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October 3, 1989

Dr. Thomas E. Murley, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Byron Station Units 1 and 2
Braidwood Station Units 1 and 2
Application for Amendment to Facility Operating
Licenses NPF-37, NPF-66, NPF-72, and NPF-77
NRC Docket Nos. 50-454/455 and 50-456/457

Dear Dr. Murley:

Pursuant to 10 CFR 50.90, Commonwealth Edison proposes to amend Appendix A, Technical Specifications of Facility Operating Licenses NPF-37, NPF-66, NPF-72, and NPF-77. The proposed amendment requests changes to Specification 3/4.8.3.1, Onsite Power Distribution. The detailed description is contained in Attachment A. The revised Technical Specification pages are contained in Attachment B.

The proposed changes have been reviewed and approved by both on-site and off-site review in accordance with Commonwealth Edison procedures. Commonwealth Edison has reviewed this proposed amendment in accordance with 10 CFR 50.92(c) and has determined that no significant hazards consideration exists. This evaluation is documented in Attachment C.

Commonwealth Edison has evaluated the proposed amendment with the requirements of 10 CFR 51.21. Attachment D contains the corresponding Environmental Assessment Statement.

Commonwealth Edison is notifying the State of Illinois of our application for this amendment by transmitting a copy of this letter and its attachments to the designated State Official.

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Please direct any questions regarding you may have this matter to this office.

Very truly yours,

R. A. Chrzanowski
Nuclear Licensing Administrator

Attachments

cc: Senior Resident Inspector - Byron
Senior Resident Inspector - Braidwood
L.N. Olshan - Project Manager, NRR
S. P. Sands - Project Manager, NRR
Regional Administrator - Region III
Office of Nuclear Facility Safety - IDNS

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ATTACHMENT A

DETAILED DESCRIPTION

INTRODUCTION

The Byron and Braidwood Stations Technical Specification 3/4.8.3.1 requires that each 120 VAC instrument bus be energized from its associated inverter connected to its associated DC bus during operation in Modes 1, 2, 3, and 4. An action statement allows the instrument bus to be de-energized for a period of up to 2 hours and not energized from its associated inverter connected to its associated DC bus for a period of up to 24 hours. Failure to meet either of the action statement conditions would require the plant to be in hot standby within the next 6 hours and in cold shutdown within the following 30 hours. This attachment supports a proposed amendment to the Technical Specifications which would allow one 120 VAC instrument bus to be energized from its associated constant voltage transformer for a period of up to 72 hours. The proposed amendment will:

1. Reduce the hesitancy to allow planned outages on inverters for preventive maintenance to be performed due to the short 24 hour allowed out-of-service time currently permitted by Technical Specifications and,

2. Allow sufficient time to troubleshoot, repair, test, tune, clean and inspect failed inverters before requiring a plant shutdown.

BACKGROUND

The 120 VAC Instrumentation System supplies a reliable source of regulated instrument and control power to equipment and systems which must remain in operation during a momentary or complete loss of AC power. These systems include the Reactor Protection System, the ESF Actuation System, Process Instrumentation System, and certain Safety Category II (non-safety related) loads required to facilitate plant operation. Each of the Byron units has four 120 VAC instrumentation busses, supplying one of the four Reactor Protection System channels.

Each of the two 480 VAC ESF Divisions supplies two of the 120 VAC instrumentation busses. A 120 VAC instrumentation bus is capable of receiving power from its 480 VAC ESF busses by two means: 1) from its associated static inverter or 2) from its associated 480/120 Volt self-regulating constant voltage transformer. The inverter and transformer feeder breakers are mechanically interlocked to prevent their simultaneous closure and subsequent paralleling of the inverter and the transformer power feeds. The inverter power supply frequency is much more regulated (60 Hz $\pm$0.5%) than the constant voltage transformer output and parallel operation might cause overheating of the inverter. The inverter is the normal and preferred source while the constant voltage transformer serves as a backup source when the inverter is out-of-service for maintenance or repair.

The 7.5 KVA inverter provides additional redundancy in that it is capable of being powered from either the 480 VAC ESF bus or from a 125 VDC control power battery bus. The inverter produces a single phase, 60 Hz, 118 VAC output. The 480 VAC ESF bus is the normal source of power to the inverter with automatic transfer to the 125 VDC bus if the AC input fails. The three-phase, 480 VAC input to the inverter is first transformed then rectified to a DC output voltage. DC output voltage is adjusted so that it does not exceed 140 VAC and is not less than the battery voltage. A blocking diode is installed in the battery input circuit. This blocking diode is normally reverse-biased, thus blocking the DC bus input. If the AC power supply fails, the diode will conduct and automatically "bumplessly" transfer battery power to supply the instrument bus through the inverter.

The 10 KVA constant voltage transformer is classified as Safety Category I (Class IE) and is powered from its associated 480 VAC ESF bus. The transformer produces a single-phase, 60 Hz, 120 VAC output. The transformer is the controlled ferro-resonant type and provides output voltage regulation to within $\pm 2\%$ with +10% to -15% input variation. The constant voltage transformer is a reliable piece of equipment and no failures have occurred on Byron Units 1 and 2 based on a review of the Nuclear Plant Reliability Data System. In addition, a review of the Total Job Management data base identified that no maintenance activities have been required on these transformers as a result of any work requests. A sketch of the bus arrangements is provided in Addendum 1.

Plant Response to a Complete Loss of an Instrument Bus

The complete loss of power to a 120 VAC instrument bus can interrupt the following safety related and non-safety related power supplies depending on the particular bus de-energized:

SAFETY RELATED

1. NIS Channel Control Power
2. NIS Channel Instrument Power
3. Auxiliary Safeguards Relay Power
4. Safeguard Test Relay Power
5. Reactor Coolant Loop Stop Valve Protection System Power
6. Solid State Protection System Train "A" Input Channel Power
7. Solid State Protection System Train "B" Input Channel Power
8. ESF Sequencing and Actuation Cabinet Power
9. Main Control Board ESF Power Supply
10. Process Instrumentation and Control Rack Channel Power Supply
11. Solid State Protection System Output Relay Power

NON-SAFETY RELATED

12. Process Instrumentation and Control Rack Channel Power Supply
13. Main Control Board Instrument Channel Power Supply

It should be noted that an automatic transfer to reserve power separate from the 120 VAC instrument busses is provided for the process instrumentation and control cabinets identified in items 10 and 12 above. Therefore on a loss of instrument bus power it is highly unlikely that the process I & C cabinets would be de-energized. Additionally, the operator is required by procedure to select alternate control channels or defeat inoperable control channels and is provided with Abnormal Operating Procedures to identify which process instruments have been lost when a particular instrument bus is de-energized.

It should be noted that for each of the two ESF Divisions only one of the two 120 VAC instrument busses on that division supplies power to its dedicated train Solid State Protection System (SSPS) output relay cabinet. As such for Division 11 (21), only 120 VAC instrument bus 111 (211) supplies power to SSPS Train A output relay cabinets while bus 113 (213) does not. Similarly, for Division 12 (22), only 120 VAC instrument bus 114 (214) supplies power to SSPS Train B output relay cabinets while bus 112 (212) does not. With instrument bus 111 (114) [211 (214)] on the Constant Voltage Transformer (CVT) and with a loss of offsite power concurrent with an SI signal the shutdown sequencer and safety loads would sequence on the 4KV bus per design. There would be no reduction in the level of safety provided by an instrument bus fed from either its associated instrument inverter or from its associated CVT. No single failure during a loss of offsite AC power would prevent the automatic actuation of at least one division of safety, should it be required. This is because of the inherent system design. When instrument bus 111 (114) [211 (214)] is deenergized the SSPS would process the SI signal up to the master relays. When the 4KV ESF bus 141 (142) [241 (242)] is reenergized the slave relays associated with the SI signal would be energized. The sequencing cabinet does not start sequencing until the undervoltage relay for the 4KV ESF bus has reset. The time for this reset is about 1.8 seconds. The average time for the SSPS to process an ESF signal is less than 0.5 seconds. Thus the automatic ESF System for the associated 4KV ESF bus will respond as designed under loss of offsite power with an SI signal upon the diesel generator (DG) for the associated 4KV ESF bus reaching rated speed and voltage at which time the DG feed breaker to the associated 4KV ESF bus would close and the loads would sequence on the 4KV ESF bus. The bus feed breaker from the 4KV ESF bus to the 480 VAC bus which feeds the CVT and the breaker from the 480 VAC bus to the CVT does not open on undervoltage. Thus the instrument bus would be reenergized when the DG feed breaker closes on the 4KV bus. Some control board indication would be lost until the DG feed breaker closed on the bus, but indication of plant parameters would be provided by the other instrument busses on their respective 125 VDC battery source through the inverter. There would be no delay in providing any protection required due to the instrument bus being fed from the CVT.

All ESF functions would respond as required on a loss of offsite AC if the Diesel Generator on the division not affected by the inverter outage were to fail.

Abnormal Operating Procedure 1/2BOA ELEC-2, LOSS OF INSTRUMENT BUS provides the symptoms and required operator actions for a loss of any of the four 120 VAC instrument busses. While the procedure is written based on the loss of an instrument bus while on its associated inverter, it would also be applicable for loss of the bus while on the constant voltage transformer.

The control room indications following a loss of an instrument bus would include one or more of the following:

1. Possible Reactor Trip and/or Safety Injection from logic coincidences made up by tripped bistables.

2. Tripped status lights for a particular channel indicate a tripped condition.

3. Abnormal main control board indications fed from the de-energized instrument bus.

4. Various main control board alarms.

5. Loss of instrument and control power to the channel of nuclear instrumentation fed from the de-energized bus.

6. General Warning alarm from the Solid State Protection System Cabinet A or B.

Required operator actions consist of:

1. Check Rod Control System in manual.

2. Check T_{AVE} - T_{REF} deviation is stable and within 1°F.

3. Check that the following instrument control channels are operable:

   Pressurizer pressure
   Pressurizer level
   Steam flow
   Steam generator level
   Feedwater flow
   Turbine Impulse Pressure
   T_{AVE}
   Delta T

4. Determine which instrument bus is de-energized by verifying instrument and control power is available to all NIS.

5. Restore power to affected instrument bus(ses) by checking inverter amps and voltage, verifying supply and individual load breakers are closed and transferring to the constant voltage transformer if necessary.

6. Check that the instrument bus(ses) is(are) reenergized and available to all NIS.

Onsite Power Distribution Technical Specifications

The basis for the operability of the AC and DC power sources and associated distribution systems during operation ensures that sufficient electrical power will be available to supply safety related equipment required for: 1) the safe shutdown of the facility, and 2) the mitigation and control of accident conditions within the facility. The minimum specified AC and DC power sources and distribution systems satisfy the requirements of General Design Criteria 17 of Appendix A to 10CFR part 50.

As mentioned above, Technical Specifications currently limit operation with an inverter out-of-service to 24 hours during which time the 120 VAC instrument bus is energized by its constant voltage transformer. If during this time period transformer power becomes unavailable for any reason, one Reactor Protection System channel is lost and one train of ESF Protection may be lost and the degree of protection redundancy is potentially reduced.

The Technical Specification Bases do not present a discussion of the basis for the allowable out-of-service times for the power distribution system, but does state that the AC and DC source allowable out-of-service times for the power sources are based on Regulatory Guide 1.93, "Availability of Electrical Power Sources", December 1974. For the lack of a more definitive guidance, the regulatory position as presented in Regulatory Guide 1.93 will be used as a reference for extending the allowable out-of-service time with an inverter out-of-service from 24 to 72 hours during which time the 120 VAC instrument bus is energized by the constant voltage transformer.

Regulatory Guide 1.93 states that whenever the Technical Specifications allow power operation to continue with less than the required number of electrical power sources, such continued power operation should be contingent on: a) an immediate verification of the availability of the remaining sources, b) reevaluation of the availability of the remaining diesel-generators at a time interval not to exceed eight hours, c) verification that required maintenance activities do not further degrade the power system or in any way plant safety, and d) compliance with the additional conditions stipulated for each specified degradation level.

Since Regulatory Guide 1.93 was intended to provide a basis for the allowable out-of-service times for power sources to the 4 Kv ESF busses strict application of items a) through d) above is not deemed appropriate for power sources to the 120 VAC instrument busses. Each item and its application to the extension of the action time allowed for an A.C. instrument bus to be energized from a source other than from the inverter connected to its associated D.C. Bus is commented on below.

Item a) an immediate verification of the availability of the remaining sources.

There are two sources under consideration: 1) the sources supplying the instrument bus <u>not energized</u> from its associated inverter and 2) the sources supplying the three instrument busses <u>energized</u> from their associated inverters.

For the instrument bus <u>not energized</u> from its inverter the sources under consideration are the supplies to its associated Division 4 Kv ESF bus and 125 VDC battery. Since the battery is not capable of supplying the instrument bus via the constant voltage transformer, the remaining sources are the associated diesel generator and either units System Auxiliary Transformer (SAT) as prescribed in specification 3.8.1.1. Surveillance Requirement 4.8.3.1.2 has been added to meet the intent of this item.

4.8.3.2 The 480-Volt A.C. ESF bus energizing the affected 120-Volt A.C. instrument bus shall be determined energized in the required manner by verifying correct breaker alignment and indicated voltage on the associated 4160-Volt and 480-Volt busses.

For the three instrument busses <u>energized</u> from their associated inverters the sources under consideration are the supplies to their associated 4 Kv ESF bus and 125 VDC battery. Surveillance Requirement 4.8.3.1.3 has been added to meet the intent of this item.

4.8.3.3 The three unaffected 120-Volt A.C. instrument busses shall be determined energized from an OPERABLE inverter by verifying correct breaker alignment and indicated voltage on the associated ESF and 125-Volt D.C. busses.

The current action statement does not require immediate verification of the availability of the remaining sources, but allows 24 hours of operation on the constant voltage transformer. This is consistent with NUREG-0452 and in general with all stations whose Technical Specifications are based on NUREG-0452, Rev. 4 and later. Insertion of the Regulatory Guide 1.93 requirement to immediately verify the remaining sources would make the action statement more restrictive than the current action statement since any variation in breaker alignment or indicated voltage on associated 480-Volt and 4 Kv busses could immediately force the plant into shutdown via specification 3.0.3.

Based on the above the action statement has been modified to allow 72 hours of operation with the instrument bus not energized from its associated inverter. Verification of correct breaker alignment and indicated voltage would be required within 24 hours and at least once per 8 hours thereafter. The choice of the 24 hours is consistent with the current industry practice of allowing 24 hours of operation on the constant voltage transformer without verification of sources and consistent with the Regulatory Guide of requiring immediate verification (after the 24 hour period) for the extension period.

Item b) re-evaluation of the availability of the remaining diesel-generators at a time interval not to exceed eight hours.

The proposed amendment request does not specifically require that the availability of the remaining diesel-generators be reevaluated, but does require verification by Surveillances 4.8.3.1.2 and 4.8.3.1.3 of correct breaker alignment and indicated voltage on the 4 Kv ESF busses. The term verify as used in this context means to administratively check by examining logs or other information to determine if certain components are out-of-service for maintenance or other reasons and this would include the diesel generators. It is felt that these additional surveillances, and with the requirements of ACTION C. of specification 3.8.1.1 if one diesel-generator were inoperable, are sufficient to meet the intent of this item.

Item c) verification that required maintenance activities do not further degrade the power system or in any way plant safety.

This item will be covered by the performance of surveillance 4.8.3.1.2 and 4.8.3.1.3 above. Additionally, the station out-of-service procedure BAP 330-1, Revision 4, dated December 20, 1989 states the following:

1. Prior to taking a Technical Specification required component OOS, the redundant train will be verified operable (item 2.a page 3)

2. The Shift Engineer or SRO licensed assistant determines that the redundant train of Safety Related equipment is operable by checking the Master Out-of-Service board, prior to approving an outage on Safety Related equipment.

Item d) compliance with the additional conditions stipulated for each specified degradation level.

There is only one degradation level under consideration, the instrument bus supplied for a period of time (72 hours) by its constant voltage transformer instead of the inverter. Additional considerations are provided by the modified action statement and the addition of surveillance requirements.

The proposed Technical Specification changes are provided in Attachment B. The proposed amendment will reduce the time pressures to complete repairs or limit opportunities for preventive maintenance on the inverters currently felt as a result of the 24 hour limit. While a quantitative assessment of plant availability has not been conducted it is felt that it is good engineering practice to provide sufficient time for the conduct of both these repair/maintenance activities. The current 24 hour limit is insufficient when considering that:

1. It takes several hours to complete the required paperwork and equipment tag out process prior to any work being started.

2. Troubleshooting the inverters has historically taken 10 to 15 hours depending on the complexity of the circuit that has failed.

3. Once the failed item is determined, a paper work change with accompanying repair work instructions and signatures must be obtained prior to repair.

4. Following repair the inverter must be temporarily energized and loaded to verify proper operation and tuning.

5. It can take several hours to clear the equipment tags and complete the required paperwork to return the inverter to service.

The total time for the above process outline for a corrective action is in the range of 15 to 21 hours depending on the complexity of the failure. This does not include any additional time for preventive maintenance actions such as tuning the ferro-resonant transformer, capacitor change outs, cleaning the inverter, ascertation of electrical connection tightness and new part "burn in" time.

The inverter units need periodic inspections for dust and dirt buildup on electrical circuit components and particularly on capacitors located in the ferro-resonant transformer. This requires that the normal paperwork and equipment tag out process described above be completed in order to disassemble and access the ferro-resonant transformer for cleaning. With the 24 hour time clock operating, repair of all but minor problems would be limited.

It should be noted that the Regulatory Guide does not specify a particular time limit for allowed out-of-service time for this bus. Additionally, the instrument bus will be energized during this period from a very reliable 480 VAC ESF bus with increased surveillances on both the affected and unaffected busses. For these reasons and those discussed above, we believe it is acceptable to allow an instrument bus to be supplied via the 10 KVA constant voltage transformer for up to 72 hours to allow for sufficient time for the performance of both comprehensive repair and maintenance actions in accordance with good engineering practices.