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AEP
INDIANA MICHIGAN POWER

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Docket No: 50-315

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Stop O-P1-17
Washington, D. C. 20555-0001

Donald C. Cook Nuclear Plant Unit 1
TECHNICAL SPECIFICATION CHANGE REQUEST
4kV BUS UNDERVOLTAGE SETPOINT
REQUEST FOR ADDITIONAL INFORMATION
(TAC No. MB3499)

References:
1) Letter from M. W. Rencheck, Indiana Michigan Power Company, to U. S. Nuclear Regulatory Commission Document Control Desk, "Donald C. Cook Nuclear Plant Unit 1, Technical Specification Change Request 4kV Bus Undervoltage Setpoint," submittal C1101-03, dated November 16, 2001.

2) Letter from J. F. Stang, Jr., Nuclear Regulatory Commission (NRC) to A. Christopher Bakken III, Indiana Michigan Power Company, "Donald C. Cook Nuclear Plant, Units 1 and 2 - Request for Additional Information, 'License Amendment Request Engineered Safety Feature Actuation System Instrumentation Trip Setpoints' (TAC NOS. MB3499)," dated February 21, 2002.

Indiana Michigan Power Company (I&M), the licensee for Donald C. Cook Nuclear Plant Unit 1, submitted proposed revisions to Unit 1 Technical Specification (TS) Table 3.3-4 and the bases for TS 3/4.3.1 and 3/4.3.2 in Reference 1. The proposed revisions would:

- Change the settings for the loss of voltage trip setpoint for the motor driven auxiliary feedwater pumps and the loss of power functional units.

- Revise the degraded voltage trip setpoint, time delay, and allowable values for the loss of power functional unit.

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- Explain the applicability of the time delay associated with the 4.16 kV bus degraded voltage trip setpoint.

The NRC subsequently requested additional information regarding the proposed revisions in Reference 2. The attachment to this letter provides I&M's response to the NRC request for additional information.

This letter contains no new regulatory commitments.

Should you have any questions, please contact Mr. Gordon P. Arent, Manager of Regulatory Affairs, at (616) 697-5553.

Sincerely,

A. C. Bakken III
Senior Vice President, Nuclear Operations

Attachment

/bjb

c: K. D. Curry, w/o attachment
J. E. Dyer
MDEQ - DW & RPD, w/o attachment
NRC Resident Inspector
R. Whale, w/o attachment

AFFIRMATION

I, A. Christopher Bakken III, being duly sworn, state that I am Senior Vice President, Nuclear Operations of American Electric Power Service Corporation and Vice President of Indiana Michigan Power Company (I&M), that I am authorized to sign and file this request with the Nuclear Regulatory Commission on behalf of I&M, and that the statements made and the matters set forth herein pertaining to I&M are true and correct to the best of my knowledge, information, and belief.

American Electric Power Service Corporation

A. C. Bakken III
Senior Vice President, Nuclear Operations

SWORN TO AND SUBSCRIBED BEFORE ME

THIS 12 DAY OF March, 2002

Jennifer L Kernosky
Notary Public

My Commission Expires 5/24/05

ATTACHMENT TO AEP:NRC:2008

4kV BUS UNDERVOLTAGE SETPOINT
REQUEST FOR ADDITIONAL INFORMATION

Indiana Michigan Power Company (I&M), the licensee for Donald C. Cook Nuclear Plant (CNP) Unit 1, submitted proposed revisions to Unit 1 Technical Specification (TS) Table 3.3-4 and the bases for TS 3/4.3.1 and 3/4.3.2 in a letter from M. W. Rencheck to U. S. Nuclear Regulatory Commission (NRC) Document Control Desk, dated November 16, 2001. The proposed revisions would:

- Change the settings for the loss of voltage trip setpoint for the motor driven auxiliary feedwater pumps and the loss of power functional units.
- Revise the degraded voltage trip setpoint, time delay, and allowable values for the loss of power functional unit.
- Explain the applicability of the time delay associated with the 4.16 kV bus degraded voltage trip setpoint.

The NRC subsequently requested additional information regarding the proposed revision in a letter from J. F. Stang, Jr. to A. Christopher Bakken III dated February 21, 2002. The responses to the NRC request for additional information are provided below.

NRC Question Number 1

"The existing degraded voltage and loss of voltage setpoints were based upon an electrical auxiliary bus voltage analysis that considered the auxiliary system loading for the operating period from 1985-1990. The subject analysis, which was based upon a nominal bus voltage of 4000 volts, indicated a minimum steady state bus voltage and minimum transient bus voltage of 3708 volts and 3492 volts respectively. The existing minimum degraded voltage and loss of voltage allowable values are 3578 volts and 3160 volts, respectively. The proposed degraded voltage setpoint is based upon an analytical limit that is, the voltage value at which all safety-related loads have sufficient voltage to perform their intended safety function, [that] has been determined to be 3902 volts. Please state the analytical limits for the degraded voltage and loss of voltage functions prior to the planned design change to increase the reliability of the offsite power system, the analytical limit for the loss of voltage function after the subject design change, and explain, how the subject design change (i.e., replacement of the existing 4 kV offsite power transformers with auto-load tap changing type transformers and replacement of the loss of voltage and degraded voltage relays with relays of an improved design) affected the subject analytical limits."

I&M Response

I&M initiated the planned design change following the discovery that the terminal voltage at some safety-related electrical equipment may not be adequate during a postulated design basis accident coincident with a degraded-voltage condition. This finding was reported to the NRC in Licensee Event Report 315/1999-022-01 dated March 23, 2000, and actions were taken to assure that safety-related loads would have adequate voltage. Subsequently, in a May 4, 2000, letter from Robert C. Godley (I&M) to NRC Document Control Desk, I&M committed to the installation of automatic load tap-changing transformers, and performing a re-evaluation of the electrical distribution system's design and licensing bases.

The corrective action for the inadequate terminal voltage included the development of an analytical limit (AL). The AL is 3902 volts and will not be impacted by the design change. The AL is the minimum required steady-state voltage to ensure all essential loads perform their design functions. For transient conditions, the main concern is that the connected loads do not become unavailable due to either the loss-of-voltage relays or the degraded-voltage relays tripping and that they are not damaged. The loss-of-voltage relays will provide proper protection for transient conditions, and the acceptable minimum limit for the relays has been determined to be a nominal 3220 volts. The design change will improve the ability of the electrical auxiliary system to handle changes in the grid voltage and also improve the accuracy of the relays to ensure that the minimum allowable voltages are maintained.

NRC Question Number 2

"The D.C. Cook plant design has safety-buses feeding a mixture of safety-related and important non-safety related loads because the original designers of the plant considered the powering of important non-safety-related loads from the emergency buses as a needed design feature. A loss of offsite power results in the shedding of all of the 4 kV loads, both safety and non-safety loads, other than some permanently connected loads. The 4 kV safety buses consist of two redundant and independent trains, each supplied from its own emergency diesel generator (EDG). After the EDGs have started and have assumed the unshed loads, the remaining required safety loads are automatically sequenced back onto the safety buses. Load shedding of the non-safety loads is required because the EDGs cannot start or carry all of the loads that are normally on the safety buses. The existing degraded voltage trip setpoint includes a 2.0 minute time delay which is long enough to prevent disconnecting the offsite power source due to short, inconsequential grid disturbances, yet short enough to prevent failures of the safety-related equipment due to running with inadequate voltages.

The subject amendment proposes to change the existing 2.0-minute time delay for a degraded voltage condition to a 9 second time delay when a safety injection signal or steam generator low-low level signal is present for the degraded voltage function. A longer time delay for a degraded voltage condition will apply when neither a steam generator low-low level signal or safety injection signal [is present. This time delay] will be included in an owner-controlled document

instead of the technical specifications. Please identify the longer time delay(s) to be included in the subject owner-controlled document and the associated control logic sequences and discuss whether the concerns stated in NRC Information Notice 93-17, 'Safety Systems Response to Loss of Coolant and Loss of Offsite Power,' have been addressed by the subject design change."

I&M Response

The longer time delay is the original 2-minute delay. The longer time delay is for non-accident conditions. This time delay is not impacted by the design change. It will continue to prevent unnecessary disconnecting of the offsite power source due to short, inconsequential grid disturbances and prevent unnecessary challenges to safety systems of the unit. As part of the design change to install the automatic load tap-changing transformer, I&M has developed an additional shorter time delay for the degraded voltage relays. The second time delay, 9 seconds, is for accident conditions and will be in effect when a safety injection or steam generator low-low level signal occurs coincident with a degraded voltage condition. This shorter time delay assures that the requirements of the Updated Final Safety Analysis Report Chapter 14 analyses are met.

The intent of the design change is not to address the Information Notice (IN) 93-17 concerns. The main intent of the design change is to improve the ability of the electrical auxiliary system to accommodate changes in the grid voltage, and also improve the accuracy of the relays to ensure sufficient voltage is maintained. CNP was licensed on the basis of a loss-of-coolant accident coincident with a loss-of-offsite power event. Nevertheless, CNP can adequately accommodate the conditions described in IN 93-17. This capability will not be impacted by the design change.

NRC Question Number 3

"Please confirm that any time delay associated with the voltage changes by the new auto-load tap changing offsite power transformer has been considered in the proposed 9 second time delay determination to address the safety analysis assumptions in Chapter 14 of the updated final safety analysis report."

I&M Response

The time delay associated with the voltage changes by the new automatic load tap-changing transformer has been considered in the proposed 9-second time delay determination. This time delay value will support the safety analysis assumptions and meet the accident mitigation time requirements.

NRC Question Number 4

"The subject amendment cites NRC Branch Technical Position (BTP) PSB-1, 'Adequacy of Station Electric Distribution System Voltages,' as a basis for not including in the Technical Specifications time delays related to safety analyses. However, the Safety Evaluation for

Amendment No. 137 to Facility Operating License No. DPR-58 which established the existing degraded voltage trip setpoints and allowable values noted '...that the degraded grid protection relays are in force only when the safety buses are powered from the offsite source and are not acting during normal operation. This is not in conformance with the Standard Review Plan, Chapter, Appendix 8A, BTP PSB #1. Therefore, in order to have added protection for safety buses from degraded voltage conditions, the staff recommends that these degraded grid voltage relays remain in force regardless of the power sources connected to the safety buses; i.e., whether powered from the unit auxiliary transformer or the offsite power system.' Please update the record whether the proposed design change will meet BTP PSB-1, specifically for:

a. The voltage levels at the safety-related buses should be optimized for the maximum and minimum load conditions that are expected throughout the anticipated range of voltage variations of the offsite power sources given the range of the new auto-load tap changing transformers (B.3 of PSB-1), and

b. The analytical techniques and assumptions used in the voltage analyses cited in item 3 must be verified by actual measurement (B.4 of PSB-1)."

I&M Response

I&M has used BTP PSB-1 as guidance in developing the setpoints and time delays for the relays. The setpoint and a time delay of 9 seconds for the degraded voltage relay has been determined by an analysis of the electrical system to support compliance with the accident analyses. The setpoint and the 9-second time delay are included in the proposed TS. Additionally, a second time delay, 2 minutes, has been selected for non-accident conditions. As the second time delay is not related to the accident analyses, I&M has proposed that this value be maintained in an owner-controlled document rather than the TS.

The intent of BTP PSB-1 positions B.3 and B.4 is met as described below.

BTP PSB-1, Item B.3 is not directly applicable to the automatic load tap-changing transformers. With the non-automatic load tap-changing transformers, the voltage on the secondary side of the transformers will change with the changing grid voltage or changes in auxiliary system loading. Therefore, it is necessary to manually select an optimum tap position for non-automatic load tap-changing transformers. However, the design change will install automatic load tap-changing transformers. The automatic load tap-changing transformers automatically adjust the tap positions to provide the desired voltage on the secondary side. They will be programmed to automatically change taps to maintain a nominal secondary voltage of 4160 volts when supplying power.

I&M does not plan to perform the test described in BTP PSB-1, Item B.4. This item provides specific criteria to be used for the tests to verify the analytical techniques and assumptions used in the voltage analyses. The main purpose of Item B.4 is to verify the validity and results of the

mathematical calculations. Since the issuance of the BTP, better tools for power system analysis have become available and accepted industry wide. The latest advances in computer technology and development of sophisticated analytical computer programs allow the plant configuration and different operating scenarios to be easily modeled and analyzed with great precision, accuracy and repeatability. Therefore, it is no longer as critical to verify the mathematical model and the results of the mathematical calculations with the measured data.

I&M uses the Electrical Transient Analyzer Program (ETAP) to perform power system analysis. ETAP is widely accepted and used in the industry as the power system analysis tool. This program meets 10 CFR 50, Appendix B requirements, and has been verified and validated. The system modeled in ETAP was developed in accordance with approved design drawings and procedures. The system model mirrors the normal operating configuration and expected operating configurations during design basis events.

Although I&M is not committed to BTP PSB-1, I&M considers that the intent of items B.3 and B.4 is met as described above.

NRC Question Number 5

"Clarify that all onsite distribution levels include 120/208 volt levels."

I&M Response

The degraded-voltage relay's setpoint and time delay values are established based on the requirements that all essential loads perform their design functions. The analysis considers all essential loads at all auxiliary system distribution levels, including the 120/208 volt system level.

NRC Question Number 6

"Provide details of the auxiliary bus voltage analysis (specifically, assumptions, loading and summary of results.)"

I&M Response

The AL was established as the minimum required steady state voltage by a voltage analysis of the auxiliary system. The AL is the required minimum steady state voltage at the 4.16 kV safety-related busses. All essential loads in the system will have adequate voltage to perform their design function as long as the 4.16 kV safety-related voltages remain at or above this AL. The analysis calculates the available voltages at the bus level and the equipment terminals, and verifies that the available voltages are adequate for all essential loads to perform their design functions. The ETAP program is used to perform the power system analysis, and the system model is developed from approved design drawings and procedures. The system model reflects the configuration of CNP and the expected configurations under design basis accident

conditions. Connected loads and their operating conditions used in the model (i.e., percent loading, duration, etc.) are based on available design information for meeting their most demanding design requirements. The results of the analysis confirm that all essential loads in the system will have adequate voltage to perform their design function as long as the voltages remain at or above the AL of 3902 volts, or 93.8% at the 4.16 kV safety-related busses.

Details of the loads are provided in Figure 1, which is a one-line drawing of the 4.16 kV and 600 volt busses. In accordance with the restrictions stated on the drawing, I&M hereby releases this document to the NRC for its information and use in connection with the review of our submittal. I&M also permits the NRC to reproduce the drawing as necessary to facilitate review and distribution of the submittal to meet NRC requirements. The assumptions pertinent to the relay setpoints are provided in Table 1, and the results of the degraded voltage analysis are provided in Table 2.

NRC Question Number 7

"A longer time delay will apply when neither a steam generator low-low level nor a safety injection signal is present, but it is not included in the TS. The longer time delay is allowed in order to restore adequate voltages. Describe the procedure, including any changes in degraded voltage setting, used to restore adequate voltages."

I&M Response

I&M has established provisions to monitor and maintain adequate switchyard voltages, and to respond in the event that the switchyard voltages drop below the minimum acceptable levels. To ensure that all essential loads can adequately perform their design functions, an interface agreement between the American Electric Power (AEP) Energy Delivery and Customer Relations Group and the AEP Nuclear Generation Group, a real-time switchyard voltage-monitoring computer program, and response procedures have been developed.

The interface agreement provides guidance to ensure that the organizations responsible for operation, maintenance, and engineering consider the impact of their activities on facilities located at CNP and on the AEP transmission system. Specifically, the interface agreement contains a provision that system control center personnel monitor system conditions to ensure that adequate voltage levels to support CNP in the event of an accident are maintained.

Switchyard voltages are monitored on the CNP Online Load Flow (CKOLF) computer program, which is a real-time state-estimator/load-flow computer program. CKOLF determines the expected voltage levels at the switchyards assuming a CNP one-unit trip (if only one unit is operating) or a CNP two-unit trip (if both units are operating). The program provides an alarm to the AEP Transmission Coordinator (AEPTC) if the expected switchyard voltage is not within the acceptable limits. A special operating procedure (SOP), "Cook Nuclear Plant Transmission/Auxiliary Voltage Operating Guide," is followed by the AEPTC. This procedure

provides directions for the AEPTC to respond to switchyard voltage conditions outside of the limits acceptable to CNP as indicated by the alarm. The AEPTC's required actions include notifying CNP Unit Supervisors of the switchyard voltage conditions and also taking immediate compensatory actions to restore voltage levels within acceptable limits. Additionally, CNP has an operating procedure "Degraded Offsite AC Voltage Response," that provides directions for responding to degraded switchyard voltage conditions.

If voltage level conditions are below acceptable limits at the switchyards, the AEPTC will follow the steps in the SOP to raise the voltage levels above the limits. The AEPTC will initiate switching of electrical reactors to improve switchyard voltages and will also inform CNP Unit Supervisors. However, if the voltage levels do not improve to acceptable levels as expected, then a split transformer configuration would be considered if offsite power were being supplied to both safety trains by a single transformer. Under the split transformer configuration, separate transformers supply power to a single safety train from each unit. This divides the load on the safety-related buses between two transformers and reduces the load on the transformer. Additionally, system operations' personnel may close transmission interconnections or request neighboring control area generating plants to increase the voltage levels to achieve acceptable values.

When the unit is online, CNP personnel, through coordination with AEPTC and in addition to the steps in the SOP, may consider raising the generator output voltage or taking the unit offline. If the degraded voltage condition occurs while the unit is offline, then no direct means of bus voltage control is available. They will coordinate with AEPTC to implement the steps in the SOP, as described above, to raise the switchyard voltages. In addition, they will consider de-energizing plant equipment and/or transferring redundant components to redistribute loads.

CNP personnel, upon receiving notification from AEPTC and/or discovering low voltage conditions on CKOLF program/Control Room Annunciators, will enter the appropriate response procedures. They will verify the voltage conditions and declare offsite AC sources inoperable per TS 3.8.1.1 as applicable. They will enter additional response procedures and implement steps identified in those procedures in order to restore adequate voltage levels.

Although the installation of the automatic load tap-changing transformers will allow greater operating flexibility and reduce susceptibility to varying switchyard voltage conditions, I&M currently does not plan to eliminate the interface agreements, CKOLF, or response procedures.

NRC Question Number 8

"The criteria used to determine the loss-of-voltage setpoint include:

- Preventing running Class 1E motors from stalling.
- Ensuring any load can be started without damaging any loads that are already running.
- Preventing load shedding due to thermal overload/relaying.

Describe how these criteria are met in voltage response analysis."

I&M Response

Loss of Voltage Setpoint Allowable Values

The lowest anticipated voltage on the 4.16 kV bus is 81% of the rated bus voltage, and results from the start of a reactor coolant pump. The minimum required voltage to prevent class 1E motor stalling has been determined to be 77.4% of the rated bus voltage. The proposed technical specification loss-of-voltage (LOV) relay setting has a range of 3245 volts to 3328 volts. These values correspond to 78% and 80%, respectively. This range is sufficient to prevent spurious actuation during transients (i.e., the relay should not actuate during voltage transients experienced during the starting of plant motors). The range is also sufficient to preclude the stalling, damage, or unavailability of class 1E motors due to low voltage.

The voltage analysis has demonstrated that:

- The voltage of the relay busses remains above the upper allowable value of the LOV relay during the start of the largest plant motor.

- The voltage of the relay busses remains above the upper allowable value of the LOV relay during the start of the largest motor connected to a fully loaded relay bus.

- The voltage of the relay busses remains above the upper allowable value of the LOV relay during sequential motor starting, while connected to the offsite power system.

- The minimum allowable voltage is sufficient to preclude the stalling of class 1E motors.

- The increased current resulting from the voltage just above the lower allowable value of the LOV relay is within the allowable range of the class 1E motor overcurrent protection, which is 121% - 144%. This ensures that the motor will not be thermally damaged.

- The lower allowable value of the LOV relay is high enough so that the time required for voltage decay allows the loss of voltage relay to actuate fast enough to meet the Emergency Core Cooling System pump flow requirement established in the accident analysis.

Loss of Voltage Relay Time Delay

The time delay for the loss of voltage relay has been historically set at 2 seconds with a tolerance of +/-0.2 seconds. The 2-second time delay was chosen to bypass short duration system voltage drops and to function in sufficient time to allow the protective actions initiated by the loss of voltage to meet the accident analysis equipment start times.

TABLE 1
ASSUMPTIONS FOR THE DEGRADED VOLTAGE ANALYSIS

1. Safety-related cable conductor temperature is assumed to be 90 degrees Celsius (°C) for load flow and voltage drop modeling unless otherwise noted. This is based on the continuous rating of the cable insulation.

2. Cable conductor temperature for motor operated valve (MOV) cables is assumed to be 90°C outside of containment and in non-high energy line break areas.

3. If walkdown information is not available, motor information (power factor, starting power factor, and efficiency) will be based on NEMA Standard MG-1 and Sargeant and Lundy (S&L) Standards S&L ESC-165 and ESC-193.

4. Battery chargers and inverters will be modeled as constant kilo-volt ampere (kVA) loads, which is conservative. These devices are essentially regulated power supplies at or below their ratings and they current limit when their ratings are exceeded. Modeling them as constant power loads ensures maximum current when input line voltage is low, which is conservative for voltage drop and loading calculations.

5. Intermittent loads (i.e., valves, compressors, sump pumps, etc.) will be modeled as "off" for steady state load flow cases. These loads operate for short periods and are not likely to operate simultaneously.

6. Unless specifically indicated otherwise, the allowable operating voltages for electrical equipment is assumed to be ±10% of nominal.

7. Unless specifically indicated otherwise, the minimum allowable operating voltages for safeguards motors are as follows (excluding MOVs):

   - 4.16 kV or 4 kV class motors (starting): 80% nominal rating
   - 4.16 kV or 4 kV class motors (running): 90% nominal rating
   - 575 V class motors >200 horsepower (starting): 80% nominal rating
   - 575 V class motors (running): 90% nominal rating

8. This calculation assumes a minimum allowable starting voltage of 85% rated voltage for 575 V alternating current (AC) motors 200-horsepower (HP) or smaller (excluding MOVs).

9. The motors that receive a safety injection/containment spray (SI/CS) start signal for Unit 1 will be the Unit 1 equivalents of the motors that start on an SI/CS signal in Unit 2.

10. When the starting power factor is not available, 85% is used for motors less than 0.5 HP and 20% is used for motors greater than 250 HP.

11. When locked rotor current is not available, 625% of rated full load current is used.

12. For lighting and distribution transformers, the loading on the transformer is assumed to be 80% of the kVA rating.

13. When walkdown data is not available, the design document (i.e., station drawings) data is assumed to be correct.

14. A 90% power factor will be used for MOV starting power factor if nameplate information is not available.

15. It is assumed that 575 V AC motor parameters (power factor, service factor, etc.) are the same as for 460 V AC motors on a percentage basis.

16. Small distribution transformer (e.g., 600 V-240/120 V) loading is assumed to be 80% of nameplate if the loading is not shown on design documents.

17. Low inertia 4.16 kV and 4 kV pump motors are assumed to accelerate in five seconds or less at minimum starting voltage.

TABLE 2
RESULTS OF DEGRADED VOLTAGE STUDY

Results

All safety-related loads were found to have voltages greater than or equal to the 90% acceptance criteria at the analytical limit except for the following:

Motor Control Center Number	Load Identification	Voltage Percentage
MCC 1-AM-A-R5C	Component cooling pump area fan.	89.27
MCC 1-AB-D-2C	Control room air handling unit fan 1	89.31
MCC 1-AM-A-5A	Control room air handling unit fan 2	89.45
MCC 1-AM-A-R2A	Control room pressurizer fan	89.51
MCC 1-EZC-C-R3C	Air circulation/hydrogen skimmer fan	89.82
MCC 1-EZC-B-R2D	Air circulation/hydrogen skimmer fan	89.99

Operation at these voltages has been evaluated and found to be acceptable.

FIGURE 1

MAIN AUXILIARY ON-LINE DIAGRAM
BUS "A" & "B"
ENGINEERED SAFETY SYSTEM
(TRAIN "B")