



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

May 28, 2014

Mr. Adam C. Heflin
President, Chief Executive Officer,
and Chief Nuclear Officer
Wolf Creek Nuclear Operating Corporation
Post Office Box 411
Burlington, KS 66839

SUBJECT: WOLF CREEK GENERATING STATION – INTERPRETATION OF TECHNICAL SPECIFICATION SURVEILLANCE REQUIREMENT 3.7.11.1, “VERIFY EACH CRACS TRAIN HAS THE CAPABILITY TO REMOVE THE ASSUMED HEAT LOAD” (TAC NO. MF3665)

Dear Mr. Heflin:

By letter dated March 21, 2014 (Agencywide Document Access and Management System (ADAMS) Accession No. ML14091A244), Wolf Creek Nuclear Operating Corporation (WCNOC, the licensee) requested the U.S. Nuclear Regulatory Commission (NRC) staff’s interpretation of the licensee’s position regarding the intent of the Technical Specification (TS) Surveillance Requirement (SR) 3.7.11.1, “Verify Each CRACS Train Has the Capability to Remove the Assumed Heat Load.” Your letter stated, in part, that

The intent of the SR is met by verifying the heat removal capability of the condenser heat exchanger (either through performance testing or inspection), ensuring the proper operation of major components in the refrigeration cycle, verification of unit air flow capacity, and water flow measurement.

WCNOC considers this position on SR 3.7.11.1 to be consistent with the Wolf Creek Generating Station (WCGS) licensing basis.

The NRC staff concluded that your implementation of SR 3.7.11.1 meets the intent of the SR. The staff’s conclusion was provided to your staff in an email dated April 9, 2014 (ADAMS Accession No. ML14099A369). Enclosed is the NRC staff’s evaluation of your position regarding the intent of SR 3.7.11.1, as requested in your letter dated March 21, 2014.

The NRC staff notes that your request for TS interpretation was untimely, since it was made a year and a half after you became aware of the issue during an NRC inspection, and less than 2 months before expiration of SR 3.0.3. The NRC staff considers that timely requests help ensure sufficient time is available for staff review and contribute toward the NRC’s goal of efficient and effective use of NRC staff resources.

A. Heflin

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If you have any questions, please contact me at 301-415-2296 or via e-mail at
fred.lyon@nrc.gov.

Sincerely,

CFlyon

Carl F. Lyon, Project Manager
Plant Licensing Branch IV-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-482

Enclosure
Evaluation of TS Interpretation

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
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EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

TECHNICAL SPECIFICATION INTERPRETATION

SURVEILLANCE REQUIREMENT 3.7.11.1

WOLF CREEK NUCLEAR OPERATING CORPORATION

WOLF CREEK GENERATING STATION

DOCKET NO. 50-482

1.0 INTRODUCTION

By letter dated March 21, 2014 (Agencywide Document Access and Management System (ADAMS) Accession No. ML14091A244), Wolf Creek Nuclear Operating Corporation (WCNOC, the licensee) requested the U.S. Nuclear Regulatory Commission (NRC) staff's interpretation of the licensee's position regarding the intent of the Technical Specification (TS) Surveillance Requirement (SR) 3.7.11.1. The licensee stated that it based its request on the guidance in NRC Information Notice 97-80, "Licensee Technical Specification Interpretations," dated November 21, 1997 (ADAMS Accession No. ML031050052), as supported by NRC Inspection Manual, Part 9900: Technical Guidance, Chapter STSINTR, "Licensee Technical Specification Interpretations." SR 3.7.11.1 states,

Verify each CRACS [control room air conditioning system] train has the capability to remove the assumed heat load.

The licensee's letter stated, in part, that

The intent of the SR is met by verifying the heat removal capability of the condenser heat exchanger (either through performance testing or inspection), ensuring the proper operation of major components in the refrigeration cycle, verification of unit air flow capacity, and water flow measurement.

WCNOC considers this position on SR 3.7.11.1 to be consistent with the Wolf Creek Generating Station (WCGS) licensing basis.

In its letter dated March 21, 2014, the licensee stated, in part, that

WCNOC, in conjunction with industry experts, developed a new test method to measure the capability to remove the assumed heat load. Based on recent testing of the WCGS CRACS trains, it is unlikely that the test method developed

Enclosure

will produce repeatable, valid results for the reason that the CRACS operates with a heat load that is much less than design limiting conditions during normal operation. WCNOC has determined that a heat transfer test that performs an actual measurement of the CRACS trains capability to remove the assumed heat load under design conditions is impractical.

The licensee's position is that the intent of the SR can be met by verifying the heat removal capability of the condenser heat exchanger through performance testing or inspection, ensuring the proper operation of major components in the refrigeration cycle, verification of unit air flow capacity, and Essential Service Water (ESW) flow measurement. The licensee provided the plant procedures used to implement the SR.

2.0 REGULATORY EVALUATION

Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.36(c)(2)(ii)(C), "Criterion 3," requires, in part, that a TS limiting condition for operation (LCO) must be established for a component that is part of the primary success path and which functions or actuates to mitigate a design basis accident or transient that either assumes the failure of or presents a challenge to the integrity of a fission product barrier. As described in the WCGS TS Bases, Section B 3.7.11, and the Updated Safety Analysis Report (USAR) Section 9.4.1, "Control Building HVAC [heating, ventilation, and air conditioning]," the CRACS satisfies Criterion 3. Accordingly, WCGS TS 3.7.11, "Control Room Air Conditioning System (CRACS)," contains an LCO for the CRACS.

The regulations in 10 CFR 50.36(c)(3), "Surveillance requirements," state that SRs are requirements relating to test, calibration, or inspection to assure that the necessary quality of systems and components is maintained, that facility operation will be within safety limits, and that the LCOs will be met. Accordingly, TS 3.7.11 contains SR 3.7.11.1 to verify that the LCO will be met.

As recognized in 10 CFR 50.109(a)(7) (addressing "Backfitting"), if there are two or more ways to achieve compliance with a license, then ordinarily the applicant or licensee is free to choose the way which best suits its purposes.

NRC Inspection Manual Chapter (IMC) 0326, "Operability Determinations & Functionality Assessments for Conditions Adverse to Quality or Safety," contains guidance to NRC inspectors to assist their review of licensee determinations of operability and resolution of degraded or nonconforming conditions. Section 04.03, "Presumption of Operability," states, in part, that

The TSs are organized and implemented on the presumption that systems are operable. Without information to the contrary, it is reasonable to assume that once a system or component is established as operable it will remain operable. The previous verification of operability (e.g., surveillance, or operability determination) provides that assurance.

Section 03.09, "Reasonable Expectation," contains a discussion of the level of assurance of operability a particular verification may provide. The verification of operability must meet the high standard of "reasonable expectation"; however, "reasonable expectation" does not mean

absolute assurance that the SSCs (structures, systems, or components) are operable. Section 03.09 states, in part, that

The discovery of a degraded or nonconforming condition may call the operability of one or more SSCs into question. A subsequent determination of operability should be based on the licensee's "reasonable expectation," from the evidence collected, that the SSCs are operable and that the operability determination will support that expectation. Reasonable expectation does not mean absolute assurance that the SSCs are operable. The SSCs may be considered operable when there is evidence that the possibility of failure of an SSC has increased, but not to the point of eroding confidence in the reasonable expectation that the SSC remains operable. The supporting basis for the reasonable expectation of SSC operability should provide a high degree of confidence that the SSCs remain operable.

Therefore, an SR is met when implemented in a manner that provides a reasonable expectation, or a high degree of confidence, that the SSC is operable. An SR is not meant to provide absolute assurance that the SSC is operable.

3.0 TECHNICAL EVALUATION

As discussed in the TS Bases, the CRACS must be capable of removing the heat load assumed in the safety analysis, which is in the USAR. The purpose of SR 3.7.11.1 is to verify that the CRACS has the capability to perform its safety function. As discussed below, the staff concluded that the procedures the licensee uses to implement SR 3.7.11.1 provide reasonable assurance that the CRACS is operable. Therefore, the procedures are acceptable in meeting the intent of the SR.

As stated in the licensee's letter,

Updated Safety Analysis Report (USAR) Section 9.4.1.1 specifies that the CRACS provides the control room with a conditioned atmosphere during all modes of plant operation, including post-accident operation (General Design Criteria - 19). The CRACS operates in a continuous recirculation mode to maintain the control room temperature. The amount of cooling provided by the self-contained refrigeration system is self-regulating and, therefore, automatically compensates for changes in the control room heat load, including latent load due to presence of moisture.

Calculation GK-M-001, Rev. 3, "Cooling and Heating Load Calculation for Control Room HVAC System Capabilities During Normal Plant Operation and Accident Conditions — (SGK04A/B)," calculates the minimum required cooling coil (evaporator) capacity for accident conditions to be 463,087 BTU/hr...The manufacturer of the installed equipment used a total cooling coil load design input of 493,700 BTU/hr (M-622.1A-VDS-1.03 Revision W02, "SGK04A/B Cooling Coil and Compressor Data Sheet") to size the equipment. This input is conservatively 30,613 Btu/hr greater than the minimum required.

The condenser heat exchanger is manufactured to reject the assumed accident cooling coil load of 493,700 BTU/hr plus compressor work input at design limiting conditions...the SGK04A/B condensers are capable of removing the required heat from the refrigerant to maintain the overall total cooling capacity for the SGK04A/B units, based on available margin.

Therefore, SGK04A/B were designed to remove a heat load greater than that assumed in the safety analysis.

At WCGS, the licensee uses four test procedures to implement SR 3.7.11.1. Procedure STS GK-002A/B is an operability test which runs each train of the air conditioning and ventilation system for 4 consecutive hours. Procedure STS PE-010A/B measures the air flow across the evaporator. Procedure STS MT-072/073 requires cleaning and inspection of the air conditioning condenser tubes. This third procedure was also credited to satisfy the heat exchanger reliability program guidance of NRC Generic Letter (GL) 89-13, "Service Water System Problems Affecting Safety-Related Equipment," dated July 18, 1989 (ADAMS Accession No. ML031150348), for the control room air conditioning units. Procedure STN PE-037A/B measures ESW train heat exchanger flow and differential pressure. The NRC staff also reviewed the licensee's most recent performance data from procedure STS GK-002A and the applicable system operator log sheets from procedure CKL ZL-001.

As stated in the licensee's request for TS interpretation,

SGK04A/B utilize direct-expansion refrigerant coils to cool the air as opposed to a chilled water system used in some plants that do have test procedures for CRACS. To achieve testing similar to what has been done by other utilities on chilled water systems, air-side data points would have to be collected including inlet and outlet temperature and humidity. This data is achievable, but will have very high individual parameter uncertainty due to high bias measurement uncertainty, which significantly increases the overall test uncertainty. This occurs because the flow distribution across air coils is never completely uniform, creating large temperature gradients across the coil face. In addition, compressor work would have to be determined and subtracted from the condenser heat load to properly credit total system heat removal. If the design condition could be accurately modeled, the uncertainty involved with each value would produce significant error upon extrapolation to design conditions.

The SGK04A/B condenser heat exchangers are dependent on the efficiency of the refrigeration cycle, which is directly dependent on the cycle's ability to reject heat through the condenser, which is dependent on the service water flow and temperature. Subjecting the unit to limiting conditions [for testing would] provide an accurate measurement of the heat load removal capabilities of the entire system. However, duplicating design conditions is not practical.

The industry and NRC have previously recognized the impracticality of conducting a heat transfer test on condenser heat exchangers that are dependent on the refrigeration cycle, due to the phase changes of the refrigerant that occur in the cycle. Electric Power Research Institute (EPRI) topical report TR-107397, "Service Water Heat Exchanger [SWHX] Testing Guidelines,"

March 1998 (available at <http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=TR-107397>), Chapter 2, "Test Methods," describe a variety of testing and monitoring methods used in the nuclear industry to evaluate the thermal performance of SWHXs, including,

- Functional test method
- Heat transfer test method
- Temperature effectiveness test method
- Temperature difference monitoring method
- Pressure loss monitoring method
- Visual inspection monitoring method

As discussed in the licensee's request, the applicability sections for each test method discussed in Chapter 2 of EPRI TR-107397 describe that only the pressure loss monitoring method and visual inspection monitoring method are practical for SGK04A/B. As summarized by the licensee,

...a Functional Test is not possible because the limiting conditions cannot be achieved for test conditions. A Heat Transfer Test has been found not to be accurate because when data is extrapolated to design conditions instrument uncertainty becomes large, accident flow/temperature conditions are not achievable and phase changes that occur throughout the cycle require extensive modeling that is based on assumptions that may be inaccurate during test conditions. A Temperature Effectiveness Test is not applicable because mass flow rates must closely approximate limiting condition, which is not possible given the load variance of the refrigeration cycle. The Temperature Difference Monitoring method is not applicable because it cannot be used for situations involving phase change such as condensation, which is present across both the shell and tube side of the evaporator.

In GL 89-13, Supplement 1, the NRC staff provided guidance applicable to the situation with SGK04A/B and similar heat exchangers in Enclosure 1, Question III.A.6:

Recommended Action II requires that "the relevant temperatures should be verified to be within design limits." Also, Enclosure 2, Item II.A states, "Perform functional testing with the heat exchanger operating, if practical, at its design heat removal rate to verify its capabilities. Temperature and flow compensation should be made in the calculations to adjust the results to the design conditions."

It is not practical to test the heat exchangers at design heat removal rates. Also, we are unable to find a method which has the requisite level of precision to adjust the test results to design conditions.

Please discuss an acceptable method to adjust the test results to the design conditions. Also provide the scientific bases, or a reference, for the proposed method.

Also, the heat removal test cannot be performed on the containment spray heat exchangers because there is no heat source. The only test that can be performed is a pressure drop test. Is this acceptable? If not, what is recommended? (Indiana and Michigan Power)

Answer

As mentioned previously, the NRC does not have a recommended test method. See the answer to the previous question. With regard to the testing of containment spray heat exchangers, as of all safety-related heat exchangers, a pressure drop test alone is not sufficient to satisfy the indicated heat transfer capability concerns. *If it is not practicable to test a heat exchanger, then the licensee or applicant may propose a program of periodic inspection, maintenance, and cleaning as an alternative.* We are aware, however, of one licensee who was able to test the containment spray heat exchanger by heating the refueling water storage tank water approximately 10 F and then performing temperature monitoring tests as well as pressure drop tests. [Emphasis added.]

Therefore, both the industry and NRC staff have long recognized the impracticality of heat transfer testing on some heat exchanger designs and allowed for acceptable alternatives. The alternative testing and monitoring implemented by the licensee to do the SR provides reasonable assurance that SGK04A/B will continue to perform as designed. Since the SGK04A/B design capacity is greater than the heat load assumed in the safety analysis, the NRC staff concludes that the procedures implemented by the licensee to do the SR demonstrate that there is reasonable assurance that the CRACS will continue to perform its safety function and, therefore, meet the intent of the SR to verify that each CRACS train has the capability to remove the assumed heat load.

4.0 CONCLUSION

As discussed in the licensee's request for TS interpretation, the procedures implement heat exchanger inspection and cleaning, verify proper operation of the major components in the refrigeration cycle, verify unit air flow capacity, and measure ESW system flow rate. The licensee's procedures provide an acceptable alternative to a heat transfer test, which is impractical to perform, on SGK04A/B. The NRC staff concluded that the licensee's procedures implementing the SR provide reasonable assurance that the CRACS is operable. Therefore, based upon the information provided by the licensee and the staff's position provided in GL 89-13, Supplement 1, the NRC staff concludes that the implementing procedures used by the licensee meet the intent of SR 3.7.11.1.

Principal Contributors: M. Hamm, NRR/DSS/STSB
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Date: May 28, 2014

A. Heflin

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If you have any questions, please contact me at 301-415-2296 or via e-mail at
fred.lyon@nrc.gov.

Sincerely,

/RA/

Carl F. Lyon, Project Manager
Plant Licensing Branch IV-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-482

Enclosure
Evaluation of TS Interpretation

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*email dated April 9, 2014

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