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

May 28, 2014

Mr. Fadi Diya
Senior Vice President and
Chief Nuclear Officer
Union Electric Company
P.O. Box 620
Fulton, MO 65251

SUBJECT: CALLAWAY PLANT, UNIT 1 – 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. MF3695)

Dear Mr. Diya:

By letter dated March 26, 2014 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML14108A325), Union Electric Company (dba Ameren Missouri, 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

> SR 3.7.11.1 requires verification that each Control Room Air Conditioning System (CRACS) train has the capability to remove the assumed heat load. At Callaway Plant, this Surveillance Requirement is satisfied 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 and verification of unit air flow capacity.

Ameren Missouri considers this position on SR 3.7.11.1 to be consistent with the Callaway Plant 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 26, 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.

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. 50-483

Enclosure:
Evaluation of TS Interpretation

cc w/encl: Distribution via Listserv

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

EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

TECHNICAL SPECIFICATION INTERPRETATION

SURVEILLANCE REQUIREMENT 3.7.11.1

UNION ELECTRIC COMPANY

CALLAWAY PLANT, UNIT 1

DOCKET NO. 50-483

1.0 INTRODUCTION

By letter dated March 26, 2014 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML14108A325), Union Electric Company (dba Ameren Missouri, 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

> SR 3.7.11.1 requires verification that each Control Room Air Conditioning System (CRACS) train has the capability to remove the assumed heat load. At Callaway Plant, this Surveillance Requirement is satisfied 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 and verification of unit air flow capacity.
>
> Ameren Missouri considers this position on SR 3.7.11.1 to be consistent with the Callaway Plant licensing basis.

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 meet the SR.

2.0 REGULATORY EVALUATION

Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, paragraph 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 Callaway Plant TS Bases, Section B 3.7.11, and the Final Safety Analysis Report (FSAR) Section 9.4.1, "Control Building HVAC [heating, ventilation, and air conditioning]," the CRACS satisfies Criterion 3. Accordingly, Callaway Plant 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," states 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 FSAR. 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,

> FSAR 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 Criterion 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.
>
> Using an assumption that minimum required cooling coil (evaporator) capacity for accident conditions was 432,851 BTU/hr...The manufacturer of the installed equipment used a total cooling coil load design input of 493,700 BTU/hr to size the equipment. This input is conservatively 60,849 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 Callaway Plant, the licensee uses four procedures to implement SR 3.7.11.1. Procedure ESP-GK-0004A/B, "Condenser Inspection for SGK04A/B," is an inspection to check for blocked and plugged heat exchanger tubes inside control room air conditioning units SGK04A and SGK04B. Procedure ESP-EF-0002A/B, "Essential Service Water Train A/B Flow Verification,"

is a test for adequate flow through the essential service water system, which cools the control room air conditioners. Procedure ETP-ZZ-03001, "GL 89-13 Heat Exchanger Inspection," directs the cleaning and inspection of heat exchanger tubes (as referenced in EDP-ZZ-01112, "Heat Exchanger Predictive Performance Manual"). This procedure is intended to satisfy the heat exchanger reliability program requirements of NRC Generic Letter (GL) 89-13, "Service Water System Problems Affecting Safety-Related Equipment," dated July 18, 1989 (ADAMS Accession No. ML031150348). Procedure MSE-GK-0004A/B, "Refrigeration Cycle and Air Flow for SGK04A/B," is an operability test for SGK04A and SGK04B compressors, control circuits, evaporator coils, and fans. The NRC staff also reviewed the licensee's most recent performance of procedures ETP-ZZ-03001 and MSE-GK-0004A.

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
A. Sallman, NRR/DSS/SCVB
F. Lyon, NRR/DORL/LPL4-1

Date: May 28, 2014

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. 50-483

Enclosure:
Evaluation of TS Interpretation

cc w/encl: Distribution via Listserv

DISTRIBUTION:

PUBLIC	RidsNrrDssScvb Resource	RidsRgn4MailCenter Resource
LPL4-1 Reading	RidsNrrDssStsb Resource	MHamm, NRR/DSS/STSB
RidsAcrsAcnw_MailCTR Resource	RidsNrrLAJBurkhardt Resource	ASallman, NRR/DSS/SCVB
RidsNrrDorlLpl4-1 Resource	RidsNrrPMCallaway Resource	

ADAMS Accession No.: ML14105A369 *email dated April 9, 2014

OFFICE	NRR/DORL/LPL4-1/PM	NRR/DORL/LPL4-1/LA	NRR/DSS/STSB/BC*	NRR/DSS/SCVB/BC
NAME	FLyon	JBurkhardt	RElliott	RDennig
DATE	4/16/14	4/16/14	4/9/14	4/18/14
OFFICE	OGC	NRR/DORL/LPL4-1/BC	NRR/DORL/LPL4-1/PM	
NAME	not required	MMarkley	FLyon	
DATE		5/27/14	5/28/14	

OFFICIAL RECORD COPY