PHILADELPHIA ELECTRIC COMPANY

2301 MARKET STREET

P.O. BOX 8699

PHILADELPHIA, PA. 19101

(215) 841-5001

SHIELDS L. DALTROFF
VICE PRESIDENT
ELECTRIC PRODUCTION

November 13, 1980

Re: Docket Nos. 50-277
50-278

Mr. Robert W. Reid, Chief
Operating Reactors Branch #4
Division of Licensing
US Nuclear Regulatory Commission
Washington, DC 20555

Reference:

1. NRC Letter to Philadelphia Electric Co., dated August 8, 1979, concerning the "Adequacy of Station Electric Distribution Systems"

2. Philadelphia Electric Company, (S. L. Daltroff) letter to the NRC (T. A. Ippolito), dated December 31, 1979.

Dear Mr. Reid:

Your letter dated September 22, 1980 requested additional information on our December 31, 1979 letter concerning the Adequacy of Station Electric Distribution Systems Voltages for Peach Bottom Units 2 and 3. The information requested and our responses are listed sequentially below.

1. Reference 1, guidelines 3, 6, 9, 10 and 12 establish several criteria for evaluating the onsite distribution voltages. These guidelines, in part, are asking the licensee to evaluate the onsite distribution system voltages when the grid is at a minimum expected level at a time when loads are being transferred or a large non-safety load is being started. The evaluation should compare the calculated Class 1E equipment terminal voltages, both minimum transient and steady state, with the equipment ratings. This should include all Class 1E equipment and controls at all nominal voltages including

A015
S,P

P 8011180695

the 115 volt controls. Also to be included is a comparison of the calculated bus voltages with the loss of voltage and degraded voltage relay setpoint values.

Response

The voltages on the 115V AC distribution system have all been adjusted (during the preoperational and startup phases of plant operation) so as to maintain 115V on the normally loaded distribution panels when the motor control centers are operating at 460 V. Therefore, whenever percentages are discussed, they are applicable to both the 460V and 115V systems. Since there is no appreciable 115V AC accident load, the normal running load on the distribution panels represents the typical load on these panels. The voltages on several typical distribution panels were recently verified to be on the same per unit basis (in all cases within .5%) as their corresponding motor control centers.

a) What are the lowest steady state and transient voltages on Class 1E equipment and buses after the plant load including Class 1E loads are transferred from the auxiliary transformer to the startup transformer and also that for starting a large non-safety load (such as condensate pump) while all Class 1E equipment is operating?

Response

Cases 4 and 5 of our 12/31/79 submittal describe the lowest steady state voltages on the 4 kv buses after the unit auxiliary buses (plant load) are transferred from the unit auxiliary transformers to the startup transformers. The plant electrical systems are being modified to provide automatic load shedding to preclude Case 4. The voltages shown for Case 5 represent Case 4 with the proposed modification.

For both of these cases, the unit auxiliary buses are transferred in-phase to the startup source(s) and there is no dip in voltage due to motor accelerating current. The larger ECCS pumps are stagger started when offsite power is available. The largest voltage transient would result from the start of two RHR pumps following the transfer of the unit auxiliary buses to the offsite sources. This voltage dip is to 59.4% of nominal, however, it does not persist for more than a few seconds. At this voltage, the relays that sense degraded voltage would take approximately thirteen seconds to operate.

The case of starting a large non-safety load while all the Class 1E equipment is operating is not a realistic case for PBAPS. Any accident, while the unit is operating, would result in the unit auxiliary buses transferring in-phase to the offsite sources. The large pumps on the unit auxiliary buses continue to run

through the transfer with the exception of the recirculation pumps. The recirculation pumps trip on the automatic transfer to the offsite sources. They cannot be restarted while the Class 1E loads are responding to an accident since the circuit breaker control scheme is interlocked with the pump valves. These valves close from the same accident signal that initiates the Class 1E loads. Therefore, the Case 5 loads represent the largest steady state loads that can exist on the offsite sources.

b) Verify that these loads will not cause a spurious trip from the offsite source by either the loss of voltage relays or the degraded voltage relays.

Response

The relays used for the detection of degraded voltage were selected primarily for their time delay characteristics. The characteristics are such that they would not operate for the most severe voltage transient (as discussed in response to question (1(a) above) or for the most severe steady state voltage degradation (as presented in Case 5 of our 12/31/79 submittal).

2. Reference 1, guideline 2, requires an analysis of station voltages when there has been an accident in one unit and a simultaneous shut down of the second unit. Case 6 and Case 7 of Reference 2 provide an analysis of these voltages. Clarify the time of the second unit shut down in reference to the accident unit being analyzed. If the results for Case 6 and Case 7 were not for a simultaneous accident/shut down, provide the required calculations.

Response

Guideline 4 of the NRC letter to PECO, dated August 8, 1979, stated that "Manual load shedding should not be assumed." Our voltage studies were conducted using this guideline for the accident unit. The studies did not assume a simultaneous shutdown in the non-accident unit since manual operations would be required to shutdown the unit. There is nothing resulting from the accident, or the voltage dip caused by the accident, that would cause the non-accident unit to trip off.

The sequence of events for the analyses (Case 6 & 7) were as follows:

a) Both units at full power
b) Accident in one unit, other unit continues to operate.

c) Accident unit is stabilized, non-essential load is shed.
d) Power level in non-accident unit is reduced in preparation for shutdown.
e) Non-accident unit is tripped off, unit auxiliary load is transferred to offsite sources.

Typically, events (a) and (b) would take place within the first ten minutes of the accident, event (c) would take place from ten minutes to an hour, and events (d) and (e) would commence after the first hour (these times are from the accident scenarios in the PBAPS FSAR). Actually, transfer of the unit auxiliary bus load for the accident unit would not take place simultaneously with the starting of the accident load. For the design basis LOCA the loading would be spread over the first minute of the accident. For smaller breaks the loading would be spread out beyond the first minute. The times utilized in the studies represent the most severe loadings in keeping with the assumptions of non-coincident accident and shutdown. Since there is nothing that automatically initiates the shutdown of the non-accident unit, it is not realistic to disallow manual operations for purposes of load shedding and to require them for the shutdown.

If the unit auxiliary buses for both units were to transfer to a single offsite source at the same time, that single source would be degraded below the setpoint of the detection relays and the 4 kv buses would be transferred to onsite diesel generators. The simultaneous accident and unit shutdown utilizing onsite power is discussed in the FSAR.

3. Reference 1, page 2, requested a review of the electrical power systems to determine if any potential exists for violation of GDC-17. Provide the results of this review.

Response

As demonstrated by the two source analyses, the loading on either of the two sources does not cause a voltage degradation below the setpoints of the detection relays such that the sources would be unavailable to the emergency buses for either the normal or accident conditions (Cases 1 & 2).

The single source analyses (Cases 3 through 7) also demonstrated that the voltages would not be degraded below the setpoints of the relays with two exceptions (Cases 4 & 6). Hardware and procedure modifications are in progress to preclude these two cases. Following the completion of the modifications, there will be no potential for operation of the proposed detection relays for any loading scenarios.

Based on this information, we conclude that the offsite sources have sufficient capacity and capability as required by GDC 17.

4. Reference 1, page 2, requests that the calculations be verified by tests. Please provide now a description of the method for performing this verification and when completed, the test results.

Response

Prior to the pre-operational test phase of the plant the voltages within the plant electrical system were adjusted to obtain an optimal setpoint. During the pre-operational tests, some voltage recordings were made to verify the design calculations and to demonstrate that the sources were adequate. These tests demonstrated that the sources responded as anticipated with respect to the voltages, both steady state and transient.

Additional tests to verify the results of the cases analyzed in our 12/31/79 submittal would be impossible or impractical. All of the cases assume that the transmission network is operating at its lower limit of 95%. This is not a valid operating condition since substantial load would be shed prior to getting to this level in an attempt to restore the voltage to its nominal value. Five of the seven cases analyzed assume that one offsite source is unavailable and four of these assume an accident in one of the units. Tests to simulate these conditions would not be practical.

The analyses that were performed used a load flow computer program which calculates line loadings and bus voltages based on the system configuration. This program has been repeatedly verified by comparing predicted results with actual operating conditions.

Because it is impossible to test the cases in our 12/31/79 submittal under actual operating conditions and the accuracy of the computer simulation has been verified in other applications, we are proposing no new tests for the electrical systems at PBAPS.

Very truly yours,