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Washington, D.C. 20555

Subject: Clinton Power Station – Removal of Minimum Loading Requirement for Reserve Auxiliary Transformer

Dear Madam or Sir:

This letter is provided to inform the NRC of a change in commitment related to Amendment 122 of the Clinton Power Station (CPS) Operating License, which was issued March 26, 1999 in response to requested changes to the setpoints specified in the Technical Specifications for the plant safety-bus degraded voltage relays (DVRs). The change in commitment is based on additional analyses that have been performed subsequent to the issuance of Amendment 122. The new analyses involve no changes to the degraded voltage relay setpoints themselves.

By letter U-603146, dated January 20, 1999, and Supplements dated February 4, 8, 25 and March 5, 1999, CPS requested amendment of its Operating License (License No. NPF-62) pursuant to 10CFR50.90 for changes to Technical Specification 3.3.8.1, "Loss of Power Instrumentation," and to various Surveillance Requirements (SRs) under Technical Specification 3.8.1, "AC Sources-Operating." In particular, CPS requested approval of revised DVR setpoints to ensure adequate voltage for limiting 120-volt circuits based on higher analyzed voltage requirements for the 120-volt circuits. A boost to the plant reserve auxiliary transformer (RAT) secondary voltage through a change in the position of the RAT tap setting was also to be implemented to maintain the capability of the offsite source to reset the DVRs when offsite voltage is greater than or equal to the minimum expected level.

With the RAT tap setting at a higher position, and as described in the January 20, 1999 amendment application, it was determined that the potential for an overvoltage condition exists for certain Class 1E components when offsite grid (345 kV) voltage exceeds approximately 1.01 per unit (348.5 kV) and the RAT static VAR compensator (SVC) is not available. (Application of the 1.01 per-unit steady-state voltage level as the "overvoltage"

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threshold for all potential affected loads was conservative and was used since more detailed analyses at the individual load level to determine the upper voltage limit for each type of load under short-term conditions had not been completed at the time.) This potential overvoltage condition could occur in the event of a RAT SVC trip when the ESF buses are fed from the RAT. Compensatory measures to mitigate and prevent this condition were thus proposed. These measures include revising the operating configuration for the 4.16 kV buses such that the 4.16 kV balance-of-plant (BOP) buses 1A and 1B would be normally supplied from the RAT rather than the unit auxiliary transformers (UATs), and implementing additional procedural changes to require plant operators to transfer one of the two safety buses (Division 1 or Division 2) to the ERAT if the total RAT 4.16 kV load becomes less than required to protect against an overvoltage condition (in the event of SVC trip). The NRC staff approved the revised DVR setpoints, the RAT tap change, and the measures proposed for precluding or mitigating potential overvoltages, via Amendment No. 122 to the CPS Facility Operating License, which was issued on March 26, 1999.

The above-described changes were thus implemented upon receipt of Amendment 122. However, subsequent to that amendment CPS completed more detailed analyses of the maximum voltages that would occur at the Class 1E components during an unlikely event in which the RAT SVC trips coincident with the maximum 345 kV grid voltage (362.25 kV or 1.05 pu). The RAT loading condition that was evaluated for these additional analyses was minimum expected loading on the Class 1E buses and no load contribution from 4.16 kV BOP buses 1A and 1B. This evaluation encompassed all components that are fed from the Class 1E system at all voltage levels, including components fed from the non-regulated Class 1E distribution transformers, and included (where needed) determination of the maximum voltage level that can be tolerated by each type of load on a short-term as well as long-term basis. The results of the analyses show that the maximum transient overvoltage condition that could occur at the ESF buses as a result of a RAT SVC trip would not adversely impact performance of the Class 1E components except for four components. The four Class 1E components that were identified as not being sufficiently capable of withstanding the postulated transient overvoltage condition have since been replaced with components qualified for higher maximum voltages. These modifications were completed just prior to the recent refueling outage at CPS (i.e., RF-7).

With the completion of the detailed voltage analyses and replacement of the four limiting components, the original overvoltage concern has been resolved such that there is no longer a need to maintain a minimum BOP load on the RAT. Consequently, upon restart from RF-7 the 4.16 kV BOP buses (1A and 1B) have been re-aligned to the UATs consistent with the original plant configuration for normal operation. Since this is a change to the commitment made pursuant to License Amendment 122, this letter is submitted to inform the NRC of this change.

Additional details concerning this change, including historical background information and further explanation of the revised voltage analyses that enabled this change, are provided in the attachment (Attachment 1) to this letter. It should be noted that appropriate changes to the CPS USAR have been made to support this change. The USAR changes, as well as the

associated plant modifications (for replacement of the four Class 1E components), were evaluated against the criteria of 10CFR50.59, and it was concluded that this change does not involve an unreviewed safety question. No changes to the Technical Specifications were required, as the changes approved pursuant to Amendment 122 remain valid.

Sincerely yours,

Paul D. Hinnenkamp
CPS Plant Manager

TBE/blf

Attachments

cc: Regional Administrator, Region III, USNRC
NRC Resident Office, V-690
Illinois Department of Nuclear Safety

REMOVAL OF RAT MINIMUM LOADING RESTRICTION

Background:

An offsite electric power system and an onsite electric power system are provided for Clinton Power Station (CPS) pursuant to General Design Criterion (GDC) 17 of 10CFR50 Appendix A. The offsite power system is the preferred and normal source for the 4.16 kV Engineered Safety Feature (ESF) buses associated with the CPS Class 1E AC power system. The primary offsite source of power for the unit Class 1E AC power system is via the Reserve Auxiliary Transformer (RAT) which is connected to a 345 kV offsite network with multiple incoming lines. The secondary offsite source of power for the unit Class 1E AC power system is via the Emergency Reserve Auxiliary Transformer (ERAT) which is connected to a separate, independent 138 kV offsite network. These circuits (the RAT and ERAT) provide the two qualified offsite circuits required by Technical Specification 3.8.1, "AC Sources-Operating," and GDC 17 of 10CFR 50 Appendix A. The onsite standby power supply system for the Class 1E AC power system consists of diesel generators (DGs), one for each of the three divisional load groups, such that each 4.16 kV ESF bus has a dedicated DG.

In addition to the onsite Class 1E AC electrical power distribution system (consisting of three independent AC power distribution systems, including the three 4.16 kV ESF buses), the unit auxiliary AC power system supplies power to unit loads that are not safety-related, i.e., non-Class 1E balance-of-plant (BOP) loads. The unit auxiliary AC power system extracts power from the main generator via two unit auxiliary transformers (UATs) so that power to BOP loads can be provided via the UATs. The UATs provide power to the 6.9 kV and 4.16 kV non-safety buses when the main generator is online. Each UAT is sized to carry one-half of the full load requirements of the unit. Power to BOP loads can also be provided via the RAT, as the RAT was sized for such capability. Manual transfer capability for the BOP buses between the RAT and UAT is provided, and automatic transfer capability for transferring BOP loads from the UATs to the RAT (such as during a plant trip) is provided as well.

The RAT is sized to provide the BOP auxiliary load required for the unit in addition to the total coincidental ESF auxiliary load required for a LOCA. The RAT is also sized to carry the auxiliary load required for startup and shutdown of the unit. By comparison, the ERAT is sized to carry only the ESF auxiliary load required for a LOCA, and thus can supply only the three 4.16 kV ESF buses. The ERAT is equipped with online load tap changing capability to provide a relatively constant 4.16 kV output. Manual and automatic capability for transfer of the safety buses from the RAT to the ERAT, or vice versa, is provided.

The RAT and ERAT are each supported with a static VAR compensator (SVC). The SVCs provide dynamic (and static) reactive power support to support voltage at the secondary side of these transformers. In this regard, the SVCs enhance the plant's capability to accommodate postulated degraded grid conditions, thus supporting offsite source availability. Generally, an SVC is in service whenever its associated reserve auxiliary transformer (RAT/ERAT) is in service.

Background (cont'd):

During normal plant operation, when the unit is synchronized to the transmission system, each 4.16 kV ESF bus is connected to the preferred source, i.e., the offsite transmission system, via the RAT or ERAT. The preferred configuration (per the original CPS design) is to have the RAT as the primary offsite source of power for the unit Class 1E AC power system, and to have the UATs as the primary source of power for the BOP loads.

With regard to the above-described power sources and plant loads, much effort has been devoted to analysis of plant bus and load voltages to ensure acceptable performance during normal as well as accident conditions. Analyses of bus voltages, including the associated calculations, were discussed to a significant degree in the amendment application that led to issuance of Amendment 122 to the CPS Operating License (as noted in the cover letter to this attachment). These analyses are documented in several important plant calculations. Per these calculations, safety related buses are analyzed for sustained operation as low as the secondary undervoltage relay automatic DG start/bus tie-in setpoint (> 3848 V and < 3876 V, nominal 3862 V). Safety-related buses are also analyzed for sustained operation and operability up to 4300 volts [approx. 1.01 per unit (pu) @ 345 kV grid voltage]. Auxiliary power system voltages are analyzed in Calculation 19-AK-06, Rev. 0 and associated volumes. 120-volt circuits fed from non-regulated Class 1E-distribution transformers are analyzed in Calculation 19-AJ-74, Rev. 0 and associated volumes. 120-volt circuits fed from the motor control center (MCC) control power transformers (CPTs) are analyzed in Calculation 19-AJ-70, Rev. 2 and associated volumes.

Technical Specification (TS) Limiting Conditions for Operation (LCOs) and Surveillance Requirements (SRs) for the AC Sources and Electrical Distribution System are provided in TS 3.8.1/2 (AC Sources – Operating/Shutdown) and TS 3.8.9/10 (Distribution Systems – Operating/Shutdown), respectively.

Amendment 122 Changes:

On January 20, 1999, while CPS was in its extended plant shutdown for RF-6, a license amendment request was submitted to revise the setpoints (Allowable Values) specified per Technical Specification (TS) 3.3.8.1, "Loss of Power Instrumentation," for the 4.16-kV ESF bus degraded voltage relays (DVRs). (Consistent with those changes, changes were also requested for various Surveillance Requirements (SRs) under TS 3.8.1, "AC Sources – Operating," to revise the minimum steady-state bus voltage limit specified in those SRs.)

The changes were prompted by the latest developments, at that time, in the implementation of plant modifications to resolve degraded voltage concerns at CPS. Modifications completed at that time included the installation of new, more accurate degraded voltage relays, replacement of the ERAT with a new transformer having load tap-changing capability, and the installation of SVCs for the RAT and ERAT. (These modifications were supported or authorized by License Amendments 110, 116 and 117, respectively.) In addition to those modifications, the installation of a significant number of 480/120-volt regulating transformers had been planned for completion at the time. Re-assessment of that approach, however, led to identification of an

Amendment 122 Changes (cont'd):

alternate approach wherein adequate voltage to many of the limiting 120-volt loads could be ensured (without the use of a large number of regulating transformers) by a 5% boost in the RAT secondary voltage through a change in the tap setting of the RAT (to tap # 3). With corresponding changes to the DVR setpoints this approach would continue to ensure the capability of the offsite source(s) to reset the DVRs when offsite voltage is greater than or equal to the minimum expected level.

In the January 20, 1999 license amendment application, it was identified that with the RAT tap setting at a higher position to support the proposed DVR setpoints, the potential for an overvoltage condition exists when the offsite grid (345 kV) voltage exceeds approximately 1.01 pu (348.5 kV) and the RAT SVC is not available. Application of the 1.01 per-unit steady-state voltage level as the "overvoltage" threshold for all affected loads was conservative and was used since, at that time, more detailed analyses at the individual load level to determine a maximum tolerable voltage for each type of load under short-term conditions had not been completed.

Because of this identified potential for overvoltage, commitments (contingencies) were identified in the amendment application to preclude or mitigate the identified, potential overvoltage condition. In particular, the operating configuration for the 4.16 kV buses was to be revised such that 4.16 kV BOP buses 1A and 1B would be normally supplied from the RAT (rather than the UATs) to increase the voltage drop across the RAT. Procedural changes were also to be implemented to require the operators to transfer a Division 1 or Division 2 bus to the ERAT if the total RAT 4.16 kV load becomes less than required to protect against an overvoltage condition (in the event of an SVC trip or removal from service). To support these commitments a design change was also prepared for installing a "RAT 4KV LOW LOAD" alarm in the main control room (Panel 1H13-P680, window 5005-3F) to alert the operators whenever the total 4.16 kV load on the RAT drops below the minimum load required for prevention or mitigation of an overvoltage condition in the event of an SVC trip. In its Safety Evaluation Report (SER) for Amendment 122, the NRC staff approved the proposed changes to the DVR setpoints, the proposed RAT tap change, and the commitments identified to prevent the associated potential overvoltage condition. A requirement to revise the USAR to reflect implementation of the noted commitments was specifically included in the staff's SER.

Upon issuance of Amendment 122, all of the above-noted commitments were implemented. The RAT low-load level alarm was installed as well. The CPS USAR was thus revised (via USAR Change Package 8-257) to identify the RAT as the normal source of power for a portion of the unit auxiliary BOP loads. With this USAR change, and the associated procedure changes, the operating configuration that was established for the 4.16/6.9 kV buses with the main generator on-line may be summarized as follows:

Amendment 122 Changes (cont'd):

Generator On-Line	Primary Source	Secondary Source
4160V Safety Buses	RAT	ERAT
4160V Non-Safety Buses	RAT	UAT*
6900V Non-Safety Buses	UAT	RAT

* Manual transfer only

It should be noted that the potential for a similar overvoltage condition for loads connected to the ERAT was identified not to exist. This is because a tap setting for the ERAT was chosen such that the possibility of a high voltage condition (caused by an ERAT SVC trip) could not be created.

Revised Voltage Analysis:

The plant configuration that was established pursuant to Amendment 122 was in place for the duration of Operating Cycle 7. Although this was an acceptable configuration, it was recognized that more detailed analyses of bus voltages and load requirements, along with any design changes that may be required, would be able to support elimination of the requirement to maintain BOP load on the RAT, thereby allowing the BOP loads to be supplied by the UATs per the original plant configuration for normal operation (with the main generator on line). Thus, during Operating Cycle 7, CPS completed more detailed analyses of the maximum voltages that would occur at the Class 1E components during an unlikely event in which the RAT SVC trips coincident with the maximum 345 kV grid voltage (362.25 kV or 1.05 pu) for the loading condition where BOP loads are not fed from the RAT. This evaluation encompassed all components fed from the Class 1E system at all voltage levels, including components fed from the non-regulated Class 1E distribution transformers, and included (where needed) determination of the maximum voltage level that can be tolerated by each type of load on a short-term as well as long-term basis.

For evaluation of the maximum voltage levels that can be tolerated by plant loads under the above-described conditions (i.e., the SVC trips coincident with maximum grid voltage (1.05 pu) and no BOP load on the RAT), a sustained overvoltage condition was assumed to exist for 30 minutes. A 30-minute duration is based on such considerations as the capability of plant operators to take actions to change or add load to reduce voltage, transfer loads from the RAT to the ERAT (or vice versa) or from the UATs to the RAT, SVC operating experience to date, and how much voltage the various types of loads can tolerate.

The results of these analyses showed that the maximum transient overvoltage condition can be sustained for all Class 1E components except for four solid-state components. The four components that were identified are two Moore automatic ramp buffers (ARBs), 0FX-VG004

Revised Voltage Analysis (cont'd):

and 0FX-VG104, which provide a ramp signal in the control circuit for two dampers associated with the Standby Gas Treatment (VG) system (to prevent "slamming" of the dampers in response to an "open" signal), and two internal power supplies for the Containment Monitoring (CM) system temperature controller racks (YK167). These two pairs of components were addressed as follows:

(1) Calculation 19-AJ-74, Rev. 0, Vol. I showed that with the RAT SVC unavailable, the calculated input voltage at the VG system ARBs could exceed the rated input voltage of 117 VAC $\pm$ 10%. Therefore, design changes were implemented to procure and install new replacement ARBs with components that can function at a higher maximum input voltage, and to qualify the ARBs for seismic category I as well as to validate the input voltage rating for the maximum possible voltage caused by a RAT SVC trip.

(2) Calculation 19-AK-06, Rev. 0, Vol. BH showed that the secondary voltage at the 480/120 VAC control power transformer (CPT) which supplies power to the CM Validyne power supplies associated with the YK167 temperature controller racks (and to other components as well) could be as high as 140 VAC with the RAT SVC unavailable. Based on review of Calculation 19-AJ-70, Rev. 2 for components fed from this CPT, an unacceptable voltage could exist for the Validyne power supplies. Therefore, design changes were implemented to relocate the input power source for the CM temperature controller racks to another 120 VAC distribution panel where the calculated maximum voltage is less than 136 VAC, and to qualify the input voltage rating for the CM temperature controller racks (Validyne power supply) to 100-136 VAC by appropriate testing.

With the implementation of the above design changes, the maximum postulated transient overvoltage condition can be sustained for all Class 1E components. The associated hardware modifications for these design changes were completed just prior to the recent refueling outage (RF-7).

Additional Considerations and Justification for Removal of RAT Minimum Load Requirement

With the implementation of the identified design changes, the above-described voltage analyses demonstrate that the maximum postulated transient overvoltage condition (RAT SVC trip/unavailability concurrent with 345-kV grid voltage @ 1.05 pu) can be sustained for all Class 1E components with no BOP load on the RAT. With no need to maintain BOP load on the RAT for mitigation of the postulated overvoltage condition, the requirement to maintain such load can be deleted.

Deletion of the minimum RAT loading requirement is further supported by plant procedures for responding to abnormal bus voltages and to trips of the SVCs. For example, although the procedures now reflect the fact that BOP loads are not normally aligned to the RAT, during

Additional Considerations and Justification for Removal of RAT Minimum Load Requirement (cont'd)

abnormal bus voltage conditions the procedures direct plant operators to align BOP loads to the RAT as one of the actions that can be taken to reduce overvoltage for the affected buses. The guidance provided by these procedures is summarized below. (Note: This summary procedure information is provided for information only.)

RAT SVC Trip and Trouble Annunciator Procedures (CPS Nos. 5011.07): The RAT SVC has a "RAT SVC TRIP" and "RAT SVC TROUBLE" annunciator in the main control room that promptly alerts the plant operators in the event of SVC trouble and/or an SVC trip. The annunciator response procedure for these annunciators directs the operators to declare the associated offsite source inoperable (which will result in entry into the Required Actions of TS 3.8.1/2) and transfer the affected 4.16 kV safety buses to the ERAT in accordance with CPS Procedure 3501.01, "High Voltage Auxiliary Power System," which includes instructions for addressing abnormal system operating conditions (as addressed below).

High 4.16 kV Bus Voltage Annunciator Procedure (CPS No. 5007.05): A "4KV BUS HIGH VOLTAGE" annunciator is also located in the main control room. This annunciator alerts plant operators when voltage exceeds a specific limit (~4251 Volts) on any of the three divisional ESF 4.16 kV buses. The annunciator response procedure refers to the possible causes of this alarm, including high grid voltage and SVC failure. The procedure refers the plant operators to CPS Procedure 3501.01 for guidance for lowering/controlling bus voltage, and it requires the initiation of increased monitoring of the bus voltage. The procedure requires restoring bus voltage to less than 4300 Volts within 30 minutes. Depending on the magnitude of the overvoltage condition, it also requires declaring the affected electrical divisional distribution subsystem(s) inoperable, and performing an engineering/operability evaluation to assess the impact of the condition prior to declaring the electrical distribution subsystem(s) operable.

High Voltage Auxiliary Power System Operating Procedure (CPS No. 3501.01): This procedure provides instructions for placing the 4160 Volt and 6900 Volt auxiliary power system into various operational modes, including the transfer of a bus to or from its reserve or main source. It also includes directions for taking corrective actions in the event of abnormal system operation or conditions, including high voltage conditions. The section that addresses transferring a bus(es) requires increased monitoring of the bus(es) when the associated source SVC is not in service. The section that addresses high voltage conditions also requires increased monitoring of bus voltage. In addition, it provides several actions that may be taken to maintain and/or restore bus voltage to within acceptable limits, including increasing RAT loading by placing additional BOP load on the RAT, transferring the affected loads/buses to the alternate offsite source (RAT to ERAT or vice versa), requesting the Electric Supply Dispatcher to lower 138kV/345kV line voltage, and lowering DG output voltage. It also notes that a 30-minute operability time limit applies when voltage is greater than a specified limit.

Additional Considerations and Justification for Removal of RAT Minimum Load Requirement (cont'd)

The above procedural requirements and guidance provide added assurance that an overvoltage condition is prevented or mitigated notwithstanding the results of the analysis that demonstrate the capability of an overvoltage event to be sustained without the requirement for normally maintaining a minimum BOP load on the RAT.

Finally, it should be noted that although the plant configuration in which the BOP buses (1A and 1B) are maintained on the RAT is an acceptable configuration, the CPS plant risk analysis shows that a risk improvement may be gained if BOP buses are maintained on the UATs per the original plant configuration. Automatic fast-transfer capability from the UATs to the RAT allows the RAT to serve as an automatic backup source for the BOP buses. Maintaining availability of the BOP loads, especially during a plant trip, reduces the potential for challenges to the Class 1E safety systems.

Conclusion:

Since the above-described voltage analysis demonstrates that (with the implementation of the above-noted design changes) the maximum postulated transient overvoltage condition can be sustained for all Class 1E components with no BOP load on the RAT, there is no longer any need to maintain a minimum BOP load on the RAT for mitigation of such an overvoltage condition involving a trip or unavailability of the SVC. Further, with the completion of the voltage analysis and associated design changes, risk analysis shows that plant risk is reduced if the BOP buses are normally aligned to the UATs (with the RAT as an automatic backup source) instead of being normally aligned to the RAT. Therefore, CPS has implemented the necessary USAR and procedure changes to eliminate the requirement for maintaining the BOP buses 1A and 1B on the RAT. These buses are now being normally maintained on the UATs during plant operation.

This change constitutes a change in commitment originally made pursuant to Amendment 122 of the CPS Operating License. However, the change has been evaluated pursuant to 10CFR50.59, and from that evaluation (performed to support the necessary USAR and procedure changes) it was concluded that no unreviewed safety question exists.