September 12, 2006

MEMORANDUM TO: Arthur T. Howell, III, Director
Division of Reactor Projects
Region IV

FROM: Cornelius F. Holden, Deputy Director **/RA/**
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

SUBJECT: FINAL RESPONSE TO TASK INTERFACE AGREEMENT - TIA 2005-05, EVALUATION OF MAIN STEAM ISOLATION VALVE (MSIV) LOCAL LEAKAGE RATE TESTING (LLRT) AT COLUMBIA GENERATING STATION (TAC NO. MC7040)

During an inspection at Columbia Generating Station, the resident inspectors observed that Energy Northwest used the non-safety-related instrument air system during MSIV LLRT and that Energy Northwest's use of instrument air provided more valve seating pressure than would be available during a design-basis accident. The instrument air system provides about 108 pounds per square inch gauge (psig) to help seat the MSIVs, whereas the safety-related accumulators would provide only about 65 psig of seating pressure. Energy Northwest subsequently performed sensitivity testing and concluded that the difference in air pressure can have a non-conservative impact on the LLRT results. The regional inspectors found that performing Technical Specifications Surveillance Requirement (TSSR) 3.6.1.3.11 with the use of the instrument air system to close and seat the valves does not ensure that leakage past the MSIVs is less than or equal to the limit identified in Energy Northwest's design-basis accident analysis (11.5 standard cubic feet per hour (scfh) per valve). By letter dated May 3, 2005, Region IV submitted TIA 2005-05 requesting assistance from the Office of Nuclear Reactor Regulation (NRR) to determine:

1. Is Energy Northwest in compliance with TSSR 3.6.1.3.11, their primary containment leakage rate testing program, and Part 50 of Title 10 of the *Code of Federal Regulations* (10 CFR), Appendix J, with the use of the instrument air (containment air) MSIV LLRT?

2. Does TSSR 3.6.1.3.11 verify the lowest functional capability for the MSIV requirement of 10 CFR 50.36(c)(2) when the instrument air system is utilized to close and seat the valves for LLRT?

3. Is Energy Northwest's testing method adequate to ensure that 10 CFR Part 100 limits will not be exceeded during a design-basis accident?

4. What is the meaning of the term "normal operation" as used in Appendix J and related Nuclear Energy Institute documentation?

NRR's Division of Safety Systems, Containment and Ventilation Branch, and Division of Component Integrity, Component Performance and Testing Branch have completed their assessment of the above technical issues. The staff's assessment is attached.

Docket No. 50-397

Attachment: As stated

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STAFF ASSESSMENT BY THE OFFICE OF NUCLEAR REACTOR REGULATION

FOR TASK INTERFACE AGREEMENT (TIA) 2005-05

EVALUATION OF MAIN STEAM ISOLATION VALVE LOCAL LEAKAGE RATE TESTING

AT COLUMBIA GENERATING STATION

DOCKET NO. 50-397

1.0 INTRODUCTION

By letter dated May 3, 2005, Region IV submitted TIA 2005-05 requesting assistance from the Office of Nuclear Reactor Regulation (NRR) in evaluating the local leakage rate testing (LLRT) of the main steam isolation valves (MSIVs) at Columbia Generating Station (Columbia). In particular, Region IV requested responses to four questions:

1. Is Energy Northwest in compliance with Technical Specifications Surveillance Requirement (TSSR) 3.6.1.3.11, their primary containment leakage rate testing program, and Part 50 of Title 10 of the *Code of Federal Regulations* (10 CFR), Appendix J, with the use of the instrument air (containment air) for MSIV LLRT?

2. Does TSSR 3.6.1.3.11 verify the lowest functional capability for the MSIV requirement of 10 CFR 50.36(c)(2) when the instrument air system is utilized to close and seat the valves for LLRT?

3. Is Energy Northwest's testing method adequate to ensure that 10 CFR Part 100 limits will not be exceeded during a design-basis accident (DBA)?

4. What is the meaning of the term "normal operation" as used in Appendix J and related Nuclear Energy Institute (NEI) documentation?

2.0 BACKGROUND

During an inspection at Columbia, the resident inspectors observed that Energy Northwest used the non-safety-related instrument air system during MSIV LLRT and that Energy Northwest's use of instrument air provided more valve seating pressure than would be available during a DBA. The instrument air system provides about 108 pounds per square inch gauge (psig) to help seat the MSIVs, whereas the safety-related accumulators would provide only about 65 psig of seating pressure. Energy Northwest subsequently performed sensitivity testing and concluded that the difference in air pressure can have a significant, non-conservative impact on the LLRT results. The regional inspectors found that performing TSSR 3.6.1.3.11 with the use of the instrument air system to close and seat the valves does not ensure that leakage past the MSIVs is less than or equal to the limit identified in Energy Northwest's DBA analysis (11.5 standard cubic feet per hour (scfh) per valve).

3.0 DISCUSSION

Valve Operation

Boiling-water reactor MSIVs are containment isolation valves and must meet the requirements of Appendix J to 10 CFR Part 50, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors." At Columbia, the MSIVs are typical air-and-spring-operated valves. The valves use a non-safety-related compressed air supply (e.g., instrument air) to open (opening is a non-safety function) and air and springs to close (the safety function). In the event of an accident, a valve on the actuator opens to vent the instrument air maintaining the MSIV open, and a second valve on the actuator opens to admit air to close the MSIV. The source of air for closing the MSIVs (together with the springs) in the event of an accident will be the non-safety air supply, if it is available. If the non-safety air is not available (e.g., as a result of a seismic event), the MSIV actuators are supplied with safety-related air accumulators for accident mitigation. The accumulators initially start at the non-safety-related air system pressure (i.e., 108 psig at Columbia) and depressurize to a lower pressure (i.e., between 55 and 65 psig at Columbia) during the closing stroke. The accumulators' air helps to seat the valves during the initial part of the accident, but the accumulators will eventually depressurize to ambient conditions.

Non-safety-related air system compressors are non-seismic and powered from a non-safety-related source and are not credited (are assumed lost) for all DBAs.

Requirements

Appendix J, Option A states, in part:

> Each valve to be tested shall be closed by **normal operation** and without any preliminary exercising or adjustments (e.g., no tightening of the valve after closure by valve motor). [emphasis added]

For an Appendix J, Option B plant, the following equivalent passage from American National Standards Institute (ANSI)/American Nuclear Society (ANS)-56.8-1994 applies:

> Closure of primary containment isolation valves for Type C testing shall be accomplished by **normal or equivalent means** and without adjustment (e.g., no hand tightening of remotely operated valves after closure). Exercising valves for the purpose of improving leakage performance shall not be permitted. [emphasis added]

As set forth in Technical Specification (TS) 5.5.12, Appendix J, Option B requirements apply to Columbia.

Most plant valves are either motor-operated or simple air-operated valves (spring to close/instrument air to open - closing being the safety direction). For these valves, the closure methods and seating forces under accident and non-accident conditions are essentially the same. While motor-operated valves may be tested with offsite power available, offsite power is not a superior power source when compared to the sites' safety-related emergency diesel

generators. For simple air-operated valves, the springs alone work to close the valves under accident and non-accident conditions. Therefore, for motor-operated and simple air-operated valves, closure under non-accident conditions reasonably duplicates valve closure under accident conditions.

Unique MSIV Design

MSIV design is unique, compared to that of other containment isolation valves. The MSIVs have the unique design feature of safety-related air accumulators to assist in closing the valves under accident conditions. Of the valves subject to LLRT at Columbia, the MSIVs are the only valves with safety-related air accumulators.

Interpretation of "Normal Operation"

There have been varied opinions as to the correct interpretation of "normal operation" or "normal means." The licensee states that the non-safety-related air system is the normal means of closing the MSIVs. The licensee stated that non-safety-related air would normally be available when the licensee closes the valves during normal plant operations. While non-safety-related air would normally be available, the normal method for closing the MSIVs during normal operations is with springs only (slow closure, no instrument air or accumulator air). The licensee normally slow closes the valves to prevent damaging the valves. Testing the MSIVs by closing them with the springs could result in the MSIV's failure to satisfy the LLRT in most, if not all cases.

The Final Safety Analysis Report (FSAR) states in Section 5.4.5.4, "Inspection and Testing" that "all MSIVs are closed utilizing both spring force and air pressure on the operating cylinder." This section, however, does not indicate the source of the air pressure. If the non-safety air supply is available in the event of a DBA, it will provide air to close the MSIVs. While there is no assurance that the non-safety air supply will be available during a DBA, its availability likewise cannot be ruled out, even during or after a seismic event. Under such circumstances, the term “normal or equivalent means” could reasonably be understood to include the non-safety air supply. To require otherwise would be to rewrite ANSI/ANS-56.8-1994 (and 10 CFR Part 50, Appendix J) to require “safety-related” or “design basis” means for closing MSIVs for LLRT purposes.

Guidance on Similar Matters

The generic instructions were intended to dissuade licensees from taking advantage of inappropriate non-credited valve closure/seating techniques to artificially enhance valve test results. The licensee's use of the non-safety-related air system during these tests could have a similar effect on the results as the tightening of a valve after closure with a valve motor, which is specifically cited as a prohibited practice.

Moreover, the U.S. Nuclear Regulatory Commission (NRC) has previously addressed a similar issue in NRC Information Notice 85-84, "Inadequate Inservice Testing of Main Steam Isolation Valves," dated October 30, 1985. The information notice states, in part:

> The practice of performing inservice testing of components, which are relied on to mitigate the consequences of accidents, with sources of power not considered in the safety analyses is not in keeping with the objective of periodic testing. This objective is to test equipment to verify operational readiness under conditions that reasonably duplicate the design basis.

While the staff believes that the above should apply generically to all inservice testing, and LLRT is a type of inservice test, the specific issue addressed by the information notice involved ASME Code-required testing (versus LLRT).

While the licensee's MSIV LLRT methods meet the requirements in 10 CFR Part 50, Appendix J, they are inconsistent with the general guidance provided in NRC Information Notice 85-84, in that the licensee performs the testing with a source of power (instrument air) that was not considered in the safety analyses. The licensee's test conditions do not conservatively represent design-basis conditions.

Compliance with 10 CFR 50.36

The Commission's regulation in 10 CFR § 50.36(c)(3) requires that TSs include surveillance requirements (SR), which are requirements relating to test, calibration, or inspection to assure, among other things, that the limiting conditions of operation (LCOs) will be met. A question has been raised regarding whether there is any violation of 10 CFR § 50.36(c)(2) with respect to the lowest functional capability or performance level of the MSIVs. However, there does not appear to be any defect in the MSIV LCO itself. Rather, the SR associated with the LCO does not appear to be sufficient to assure that the LCO will be met.

Effect on Leakage Rate

Lower air pressure means less force to push the valve closed and hold it closed. The current testing could underestimate the accident leakage rate and could falsely indicate an operable containment, when in fact, the containment leakage rate during an accident might be greater than considered in the accident analysis.

Answers to Specific Region IV Questions

1. Is Energy Northwest in compliance with TSSR 3.6.1.3.11, their primary containment leakage rate testing program, and 10 CFR Part 50, Appendix J, with the use of the instrument air (containment air) system for MSIV LLRT?

   Answer: Yes. The FSAR states in Section 5.4.5.4, "Inspection and Testing," that "all MSIVs are closed utilizing both spring force and air pressure on the operating cylinder." The term "normal or equivalent means" can reasonably be interpreted to include the non-safety air supply.

2. Does TSSR 3.6.1.3.11 verify the lowest functional capability for the MSIV requirement of 10 CFR 50.36(c)(2) when the instrument air system is utilized to close and seat the valves for LLRT?

Answer: Use of the non-safety air supply system to close the MSIVs, during the performance of SR 3.6.1.3.11, may not alone directly assure that the associated LCO will be met during accident conditions. However, such testing is not a violation of 10 CFR § 50.36(c)(2), wherein surveillance tests attempt to approximate accident conditions, and many tests are modified to take this into account.

3. Is Energy Northwest's testing method adequate to ensure that 10 CFR Part 100 limits will not be exceeded during a DBA?

   Answer: The purpose of the test is not to specifically confirm that Part 100 limits are met. There are significant conservatisms in the dose calculations associated with Part 100, including the 11.5 scfh per MSIV. The method of testing does not and cannot exactly mimic DBA conditions (e.g., pressurizing between the valves at a pressure less than P_a, absence of steam assistance to close valves, cold piping, likelihood that instrument air is available), but it provides useful information about the functionality of the valves, and the testing meets regulations.

4. What is the meaning of the term "normal operation" as used in Appendix J and related NEI documentation?

   Answer: This is answered in detail above.

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