WOLF CREEK
NUCLEAR OPERATING CORPORATION

Stephen L. Smith
Vice President Engineering

September 10, 2019
ET 19-0019

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

References:
1) Letter ET 19-0002, dated March 18, 2019, from S. L. Smith, WCNOC, to USNRC

2) Letter dated August 12, 2019, from B. K. Singal, USNRC, to S. L. Smith, WCNOC, "Request for Additional Information Re: Revision to Technical Specification 3.3.5, 'Loss of Power (LOP) Diesel Generator (DG) Start Instrumentation' Wolf Creek Generating Station (EPID No. L-2019-LLA-0062)"

Subject: Docket No. 50-482: Response to Request for Additional Information "Revision to Technical Specification 3.3.5, Loss of Power (LOP) Diesel Generator (DG) Start Instrumentation"

To Whom It May Concern:

Reference 1 provided the Wolf Creek Nuclear Operating Corporation (WCNOC) application to revise the Wolf Creek Generating Station (WCGS) Technical Specifications (TS). The proposed amendment would revise TS Surveillance Requirement (SR) 3.3.5.3 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 (RIS) 2011-12, Revision 1, "Adequacy of Station Electric Distribution System Voltages." Reference 2 provided a request for additional information (RAI) related to the application. The RAI consisted primarily of questions related to 10 CFR 50.36(c)(3), "Surveillance Requirements," specifically tests and margins that ensure limiting conditions of operation (LCOs) are met. Attachment I provides the response to the RAI. Attachment II provides the revised TS SR 3.3.5.3 markup and Attachment III provides the TS SR 3.3.5.3 clean copy.

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NRR

During discussions between the NRC staff and WCNOC personnel, it was determined that a supplement to this letter would be needed and it will be provided to the NRC at a later agreed-upon date.

The information provided in this submittal does not expand the scope of the application and does not impact the significance hazards consideration determination presented in Reference 1. In accordance with 10 CFR 50.91, "Notice for public comment; State consultation," a copy of this submittal is being provided to the designated Kansas State official.

This letter contains no commitments. If you have any questions concerning this matter, please contact me at (620) 364-4093, or Ron Benham at (620) 364-4204.

Sincerely,

Stephen L. Smith

SLS/rlt

Attachments:
- I Response to Request for Additional Information "Revision to Technical Specification 3.3.5, Loss of Power (LOP) Diesel Generator Start Instrumentation"
- II Proposed Technical Specification Changes (Mark-up)
- III Revised Technical Specification Pages

cc: S. A. Morris (NRC), w/a
N. O'Keefe (NRC), w/a
B. K. Singal (NRC), w/a
K. S. Steves (KDHE), w/a
Senior Resident Inspector (NRC), w/a

STATE OF KANSAS)
) SS
COUNTY OF COFFEY)

Stephen L. Smith, of lawful age, being first duly sworn upon oath says that he is Vice President Engineering of Wolf Creek Nuclear Operating Corporation; that he has read the foregoing document and knows the contents thereof; that he has executed the same for and on behalf of said Corporation with full power and authority to do so; and that the facts therein stated are true and correct to the best of his knowledge, information and belief.

By______________________________
Stephen L. Smith
Vice President Engineering

SUBSCRIBED and sworn to before me this 10TH day of September, 2019.

RHONDA L. TIEMEYER
Notary Public, State of Kansas
My Appointment Expires
January 11, 2022

Rhonda L. Tiemeyer
Notary Public

Expiration Date January 11, 2022

Attachment I to ET 19-0019
Response to Request for Additional Information "Revision to Technical Specification 3.3.5, Loss of Power (LOP) Diesel Generator (DG) Start Instrumentation"
(12 Pages)

Response to Request for Additional Information "Revision to Technical Specification 3.3.5, Loss of Power (LOP) Diesel Generator (DG) Start Instrumentation"

Reference 1 provided the Wolf Creek Nuclear Operating Corporation (WCNOC) application to revise Wolf Creek Generating Station (WCGS) Technical Specifications (TS). The proposed amendment would revise TS Surveillance Requirement (SR) 3.3.5.3 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 (RIS) 2011-12, Revision 1, "Adequacy of Station Electric Distribution System Voltages." Reference 2 provided a Request for Additional Information (RAI) related to the application. The specific Nuclear Regulatory Commission (NRC) requests are provided in italics.

RAI No. 1

In the LAR, Attachment I, Page 2, the licensee stated:

> *The LOV logic signal is set below the minimum bus voltage encountered during DG [Diesel Generator] sequential loading.*

In the LAR, the licensee has proposed to raise the LOV nominal Trip Setpoint from 83 Volts (V) to 91.28 V. Please provide minimum transient bus voltage encountered during DG sequential loading to verify that the LOV logic signal setting will remain below the minimum transient bus voltage.

Response to RAI No. 1

Based on Reference 1 (see Section 2.B.6), the loss of voltage relays will not spuriously operate when the EDG is operating at the tech spec voltages and frequencies. All the NB bus voltages remains above the 3240.1V. From Tables 6 and 7 (of Reference 1), the worst-case scenarios (1-2A, 1-2B), that is, EDG at minimum voltage (3950V) and maximum frequency (60.6) Hz, the minimum transient bus voltage is 3256.45V (78.28% of 4160V) which remains above the maximum dropout voltage of the Loss of Voltage Relay (LOV), that is, 3240.1 V (92.3 V). The maximum As-Found LOV relay dropout voltage is 92.3 V (Reference 2, page 80 of 100).

References:

1. NE-E-001-000-CN007
2. XX-E-009-001-CN006

RAI No. 2

In the LAR, Attachment I, Page 3, the licensee stated:

> *Should the DV condition occur in a non-accident condition (no SIS [safety injection signal] present), with the current time delay setting applied, an additional 111 second time delay is provided. These time delays are specific to the feeder breakers (2 per bus). If the DV is not alleviated in the overall 119*

seconds (nominal delay), the bus feeder breaker is tripped. An alarm is also provided to alert the operator to a DV condition.

According to LAR, Attachment IV, the TS Bases for SR 3.3.5.4 the Grid Degraded Voltage Function, the total response time without a SIS present will be revised from 144 seconds to 78 seconds. Please explain relationship between 119 seconds mentioned above, and 144 seconds and 78 seconds mentioned in Attachment III of the LAR.

Response to RAI No. 2

Per TS bases, "SR 3.3.5.4 is the performance of the required response time verification every 18 months on a STAGGERED TEST BASIS. This SR measures the total response time of the undervoltage relays, logic circuitry and DG start time."

It takes the Emergency Diesel Generators (EDGs) 144 sec to start supplying the Class 1E NB bus loads for an event when there is no accident and with the worst-case tolerances, dropout and DG start time are included.

With the existing plant settings if the voltage drops below the DVR maximum pickup setpoint and then stays above the Loss of Voltage Relay dropout point (3837.08 ≥ V ≥ 3240.1), the DVR actuation will occur within 8 seconds accident time delay provided there is an SIS. If there is no SIS signal an additional 111 seconds for the non-accident time delay will elapse. When the DVR times out approximately 119 seconds later, the Class 1E NB buses are isolated from offsite power. This causes a loss of all AC power which results in an actuation of the Loss of Voltage Relay (LOVR). The LOVR is set to actuate in 1.0 second with maximum of 0.1 seconds drop out time. Once the LOVR trip is initiated, the DGs are started taking about 12 seconds and then the Class 1E NB buses are once again energized. The 144s is calculated as follows:

Existing non-accident time delay 144s summary:

LOVR time delay setting	1.0 seconds
DVR initial time delay setting	8.0 seconds (trip output is blocked without SIS present, but it starts the non-accident 111 seconds timer=119s)
DVR non-accident time delay setting	111.0 seconds
Plus:	
LOVR maximum dropout time	0.1 seconds
DVR initial time delay tolerance	0.5 seconds
DVR non-accident time delay tolerance	11.1 seconds
LOVR time delay setting tolerance	0.2 seconds
EDG start time	12.0 seconds
	Total 143.9 seconds (rounded up to 144 sec)

Proposed non-accident time delay 78s summary:

LOVR time delay setting	1.0 seconds
DVR initial time delay setting	8.0 seconds (trip output is blocked without SIS present, but it starts the non-accident 48 seconds timer=56s)
DVR non-accident time delay setting	48.0 seconds

Plus:	
LOVR maximum dropout time	0.1 seconds
DVR initial time delay tolerance	0.5 seconds
DVR non-accident time delay tolerance	8.0 seconds
LOVR time delay setting tolerance	0.2 seconds
EDG start time	12.0 seconds
	Total 77.8 seconds (rounded up to 78 sec)

References:

1. STS IC-805A
2. STS IC-802A
3. STS IC-806A
4. STS KJ-001A

RAI No. 3

In the LAR, Attachment I, Page 4, the licensee stated:

> *The current TS value of 119 seconds encompasses both the DV time delay with an SIS present (8 seconds) and without an SIS present (111 seconds). The proposed change revises the TS to provide only the time delay associated with a SIS present.*

Please provide justification why the proposed change revises the TS to provide only the time delay associated with a SIS present.

Response to RAI No. 3

Based on further review Wolf Creek has determined that per NUREG-0800 (B.1.b) two separate time delays are required for the TS second level of undervoltage protection. The first-time delay is the 8.0 second "DVR initial time delay" and the second-time delay is the 48.0 second "DVR non-accident time delay setting identified in response #2. Based on this LAR, TS requested TS changes for TS 3.3.5, SR 3.3.5.3b have been revised as follows:

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 108.46, 120V bus	18 months

RAI No. 5

In the LAR, Attachment I, Page 7, the licensee stated:

> *The following equipment will have running terminal voltages slightly less than the rated voltage (< 90% of rated):*
>
> *a. Inverter NN011 - 89.11%*
> *b. Inverter NN012 - 89.91%*
> *c. Inverter NN013 - 89.87%*
> *d. Inverter NN014 - 89.26%*

The above voltages are slightly below the acceptance criteria of greater than or equal to 90% rated voltage. The licensee stated that this is acceptable, since the NN inverters are not considered OPERABLE unless they are powered from a Class 1E 125 VDC battery bus.

According to the WCGS, Updated Final Safety Analysis Report (UFSAR) Figure 8.3-6-01, "DC Main Single Line Diagram," the NN inverters are normally fed from Class 1E 125 VDC buses. However, if an inverter is inoperable, then based on TS 3.8.7, the associated vital bus can be fed from a regulating transformer, up to a Completion Time of 24 hours. Please describe the voltage regulating feature of regulating transformer, and whether this feature was modelled in the load flow analysis. If not modelled, please explain whether the voltage regulating feature of regulating transformer could alleviate the low voltage conditions at the above inverter buses.

Response to RAI No. 5

The NN Inverters are ferroresonant transformer-based voltage regulating device intended for use in uninterruptible power systems (UPS) or in stand-alone applications (Reference 1). It is a transformer-based power supply that uses nonlinear magnetic properties and a resonant circuit to provide a stable output voltage over a wide range of input voltage and load current variations.

The principle of ferroresonance is used to drive the transformer core in saturation that regulates wide range of unregulated input voltages and convert them to a well regulated stable desired output voltage at the loads.

The voltage regulating transformer is not modeled in the load flow studies. However, the inverter loads were conservatively modeled as a constant kVA load in the load flow studies for busses associated with the voltage regulating transformers. It is however determined that the output of the regulating transformer supplying the 120 VAC loads will remain within the specified stable regulating range of ±2%. This determination is based on a review of test data (Reference 2) on the regulating units (also called Isolimiter) of the above listed NN Inverters. The determination is supported by the following argument.

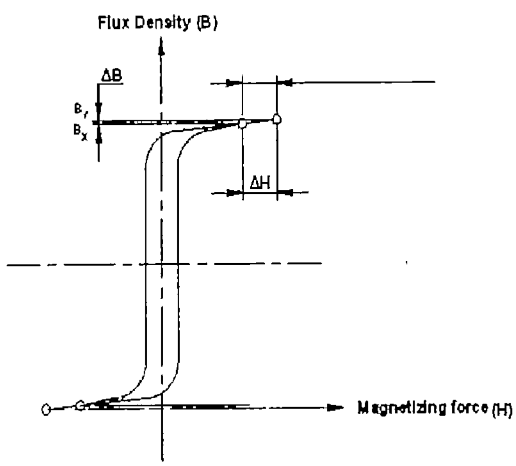
- Based on Reference 2, the regulation data in the range of 432 V (90% of 480V) to 528 V (110% of 480 V) is provided. Based on the test data it can be concluded that output voltage is within regulating range of ±2% when input voltage varied ±10% of 480 V. It is also concluded that the regulation is independent of the input voltage variations (proof of Ferroresonance or Constant Voltage Transformer (CVT) - operating in the highly saturation region of the transformer).
- The test data also suggests that the voltage levels at the output remained stable irrespective of the input voltage swings of ±10%. The NN Inverters are loaded less than 60% of its load rating at power factor higher than 0.86 (Reference 3). The minimum output voltage at 432 volts input (90% of 480 V) is 117.9 volts (or 98.25%, 117.9x100/120) at full-load and power factor of 0.8. The output voltage at full-load at a unity power factor is 121.0 V. Using linearity, the voltage at 0.86 power factor will be approximately 118.675 V (117.9+ 0.06x(121-117.9)/0.2 =118.83 V, which is approximately 99% of 120V). Therefore, the NN Inverters are operating at minimum of about 99% of 120 V at existing loads and power factor. Typically, the magnetic core will remain in saturation when the input voltage drops from 90% to 89%. In the worst case scenario that the magnetic core becomes unsaturated and enter the linear regions of the B-H curve, the output voltage will drop by 1% when the input drops from 90% to 89%. Therefore, the output of the NN inverted will be no less than 98% (of 120 VAC) at power factor of 0.86 or higher when the input voltage drops to 89% of rated input voltage. See further discussion below.
- Refer to a typical B-H loop (see below), specifically the region used to achieve the transformer reactor saturation design for the application of CVT. When the transformer is saturated to regulate the desired voltage, the flux density B is constant ($\Delta B=0$, independent of input voltage) and the voltage across the transformer (treated as reactor) becomes constant (voltage output = 4.44BNAf, where N is number of turns, A is area of cross section, f is the operating frequency, are constant) irrespective of the input voltage. For a highly saturated region (between X and Y), the output voltage remains constant for input voltages. Consider the input voltage range from 90% to 110% of 480 V (the voltage range the CVT is tested). Now consider the input voltage is at 89% of the 480 V and assuming that the saturation region of magnetic B-H curve is no longer in the highly saturated region ($\Delta B \neq 0$, but still in the neighborhood of the knee of saturation), it is argued that the flux density is still relatively near the saturation region and will not abruptly pulled in the linear region of the B-H curve. This reasoning is based on the review of test data (Reference 2) where it is shown that the CVT performs in the highly saturated region in the in the input voltage range of 90% to 110% of 480 V. This can be seen on the characteristics of B-H curve, the region of B-H just to the left of X shown on the B-H curve. For all practical purposes, the change in the output voltage at 89% of 480 V can be argued to much less than 1% due to the non-linear characteristic of the B-H curve near that region. Therefore, for a drop of less than 1% input

voltage from the 90% (432 V) where the magnetic saturation is proven to be maintained shown by the test data, the output voltage will remain within less than 1% than the rated output voltage (since the regulator minimum voltage is at 99% of the rated voltage as indicated above). Further, the regulator output will remain above the 98% of the rated voltage since the minimum load is less than 75% of the rated inverter load at a relatively higher power factor than 0.8 tested in Reference 2.

- As stated earlier, the CVT is capable of accepting a wide range of input voltage to regulate a stable (or constant) output voltage. The only limiting operating characteristic of the ferroresonance voltage regulator is that its design limits current to the load. In the event load current in excess of 150% of rated current, the regulator transitions out of the saturation region and the output voltage collapses to a very small value and limits the current to the load. This situation is unlikely in this particular application.
- Based on the above arguments, it can be stated the CVT design will not be pulled out from the saturation region at 89% of the input voltage. The test data show that the transformer reactor is operating in the highly saturated region of B-H curve at 90% of 480 V. Thus, for a change in input voltage less than 1% from the minimum input voltage tested where the B-H curve maintains the transformer reactor in a highly saturation region, the output voltage will not deviate linearly and therefore remain above the 98% of the rated voltage. It is therefore concluded that the NN Inverters will continue to operate as CVT for an input voltage of 89% of the rated voltage and output voltage will remain within ±2% of the rated 120 V.

X Y

Saturated region



B-H LOOP for Saturated Reactor

References:

1. Document Control Number M-766A-00011 Revision W09 (AMETEK Solidstate Controls Instruction / Technical Manual, Manual # C96000037 Revision C)
2. Document Control Number M-766A-00012 Revision W01 (AMETEK Solidstate Controls Inc., Isolimeter Final Test Reports for Model Number 85-VC0075-34)
3. WO # 19-452954-000.

RAI No. 6

In the LAR, Attachment I, Page 8, the licensee stated:

> *According to NEI 15-01, the motor starting analysis can either be a dynamic simulation that demonstrates each motor can be successfully started within its required time to perform its safety function or a static "snapshot" load flow analysis that demonstrates the calculated starting voltage at locked rotor conditions is within its design requirement. The analysis performs the dynamic simulation.*

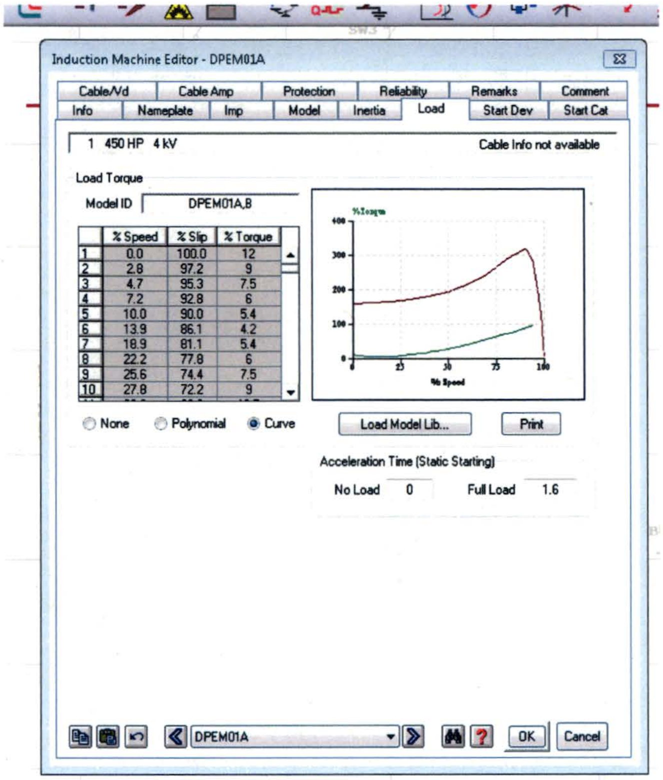
Please confirm whether the licensee performed dynamic simulation for all motors or only for certain specific motors, considering that detailed motor data for dynamic simulation is typically not readily available. Please provide a list of motors for which dynamic simulation was performed, and a brief description of the dynamic motor modelling/simulation.

Response to RAI No. 6

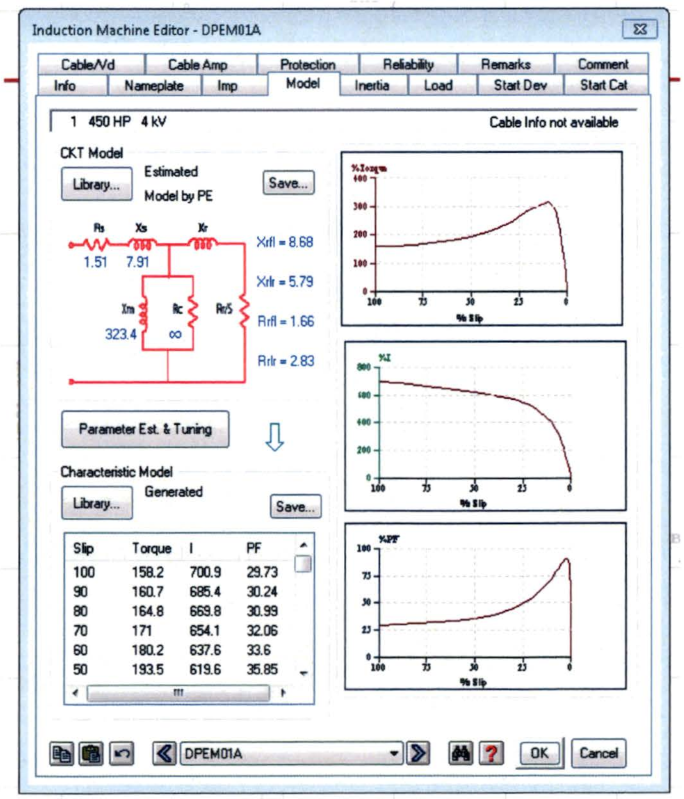
Per XX-E-009-001-CN006, Attachment A5, WC used ETAP 14.1.0N nuclear version software to perform a motor acceleration analysis. ETAP provides two methods for motor starting: Dynamic Motor Acceleration and Static Motor Starting. The Static Motor Starting method was used to confirm the adequacy of the DV relay dropout setting for motor starting because this method calculates the starting voltage for all motors that are started and does not require that the detailed motor data for dynamic simulation be entered into the ETAP program since this data was not available for all motors. Also, this method is 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). The results of this analysis are provided in Attachment A2.

An ETAP Transient Stability Analysis, which includes a Dynamic Motor Acceleration analysis, was performed as part of the enhanced overcurrent evaluation that was performed to verify the adequacy of the DV Relay Time Delay (with accident signal) for transfer to onsite emergency power. As indicated in the LAR, Attachment I, page 10, an enhanced overcurrent evaluation was performed for 20 TOLs that did not meet the acceptance criteria based on the NEI 15-01 methodology. The NEI 15-01 methodology conservatively assumes the motors continue to draw starting current until the DVR times out (8.5 seconds). The enhanced TOL evaluation determined the motor starting voltage at the LOVR lower analytical limit, which is the lowest degraded voltage that can occur without tripping the LOV relays. If the motor terminal voltage is high enough to start the motor, the resultant motor starting current and acceleration time is then calculated. After the motor reaches rated speed, the running current is determined. Thus, during the concurrent degraded voltage condition and LOCA, the TOL is evaluated for motor starting current only during the acceleration period and for running current for the remainder of the 8.5 second degraded voltage condition. The methodology for performing the enhanced overcurrent evaluation is provided in WCNOC Calculation XX-E-009-001-CN006, Section 4.7.1.3. The dynamic modeling of motors is carried out in XX-E-006 where the dynamic motor parameters are entered using vendor provided performance characteristics.

Typical ETAP dynamic modeling parameters illustrated as below.



	% Speed	% Slip	% Torque
1	0.0	100.0	12
2	2.8	97.2	9
3	4.7	95.3	7.5
4	7.2	92.8	6
5	10.0	90.0	5.4
6	13.9	86.1	4.2
7	18.9	81.1	5.4
8	22.2	77.8	6
9	25.6	74.4	7.5
10	27.8	72.2	9



Slip	Torque	I	PF
100	158.2	700.9	29.73
90	160.7	685.4	30.24
80	164.8	669.8	30.99
70	171	654.1	32.06
60	180.2	637.6	33.6
50	193.5	619.6	35.85

References:

1. XX-E-006 Rev.08
2. XX-E-009-001-CN006

RAI No. 7

In the LAR, Attachment I, Page 10, the licensee stated

> *To evaluate the performance of the TOL [thermal overload] during the 8.5-second concurrent LOCA [loss-of-coolant accident] and DV condition, the motor starting current that correlates to its starting voltage was calculated, and this motor starting current was then compared against the TCC [time-current characteristic] curves of the TOLs to obtain the trip time. The fastest operating trip time from the TCC curve was used for this evaluation. If the TOL did not trip during the 8.5-second DV condition, the TOL performance of the TOL relay heater was then evaluated during the subsequent start from the DG.*

Please provide an example of worst case evaluation which shows that the TOL relay would not trip during concurrent DV and LOCA condition, and subsequent start from the DG.

Response to RAI No. 7

Per section 4.7.1.3 of XX-E-009-001-CN006, the worst case TOL relay heaters for the 460 V motors with the lowest margin are the following:

Emergency exhaust fans, DCGG02A and DCGG02B

The methodology used to evaluate the TOLs is detailed in XX-E-009-001-CN006 (see pages 54-58). The initial TOL evaluation is documented in Appendix B3 and the enhanced evaluation in Appendix B4 in XX-E-009-001-CN006. Following the recommendation of XX-E-009-001-CN006, Section 2.1.3, TOL heaters for the Emergency Exhaust Fans, DCGG02A and DCGG02B TOL were replaced. The heaters were upsized from T50A to T53A per change package CP20157.

Based on XX-E-009-001-CN006, Appendix B4 (page B4.4), the DCGG02A and DCGG02B TOL T50A trip margin were -0.61 and -0.55 seconds, respectively. Note that these TOL margins were based on the minimum time-current characteristics (the lower curve) at an ambient temperature of 40°C (104°F). Also, the I^2t accumulated by the TOL is based on a fixed higher current during the initial motor acceleration whereas the current is decreasing as the motor is accelerates from locked rotor to its full-load running condition. Considering margin available in the accumulated I^2t and an unlikely probability of operating on the lower curve of the TOL, the TOL tripping with such low margin of -0.61 and -0.55 seconds is not likely.

Further review of WCNOC TOL performance characteristic was performed using test data. Based on the test data, the TOL performance is observed to be near the upper curve of the vendor published curve (see attached). The sample test data was also analyzed to determine the actual tolerance of vendor curve. It is determined that the vendor TOL lower tripping curve can be bounded by -30% of the vendor upper curve. Using a revised curve with -30% of the vendor upper curve (that establish the lower vendor curve), the calculations show that the TOLs will not trip.

Based on the determinations above, WCNOC believes that the T50A TOLs were marginally adequate for their performance. However, WCNOC decided to replace T50A to T53A per change package CP20157 for future improved margins.

References:

1. XX-E-009-001-CN006
2. ATT B4A - ELS - Enhanced Eval of TOLs That Trip at DVR Max Time Delay per NEI 15-01 Method.xlsx.
3. CP20157
4. WO#16-412818-001

RAI No. 8

In the LAR, Attachment I, Page 11, the licensee stated:

The results of the analysis show that the DV relay monitored bus voltage recovers above 3864 V for the scenarios studied at the lowest switchyard voltage of 98% of 345 kV [kilo volt] rated voltage.

Please provide the basis of considering lowest switchyard voltage as 98% of 345 kV rated voltage. Please describe how this value is related to the required Agreement with the Grid/Transmission Operator in accordance with North American Electric Reliability Corporation (NERC) standard NUC-001, "Reliability Standard for Nuclear Plant Interface Coordination."

Response to RAI No. 8

The lowest switchyard voltage as 98% of 345 kV rated voltage is based on NERC Interface Agreement between Westar Energy (transmission system operator entity) and Wolf Creek Nuclear Operating Corporation (see File – K01-058). Per NERC Reliability Standard NUC-001-3 and Interface Coordination Agreement (Interface coordination Agreement between Westar Energy and Wolf Creek Nuclear Operating Corporation), the switchyard minimum and maximum switchyard steady state voltages will be maintained ≥98% and ≤104.5%. See Attached Agreement (File – K01-058).

WCNOC requires that the switchyard to be operated within the established minimum and maximum switchyard steady state voltages of ≥98% and ≤104.5%. This is in accordance to Wolf Creek Licensing requirements. The Licensing Conditions are described in plant Updated Safety Analysis Report ("USAR"), Chapter 8, section 8.2.1.1 Transmission Network.

RAI No. 9

In the LAR, Attachment I, Page 12, the licensee stated:

> *At an LOV relay lower analytic limit of 3150.4 V [75.7% at 4160 V base] at the NB buses, the Class 1E motors that are running for plant design basis accidents will not stall, and the Class 1E MCC voltages exceed 345 V [75% of 460V].*

Please provide percent allowable stall voltages (maximum and minimum) based on voltage-torque characteristics of various of 4000 V and 460 V rated motors. Please also provide any related references.

<u>Response to RAI No. 9</u>

Per section 4.1.5 of XX-E-009-001-CN06, the LOV relay dropout (lower analytical limit) is selected to ensure stalling of class 1E motors is prevented during a sustained degraded voltage with/ and without LOCA.

The methodology to perform the motor stall voltage is detailed on section 4.7.1.5 section B. The motor.

The result of motors stall evaluation is documented in Attachment C2. This attachment provides the percent allowable stall voltages of the 4000 V and 460 V motors.

References:

1. XX-E-009-001-CN006.

<u>RAI No. 10</u>

In the LAR, Attachment I, Page 24, the licensee stated:

> *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 second, a time delay setting of 1.0 second is expected to ensure that no spurious trip of the feeder breaker occurs.*

Please provide the basis of calculating 0.85 second due to offsite power system faults/disturbances. Also, the margin between the above described 0.85 second and 1.0 second appears to be too low, especially considering the lower limit of LOV time delay as 0.9 second. Please justify this low margin (0.05 second) considering as per industry practice (such as IEEE Standard 242), the time coordination interval is recommended to be not less than 0.2 second for static relays and 0.3 second for electromagnetic relays.

<u>Response to RAI No. 10</u>

Per section 4.6.4 of XX-E-009-001-CN06, the Minimum Time Delay Limit for the relay was calculated such that it prevents spurious operation during momentary voltage transients caused by offsite power disturbances (such as three phase faults, or other disturbances in the offsite power system). Review of faults and recovery from the faults (fault study results in Attachment E of Reference 1), determined that the bus transient voltage is not expected to last longer than 0.85 seconds as a result of offsite power system faults (see Attachment E). The recovery time was conservatively determined to be estimated at 0.85 seconds (at 0.85 pu, the maximum reset voltage of the loss of voltage relay) and included about 0.1 second margin. Attachment E.10 of XX-E-009-001-CN06 shows that this time delay is slightly less than 0.74 seconds. Therefore, a setting delay of 1.0 second was determined to conservatively ensure that no spurious trip of the feeder breaker will occur.

Based on a 0.74 seconds of disturbance recovery time, the margin in the setting is determined to be about 0.16 seconds (0.90-0.74). Note this margin is adequate and sufficiently reliable to ensure that no spurious trip of the feeder breaker will occur during large system disturbances. Further, the Loss of Voltage Relay is only to be coordinated with the Degraded Voltage Relay and there is significant margin between their operating times.

Therefore, the margins are acceptable and conservative margins are available for coordination.

References:

1. XX-E-009-001-CN06

RAI No. 11

In the LAR, Attachment I, Page 24, the licensee stated:

> *The maximum time delay for the LOV relay is limited to the 1.2 second time used in the accident analysis response time for starting the DGs during a Loss of Offsite Power Event.*

The NRC staff could not find the above stated 1.2 second time delay used in the accident analysis response time in the USAR, for starting the DGs during a Loss of Offsite Power Event. Please provide the requisite Chapter/Section of UFSAR, where it is stated.

Response to RAI No. 11

The LOV relay time delay value is not specifically quantified in the USAR (USAR section 8.3.1.1.3, pg.8.3-13). However, USAR indicates that a brief delay to be employed to prevent false trips arising from transient undervoltage (spike) conditions.

The limiting time delay of 1.2 seconds is documented in SR 3.3.5.3.a and in procedure STS IC-806A &B, pg.9.

References:

1. Technical specification SR 3.3.5.3.
2. STS IC-806A/B.

Attachment II to ET 19-0019
Proposed Technical Specification Changes (Mark-up)
(1 Page)

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 ≥ ~~82.5V~~ 90.0V, 120V bus with a time delay of 1.0 ~~± 0.2, -0.5 sec.~~ + 0.15, -0.1 sec. Loss of voltage nominal Trip Setpoint ~~83V~~ 91.28V, 120V bus with a time delay of 1.0 sec. b. Degraded voltage Allowable Value ≥ ~~105.9V~~ 107.5V, 120V bus ~~with a time delay of 110 ± 11.6~~ sec. Degraded voltage nominal Trip Setpoint ~~106.9V~~ 108.46V, 120V bus ~~with a time delay of 110 sec.~~ 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.	18 months
SR 3.3.5.4	Verify LOP DG Start ESF RESPONSE TIMES are within limits.	18 months on a STAGGERED TEST BASIS

Attachment III to ET 19-0019
Revised Technical Specification Pages
(1 Page)

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 108.46, 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