March 20, 2013

MEMORANDUM TO: Michael T. Markley, Chief
Plant Licensing Branch I
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

FROM: Roy K. Mathew, Acting Chief ***/RA/***
Electrical Engineering Branch
Division of Engineering
Office of Nuclear Reactor Regulation

SUBJECT: WOLF CREEK GENERATING STATION – LICENSE AMENDMENT REQUEST TO CHANGE DIESEL GENERATOR SURVEILLANCE REQUIREMENTS
(TAC NO. ME7674)

By letter dated November 30, 2011 (Agencywide Documents Access and Management System Accession No. ML11340A033), Wolf Creek Nuclear Operating Corporation (WCNOC) submitted a request for amendment to Technical Specifications (TS) 3.8.1, of the Facility Operating License No. NPF-42 for the Wolf Creek Generating Station. The changes would modify the TS Surveillance Requirements (SR) by providing surveillance enhancements that will improve operation and testing of the Diesel Generators (DGs) and will provide a more restrictive voltage and frequency band for operation when not connected in parallel with the offsite sources.

By electronic mail dated June 14, 2012 (ADAMS Accession No. ML 12166A404) staff requested additional information and the licensee provided responses to staff's questions in letter dated August 16, 2012 (ADAMS Accession No. ML12237A298). The staff requested for clarification to the responses by letter dated October 09, 2012 (ADAMS Accession No. ML12283A28) and electronic mail dated January 31, 2013 (ADAMS Accession No. ML13032A226). The licensee provided supplemental information in letters dated December 7, 2012 and March 3, 2013. The supplemental information did not change the intent of the original amendment request.

The Electrical Engineering Branch (EEEB) staff reviewed the information provided in the license amendment request and request for additional information response and concluded that the proposed amendment, as discussed in the enclosed safety evaluation (SE) report, is acceptable. This memorandum and the enclosed SE complete the EEEB staff's review and evaluation efforts for Technical Assignment Control (TAC) Number ME7674.

Enclosure:
As stated

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Enclosure:
As stated

DISTRIBUTION: RLi GMatharu RMathew BBenny
NRR_DE_DPR_Resource RidsNrrDeEeeb

ADAMS ACCESSION No.: ML13078A155 *** Concurrence by E-Mail**

OFFICE	NRR/DE/EEEB	NRR/DE/EEEB	NRR/DE/EEEB
NAME	RLi *	GMatharu	RMathew
DATE	03/14/13	03/20/13	03/20/13

SAFETY EVAULATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
AMENDMENT NO.163, REVISION 1 TO FACILITY OPERATING LICENSE NO. NPF-42
WOLF CREEK NUCLEAR OPERATING CORPORATION
WOLF CREEK GENERATING STATION
DOCKET NO. 50-482

1.0 INTRODUCTION

By letter to the U.S. Nuclear Regulatory Commission (NRC) dated November 30, 2011, (Agencywide Documents Access Management System (ADAMS) Accession Number ML11340A033), the licensee, Wolf Creek Nuclear Operating Corporation (WCNOC), requested an amendment to the Wolf Creek Generating Station Operating Station (WCGS) License NPF-42. In the licensing amendment request Number 163, Rev. 1, the licensee proposed modifying the WCGS Technical Specifications (TS) Surveillance Requirements (SRs) related to providing surveillance enhancements that will improve operation and testing of the Diesel Generators (DGs) and will provide a more restrictive voltage and frequency band for operation when not connected in parallel with the offsite sources. Specifically, the licensee proposed to modify the WCGS TS SRs 3.8.1.2, 3.8.1.3, 3.8.1.7, 3.8.1.10, 3.8.1.11, 3.8.1.12, 3.8.1.14, 3.8.1.15, 3.8.1.19, and 3.8.1.20 to restrict the voltage and frequency limits for both slow and fast DG starts. The licensee is also changing EDG loading requirements to reflect the results of updated calculations.

The licensee provided supplemental information in letters dated August 16, 2012, December 07, 2012, and March 3, 2013. The supplemental information did not change the intent of the original amendment request. The proposed change would revise the Wolf Creek Generating Station Operating Station Improved Technical Specification (ITS) Surveillance Requirements (SRs) as follows.

SR 3.8.1.2 - Start Test

This SR is being revised to specify a minimum steady state voltage of ≥ 3950 Volts (V) and a frequency range of ≥ 59.4 Hertz (Hz) and ≤ 60.6 Hz. The current minimum steady state voltage is ≥ 3740 V and a current frequency range of ≥ 5 8.8 Hz and ≤ 6 1.2 Hz.

SR 3.8.1.3 - Load Run Test

This SR is being revised to specify a load range of ≥ 5650 Kilowatt (kW) and ≤6201 kW. The current load range is ≥ 5580 kW and ≤ 6201 kW.

SR 3.8.1.7 - Fast-Start Test

This SR is being revised to specify a minimum voltage of ≥ 3950 V and a minimum frequency of ≤ 59.4. The minimum steady state voltage is revised to specify a value of ≥ 3950 V and a steady state frequency range of ≥ 59.4 Hz and ≤ 60.6 Hz. The current minimum voltage and minimum

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steady state voltage is ≥ 3740 V and a current minimum frequency of ≥ 58.8 Hz and steady state frequency range of ≥ 58.8 Hz and ≤ 61.2 Hz.SR 3.8.1.10 - Full Load Rejection Test

This SR is being revised to specify a load range of ≥ 5650 kW and ≤ 6201 kW. The current load range is ≥ 5580 kW and ≤ 6201 kW.

SR 3.8.1.11 - Loss-of-Offsite Power (LOOP) Test

This SR is being revised to specify a minimum steady state voltage of ≥3950 V and a steady state frequency range of ≥ 59.4 Hz and ≤ 60.6 Hz. The current minimum steady state voltage is ≥ 3740 V and a steady state frequency of ≥ 5 8.8 Hz and ≤ 61.2 Hz.

SR 3.8.1.12 - Safety Injection Actuation Signal (SIAS) Test

This SR is being revised to specify a minimum voltage of ≥ 3950 V and a minimum frequency of ≥ 59.4. The minimum steady state voltage is revised to specify a value of ≥ 3950 V and a steady state frequency range of ≥ 59.4 Hz and ≤ 60.6 Hz. The current minimum voltage and minimum steady state voltage is ≥ 3740 V and a current minimum frequency of ≥ 58.8 Hz and steady state frequency range of ≥ 58.8 Hz and ≤ 61.2 Hz.

SR 3.8.1.14 - Endurance and Margin Test

Note 2 is being deleted. The deletion of Note 2 results in changing the "Notes" heading to "Note" and removing the number (1.) from Note 1. The load range for the 2 hours portion of the SR is being revised to specify a load range of ≥ 6300 kW and ≤ 6821 kW. The current load range is ≥ 6600 kW and ≤ 6821 kW. The load range for the remaining hours of SR is being revised to ≥ 5650 kW and ≤ 6201 kW. The current load range is ≥ 5580 kW and ≤ 6201 kW.

SR 3.8.1.15 - Hot Restart Test

Note 1 is being revised to specify a load range of ≥ 5650 kW and ≤ 6201 kW. The current load range is ≥ 5580 kW and ≤ 6201 kW. Additionally, this SR is being revised to specify a minimum voltage of ≥ 3950 V and a minimum frequency of ≥ 59.4. The minimum steady state voltage is revised to specify a value of ≥ 3950 V and a steady state frequency range of ≥ 59.4 Hz and ≤ 60.6 Hz. The current minimum voltage and minimum steady state voltage is ≥ 3740 V and a current minimum frequency of ≥ 58.8 Hz and steady state frequency range of ≥ 58.8 Hz and ≤ 61.2 Hz.

SR 3.8.1.19 - Combined SIAS and LOOP Tests

This SR is revised to specify a minimum steady state voltage of ≥ 3950 V and a steady state frequency range of ≥ 59.4 Hz and ≤ 60.6 Hz. The current minimum steady state voltage is ≥ 3740 V and a current steady state frequency range of ≥ 58.8 Hz and ≤ 61.2 Hz.

SR 3.8.1.20 - Redundant Unit

This SR is being revised to specify a minimum voltage of ≥ 3950 V and a minimum frequency of ≥ 59.4. The minimum steady state voltage is revised to specify a value of ≥ 3950 V and a

steady state frequency range of ≥ 59.4 Hz and ≤ 6 0.6 Hz. The current minimum voltage and minimum steady state voltage is ≥ 3740 V and a current minimum frequency of ≥ 58.8 Hz and steady state frequency range of ≥ 58.8 Hz and ≤ 61.2 Hz.

2) REGULATORY EVALUATION

The NRC staff used the following regulatory requirements and guidance documents during its review of the LAR:

The WCGS Updated Safety Analyses Report (USAR) Section 8.1.4.2, states that the offsite power system and the onsite power systems conform to Title 10 of *Code of Federal Regulations*, Section 50 (10 CFR 50) General Design Criterion (GDC) 17 and 18.

GDC 17, "Electric Power Systems," of Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50, requires, in part, that an onsite electric power system shall be provided to permit functioning of structures, systems, and components important to safety. The onsite electric power supplies and the onsite electric distribution system shall have sufficient independence, redundancy, and testability to perform their safety functions assuming a single failure. In addition, this criterion requires provisions to minimize the probability of losing electric power from any of the remaining supplies as a result of the loss of power from the unit, the transmission network, or the onsite electric power supplies.

GDC 18, "Inspection and Testing of Electric Power Systems," requires that electric power systems important to safety be designed to permit appropriate periodic inspection and testing to demonstrate operability and functional performance.

10 CFR Part 50.36 states that each license authorizing operation of a production or utilization facility of a type described in § 50.21 or § 50.22 will include technical specifications. The technical specifications incorporated in a license will be designed to include those significant design features, operating procedures and operating limitations which are considered important in providing reasonable assurance that the facility will be constructed and operated without undue hazard to public health and safety. The TS establish Limiting Conditions for Operation, which include Completion Times for equipment that is required for safe operation of the facility. TS also include safety limits, limiting safety system settings, and limiting control settings.

NRC Regulatory Guide (RG) 1.9, Revision 3, dated July 1993, "Selection, Design, Qualification and Testing of Emergency Diesel Generators used as Class 1E Onsite Electric Power Systems at Nuclear Power Plants," describes a method acceptable to the NRC staff for complying with the Commission's regulations with regard to design and testing of onsite DGs.

3.0 TECHNICAL EVALUATION

The staff has reviewed the licensee's regulatory and technical analyses in support of its proposed license amendment, which is described in Attachment 1 of the License Amendment Request (LAR).

The offsite and onsite power systems at the WCGS are designed to comply with the requirements of GDCs 17 and 18 respectively. The WCGS USAR states that the existing onsite

power system consists of two physically independent sources of offsite power are brought to the onsite power system, designed and located so as to minimize the likelihood of simultaneous failure. Each of these independent circuits has the capability to safely shut down the unit. The first preferred circuit, which is connected to the startup transformer, has the capacity to supply the startup and all the auxiliary loads (both group 1 and group 2 simultaneously) of the unit. The second preferred power circuit, which supplies power to the Engineered Safety Features (ESF) transformer, has the capacity to supply all the safety-related loads of the unit.

The standby Alternating Current (AC) power system for WCGS consists of two DG units separated into two independent divisions. Section 8.3.1.1.3 of the USAR states that either DG unit is capable of supplying loads needed to safely shutdown the reactor and maintaining the reactor in a safe shutdown condition after a design basis accident. Each DG is rated at 6,201 kW for continuous operation. Additional ratings are 6,635 kW for 2,000 hours, 6,821 kW for 7 days, and 7,441 kW for 30 minutes. The DG 2-hour rating is equal to the 7-day rating of 6,821 kW. Each DG is connected exclusively to a single 4.16-kV engineered safety feature bus for one load group. The load groups are redundant and have similar safety related equipment. Each load group is adequate to satisfy minimum ESF demand caused by a loss of coolant accident (LOCA) and/or loss of preferred power supply. The USAR also states that the diesel generator loads are determined on the basis of nameplate rating, pump pressure and flow conditions, or pump run-out conditions. The continuous rating of the diesel generator is based on the maximum total load required at any time.

Any variation in steady state voltage and/or frequency affects the operating characteristics of motor driven loads. If variation in both voltage and frequency occurs simultaneously, the effect will be superimposed and compounded such that the available margin in DG capacity may be eroded. In the LAR, the licensee has proposed to narrow the existing allowable range of frequency and voltage for the acceptance criteria during DG surveillance testing to avoid the potential for overloading the DGs and to assure that safe shutdown equipment will perform as required by accident analyses.

In letter dated November 30, 2011, the licensee provided details on the DG loading with consideration of frequency and voltage variation. Specifically, the licensee stated that using the current steady state frequency range of ≥ 58.8 Hz and ≤ 61.2 Hz yields worst-case accident loading on the "B" DG of 6315.7 kW at a worst-case over-frequency of 61.2 Hz. This exceeds the 6201 kW continuous rating. The worst-case accident loading on the "B" DG of 5725.5 kW (long time or continuous rating) is greater than the minimum test load value (5580 kW) specified in TSs. Therefore, the potential existed that the surveillance testing would not have bounded the design basis worst-case accident loading.

The licensee has determined that the DGs can operate in a more conservative frequency band and calculated the loads based on the proposed TS changes for allowable frequency variations. Utilizing a revised frequency band of ≥ 59.4 Hz and ≤ 60.6 Hz, the licensee computed a worst-case accident loading of 6172.2 kW during the 30 minute time period and a worst-case accident loading on the "B" DG of 5580.3 kW for the balance of accident coping period.

The LAR also proposed raising the allowable minimum steady state voltage from 3740 V and to 3950 V. The licensee has reviewed the historical data from the surveillance test procedures performed over the last several years and concluded that the minimum observed voltage at the

ESF buses was above 4000 V. The proposed minimum steady state output voltage of 3950 V is 95% of the nominal 4160 V output voltage and allows for voltage drop to the terminals of 4000 V motors whose minimum operating voltage is specified as 90% or 3600 V.

By electronic mail dated June 14, 2012 (ADAMS Accession No. ML12166A404) and January 31, 2013 staff requested additional information on the proposed minimum voltage and the new frequency band. The request included questions on adequacy of minimum voltage for equipment operability in relation to starting large motors, reset requirements for degraded voltage relays, performance capabilities of motor operated valves (MOVs), impact of pumps operating under run-out conditions during postulated events and DG fuel oil consumption changes due to revised DG loading. The staff also requested details on compliance with section 1.4 of RG 1.9 Revision 3.

The licensee provided responses to staff's questions in letters dated August 16, 2012 (ADAMS Accession No. ML12237A298) and March 03, 2013 with the following details:

The degraded voltage relay setpoint 3706.5 V* is the minimum voltage required at the 4160 V ESF bus to assure satisfactory operation of safety related equipment during accident conditions. The proposed minimum DG voltage of 3950 V is well above the minimum allowable and provides substantial margin for the equipment. The essential service water (ESW) pump motors each rated at 1750 horsepower are the largest motors. The licensee has stated that when an ESW pump motor is started on an ESF bus that is being powered by its associated DG, the voltage at the terminals of the DG drops to 3196.35V from 4160 V and recovers to 90% in less than 0.48 seconds from the minimum dip. Extrapolating the voltage drop, assuming an initial bus voltage of 3950 V, the licensee has computed that the lowest generator terminal voltage would be approximately 3036.53 V with a corresponding bus voltage of 3009 V and 2814 V at the ESW pump motor terminals. Based on these calculations, the licensee has concluded that the loss of voltage relay will not be actuated and there is adequate voltage for the ESW motor to start and accelerate in adequate time to satisfy the design requirements. The licensee also evaluated the impact of the large motor start voltage transient drop on equipment such as motor starters, contactors, inverters and auxiliary relays and stated that there is no adverse impact on these components. The license has concluded that the proposed minimum DG voltage of 3950 V provides adequate margin for satisfactory operation of safety related equipment during large motor starts. The degraded voltage relays do not have to be reset if actuated due to a loss of offsite power (LOOP) event when the DG is required to supply plant loads. These relays provide an alarm function only when the DGs are powering the ESF busses.

(* The staff did not evaluate the basis for the degraded voltage relay setpoint.)

In response to question related to compliance with RG 1.9 Revision 3, the licensee has stated that staff has previously approved compliance with sections of RG 1.9, Revision 3 and all DG testing is currently based on this revision of the RG. The licensee has requested approval of conformance to Revision 3 of Regulatory Guide 1.9 with exception to Regulatory Position C.1.3 as part of this LAR. Regulatory position C.1.3 of Regulatory Guide 1.9, Revision 3 states that at the operating license stage of review, the predicted loads should not exceed the continuous rating of the DG. At Wolf Creek, the predicted DG loads may exceed the continuous rating of the DG during the first 24 hours of a design basis accident. The predicted loads do not exceed

the DG short-term rating. This is acceptable pursuant to Regulatory Position C.2 of Regulatory Guide 1.9, Revision 1.

In response to question related to DG loading during transient conditions of postulated events, the licensee performed an evaluation of DG loading using the higher brake horsepower of pumps associated with increased flows during run-out conditions. The licensee concluded that the loading associated with LOCA loading profile exceeds the loading associated with the main steam line break (MSLB) loading profile. The response stated that the worst-case loading of 6238.1 kW occurs during the first 24 hours of a LOCA. This accident profile included the increased loading due to the effects of coincident run-out flow rates of large pumps used during injection mode of operation. The calculation also included loads that are manually loaded through emergency operating procedures. The licensee concluded that the proposed lower load range limit of 6300 kW exceeds the worst-case loading of 6238.1 kW and the proposed 2-hour portion of the SR load range of ≥ 6300 kW and ≤ 6821 kW remained acceptable. The proposed load range of ≥5650 kW and ≤ 6201 kW, for the remaining hours, envelopes the design basis accident loading for continuous operation greater than 7 days.

The licensee also evaluated the impact of the proposed change in DG load profile on DG fuel oil requirements and concluded that the existing volume calculation based on 7-day DG operation at rated continuous capacity (6201 kW) was adequate. The response also states that the capacity of the fuel oil storage tank is sufficient to meet the fuel required for a period of 7 days at the 7-day rating (6821 kW) while meeting the DTS required volume.

By letter dated October 09, 2012, the staff requested for clarification to the responses related to performance of MOVs during postulated accident scenarios with varying voltage and frequency conditions. In letter dated December 7, 2012, the licensee provided a summary of the evaluation performed to analyze MOV performance during DG loading and steady state conditions. The licensee stated that there are 142 MOVs included in the “Motor Operated Valve Program” at WCGS of which 64 are automatically connected to the DGs. A review of the accident analysis determined specific applications where the critical valves were required to function in a timely manner to satisfy the assumptions in the analysis. This review required further evaluation of 19 valves (identified in Table 1 of the attachment) that were potentially impacted by frequency variations. The licensee has concluded that the performance capabilities and higher stroke time of the critical valves does not adversely impact the accident analysis as a consequence of lower allowable DG frequency.

The noticed that the licensee has performed analyses to demonstrate the DG loading capability to support plant shutdown during postulated events with DG operating at the proposed voltage and frequency limits. The LAR and supplemental information provided by the licensee provides assurance that the proposed changes will test the capability of the DG to support plant shutdown during postulated worst case accident loading and the changes in performance capabilities of valves and pumps will not adversely impact accident analyses. The staff finds the licensee’s evaluation of the EDG loading under postulated scenarios and the conclusions, reasonable and acceptable. The staff also finds the licensee’s proposal to demonstrate compliance with RG 1.9, Revision 3 with exception to position C.1.3, as acceptable.

4.0 CONCLUSION

The staff has reviewed the licensee's proposed TS changes and supporting documentation. Based on the evaluation discussed above, the EEEB staff determined that the proposed amendment related to the allowable steady state operating voltage and frequency band of the DGs is consistent with the recommendations of the NRC guidance in RG 1.9, Rev. 3. The staff also concludes that the proposed TS change maintains compliance with requirements in GDC 17 and 18 governing the design and operation of the onsite electrical power system and provides adequate assurance of system operability. Therefore, the staff finds the proposed changes acceptable and consistent with the NRC Regulations and the Regulatory Guidance.