February 27, 2020

Mr. Cleveland Reasoner
Chief Executive Officer and
Chief Nuclear Officer
Wolf Creek Nuclear Operating Corporation
P.O. Box 411
Burlington, KS 66839

SUBJECT: WOLF CREEK GENERATING STATION, UNIT 1 - ISSUANCE OF AMENDMENT NO. 224 REGARDING: REVISION TO TECHNICAL SPECIFICATION 3.3.5, "LOSS OF POWER (LOP) DIESEL GENERATOR (DG) START INSTRUMENTATION" (EPID L-2019-LLA-0062)

Dear Mr. Reasoner:

The U.S. Nuclear Regulatory Commission (the Commission) has issued the enclosed Amendment No. 224 to Renewed Facility Operating License No. NPF-42 for the Wolf Creek Generating Station, Unit 1. The amendment consists of changes to the technical specifications (TSs) in response to your application dated March 18, 2019 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19086A111), as supplemented by letters dated August 22, 2019; September 10, 2019; November 13, 2019; and December 9, 2019 (ADAMS Accession Nos. ML19239A112, ML19260D630, ML19326A162 and ML19351C750, respectively).

The amendment revises Surveillance Requirement 3.3.5.3 in TS 3.3.5, "Loss of Power (LOP) Diesel Generator (DG) Start Instrumentation," regarding the degraded voltage and loss of voltage relays' Allowable Values, nominal Trip Setpoints, and time delays based on analysis utilizing the guidance in Regulatory Issue Summary 2011-12, Revision 1, "Adequacy of Station Electrical Distribution System Voltages," dated December 29, 2011 (ADAMS Accession No. ML113050583).

A copy of the related Safety Evaluation is enclosed. Notice of Issuance will be included in the Commission's biweekly *Federal Register* notice.

Sincerely,

Balwant K Singal

Balwant K. Singal, Senior Project Manager
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-482

Enclosures:
1. Amendment No. 224 to NPF-42
2. Safety Evaluation

cc: Listserv

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

WOLF CREEK NUCLEAR OPERATING CORPORATION

WOLF CREEK GENERATING STATION, UNIT 1

DOCKET NO. 50-482

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 224
Renewed License No. NPF-42

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment to the Wolf Creek Generating Station, Unit 1 (the facility) Renewed Facility Operating License No. NPF-42 filed by the Wolf Creek Nuclear Operating Corporation (the Corporation), dated March 18, 2019, as supplemented by letters dated August 22, 2019; September 10, 2019; November 13, 2019; and December 9, 2019, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, as amended, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this license amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment and paragraph 2.C.(2) of Renewed Facility Operating License No. NPF-42 is hereby amended to read as follows:

    (2) Technical Specifications and Environmental Protection Plan

    The Technical Specifications contained in Appendix A, as revised through Amendment No. 224, and the Environmental Protection Plan contained in Appendix B, both of which are attached hereto, are hereby incorporated in the license. The Corporation shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. The license amendment is effective as of its date of issuance and shall be implemented prior to startup from the next refueling outage or forced outage of sufficient duration from the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Jennifer L. Dixon-Herrity, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Renewed Facility
Operating License and
Technical Specifications

Date of Issuance: February 27, 2020

ATTACHMENT TO LICENSE AMENDMENT NO. 224 TO

RENEWED FACILITY OPERATING LICENSE NO. NPF-42

WOLF CREEK GENERATING STATION, UNIT 1

DOCKET NO. 50-482

Replace the following pages of the Renewed Facility Operating License No. NPF-42 and Appendix A Technical Specification with the attached revised pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

Renewed Facility Operating License

REMOVE	INSERT
4	4

Technical Specifications

REMOVE	INSERT
3.3-44	3.3-44

(5) The Operating Corporation, pursuant to the Act and 10 CFR Parts 30, 40 and 70, to receive, possess, and use in amounts as required any byproduct, source or special nuclear material without restriction to chemical or physical form, for sample analysis or instrument calibration or associated with radioactive apparatus or components; and

(6) The Operating Corporation, pursuant to the Act and 10 CFR Parts 30, 40 and 70, to possess, but not separate, such byproduct and special nuclear materials as may be produced by the operation of the facility.

C. This renewed operating license shall be deemed to contain and is subject to the conditions specified in the Commission's regulations in 10 CFR Chapter I and is subject to all applicable provisions of the Act and to the rules, regulations, and orders of the Commission, now or hereafter in effect; and is subject to the additional conditions specified or incorporated below:

(1) Maximum Power Level

The Operating Corporation is authorized to operate the facility at reactor core power levels not in excess of 3565 megawatts thermal (100% power) in accordance with the conditions specified herein.

(2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A, as revised through Amendment No. 224, and the Environmental Protection Plan contained in Appendix B, both of which are attached hereto, are hereby incorporated in the license. The Corporation shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

(3) Antitrust Conditions

Kansas Gas & Electric Company and Kansas City Power & Light Company shall comply with the antitrust conditions delineated in Appendix C to this license.

(4) Environmental Qualification (Section 3.11, SSER #4, Section 3.11, SSER #5)*

Deleted per Amendment No. 141.

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*The parenthetical notation following the title of many license conditions denotes the section of the supporting Safety Evaluation Report and/or its supplements wherein the license condition is discussed.

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.3.5.1	Not Used.	
SR 3.3.5.2	------------------------------NOTE------------------------------ Verification of time delays is not required. -- Perform TADOT.	 31 days
SR 3.3.5.3	Perform CHANNEL CALIBRATION with nominal Trip Setpoint and Allowable Value as follows: a. Loss of voltage Allowable Value ≥ 90.0V, 120V bus with a time delay of 1.0 + 0.15, -0.1 sec. Loss of voltage nominal Trip Setpoint 91.28V, 120V bus with a time delay of 1.0 sec. b. Degraded voltage Allowable Value ≥ 107.5V, 120V bus. 1. Accident time delay (SIS) 8.0 + 0.5, -0.6 sec. 2. Non-accident time delay (No SIS) 56 + 8.5, -7.6 sec. Degraded voltage nominal Trip Setpoint 108.46V, 120V bus.	18 months
SR 3.3.5.4	Verify LOP DG Start ESF RESPONSE TIMES are within limits.	18 months on a STAGGERED TEST BASIS

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 224 TO

RENEWED FACILITY OPERATING LICENSE NO. NPF-42

WOLF CREEK NUCLEAR OPERATING CORPORATION

WOLF CREEK GENERATING STATION, UNIT 1

DOCKET NO. 50-482

1.0 INTRODUCTION

By application dated March 18, 2019 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19086A111), as supplemented by letters dated August 22, 2019; September 10, 2019; November 13, 2019; and December 9, 2019 (ADAMS Accession Nos. ML19239A112, ML19260D630, ML19326A162 and ML19351C750, respectively), Wolf Creek Nuclear Operating Corporation (WCNOC, the licensee) requested changes to the technical specifications (TSs) for Wolf Creek Generating Station, Unit 1 (Wolf Creek).

The proposed changes would revise Surveillance Requirement (SR) 3.3.5.3 in TS 3.3.5, "Loss of Power (LOP) Diesel Generator (DG) Start Instrumentation," regarding the degraded voltage (DV) and loss of voltage (LOV) relays' Allowable Values (AVs), nominal Trip Setpoints, and time delays based on the analysis utilizing the guidance in Regulatory Issue Summary (RIS) 2011-12, Revision 1, "Adequacy of Station Electrical Distribution System Voltages," dated December 29, 2011 (ADAMS Accession No. ML113050583), and Nuclear Energy Institute (NEI) guidance document NEI 15-01, Revision 1, "An Analytical Approach for Establishing Degraded Voltage Relay (DVR) Settings," dated November 2015 (ADAMS Accession No. ML18024A960).

The U.S. Nuclear Regulatory Commission (NRC or the Commission) staff conducted a regulatory audit of the calculations prepared/revised in support of the proposed change, via an internet-based portal, to verify the information provided by the licensee in its application. The audit summary documenting the audit activities, list of calculations reviewed during the audit, and results of the audit are documented in an NRC staff letter dated December 6, 2019 (ADAMS Accession No. ML19330F863).

The supplemental letters dated August 22, 2019; September 10, 2019; November 13, 2019; and December 9, 2019, provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the NRC staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on May 21, 2019 (84 FR 23079).

2.0 REGULATORY EVALUATION

2.1 System Description

The DV relay dropout setpoint is set to ensure that the Class 1E 4.16 kilovolt (kV) NB01 and NB02 buses are separated from the offsite power prior to potential damage to safety-related motors or trips of such motors on overcurrent due to DV of offsite power.

The LOV relay dropout setpoint is set to ensure that the Class 1E 4.16 kV NB01 and NB02 buses are separated from offsite power due to very low voltage or loss of offsite power, which can cause immediate stalling of the safety-related motors. The loads are then transferred to the associated onsite DGs.

The design of the DV and LOV protection schemes include appropriate time delays to trip the offsite power in the event the condition does not recover to an acceptable level within the allotted timeframe. The time delays are intended to minimize undesirable operation of the onsite power sources (DGs) and separation of the offsite power supply. Thus, time delays are incorporated to ride through the DV and LOV transient conditions.

In Section 2.1, "System Design and Operation," of the licensee's application, dated March 18, 2019, the licensee stated, in part:

> The onsite [electrical] distribution system is divided into redundant load groups (trains) so that the loss of any one group does not prevent the minimum safety functions from being performed. Each train has connections to its preferred offsite power source and a single diesel generator (DG). Power is supplied to loads at 13.8kV [volt], 4.16kV, 480V, 480/277V, 208/120V, 120 VAC [volts alternating current], 250 VDC [volt direct current], and 125 VDC. The Class 1E AC [Alternating Current] System loads are separated into two load groups that are powered from separate engineered safety features (ESF) transformers. Each load group has power distributed by a 4.16 kV bus (NB01 or NB02), 480V load centers, and 480V motor control centers (MCCs). Each load group is independently capable of safely bringing the plant to a cold shutdown condition, as the Class 1E electrical power distribution system is designed to satisfy the single-failure criterion. ...
>
> The DGs provide a source of emergency power when offsite [power/voltage] is either unavailable or is insufficiently stable to allow safe unit operation. Upon recognition of an LOV or DV [condition] on a 4.16kV Class 1E bus, a logic signal is initiated to affect the following on each load group:
>
> a. Shed selected loads
> b. Send signal to start the DG
> c. Trip 4.16 kV incoming preferred power [offsite] supply breakers
>
> Two [undervoltage] sensing schemes are employed on each 4.16kV Class 1E bus [NB01, NB02] to initiate the required logic signal. One scheme recognizes an LOV, and the other recognizes a degraded voltage [condition]. Four potential transformers (PTs) (42000V:120V or 35:1) on each bus provide the necessary

> input voltages to the [undervoltage relays and other devices] necessary to achieve the above protection.
>
> In order to recognize an LOV [condition], four time-delayed undervoltage relays (127-1, 2, 3, 4/DG) are used. The output contacts of these relays are directed to logic circuits that process the four undervoltage input circuits into the 2-out-of-4 logic circuit. This scheme is used on each bus. The LOV logic signal is set below the minimum bus voltage encountered during DG sequential loading.

In its letter dated September 10, 2019, in response to Request for Additional Information (RAI) No. 1, the licensee explained that even after the proposed change to raise the LOV setpoint, the proposed LOV logic signal setting will remain below the minimum transient bus voltage encountered during DG sequential loading. As stated in its letter dated March 18, 2019, a brief time delay (approximately 1 second) is employed to prevent false trips arising from transient undervoltage (spike) conditions.

In Section 2.1 of its license amendment request (LAR)[1] dated March 18, 2019, the license further stated:

> In order to recognize a DV [condition], a diverse protection scheme is used. Four PTs provide input to four DV bistables [relays] with associated time delays for each 4.16kV Class 1E system bus for detecting a sustained DV condition. The four PTs each provide an analog output signal of 0-120 volts corresponding to 0-4200 volts on the primary. This signal is directed to logic circuits and processors that convert the analog signals into a 2-out-of-4 logic signal, whenever the signal drops below a preset value. This scheme serves only to trip the incoming offsite power circuit breakers when that power source has been determined to be degraded. This design cannot adversely affect the sequential loading of the diesel generators. The DV logic signal is set at the minimum permissible continuous bus voltage. A time delay is provided that prevents damage to or spurious tripping of the permanently connected Class 1E loads by limiting the amount of time they are exposed to a degraded voltage. The final voltage and time setpoints were determined based on an analysis of the auxiliary power distribution system, including the Class 1E buses at all voltage levels. The use of a Safety Injection Signal (SIS) contact in series with the DV logic circuit output contact ensures that the Class 1E buses are separated from the offsite power system [after a nominal time delay of 8 seconds] whenever an accident occurs and the offsite power system is not able to accept the loads continuously. If an SIS were to occur concurrently with or after the arming of the tripping circuitry, the bus [incoming] feeder breaker would open, a bus undervoltage would be sensed, and a loss of power signal would be generated. Should the DV condition occur in a non-accident condition (no SIS present), with the current time delay setting applied, an additional 111 seconds time delay is provided. These time delays are specific to the feeder breakers (2 per bus) [one normal and one alternate]. If the DV condition is not alleviated in the overall 119 seconds [8 seconds plus 111 seconds nominal delay], the bus feeder breaker is tripped. An alarm is also provided to alert the operator to a DV condition. It is delayed until any motor starting induced voltage transient bus has had sufficient time to clear.

[1] WCNOC letter dated March 18, 2019, thereafter referred to as LAR.

2.2 Proposed Technical Specification Changes.

SR 3.3.5.3 will be revised to change DV and LOV relays' AVs, nominal trip setpoints, and time delays.

The current SR 3.3.5.3 states:

Perform CHANNEL CALIBRATION with nominal Trip Setpoint and Allowable Value as follows:

a. Loss of voltage Allowable Value ≥ [greater than or equal to] 82.5V, 120V bus with a time delay of 1.0 + 0.2, -0.5 sec [seconds].

   Loss of voltage nominal Trip Setpoint 83V, 120V bus with a time delay of 1.0 sec.

b. Degraded voltage Allowable Value ≥ 105.9V, 120V bus with a time delay of 119 ± 11.6 sec.

   Degraded voltage nominal Trip Setpoint 106.9V, 120V bus with a time delay of 119 sec.

Revised SR 3.3.5.3 would state:

Perform CHANNEL CALIBRATION with nominal Trip Setpoint and Allowable Value as follows [**changes are in bold**]:

a. Loss of voltage Allowable Value **≥ 90.0V**, 120V bus with a time delay of 1.0 **+ 0.15, -0.1 sec.**

   Loss of voltage nominal Trip Setpoint **91.28V**, 120V bus with a time delay of 1.0 sec.

b. Degraded voltage Allowable Value **≥ 107.5V**, 120V bus.

   1. **Accident time delay (SIS) 8.0 + 0.5, -0.6 sec.**
   2. **Non-accident time delay (No SIS) 56 + 8.5, -7.6 sec.**

   Degraded voltage nominal Trip Setpoint **108.46V, 120V bus.**

In the LAR, the licensee stated that the current TS value of 119 seconds encompasses both the DV time delay with an SIS present (8 seconds) and with no SIS present (111 seconds). The NRC staff noted that the licensee has proposed to revise SR 3.3.5.3.b, which retains the time delay of 8 seconds with an SIS present, but would change the time delay with no SIS present from 119 seconds to 56 seconds.

In its letter dated November 13, 2019, the licensee clarified that the SIS time delay associated with DV relay is internal to the load shedder and emergency load sequencer (LSELS) rack and was chosen to be a nominal 8 seconds. This time delay was chosen such that large motor starts (and voltage dips) would not falsely arm the DV circuitry; would ensure buses are not falsely tripped; and nuisance alarms are not received in the control room on large motor starts. Based on the calculations performed by the licensee, Class 1E motors fed from the safety-related 4.16 kV buses can start in 4 seconds or less to avoid overlapping the load sequencer 5-second step times. Therefore, the time delay with SIS (nominal 8 seconds) internal to the LSELS was chosen by the licensee to be slightly longer than the maximum Class 1E motor starting time to ensure the system is not falsely challenged.

Also, in its letter dated November 13, 2019, the licensee also clarified that the current second time delay (No SIS was chosen to be 111 seconds to allow an additional period for an operator to restore bus voltage prior to tripping the bus feeder breaker(s) and transferring loads to the DG. However, the licensee later determined that 111 seconds would not be enough time to perform the required manual action, and therefore, the non-accident time delay was reduced from 111 seconds to 48 seconds to ensure that the normally running safety-related equipment is not subjected to sustained DV conditions with no SIS, which could cause degrading or tripping of the equipment. The nominal 48-second time delay for the second timer was selected to ensure no safety-related load already running would be tripped by its overcurrent protective device.

Based on its calculations discussed in Section 3.3.2 of this SE, the licensee determined that the minimum time delay was dictated by the startup time of a nonsafety reactor coolant pump (RCP) motor, which was determined to be the longest startup time in the system (31 seconds with 80 percent voltage at the RCP motor terminals). Adding additional margins, tolerances and drift, the licensee has proposed nominal 56 seconds as the nominal time delay for the DVR with no SIS.

2.3 Regulatory Requirements and Guidance

2.3.1 Regulatory Requirements

Under Title 10 *Code of Federal Regulations* (10 CFR) 50.90, whenever a holder of a license wishes to amend the license, including technical specifications in the license, an application for amendment must be filed, fully describing the changes desired. Under 10 CFR 50.92(a), determinations on whether to grant an applied-for license amendment are to be guided by the considerations that govern the issuance of initial licenses to the extent applicable and appropriate. Both the common standards for licenses in 10 CFR 50.40(a), and those specifically for issuance of operating licenses in 10 CFR 50.57(a)(3), provide that there must be 'reasonable assurance' that the activities at issue will not endanger the health and safety of the public.

The NRC staff identified the following regulatory requirements as applicable in its review of this LAR:

The regulations at 10 CFR 50.36, "Technical specifications," requires, in part, that TSs shall be included by applicants for a license authorizing operation of a production or utilization facility. The regulations under 10 CFR 50.36(c) require that TSs include items in five specific categories related to station operation. These categories are (1) safety limits (SLs), limiting safety system settings, and limiting control settings; (2) limiting conditions for operation (LCOs); (3) SRs; (4) design features; and (5) administrative controls. The proposed changes in this LAR relate to the SR category. The regulation under 10 CFR 50.36(c)(3) states that "Surveillance requirements 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 limiting conditions for operation will be met."

The regulation at 10 CFR 50.36(c)(1)(ii)(A) states, in part, "Where a limiting safety system setting is specified for a variable on which a safety limit has been placed, the setting must be so chosen that automatic protective action will correct the abnormal situation before a safety limit is exceeded. If, during operation, it is determined that the automatic safety system does not function as required, the licensee shall take appropriate action, which may include shutting down the reactor."

The regulation at 10 CFR Part 50, Appendix A, "General Design Criterion for Nuclear Power Plants," General Design Criterion (GDC) 13, "Instrumentation and control," states in part, that:

> Instrumentation shall be provided to monitor variables and systems over their anticipated ranges for normal operation, for anticipated operational occurrences, and for accident conditions as appropriate to assure adequate safety, including those variables and systems that can affect the fission process, the integrity of the reactor core, the reactor coolant pressure boundary, and the containment and its associated systems. Appropriate controls shall be provided to maintain these variables and systems within prescribed operating ranges.

The regulation at 10 CFR Part 50, Appendix A, GDC 17, "Electric power systems," states in part, that nuclear power plants have onsite and offsite electric power systems "to permit [the] functioning of structures, systems, and components [(SSC)] that are important to safety. The safety function for each system (assuming the other system is not functioning) shall be to provide sufficient capacity and capability to assure that (1) specified acceptable fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded as a result of anticipated operational occurrences and (2) the core is cooled, and containment integrity and other vital functions are maintained in the event of postulated accidents." To permit the functioning of the SSC, the power from offsite and onsite power sources must be adequate in terms of voltage and frequency. Typically, the frequency from the power sources practically remains constant (varies insignificantly). Therefore, the safety-related loads required to perform under anticipated operational occurrences and postulated accidents must have adequate voltages to perform their required function.

The Wolf Creek Updated Safety Analysis Report (USAR), Revision 32, Section 3.1, "Conformance with NRC General Design Criteria" (ADAMS Accession No. ML19092A069), discusses the extent to which the design criteria for safety-related plant SSCs comply with 10 CFR Part 50, Appendix A, GDC 13 and GDC 17.

2.3.2 Regulatory Guidance Documents

The NRC staff considered the following guidance documents in its review of this LAR:

NUREG-0800, Standard Review Plan, Chapter 8, Branch Technical Position (BTP) 8-6, "Adequacy of Station Electric Distribution System Voltages," Revision 3, dated March 2007 (ADAMS Accession No. ML070710478) (similar to the previous BTP PSB-1, Revision 2, dated July 1981 (ADAMS Accession No. ML052350520)). This BTP states, in part, that "The technical specifications should include limiting conditions for operations, surveillance requirements, trip setpoints, and maximum and minimum allowable values for the first level of undervoltage protection (LOOP [loss of offsite power]) relays and the second-level (degraded voltage) protection sensors and associated time delay devices."

Regulatory Guide (RG) 1.105, Revision 3, "Setpoints for Safety-Related Instrumentation," dated December 1999 (ADAMS Accession No. ML993560062) describes a method acceptable to the NRC staff for complying with the NRC's regulations for ensuring that setpoints for safety-related instrumentation are initially within and remain within the TS limits. The RG 1.105, Revision 3 endorses Part I of Instrument Society of America (ISA) Standard 67.04-1994, "Setpoints for Nuclear Safety-Related Instrumentation." The NRC staff used this guide to verify the adequacy of the licensee's setpoint calculation methodologies and the related plant surveillance procedures.

RIS 2011-12, Revision 1, clarifies voltage studies necessary for degraded voltage relay (second level undervoltage protection) setting bases and transmission network/offsite/station electric power system design bases for meeting the regulatory requirements specified in GDC 17 to 10 CFR Part 50, Appendix A. To meet the intent of RIS 2011-12, Revision 1, the licensee used the guidance provided in NEI 15-01, Revision 1, for calculating the DV and LOV relays settings.

RIS 2006-17, "NRC Staff Position on The Requirements of 10 CFR 50.36, 'Technical Specifications,' Regarding Limiting Safety System Settings During Periodic Testing and Calibration of Instrument Channels," dated August 24, 2006 (ADAMS Accession No. ML051810077). This RIS provides clarification of the definitions of AVs, nominal trip setpoints, and limiting trip setpoints, as well as methods acceptable for establishing and verifying "as-found" trip setpoints during periodic surveillances to be within the acceptance band limits.

For the purposes of evaluating the proposed change, the NRC staff finds that Annexure A of the Institute of Electrical and Electronics Engineers (IEEE) Std. 741-2017, "IEEE Standard for Criteria for the Protection of Class 1E Power Systems and Equipment in Nuclear Power Generating Stations" is, in general, consistent with NEI guidance document NEI 15-01, Revision 1; and that the use of both IEEE Std. 741-2017, Annexure A, and NEI 15-01, Revision 1, is acceptable.

3.0 TECHNICAL EVALUATION

3.1 Reason for the Proposed Changes

In Attachment I to the LAR, the licensee stated that the "Component Design Bases Inspection Report 05000482/2016007," dated June 10, 2016 (ADAMS Accession No. ML16162A105), included Non-Cited Violation (NCV) 05000482/2016007-01, "Inadequate Degraded Voltage Analyses of Class 1E Systems." The inspection report stated that in 2011, the NRC issued RIS 2011-12, Revision 1 to clarify voltage studies necessary for determining the proper settings for DV relays. RIS 2011-12 provided the NRC staff's position for the licensee's transmission network/offsite power system design to meet the requirements of GDC 17. The NRC inspection team identified five examples of performance deficiencies in the electrical calculations that contributed to the failure to verify and assure adequate voltages to safety-related equipment during a DV condition and/or design basis event with offsite power available in accordance with the guidelines in RIS 2011-12. The NCV stated, in part, as follows:

> Enforcement. The team identified a Green, non-cited violation of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," which states, in part, "design control measures shall provide for verifying or checking the adequacy of design, such as by the performance of design reviews, by the use of alternate or simplified calculational methods, or by the performance of a suitable testing

> program." Contrary to the above, the licensee failed to provide for verifying or checking the adequacy of design, such as by the performance of design reviews, by the use of alternate or simplified calculational methods, or by the performance of a suitable testing program. Specifically, prior to April 28, 2016, the licensee failed to verify the adequacy of the design of the Class 1E electrical equipment, because it failed to perform adequate analyses demonstrating 1) that the degraded voltage relay setpoints specified in technical specifications would ensure adequate voltage to safety-related equipment, 2) adequate voltage would be available to the safety-related loads during transient voltage conditions caused by load sequencing, and 3) that the degraded voltage relay-associated time delays provide timely separation from offsite power and transfer to the emergency diesel generator to ensure that the Class 1E safety-related loads can achieve their safety function without protective device tripping. In response to these issues, the licensee performed preliminary analyses to demonstrate that the Class 1E electrical equipment would function at degraded voltages and was operable.

The licensee also stated that in response to the NCV, WCNOC has completed analyses based on the guidance in RIS 2011-12, Revision 1, and NEI 15-01, Revision 1 to demonstrate the adequacy of the Wolf Creek electrical system. The licensee performed a review of the current licensing basis calculation of record and determined that the existing SR 3.3.5.3 AVs, nominal trip setpoints, and time delays are acceptable and that the Class 1E electrical equipment is operable. However, WCNOC determined that current licensing basis values do not provide sufficient margin for long-term operation and the existing calculation of record does not incorporate the guidance in RIS 2011-12, Revision 1.

In its letter dated November 13, 2019, in response to RAI No. 4, the licensee provided a summary of a calculation/analysis (Calculation No. XX-E-041, Revision 00, "Degraded Voltage Relays Interim Analysis") based on current TS settings to confirm that the current licensing basis does provide operational voltage margins; however, the licensee also concluded there is no margin for any additional load growth.

The licensee performed detailed analyses/calculations to demonstrate the adequacy of the Wolf Creek electrical distribution system performance, in accordance with the guidance provided in NEI 15-01, Revision 1 and IEEE Std. 741-2017; thereby, meeting the intent of RIS 2011-12, Revision 1, and the requirements of GDC 17 to ensure adequate voltage to the safety-related equipment. These analyses include evaluations of load performances during steady-state conditions as well as transient (motor starting) conditions. The analyses also establish that during a sustained DV condition, the undervoltage protection scheme settings are such that no required safety-related loads will stall or trip and lock-out, and thereby, be unable to be reconnected immediately to the onsite power supply when required.

In the LAR (including supplements), the licensee described the following analyses/calculations performed to determine the voltage and time settings of DV and LOV relays.

3.2 Analyses to Determine Analytic Limits of DV and LOV Relays

In accordance with the guidance in NEI 15-01, Revision 1, the licensee performed the following five analyses. The NRC staff performed an audit of these five analyses (related calculations) as discussed in the audit summary report dated December 6, 2019.

3.2.1 Analysis to Establish DV Relay Dropout (Minimum) Voltage Limit

In the licensee's analysis, the licensee determined minimum steady-state voltage at the DV relay monitored bus to ensure operating (running) voltages are adequate for the Class 1E loads required to support postulated design basis accidents and anticipated operational occurrences.

The licensee performed the analysis with a fixed voltage source connected to the DV relay monitored bus. The fixed voltage source was adjusted to establish the DV relay dropout setting SL, so that the operating (running) voltages of required Class 1E loads met the following acceptance criteria:

- The operating or running voltages of the required Class 1E loads must be ≥ 90 percent of rated voltage, and

- Class 1E MCC voltages for the 460 V loads must be ≥ 423.2 V (92 percent of 460 V).

To meet the above acceptance criteria, the licensee determined that a minimum required voltage of 3756.8 V (3756.8/4160 V = 90.3 percent) will be required at the DV relay monitored buses (NB01 and NB02). The licensee considered this voltage as the lower analytical limit, or as the safety limit of DV relay.

Based on the above analytical voltage (3756.8 V) at 4160 V buses NB01 and NB02, the licensee determined that all downstream equipment will have adequate steady-state (running) voltages. However, the following equipment will have running terminal voltages slightly less than the required voltage (less than (<) 90 percent of rated):

a. Inverter NN011 - 89.11 percent
b. Inverter NN012 - 89.91 percent
c. Inverter NN013 - 89.87 percent
d. Inverter NN014 - 89.26 percent

In its letter dated September 10, 2019, in response to RAI No. 5, the licensee stated that the NN Inverters contain ferroresonant transformer-based voltage regulating devices intended for use in uninterruptible power systems (UPS) or in stand-alone applications. These transformer-based power supplies are based on non-linear magnetic properties and a resonant circuit to provide a stable output voltage over a wide range of input voltage and load current variations. The voltage regulating transformer is not modeled in the load flow studies. However, based on a review of test data on the regulating units of the above listed NN inverters, the licensee stated that the output of the NN inverters will be no less than 98 percent (of 120 VAC) at a power factor of 0.86 or higher when the input voltage drops to 89 percent of rated input voltage. Since, the output voltages of the NN inverters will remain above 98 percent, adequate voltage will be available to 120 V equipment fed from the inverters. Based on the above information, the NRC staff finds the proposed analytical voltage (3756.8 V) at the DV relay monitored buses (NB01 and NB02) reasonable, and therefore acceptable.

During its review, the NRC staff performed an audit (audit report dated December 6, 2019) of the licensee's Calculation XX-E-009-001-CN006, "System NB, NG, PG Undervoltage/Degraded Voltage," to verify the information provided in the LAR and its supplements. During the audit, the NRC staff verified that the minimum dropout voltage of 3756.8 V (lower analytical voltage limit of DV relay) at the DV relay monitored bus would ensure that Class 1E loads have adequate operating (running) voltages to meet their design requirements. The NRC staff verified that the analysis performed by the licensee to establish the DV Relay Dropout (Minimum) Voltage Limit is in accordance with NEI 15-01, Section 2.1, "Establish DVR Dropout Setting," and IEEE Std. 741-2017.

3.2.2 Analysis to Confirm Adequacy of DV Relay Dropout Setting for Motor Starting

In its analysis, the licensee demonstrated that the Class 1E motors required for postulated design basis accidents or anticipated operational occurrences are capable of being started individually when the voltage at the DV relay monitored bus is at the DV relay dropout limit (lower analytical limit). The licensee performed the analysis using the motor starting analysis with a voltage source set to the lower analytical limit for the DV relay dropout setting. The worst system loading condition (that is, the highest loading on the Class 1E distribution system) was used to envelope the postulated accident and operating scenarios that manifest the most severe voltage drop. The licensee performed the following steps to verify the adequacy of the DV relay dropout setting for motor starting, and to ensure the motor starting terminal voltage is equal to or greater than the minimum design starting voltage:

- The fixed voltage source was set at a voltage of 3756.8 V (as determined by the analysis described in Section 3.2.1 above) on the Class 1E 4.16 kV NB buses.

- Each individual motor load was turned off and then restarted to obtain the motor starting voltage. The motor starting simulation was performed by the Electrical Power System Analysis Software (ETAP).

In its letter dated September 10, 2019, in response to RAI No. 6, the licensee stated that ETAP provides two methods for motor starting: (1) Dynamic Motor Acceleration and (2) Static Motor Starting. In general, the licensee used Static Motor Starting method to confirm the adequacy of the DV relay dropout setting. This method calculates the starting voltage for the motors and does not require detailed motor data for dynamic simulation. The NRC staff finds this method conservative as it uses a fixed locked rotor current during the full motor acceleration period. The purpose of this analysis was to demonstrate that each Class 1E motor required for the postulated design basis accidents or anticipated operational occurrences has adequate voltage to start individually when the voltage at the DV relay monitored bus is at the DV relay dropout setting (lower analytical limit). Based on the analysis performed, the licensee determined that the Class 1E 4.16 kV and 480 V motors would have adequate terminal voltage for any requisite motor start.

During its review, the NRC staff performed an audit of the licensee's Calculation XX-E-009-001-CN006 to verify the information provided in the LAR and its supplements. During the audit, the NRC staff verified that the Class 1E 4.16 kV and 480 V motors will have adequate terminal voltages for requisite starts. The NRC staff finds that the analytic technique adopted by the licensee is in accordance with NEI 15-01, Section 2.2, "Confirm Adequacy of DVR Dropout Setting for Motor Starting," and IEEE Std. 741-2017.

3.2.3 Analysis to Establish DV Relay Time Delay (with Accident Signal)

In its analysis, the licensee demonstrated that the Class 1E loads required for postulated design basis accidents (including control equipment) would successfully auto-transfer (not trip and lockout out on overload current) to the onsite power supply (i.e., the DGs) if the DV relay monitored bus experiences a DV condition. An upper analytical limit of the DV relay time delay was used to ensure accident analyses (core cooling) timing requirements are not exceeded.

This analysis shows that coordination exists between the DV relay time and the timing of equipment overcurrent protective devices.

The licensee performed the following analysis regarding the performance of the overcurrent devices for the Class 1E loads required for postulated design basis accidents considering starting current drawn at the lowest rated starting voltage of the motor. The NRC staff considers the approach to be conservative since the motors are capable of starting at their lowest starting voltage, which is considerably less than the DVR drop out voltage:

- For the Class 1E 4000 V motors that are started during a design basis accident, the motor starting current was compared using the time-current coordination (TCC) curve of motor overcurrent relay to verify that the overcurrent relay would not trip in 9.5 seconds. The motor overcurrent relay should not trip during a concurrent loss-of-coolant accident (LOCA) and DV condition. Based on its "System NB, Relay Setting" calculation, the licensee considered the acceptance criteria for the overcurrent relay trip time as ≥ 9.5 seconds, which bounds the proposed range of the DV relay timer of ≥ 7.4 seconds and less than or equal to (≤) 8.5 seconds.

- The Class 1E 460 V motors that are powered from the 480 V load centers are protected by General Electric or Square D Solid State Trip units. This motor starting current was then compared against the TCC curve of the trip unit to verify the trip unit would not trip in 8.5 seconds.

- Some Class 1E 460 V motors powered from the 480 V MCCs are protected by molded case circuit breakers (MCCBs). Some MCCBs have both thermal and magnetic settings, although most MCCBs have only a magnetic (an instantaneous) setting. The licensee stated that the magnetic and thermal settings are such that the MCCBs would not trip during motor starting.

- Some Class 1E 460 V motors powered from the 480 V MCCs are protected by thermal overload (TOL) relays. A TOL relay containing a heater element when subject to heating by overcurrent can result in tripping of the relay within a certain time. The TOL relay heater size must be capable of withstanding the total heat that occurs during the proposed maximum 8.5-second DV time and if required during the subsequent restart time of the DG without tripping.

From the above analysis, the NRC staff finds that most critical cases are those of Class 1E 460 V motors powered from the 480 V MCCs protected by TOL relays, since the TOL relays are subject to cumulative heating when fed from an offsite source and any subsequent start from the DG. In Attachment I to the LAR, the licensee stated that to evaluate the performance of a TOL relay during the 8.5-second DV condition concurrent with LOCA, the motor starting current that correlates to its starting voltage was calculated, and this motor starting current was then compared against the TCC curves of the TOLs to obtain the trip time. The fastest operating trip time from the TCC curve was used for this analysis. The performance of the TOL was then evaluated during the subsequent start from the DG.

In Attachment I to the LAR, the licensee stated that the analysis, which was based on NEI 15-01 methodology, showed that the overcurrent devices met the acceptance criteria (no tripping during starting of a load) except for 30 TOLs (the number of TOLs was later clarified in the letter dated November 13, 2019). For these 30 TOLs, an enhanced overcurrent evaluation was performed. The NEI 15-01 methodology conservatively assumes that the motors continue to draw a starting current until the DV relay times out (8.5 seconds). The enhanced TOL evaluation determined the motor starting voltage at the LOV relay lower analytical limit, which is the lowest DV that can occur without tripping the LOV relays. The motor starting current and acceleration time is then calculated. After the motor reaches rated speed, the running current is determined. Thus, during the concurrent DV condition and LOCA, the TOL heating is calculated for motor starting current only during the acceleration period and for the running current for the remainder of the 8.5 second DV condition.

In its letter dated September 10, 2019, in response to RAI No. 6, the licensee stated that an ETAP Dynamic Motor Acceleration analysis was performed as part of enhanced overcurrent evaluation for 30 TOLs (the number of TOLs was later clarified in the letter dated November 13, 2019). In its letter dated September 10, 2019, in response to RAI No. 7, the licensee also stated that the worst case TOL relay heaters with the lowest margin were determined to be associated with 460 V motors of emergency exhaust fans, DCGG02A and DCGG02B. Based on the licensee's analysis, the TOL relays for these exhaust fans were replaced (upsized), giving them additional capacity.

During its review, the NRC staff performed an audit of the licensee's Calculation XX-E-009-001-CN006, to verify the information provided in the LAR and its supplements. During the audit, the NRC staff verified that the Class 1E loads required for postulated design basis accidents (including control equipment) would be able to successfully auto-transfer to the onsite power supply (i.e., the DGs) if the DV relay monitored bus experienced a DV condition (below DVR setpoints requiring an auto-transfer). Based on review of the analysis, the NRC staff finds the proposed maximum 8.5-second DV time delay acceptable. The NRC staff finds that the analytic technique adopted by the licensee is in accordance with NEI 15-01, Section 2.3, "Confirm DVR Time Delay (with Accident Signal) Adequate for Transfer to Onsite Power Supply," and IEEE Std. 741-2017, except for certain motors with TOLs for which enhanced overcurrent evaluation was performed. The NRC staff also finds that deviation from NEI 15-01 methodology for certain motors for which enhanced evaluation was performed is reasonable because the motor starting current was considered for the duration of the actual motor accelerating time period and not for the full 8.5 second of DV condition, and therefore, is acceptable.

3.2.4 Analysis to Confirm Reset of DV Relay with Minimum Required Grid Voltage

As stated in Attachment I to the LAR, the licensee performed an analysis to verify that the required accident-initiated Class 1E motors will start and accelerate within the required time periods at the minimum required grid voltage (or available minimum OPERABLE grid voltage). This analysis is performed to ensure the capability of offsite power to mitigate the plant design basis accidents by demonstrating availability of adequate starting voltage to Class 1E motors that auto-start in response to an accident signal when powered at the minimum grid voltage. For the DV relay settings, this analysis also confirms that the minimum required grid voltage will be adequate to reset the DV relay after any transient dip in voltage at the DV relay to avoid automatic disconnection from the grid (offsite power). The licensee used the lower proposed TS limit of the DV relay time delay (7.4 seconds) for this analysis. Based on the analysis, the licensee determined that the DV relay monitored bus voltage recovers above 3864 V for all the scenarios studied at the lowest switchyard voltage of 98 percent of 345 kV rated voltage.

In its letters dated September 10, 2019, and November 13, 2019, in response to RAI No. 8, the licensee stated that the lowest switchyard voltage considered 98 percent of 345 kV rated voltage is based on the North American Electric Reliability Corporation (NERC) Interface Agreement between Westar Energy (i.e., the transmission system operator entity) and WCNOC. Per NERC Reliability Standard NUC-001-3 and Interface Coordination Agreement (Interface coordination Agreement between Westar Energy and WCNOC), the minimum and maximum switchyard steady-state voltages will be maintained ≥ 98 percent and ≤ 104.5 percent.

Based on the analysis (at minimum switchyard voltage), the licensee determined the following:

1. The voltages at the DV relay monitored buses NB01 and NB02 would recover above the DV relay reset voltage of 3864 V in less than 4 seconds (voltage transient due to any Class 1E motor starting) and is acceptable because the lower analytical trip time limit (as proposed in the TS) is 7.4 seconds.

2. The starting voltages for the Class 1E motors would remain above minimum [design] starting voltages.

3. Running or operating voltages of the loads, following the completion of the load sequence operation, would remain ≥ 90 percent rated.

During its review, the NRC staff performed an audit of the relevant portions of the licensee's Calculation XX-E-009-001-CN006; and Calculation XX-E-006, "AC System Analysis," Revision 8, to verify the information provided in the LAR and its supplements. During the audit, the NRC staff verified that the voltages at the DV relay monitored buses NB01 and NB02 would recover above the DV relay reset voltage of 3864 V in less than 4 seconds for accident conditions, and the starting and running voltages would remain within acceptable limits. The NRC staff finds that the analytic technique adopted by the licensee is in accordance with NEI 15-01, Section 2.4, "Confirm Reset of DVR with Minimum Required Grid Voltage," and IEEE Std. 741-2017.

3.2.5 Analysis to Confirm LOV Relay Setpoint Prevents Motor Stalling

In Attachment I to the LAR, the licensee stated that the function of LOV relay is to limit the magnitude and duration of an undervoltage condition on the Class 1E buses. The voltage dropout setting (i.e., the lower analytical limit) is determined to ensure that stalling of Class 1E motors is prevented during the postulated design basis accidents and anticipated operational transients. The time delay setting of LOV relay is determined to prevent spurious operation during momentary voltage transients caused by offsite power disturbances (such as transmission system transient faults, lightning strikes, etc.).

The licensee performed a steady-state load flow analysis using a fixed voltage source at the LOV relay monitored bus. The voltages at the required Class 1E motors are calculated to confirm that the voltages are higher than their respective stall voltage. The most conservative system loading condition (i.e., the highest loading on the Class 1E distribution system) was used by the licensee to envelop all postulated accident and operating scenarios that manifest the most severe voltage drop.

Based on the analysis, the licensee determined that an LOV relay lower analytic limit of 3150.4 V (75.7 percent at 4160 V base, as determined by the NRC staff) at the NB buses would ensure that the Class 1E motors required to run during plant design basis accidents will not stall (i.e., the torque would remain above minimum required breakdown torque (BDT), and the Class 1E MCC voltages will remain above 345 V (i.e., 75 percent of 460 V).

In its letter dated November 13, 2019, the licensee clarified that minimum allowed voltage at a motor terminal to avoid stalling of a motor was calculated as follows:

V_{min}allowed/V_{rated} = Sqrt [(%BDT)@ V_{min} allowed)/(%BDT@ $V_{rated)}$]

Where, %BDT@V_{rated} (Percent BDT at rated voltage) = % Available ratio of breakdown torque to full load torque at rated voltage.

Considering, required % BDT@Vmin allowed = 100% stalled torque

V_{min}allowed/V_{rated} = Sqrt [(100%)/(%BDT@ $V_{rated)}$]

The Percent BDT at the rated voltage (%BDT@Vrated) for the motor was adjusted based on the break horsepower (BHP) of the motor (i.e., multiplied by Rated HP/BHP).

During its review, the NRC staff performed an audit of the licensee's Calculation XX-E-009-001-CN006, to verify the information provided in in the LAR and its supplements. During the audit, the NRC staff verified that the motors would not stall or trip based on the proposed lower analytical voltage setting LOV relay. The NRC staff finds that the analytic technique adopted by the licensee is in accordance with NEI 15-01, Section 2.5, "Confirm LVR [LOV Relay] Setpoint Prevents Motor Stalling," and IEEE Std. 741-2017.

3.3 Proposed TS Settings of DV and LOV Relays

3.3.1 DV Relay Voltage Settings Proposed in SR 3.3.5.3

The licensee has proposed the DV Allowable Value as ≥ 107.5 V at 120 V; and the Nominal Trip Setpoint Value as 108.46 V at 120 V.

The above allowable and nominal values are based on an Analytical/Safety Limit of 3756.8 V (i.e., 90.3 percent at 4160 V base, as discussed in Section 3.2.1 of this safety evaluation (SE)).

On page 17 of Attachment I to the LAR, the licensee also listed in tabular form the other relevant voltage values of DV relay, which are calculated based on total loop error, total measurable uncertainties, setpoint tolerance, etc. The DV relay voltage settings are further evaluated in Section 3.4 of this SE.

3.3.2 DV Relay Time Delay Settings Proposed in SR 3.3.5.3

The licensee has proposed the DV time delay (with SIS) Allowable Value as 8.0 seconds, +0.5 seconds, -0.6 seconds (Nominal Setpoint Value as 8 seconds).

On page 21 of Attachment I to the LAR, the licensee stated that the minimum analytical limit of time delay is 5 seconds based on review of auto-sequenced safety-related motor starting times. The maximum analytical limit of time delay is 10 seconds based on the review of thermal capability of motors used in valves. After allowing margins for setting tolerance, drift, etc., the licensee has proposed a DV Time Delay Allowable Value ≥ 7.4 seconds and ≤ 8.5 seconds, and a Nominal Value as 8.0 seconds. The lower allowable time value (7.4 seconds) is discussed in Section 3.2.4 of this evaluation. These values are well within the minimum analytical limits (AL) of 5 seconds and maximum AL of 10 seconds.

The DV relay time delay settings (with SIS) are further evaluated in Section 3.4 of this SE.

The licensee has also proposed a DV Time Delay (No SIS Allowable Value as 56 seconds, +8.5 seconds, -7.6 seconds (Nominal Setpoint Value as 56 seconds).

As discussed in Section 2.2 of this safety evaluation, in its letter dated November 13, 2019 (on page 2 of the attachment), the licensee clarified that the current second time delay (No SIS) was chosen to be a nominal 56 seconds (sum of DV relay timer of 8 seconds plus no SIS delay timer of 48 seconds) to ensure that the normally running safety-related equipment is not subjected to sustained DV condition, which could cause degrading or tripping of the equipment. The nominal 48-second time delay for the second timer was selected to ensure no safety-related load already running would be tripped by its overcurrent protective device (this analysis was performed for a total of 56 seconds + 8.5 seconds = 64.5 seconds). Based on its Calculation XX-E-009-001-CN006, the licensee also determined that the minimum time delay was dictated by the startup time of the nonsafety RCP motor, which was determined to be the longest startup time in the system (31 seconds with 80 percent voltage at the RCP motor terminals). To verify the start-up time of RCP motor, the NRC staff also performed an audit of this calculation as discussed in the audit summary report dated December 6, 2019. The NRC staff finds the time delay analysis of the DV relay for no SIS condition as reasonable.

The DV relay time delay settings (No SIS are further evaluated in Section 3.4 of this SE.

3.3.3 LOV Relay Voltage Settings Proposed in SR 3.3.5.3

The licensee has proposed the LOV Allowable Value as ≥ 90.0 V at 120 V; and Nominal Trip Setpoint Value as 91.28 V at 120 V.

The above allowable and nominal values are based on an Analytical/Safety Limit of 3150.4 V (i.e., 75.7 percent at 4160 V base, as discussed in Section 3.2.5 of this SE).

On page 19 of Attachment I to the LAR (as updated in letter dated August 22, 2019), the licensee listed, in a tabular form, other relevant voltage values of LOV relay, which are calculated based on total loop error, total measurable uncertainties, setpoint tolerance, etc. The LOV voltage settings are further evaluated in Section 3.4 of this SE.

3.3.4 LOV Relay Time Delay Settings Proposed in SR 3.3.5.3

The licensee has proposed the LOV Time Delay Allowable Value as ≥ 0.9 seconds and ≤ 1.15 seconds; and the Nominal Trip Setpoint Value as 1.0 seconds.

On pages 23 through 24 of Attachment I to the LAR, the licensee stated that the LOV relay is an instantaneous undervoltage relay. An intentional time delay is introduced to delay the LOV relay actuation to ensure that sufficient time is allowed prior to tripping the bus feeder breakers spuriously due to a disturbance or transient in the offsite power system. The minimum time delay limit for the LOV relay is calculated such that it prevents spurious operation during momentary voltage transients caused by offsite power disturbances. Since the bus transient voltage is not expected to last longer than the calculated 0.85 seconds due to offsite power system faults, a time delay setting of 1.0 second is expected to ensure that no spurious trip of the feeder breaker occurs.

The NRC staff was concerned with a very small margin between the 0.85 seconds of transient voltage due to the offsite power system faults and the minimum allowable time delay setting of 0.9 seconds. In its letter dated September 10, 2019, in response to RAI No. 10, the licensee stated that the transient bus voltage recovery time of 0.85 seconds already included a margin of about 0.1 seconds. Considering this additional margin, the NRC staff finds the lower analytic limit of time delay as 0.85 seconds as acceptable.

In Attachment I to the LAR, the licensee also stated that the current maximum time delay for the LOV relay is limited to 1.2 seconds. The licensee proposed to revise the maximum time delay value from 1.2 seconds (currently in the SR 3.3.5.3.a) to 1.15 seconds based on time delay relay drift, tolerances, etc. The time delay settings are further evaluated in Section 3.4 of this SE.

3.3.5 Summary of the Evaluation – Analytical Limits of DV and LOV Relays

Based on the above, the NRC staff finds that the analyses to determine analytic limits of DV and LOV relays and the proposed TS settings of DV and LOV relays are in accordance with the guidance provided in NEI 15-01, Revision 1 and IEEE Std. 741-2017 and meets the requirements of GDC 17. The NRC staff finds that the proposed changes to SR 3.3.5.3 continue to provide reasonable assurance that the necessary quality of systems and components are maintained, and therefore, continue to meet the requirements of 10 CFR 50.36(c)(3).

3.4 Setpoint Methodology Evaluation

The NRC staff has reviewed the licensee's analyses in support of the proposed changes, as described in the LAR and its supplements.

The NRC staff performed an independent confirmatory evaluation to:

- Verify the licensee's setpoint calculation methodology, using the square root of the sum of the squares (SRSS), to assure that control and monitoring setpoints are established and maintained in a manner consistent with plant safety function requirements.

- Verify the licensee's setpoint calculation values are adequate to assure, with a high confidence level, that required protective actions are initiated before the associated plant process parameters exceed their analytical limits.

The NRC staff evaluated the proposed amendment using the criteria of RG 1.105, Revision 3, and referenced Industry Standard ISA-S67.04-1994, "Setpoints for Nuclear Safety-Related Instrumentation," Part 1, to determine if setpoints for DV, LOV, and time delay of safety-related instrumentation are established and maintained within the TS limits. The following definitions, from ISA-S67.04-1994, were used in the NRC staff's evaluation:

> AL – Limit of a measure or calculated variable established by the safety analysis to ensure that a safety limit is not exceeded.
>
> Allowable Value (AV) – A limiting value that the trip setpoint may have when tested periodically, beyond which appropriate action shall be taken.

Trip Setpoint – A predetermined value for actuation of the final setpoint device to initiate a protective action.

Additionally, Section 4.3.1 of ISA-S67.04-1994, discusses the trip setpoint and provides a general discussion from which the following definition of can be established:

Margin – an allowance provided between the trip setpoint and the analytical limit to ensure a trip before the analytical limit is reached.

Finally, the proposed change was evaluated for its conformance with RIS 2006-17 regarding whether the licensee properly used the NRC staff's guidance in establishing AVs, nominal setpoints, and as-left and as-found tolerances to be used during periodic surveillances.

3.4.1 Summary of the Licensee's Methodology

The NRC staff reviewed the summary of the calculations provided in the LAR and its supplements. The NRC staff also audited the supporting details in Calculation XX-E-009-001-CN006 referenced by the licensee. The audit summary report was issued by letter dated December 6, 2019. The NRC staff confirmed the following with respect to the licensee's methodology described in its application:

- Setting tolerance to establish an acceptable as-left setpoint range was calculated using the SRSS.

- Drift was determined using statistical analysis and provides a 95/95 drift value for the relays based on monthly surveillances.

- Total loop error was calculated using the SRSS plus algebraic approaches.

The methods used by the licensee for combining uncertainties for the proposed SR 3.3.5.3 values are consistent with the guidance in Section 4.4 "Combination of uncertainties," from ISA-S67.04-1994, and Regulatory Position C.1. from RG 1.105, Revision 3. Additionally, Figure 2, "Dropout and Pickup Setpoint Diagram," from Attachment I to the LAR shows the relationship between the AL, AV, and the nominal trip setpoint. Figure 2 and the relationships shown align with those shown in Figure 1, "Nuclear Safety-Related Setpoint Relationships," from RG 1.105, Revision 3. The NRC staff found that the SRSS methodology used by the licensee to calculate the proposed AV assures that control and monitoring setpoints are established and maintained in a manner consistent with plant safety function requirements and is consistent with ISA-S67.04-1994, which is endorsed by RG 1.105, Revision 3.

3.4.2 DV and LOV Relay Setting

The licensee provided specific results from the calculations for the DV and LOV setting values on pages 17 and 19 of Attachment I to the LAR (as revised in letter dated August 22, 2019), respectively. A brief summary of these calculations is as follows:

The licensee first calculated the adjusted AV from the SR 3.3.5.3 AV to account for the potential transformer (PT) error. Next, the dropout Nominal Trip Setpoint ($NTSP_{DO}$) was calculated from the adjusted AV by adding the total measurable uncertainty (TMU). TMU is derived from the statistical analysis of the as-left and as-found data, which is equal to the instrument drift. Then, the AL was calculated from the $NTSP_{DO}$ by subtracting the total loop error (TLE). The TLE included relay uncertainties (except PT error) and is combined using straight sum and SRSS plus algebraic approaches. Finally, the dropout actual trip setpoint ($ATSP_{DO}$), was calculated by adding the $NTSP_{DO}$ to the setting tolerance (ST). The $ATSP_{DO}$ establishes the ideal as-left settings for the relays to ensure the as-found setting will always be greater than or equal to the $NTSP_{DO}$ and to provide margin from the AV and AL.

The NRC staff performed an independent confirmatory evaluation of the following margins: (a) between the AL and the nominal trip setpoint ($Margin_{setpoint}$), and (b) between the AL and the AV ($Margin_{AV}$). Based on the information in the LAR and its supplements, the NRC staff independently calculated the AL values in terms of the relay span values to support its evaluation because the licensee did not provide the relay span value in terms of relay measurement values to represent the AL. Specifically, the 35:1 potential transformer turn ratio (PT_{ratio}) and the potential transformer error (PT_{error}) of 0.3 percent were used in the following equation:

$$AL_{DVrelay} = (AL_{bus} / PT_{ratio}) * (1 - PT_{error}) = (3756.8\ V / 35) * .997 = 107.02\ V$$

$$AL_{LOVrelay} = (AL_{bus} / PT_{ratio}) * (1 - PT_{error}) = (3150.4\ V / 35) * .997 = 89.74\ V$$

The NRC staff calculated the margins and the relay setting relationships as shown in Table 1 below.

Table 1 - DV and LOV Relay Voltage Settings with Margins

Parameter (Relay Voltage)	**Degraded Voltage (V)**		**Loss of Voltage (V)**		**Equation**
	Existing	Proposed	Existing	Proposed	
Analytical Limit		**107.02[a,b]**		**89.74[a,b]**	$(AL_{bus}/35) * .997$
SR 3.3.5.3 AV	105.9	107.5	82.5	90.0	
SR 3.3.5.3 Nominal Trip Setpoint	106.9	108.46	83	91.28	
$Margin_{setpoint}$		**1.44[a]**		**1.54[a]**	Trip setpoint - AL
$Margin_{AV}$		**0.48[a]**		**0.26[a]**	AV-AL

[a]Staff-calculated, [b]includes PT error.

Based on the NRC staff independent confirmatory evaluation, as shown in Table 1, the $Margin_{Setpoint}$ and $Margin_{AV}$ confirm that the margins are adequate to assure, with a high confidence level, that required protective actions are initiated before the associated plant process parameters exceed their analytical limits. Additionally, the proposed values are all higher than the existing values applied by the licensee, which is more conservative. Finally, the NRC staff audited supporting details in Calculation XX-E-009-001-CN006, referenced by the licensee, to confirm the information provided in the LAR and its supplements.

Based on the above information, the NRC staff finds that the proposed DV and LOV settings (AV and Trip Setpoint) for SR 3.3.5.3(a) and (b) are consistent with RG 1.105, Revision 3, and satisfy the requirements of 10 CFR 50.36(c)(1)(ii)(A) and GDC 13. Therefore, these proposed changes are acceptable.

3.4.3 DV and LOV Time Delay Settings

The licensee provided specific results from the calculations for the DV (SIS),and LOV time delay settings on pages 23 and 25 of Attachment I to the LAR, respectively. Additionally, in its letters dated September 10, 2019, and November 13, 2019, the licensee proposed DV (No SIS time delay values and used a similar approach. A brief summary of these calculations is as follows:

> The licensee first calculated the DV nominal trip setpoint (ATSP) by iteration, by performing multiple ETAP runs until results yielded an acceptable value. The LOV nominal trip setpoint was unchanged from the existing SR 3.3.5.3.a value. Next, the ST is calculated by combining timer accuracy and repeatability data provided by the manufacturer via SRSS. Then, the minimum actual trip setpoint ($ATSP_{min}$) is calculated by subtracting the ST from the ATSP and the NTSP is calculated by adding the ST to the ATSP. Drift is derived using 95/95 drift values for DV relays for a monthly surveillance interval and includes uncertainties. Therefore, TLE is set equal to the drift and when combined with the NTSP, it is used to calculate the maximum analytical limit (AL_{max}). This provides protection from the SL and the difference between the SL and AL_{max} is the upper margin. Finally, the minimum analytical limit (AL_{min}) was calculated by subtracting the TLE from the $ATSP_{min}$ and is to ensure the time delay is long enough to prevent spurious operation during momentary voltage transients.

On pages 20 and 23 of Attachment I to the LAR, the licensee stated, in part:

> The time delay with an SIS is established to ensure the offsite power to the NB buses is tripped and subsequently transferred to onsite power in the event a DV persists following a LOCA. The objective of the DV relay time delay is to ensure that the delay is adequate to overcome the starting of accident loads without tripping itself from the offsite power during the sustained DV condition of the offsite power. The non-accident time delay is provided to ensure that the normal running safety-related equipment are not damaged or tripped as a result of sustained system DV condition without the safety injection signal. Additionally, another time delay is incorporated to enable RCP motor start since the starting time of the motor is significantly longer than all other motors in the system. ...
>
> Analytical limits (maximum and minimum) for the DV time delay relays [are] the TS SR 3.3.5.3b time delay Allowable Value[s]. The maximum analytical limit AL_{max} is required to protect the SL, that is, the maximum allowable DV relay time delay that include a margin.

The licensee stated the proposed DV (SIS) TS SR 3.3.5.3 AV_{min} time delay value is established to ensure that the time delay is long enough to ride through the starting of any safety-related load during a LOCA without tripping from the offsite power source during the DV condition. Furthermore, the licensee states that the proposed LOV SR 3.3.5.3 AV_{min} time delay value is established to be long enough to prevent spurious actuations in the event of momentary voltage transients caused by offsite power disturbances.

The NRC staff performed an independent confirmatory evaluation of the time delay $Margin_{AV}$ as the margin between the AL and AV_{max} to verify the proposed delay time is to ensure the margins are adequate to assure, that required protective actions are initiated before the associated plant process parameters exceed their ALs. In addition, the NRC staff independently calculated the margin between the AL and the nominal trip setpoint ($Margin_{setpoint}$). The NRC staff-calculated margins and relay setting time delay relationships are shown in Table 2 below.

Table 2 – DV and LOV Time Delay Settings with Margins

Parameter (Time Delay)	DV Time Delay (seconds)			LOV Time Delay (seconds)		Equation
	Existing	Proposed (SIS)	Proposed (No SIS)	Existing	Proposed	
SR 3.3.5.3 AV_{min}	107.4	7.4	48.4	0.5	0.90	
SR 3.3.5.3 Nominal Trip Setpoint	119	8.0	56	1.0	1.0	
SR 3.3.5.3 AV_{max}	130.6	8.5	64.5	1.2	1.15	
AL		10[b]			1.2[c]	
$Margin_{Setpoint}$		**2[a]**			**0.2[a]**	AL-setpoint (time delay)
$Margin_{AV}$		**1.5[a]**			**0.05[a]**	AL-AV (time delay)

[a]Staff calculated.
[b]AL value for DV (SIS) is from page 23 of Attachment I to the LAR, which states, "The above settings are well within the SL of 10 seconds."
[c]AL value for LOV is from page 25 of Attachment I to the LAR, which states, "The above settings are well within the allowable minimum SL of 0.85 seconds and the 1.2 seconds accident analysis limit."

Based on the NRC staff's independent confirmatory evaluation, as shown in Table 2, the $Margin_{Setpoint}$ and $Margin_{AV}$ confirm that the margins are adequate to assure, with a high confidence level, that required protective actions will be initiated before the associated plant process parameters exceed their analytical limits. Additionally, the proposed AV and trip setpoint time delay values are all shorter than the existing values, which are more conservative.

The licensee provided additional DV (No SIS) time delay settings in its letters dated September 10, 2019, and November 13, 2019. This time delay is a combination of the DV (SIS) time delay, 8 seconds (+0.5/-0.6) plus an additional second delay timer of 48 seconds (+8/-7) and is proposed to be 56 seconds (+8.5s/-7.6s). The second time delay of 48 seconds, which was reduced from 111 seconds, was changed to ensure that the normally running safety-related equipment is subjected to less heat as a result of a sustained system DV condition (No SIS. In developing the lower limit, the value is dictated by the startup time of the RCP motor, which is the worst-case motor start of approximately 31 seconds, plus a 10-second margin. The upper limit must be set so no safety-related devices, already running, would trip from overcurrent protection.

The NRC staff performed an independent confirmatory evaluation of the lower limit of the proposed DV (No SIS) time delay setting. Also, the NRC staff compared the second timer minimum of 41 seconds (48 seconds minus 7 seconds) to the RCP starting time of 31 seconds and confirmed the 10 second margin. The proposed lower limit time delay value is higher than the required time with some margin and is therefore reasonable. The NRC staff used the overall time to evaluate the upper limit of the proposed DV (No SIS time delay setting. The proposed AV_{max} is 64.5 seconds and must ensure no safety-related devices trip by its overcurrent protection. The NRC staff reviewed the information and analysis summary provided in licensee's letter dated September 10, 2019, which analyzed the new time delay duration and confirmed the overcurrent protection devices will not trip.

The LAR does not provide an absolute maximum value or analytical limit. However, the current maximum TS DV time delay value of 130.6 seconds demonstrated no safety-related devices would trip from overcurrent protection. The proposed DV (No SIS time delay value is significantly lower than 130.6 seconds, thus providing significantly more margin that previously found acceptable to the NRC staff. Therefore, the NRC staff finds, with a high confidence level, that required protective actions will be initiated before the associated plant process parameters exceed their analytical limits, since all safety-related protected devices have been demonstrated to function normally at the proposed analyzed limit, which is more conservative. Finally, the NRC staff audited supporting details in Calculation XX-E-009-001-CN006, referenced by the licensee to confirm the information provided in the LAR.

Based on discussion above, the NRC staff finds that the proposed DV (both SIS and No SIS) and LOV time delay settings (AV and Trip Setpoint) for SR 3.3.5.3(a) and (b), consistent with RG 1.105, Revision 3, satisfy the criteria of 10 CFR 50.36(c)(1)(ii)(A), and meet the requirements of GDC 13. Therefore, these proposed changes are acceptable.

3.4.4 Summary of the Evaluation for Setpoint Methodology

As described in Section 3.4.1 of this SE, the licensee's methodology used the SRSS combinatorial method to calculate the proposed settings to assure that control and monitoring setpoints are established and maintained in a manner consistent with plant safety function requirements, consistent with RG 1.105, Revision 3. Additionally, the proposed changes are consistent with RIS 2006-17 in establishing the as-left and as-found tolerances.

Furthermore, as described in Sections 3.4.2 and 3.4.3 of this SE, the NRC staff performed independent confirmatory evaluations of calculated margins and margin comparisons to confirm that required protective actions will be initiated before the associated plant process parameters exceed their analytical limits. Therefore, the NRC staff finds that proposed changes in SR 3.3.5.3 are acceptable and are consistent with RG 1.105, Revision 3, which describes a method acceptable to the NRC staff for complying with 10 CFR 50.36(c)(1)(ii)(A) and 10 CFR Part 50, Appendix A, GDC 13. Additionally, the changes do not add or remove the surveillances, and only provide new setpoint values. The proposed changes continue to provide reasonable assurance that the necessary quality of systems and components are maintained and therefore continue to meet the requirements at 10 CFR 50.36(c)(3).

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Kansas State official was notified of the proposed issuance of the amendment on December 10, 2019. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 and changes surveillance requirements. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration published in the *Federal Register* on May 21, 2019 (84 FR 23079), and there has been no public comment on such finding. Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) there is reasonable assurance that such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributors: V. Goel, NRR
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Date: February 27, 2020

SUBJECT: WOLF CREEK GENERATING STATION, UNIT 1 - ISSUANCE OF AMENDMENT NO. 224 REGARDING: REVISION TO TECHNICAL SPECIFICATION 3.3.5, "LOSS OF POWER (LOP) DIESEL GENERATOR (DG) START INSTRUMENTATION" (EPID L-2019-LLA-0062) DATED FEBRUARY 27, 2020

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