system pumps. The NRC approved as alternate testing the performance of vibration testing on the pumps in accordance with OM Part 6.

Subsequently, by letter dated February 11, 1993, CP&L received NRC approval of another relief request pertaining to pump testing. CP&L proposed to perform vibration monitoring for certain pumps in accordance with OM Part 6 rather than vibration amplitude testing in accordance with the ASME Code, Section XI, Article IWP-4500. In this case, the NRC approved as alternate testing the performance of vibration testing on the pumps in accordance with OM Part 6, provided all portions of OM Part 6 related to vibration testing are met.

OM Part 6, Paragraph 4.6.1.6, 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. The basis for the alternative testing being proposed for the Standby Liquid Control system pumps and Service Water system pumps is described below.

Standby Liquid Control System Pumps:

The nominal shaft rotational speed of the Standby Liquid Control system pumps is 385 RPM, which is equivalent to approximately 6.40 Hertz. Based on this frequency and the methodology delineated in OM Part 6, Paragraph 4.6.1.6, the required frequency response range of instruments used for measuring pump vibration is 2.14 to 1000 Hertz. The instruments currently in use at BSEP (IRD Model 890 with #970 transducer) have a frequency response ranging from 5 to 1000 Hertz.

These pumps are of a simplified reciprocating (piston) positive displacement design with rolling element bearings (Model Number TD-60, manufactured by Union Pump Corporation). The requirement to measure vibration using instruments with a response range to 1/3 shaft speed stems from the need to detect oil whip or oil whirl associated with pump journal bearings. In the case of these pumps, there are no journal bearings to create these phenomena.

Compliance with the Code requirement would require procurement and calibration of instruments to cover this range to the lower extreme (i.e., 2.14 Hertz). Procurement and calibration of this equipment will be unusually difficult without a compensating increase in pump performance or plant safety. As noted in NUREG-1482, "Guidelines for Inservice Testing at Nuclear Power Plants," Appendix G, Comment 5.4-3, instruments that can read 2 Hertz may be available, but this frequency is less than what is traceable to the National Bureau of Standards for calibration. Even though the current equipment (i.e., IRD Model 890, with accelerometer) is not calibrated to monitor the low frequency required by OM Part 6, indication of pump degradation will not be masked by the existing instrumentation not being calibrated to collect data at sub-synchronous frequencies (i.e., less than 5 Hertz).

Satisfying the frequency response range criteria will not provide meaningful information to assess the condition of these pumps. The significant modes of vibration with respect to monitoring these pumps are as follows:

- 1-Times Crankshaft Speed - 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, hydraulic instability, or loose machine foot.

- 2-Times Crankshaft Speed - 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 indications of cavitation at several valves, looseness at multiple locations, bearing degradation, rubbing, impacting, or binding.

Based on the foregoing discussion, using current vibration measuring instruments with at least a frequency response range of 5 to 1000 Hertz will provide adequate information to evaluate pump condition and ensure continued reliability with respect to the pumps' function.

Service Water System Pumps:

The nominal shaft rotational speed of these pumps is 885 RPM which is equivalent to approximately 14.75 Hz. Based on this frequency and the methodology delineated in OM Part 6, Paragraph 4.6.1.6, the required frequency response range of instruments used for measuring pump vibration is 4.91 to 1000 Hertz. The instruments currently in use at BSEP (IRD Model 890 with #970 transducer) have a frequency response range of 5 to 1000 Hertz.

The requirement to measure vibration with instruments with response to 1/3 shaft speed stems from the need to detect oil whip or oil whirl associated with oil-lubricated journal bearings. Specifically, vibration peaks for oil whip typically occur at 40 percent to 48 percent of shaft speed. Since the existing instruments can measure vibration below 40 percent to 48 percent of shaft speed for these pumps (i.e., 5.9 to 7.1 Hertz), their use is consistent with the intent of the Code. Thus, using current vibration measuring instruments with at least a frequency response range of 5 to 1000 Hertz will provide adequate information to evaluate pump condition and ensure continued reliability with respect to the pumps' function.