50.55(e)

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July 17, 1981

Mr. Boyce H. Grier
Director, Region I
U. S. Nuclear Regulatory Commission
631 Park Avenue
King of Prussia, PA 19406

SUSQUEHANNA STEAM ELECTRIC STATION
STATUS REPORT OF A DEFICIENCY RELATING TO
EXCESSIVE VOLTAGE DROPS IN POWER AND CONTROL CIRCUITS
ERs 100450/100508 FILES 821-10/840-4
PLA-883

References: PLA-560 (11/20/80)
PLA-570 (11/17/80)
PLA-638 (03/02/81

Dear Mr. Grier:

This letter serves to provide the Commission with an updated status report on a deficiency involving excessive voltage drop in power and control circuits. The deficiency was originally reported and described in the referenced correspondence.

The attachment to this letter provides a description of the deficiency, its probable cause, safety impact and the corrective actions taken and/or planned.

PP&L is pursuing further clarification of the possible causes for the deficiency with Bechtel Engineering. Upon satisfactory resolution of our concerns and the formulation of any additional corrective action plans deemed necessary, PP&L will provide the final report on the subject deficiency. We expect to provide such a report by September, 1981.

Very truly yours,

N. W. Curtis
Vice President-Engineering & Construction-Nuclear

FLW:sab

Attachment



IE27
S1/1

cc: Mr. Victor Stello (15)
Director-Office of Inspection & Enforcement
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Mr. G. McDonald, Director (1)
Office of Management Information & Program Control
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Washington, D.C. 20555

Mr. Gary Rhoads
U. S. Nuclear Regulatory Commission
P.O. Box 52
Shickshinny, PA 18655

STATUS REPORT - Attachment to PLA-883

Subject:

Excessive voltage drop in power and control circuits

Description of Problem:

Excessive voltage drop occurs in various power and control circuits when motors are started or coils are energized. The specific problem areas at Susquehanna SES are:

1. AC motor starters (motor starters are devices which provide the control of power to motors). - Excessive control cable resistance caused excessive voltage drop in control cables. This resulted in inadequate voltage across the terminals (less than 85% of rated voltage) of the motor starter. The motor starter could not operate at this reduced voltage, and therefore, the motor would fail to operate.

   A review of all safety-related AC motor starter control circuits has shown that excessive control cable resistance existed for fifty three (53) Unit I safety-related motor starters. These starters control the power to motors for valves, pumps, and fans.

2. 250V DC power cables - Excessive power cable resistance caused excessive voltage drop in power cables. This resulted in inadequate voltage (less than 80% of rated voltage) across the terminals of 250V DC motors used to operate valves. The motors would not start at this reduced voltage.

   Analysis of all safety-related DC motor circuits has shown that excessive power cable resistance existed for fifteen (15) Unit 1 safety-related 250V DC motor operated valves.

3. 4.16Kv Circuit Breaker Controls - Excessive control cable resistance caused excessive voltage drop in 125V DC control cables. This resulted in inadequate voltage across the close (less than 90 volts DC) coils of 4.16Kv circuit breakers. The subject circuit breakers would fail to operate (close) when required.

   Analysis of all 4.16Kv circuit breaker control circuits has shown that excessive control cable resistance existed for nine (9) Unit 1 safety-related 4.16Kv circuit breakers.

4. For Unit II circuits, the analyses described above resulted in documented definition of specific cables which potentially required resizing to provide acceptable voltage drops. Since these cables were not yet installed, they were identified under a stop work order pending redesign (see plan for completion below).

Cause:

The most probable cause of the low voltage problems are (1) a lack of attention to detail in the area of permissible voltage drops in power and control cables by the circuit design engineer, (2) a lack of control on final cable lengths by the engineer(s) who designed the subject schemes, and (3) a lack of the design criteria and design documentation for control of cable size and length by the design engineer.

PP&L is pursuing further clarification of the possible causes with Bechtel Engineering.

Analysis of Safety Implications:

These design deficiencies affect multiple components of various safety related systems. The systems include Residual Heat Removal, Reactor Core Isolation Cooling, and High Pressure Coolant Injection. The nature of the design deficiency is such that critical equipment will not be controllable to perform design safety functions. Engineering considers this deficiency to be reportable under 10 CFR 50.55(e).

Corrective Action:

1. AC motor starters - Interposing relays, larger control transformers, or parallel conductors (whichever is appropriate) will be installed in the deficient motor starter control circuits. Interposing relays require less power than motor starters and can operate satisfactorily with existing control cables. The interposing relay contacts will control the motor starters through rewired low impedance circuits.

   In some cases, larger control transformers could be used because the voltage drop across these transformers is less since the load remains the same. This allows a larger voltage drop in the control cable. In using this fix, the total voltage drop in the larger control transformer and the existing control cable must not be so great as to allow the starter voltage to drop below 85% of rated.

   In four (4) circuits, spare conductors in the cables were connected in parallel with existing conductors to lower the circuit impedance.

2. 250V DC power cables - existing power cables will be replaced with larger power cables for the subject devices.

3. 4.16Kv circuit breaker controls - interposing relays, applied similarly to the description in Item 1 above, will be installed.

4. Bechtel will revise their Engineering Procedures Manual to include a cable resizing or sizing procedure. This procedure will insure that power and control cables are checked for permissible voltage drops.

5. Bechtel will revise their Power Cable Ampacity Tables, Bechtel Drawing Number E-57 to include (1) maximum cable lengths for 240V DC motors, and (2) maximum cable lengths for 480V AC motor starters. (E-57 presently includes maximum cable lengths for 480V AC motors.)

Plan for Completion:

Bechtel has issued DCP'S 311 and 396 for completion of Unit 1 changes.

Power and Control Cables had not been installed for Unit II before this problem was uncovered. Therefore, a limited stop work order was issued against Unit II cable pulling for power and control circuits in the categories mentioned above in the Description of Problem. This stop work was released for all cables found to be shorter than the appropriate maximum cable lengths as soon as all actual cable lengths were determined. The stop work for all cables longer than the appropriate maximum cable lengths is being lifted through a series of partial releases after Bechtel submits revised Engineering drawings to PP&L and PP&L reviews and approves any proposed changes.