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VICE PRESIDENT

January 30, 1984

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Mr. J. F. Streeter, Chief
Engineering Branch 1
US Nuclear Regulatory Commission
Region III
799 Roosevelt Road
Glen Ellyn, IL 60137

ULNRC-736

Dear Mr. Streeter:

INSPECTION REPORT NO. 50-483/83-17

This reply is a supplemental response to our letter of December 9, 1983 which contained an interim response to an item of noncompliance identified in Inspection Report No. 50-483/83-17(DE) forwarded with your letter dated November 10, 1983. Verbal extensions were obtained from Region III on January 6, 1984 and January 20, 1984, extending the due date for this response until January 30, 1984. Our response to the item of noncompliance is presented below.

None of the material in the inspection report or in this response is considered proprietary by Union Electric Company.

(50-483/83-17-01) SEVERITY LEVEL IV VIOLATION

10 CFR 50, Appendix B, Criterion XI states: "A test program shall be established to assure that all testing required to demonstrate that structures, systems, and components will perform satisfactorily in service is...performed..." Pursuant to this requirement, SNUPPS FSAR, Appendix 3A, indicates compliance with Regulatory Guide 1.68, Revision 2, "Initial Test Programs for Water-Cooled Nuclear Power Plants"; and SNUPPS-C FSAR, Appendix 3A, indicates compliance with Regulatory Guide 1.30 which endorses ANSI N45.2.4-1972, "Installation, Inspection, and Testing Requirements for Instrumentation and Electric Equipment During the Construction of Nuclear Power Generating Stations."

Regulatory Guide 1.68, Revision 2, Appendix A, Item 1 states: "Following plant construction, testing should be accomplished to demonstrate the proper performance of structures, systems, components, and design features in the assembled plant," and "Preoperational tests should demonstrate that structures, systems and components will operate in accordance with design in all operating modes and throughout the full design operating range."

Item 1.g., Electrical Systems, states: "Appropriate system and component tests should be conducted to verify, to the extent practical, that these systems will operate in accordance with design." Both Items 1.g.(1), Normal AC Power Distribution System, and 1.g.(2), Emergency AC Power Distribution System, state: "This testing should simulate, as closely as practical, actual service conditions, e.g., fully loading motor control centers and operation of supplied loads at rated conditions, etc."

ANSI N45.2.4-1972 states (in subsection 6.2.1): "Tests shall be performed to verify that the quality of installed equipment has not deteriorated during the construction phase," and "Tests shall be made to determine that proper response is obtained over the operating range of the device."

Contrary to the above, preoperational test procedures CS-03NN01, R0, "Instrument AC Systems (Class 1E) Preoperational Test," and CS-03NK01, R0, "125V (Class 1E) DC System Preoperational Test," have been written and approved without including testing to adequately meet these requirements. Specific examples include:

a. Vital inverter design load testing is not included in the program.

b. Verification of other vital inverter design features are not verified, such as voltage and frequency regulation and transient limits.

c. The ability of the backup transformers to supply design instrument loads is not verified.

d. The battery chargers provide the normal function of a regulated, filtered, DC power supply for the DC electrical bus. Design features related to this function are not verified, such as regulation and filtration.

Response

In regards to preoperational testing of class 1E Instrument AC systems and 125V DC systems, Union Electric feels the present scope of testing is in compliance with regulatory requirements.

Regulatory Guide 1.68, Revision 2, Appendix A, Both Item 1.g.(1), Normal AC Power Distribution systems and 1.g.(2), Emergency Power Distribution System, state: "This testing should simulate as closely as practical, actual service conditions, e.g., fully loading motor control centers and operation of supplied loads at rated conditions, etc." Preoperational tests CS-03NN01, Instrument AC systems (Class 1E), and preoperational test CS-03NK01, 125V class 1E DC systems, verify the operational aspects of the chargers, inverters and transformers in these systems.

Additional testing, not identified in the Notice of Violation (50-483/83-17-01), was performed during the plant performance test (S090007) as a part of Hot Functional Test. Also, instrument AC inverters and 125V DC system battery chargers are tested during operation of the supplied loads.

The design of the individual components of these systems (chargers, inverters, and transformers) is proven by factory design and production tests. Union Electric feels the factory tests prove the design of these components to perform their intended function.

The preoperational test and plant performance test prove the system components have not deteriorated and will supply the design loads at service conditions. Union Electric feels the factory tests prove the design of the individual system components to operate at their maximum ratings. The preoperational test and plant performance test have verified the ability of the components to function in these systems when supplying the designed loads under operating conditions. Repeating the factory component tests would not further confirm the ability of the Instrument AC system and 125V DC systems to function as designed.

These preop procedures, as written and approved, are consistent with commitments given in the SNUPPS FSAR Chapter 14 abstracts for these tests. Prior to issuance of the Callaway SER, NRC-NRR thoroughly reviewed the preop test program including evaluations against the recommendations of Regulatory Guide 1.68. These test abstracts are clear in their intent not to test inverters and backup transformers to their maximum ratings and not to verify all design aspects of the battery chargers. The Callaway SER does not challenge these test abstracts.

Union Electric believes its testing program satisfies regulatory requirements. However, to resolve the concerns listed in the Notice of Violation, we offer the following:

a. An inverter load test will be performed. A purely resistive load bank will be utilized because the normal service loads are largely resistive.

b. In conjunction with the above inverter load test, voltage and frequency regulation will be verified. Inverter output voltage readings will be taken at maximum and minimum DC input voltage. The battery chargers, with the batteries disconnected, will be used to vary the input voltage to the inverters.

   Field testing of transient withstand or transient limit capability on static solid-state power inverters is not recommended. This testing is severe and is generally

limited to a manufacturer's prototype testing program or to a factory production test if the inverter is applied in an application where frequent transients are anticipated. For example, NEMA PV-5 requires that manufacturers of static solid-state battery chargers include transient tests only in the design test program. NEMA PV-4 requires that manufacturers of static solid-state power inverters include transient tests only into their design or production testing program, depending on the specific application of the inverter.

The application of the SNUPPS Class IE inverters precludes the need to perform field transient testing. The load served by the inverter is totally an instrument load, resistive and constant. The Class IE 125 volt DC system that provides the input power to the inverters is similarly designed. The DC system serves only largely resistive loads such as DC power supplies and DC controlled equipment such as circuit breakers and relay panels. There are no rotating loads or switched loads on the Class IE DC system. (The turbine emergency DC oil pump motors are powered from a separate battery.) Therefore, the potential for the generation of voltage transients on the DC or AC systems associated with the Class IE inverters has been substantially eliminated by design.

The SNUPPS Class IE inverters have been specified by Westinghouse to be provided with suitable surge protection to protect all solid-state components against voltage transients. Factory transient tests are severe, even under controlled factory conditions. Under these tests, definite loss of service life to the installed components occurs. Given the design of the SNUPPS Class IE DC and instrument AC systems, field transient testing of the inverters, which would reduce the service life of the inverters by subjecting them to undue stress, is not justified. Therefore, Union Electric does not believe verification of inverter transient limit capabilities in the preop testing is necessary or desirable.

c. An instrument AC transformer load test will be performed. The transformer will be tested at rated load and voltage.

d. The SNUPPS Battery Chargers are capable of supplying their rated output current at rated regulation with a $\pm 10\%$ variation of rated input voltage. Sustained operation at a voltage below this is precluded by the degraded voltage protection design. Short-term operation of a battery charger at somewhat below minimum required input voltage will have no detrimental effect on the charger or the DC system. The battery charger diodes isolate the DC system from disturbances on the AC side such as

degraded or loss of voltage. The DC system voltage will be maintained by the battery if the charger voltage should fall due to malfunction or loss of AC input voltage. However, these design considerations are not intended to be tested under the DC system preoperational test. They do not dictate performance requirements of the DC system but rather indicate design margins that are inherent in the DC system design.

Based on the above considerations, the preoperational testing is intended to verify operational aspects of the chargers, specifically that they are capable of fully recharging a depleted battery within the required time while simultaneously supplying the design system load. While conducting this capacity test, data is obtained to develop the battery charger profile which verifies that the battery is functionally charged as well as proper operation of the charger current limiting feature. Therefore, Union Electric does not feel any additional testing of the battery chargers is required.

If you have any questions regarding this response or if additional information is required, please let me know.

Very truly yours,

Robert F. Schukai

for Donald F. Schnell

RWF/jds

cc: J. E. Konklin, Region III
NRC Resident Inspectors, Callaway Plant (2)
Missouri Public Service Commission