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NUCLEAR ENGINEERING & SERVICES DEPARTMENT

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U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

SUBJECT: Peach Bottom Atomic Power Station, Units 2 and 3
Response to Request for Additional Information
Regarding Revised Station Blackout Response

REFERENCES: 1) Letter from D. R. Helwig (PECo) to NRC dated April 24, 1991

2) Letter from J. W. Shea (NRC) to G. J. Beck (PECo) dated January 28, 1992

Dear Sir:

In Reference (1), Philadelphia Electric Company (PECo) submitted a revised complete Station Blackout (SBO) analysis for Peach Bottom Atomic Power Station (PBAPS), Units 2 and 3. This revised analysis included information which we agreed to provide during our April 5, 1991 meeting with the NRC. In Reference (2), the NRC requested additional information regarding our revised analysis. The purpose of this letter is to provide the additional information. In the Enclosure to this letter, each NRC request is restated followed by PECo's response.

If you require additional information, please do not hesitate to contact us.

Sincerely,

G. J. Beck, Manager
Licensing Section

Enclosure

cc: T. T. Martin, Administrator, Region I, USNRC
J. J. Lyash, USNRC Senior Resident Inspector, PBAPS

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Peach Bottom Atomic Power Station, Units 2 and 3
Response to Request for Additional Information
Regarding Revised Station Blackout Analysis

1. In light of the fact the licensee's projected EDG electrical loads summary shows a very small margin to the 3000 kW, 2000 hour rating of the EDGs, provide: 1) the timing for startup of the 1410 kW RHR pump and 2) an evaluation of the effect of pump startup power fluctuations and transients on the ability of the EDGs to maintain voltage and frequency within limits consistent with established electrical standards. A justification or test results which substantiates the new EDG 2000 hour rating, and testing requirements in support of the maximum stated load of 3000 kW should also be provided.

PECo RESPONSE:

A) The Station Blackout (SBO) scenario used for Peach Bottom Atomic Power Station (PBAPS) does not require operation of any of the Residual Heat Removal (RHR) pumps for the duration of the Station Blackout event. The Emergency Alternating Current (EAC) analysis, in which two of the four Emergency Diesel Generators (EDGs) are available to mitigate a loss of offsite power (LOOP), assumes two RHR pumps (one per unit) will be used. The RHR pumps will be started after one hour but before eight hours following the LOOP.

B) The Peach Bottom Diesel Generator Load Profiles and System Voltage Regulation Study includes a report prepared by Colt Industries, the Emergency Diesel Generator (EDG) manufacturer, entitled "Diesel Generator Load Analysis." This report details the EDG voltage and frequency responses during various loading scenarios. The PBAPS EAC analysis scenario initiates a RHR pump after one hour but before eight hours following the LOOP. At the time the RHR pump starts, it is expected that the preload (load on the EDG prior to the start of the large motor) will be less than 800 kW. Administrative controls exist to restrict the start of a RHR pump if the preload is greater than 1400 kW. The EDG load analysis report provided by Colt Industries analyzed the start of an RHR pump with preloads of 500, 1000, and 1500 kW. With a preload of 1000 kW (conservatively higher than the PBAPS projected preload of less than 800 kW), EDG frequency is maintained above 95% of nominal (60 Hz), but EDG voltage drops to approximately 60% of nominal (4160 volts). Section 8.5.3 of the PBAPS Updated Final Safety Analysis Report (UFSAR) addresses the acceptability of the voltage transient experienced during the starting of an RHR pump when powered by the EDGs. The EDG voltage regulation study also addresses the voltage transient and identifies the need to

procedurally monitor operating equipment to correct any conditions that may result from connected equipment that is subjected to the voltage transient. Typically, the effects would be contactors being momentarily de-energized. This EAC analysis is bounded by the UFSAR Loss of Coolant Accident (LOCA)-LOOP analysis.

As stated in PECo letter to the NRC dated April 15, 1991, a transcription error occurred during the incorporation of the Final Safety Analysis Report, Supplement 1 information into the UFSAR. This resulted in the EDG 2000 hour rating being specified as 2840 kW instead of 3000 kW. A letter from the Fairbanks Morse Engine Division of Coltec Industries dated March 8, 1991 has confirmed the 3000 kW rating for the 2000 hour duration for the PBAPS EDGs. The complete rating profile is as follows.

Load	Duration
2600 kW	Continuous, DEMA Standard Condition
2840 kW	Peaking, 4 continuous hours in any 24-hour period
2860 kW	10% overload, 2 hours in any 24-hour period
3000 kW	2000 Hours
3100 kW	200 Hours
3250 kW	30 minutes

The EDGs are tested at least once per month at the continuous-rated loading of 2600 kW for at least a one-hour period. At least once per operating cycle, each EDG is operated for a short time at a loading in excess of the 2000 hour rating of 3000 kW.

2. The licensee states that a "modest" number of operator actions are needed during an SBO and provides two tables which delineate these actions. For the minimum number of operators available, provide the time required for sequentially performing these actions and show that they can be performed within the required time frame.

PECo RESPONSE:

PBAPS personnel walked through the operator actions required to be performed within one hour following initiation of a LOOP in accordance with Tables 3 and 4 in the April 24, 1991 submittal for the EAC and SBO scenarios, respectively. The total time required to perform the necessary actions by the minimum number of operators expected to be available during the actual events was in each case within the specified one-hour time frame (less than 40 minutes for each case -- if control room ceiling tiles are to be removed during a SBO, a total of 55 minutes is required). The remaining load

management activities in the Table 3 EAC scenario, performed to reduce EDG loading for alignment of an RHR and a High Pressure Service Water (HPSW) pump, can be accomplished within the required 8-hour time frame.

3. On Page 7 of the licensee's revised SBO submittal, the terms "selected room ventilation, selected emergency lighting . . ., and necessary system controls and instrumentation" are used to describe some of the EDG electrical loads during an SBO event. What is the basis for these "selected and necessary loads?" How does the operator determine these loads? What systems and information are degraded in picking this subset of normal electrical loads?

PECo RESPONSE:

The ventilation, lighting, controls, instrumentation, and other loads powered by the EDG used as the AAC source are the loads previously aligned to the required buses. Their selection is not a separate decision required on the part of the operator. In selecting the buses to be powered, it was decided what loads were required for safe shutdown, and buses were energized to obtain power to those loads. For example, all eight battery chargers were energized because of the decision to retain all dc instruments in the control room. The lighting, ventilation, and other loads that are also obtained are those loads which are supplied from the same buses and automatically start when re-energized. In this way, decisions were made regarding what loads were desired not to be degraded, and power to those loads (and the other resultant loads, due to their alignment as listed in Table 2 of our April 24, 1991 submittal) was obtained.

4. Regarding decay heat removal condensate inventory, how is the RCIC or HPCI pump suction switched from the CST to the torus? Is this procedure different or in any way inhibited by the SBO event?

PECo RESPONSE:

Initially, High Pressure Coolant Injection (HPCI) and Reactor Core Isolation Cooling (RCIC) suction is aligned from the Condensate Storage Tank (CST). HPCI and/or RCIC pump suction is manually transferred from the CST to the torus using control switches in the control room per procedures specifically dealing with the SBO event. This step is taken to conserve CST inventory and makes use of initially cool torus water since the water being pumped by HPCI and RCIC provides the cooling for their respective lube oil systems. The guidance provided in the SBO procedure therefore directs the use of the torus at low torus temperatures to preserve CST inventory and to limit the increase in torus level that would result from use of external makeup sources. As torus temperature increases,

switching the suction source from the torus back to the CST is also proceduralized to protect the pumps from high lube oil temperatures and pump net positive suction head (NPSH) problems that could potentially affect pump operability. The switching of suction sources is only applicable and proceduralized for events involving a loss of offsite power and multiple EDG failures.

5. Provide the calculations in support of the control room, containment, and suppression pool heatup analyses for an SBO event. If a computer code is used, provide detailed information on its qualifications, input parameters with proper references, and the associated output.

PECo RESPONSE:

The calculations developed in support of the room heatup analyses utilize input, assumptions, and methodology determined by PECo to be applicable and suitable for their intended purpose. Additionally, PECo obtained contractor support in providing computer generated calculations for the control room, containment, and suppression pool heatup during the PBAPS SBO event. These calculations are maintained in PECo's SBO files and are available at our Chesterbrook facility for examination by the NRC. PECo will obtain, as necessary, support from its supplying contractors to answer any specific question resulting from such an examination.

6. Provide the results of an evaluation of RCIC and HPCI pump operability for the highest expected suppression pool temperature during an SBO event.

PECo RESPONSE:

Existing PBAPS calculations show that the NPSH requirements of the HPCI and RCIC pumps are satisfied at suppression pool temperatures of up to 196°F and 200°F, respectively, with no credit taken for torus atmosphere pressurization. These temperatures are greater than the 190°F point at which the pump suction is switched from the torus to the CST by procedures specifically dealing with the SBO event. Additionally, the lube oil used in the turbine will not break down at the temperatures associated with operation at a suppression pool temperature of 200°F, which bounds the SBO procedural pool temperature of 190° where pump suction is switched to the CST.

7. In Table 4 of the licensee's submittal, the operators are required to first trip EDG-1, the only EDG which starts, and later restart this same EDG. Provide a technical evaluation of the reliability of EDG restarting after being tripped. It appears that purposely tripping an EDG which has successfully started during an SBO event with the intent of

later restarting this same EDG constitutes a degradation of safety. Provide a technical justification for this action including an evaluation of alternatives.

PECo RESPONSE:

EDG-1 was selected as the Table 4 example for operator actions with one EDG available since it requires the most actions. It is the only EDG that would have to be tripped and re-started after backfeeding the 4kV buses, since it is the only one that does not power an Emergency Service Water (ESW) pump. None of the other EDG's would require this trip and restart action. As stated in Table 4, the tripping of EDG-1 within 3 minutes, if it is the only EDG to start, is a trained action on the part of the operators. If it is not manually tripped, it will automatically trip on high jacket water or lube oil temperature. This is per design, and neither the manual nor the automatic trip causes any damage to the EDG. Following completion of the circuit bypass needed to establish the 4kV bus backfeed, EDG-1 is re-started and power is made available to an ESW pump for EDG cooling.

PECo has high confidence that the EDG will restart following the trip. The prototype model diesel engine underwent a 100-in-a-row start test performed by the manufacturer with no engine failures. Each of the eight Limerick Generating Station EDGs, which are the same model EDG as PBAPS, were successfully tested in a 23-in-a-row start and grid alignment test. At PBAPS, regularly performed surveillance tests demonstrate the reliability of the EDG's to start and perform their design function. It is PECo's judgement that the start-and-trip cycle on EDG-1 will have a negligible effect on the probability of a successful restart as would be required if EDG-1 were the only EDG available.

8. In light of the fact that the licensee's projected EDG electrical load summary shows a very small margin to the 3000 kW rating of the EDG, provide an evaluation of the effect of the magnetizing current of the emergency auxiliary transformer on the ability of the EDG to maintain voltage and frequency within limits consistent with established electrical standards.

PECo RESPONSE:

An emergency auxiliary transformer will be energized any time the 4kV buses are backfed with either the 00A19 or 00A20 bus. In the SBO scenario, the backfeed will be established following the start of a diesel. When this backfeed is established, the load on the backfeeding EDG will be less than 900 kW. The EAC scenario establishes the backfeed after the start of the two diesels, but prior to the start of an RHR pump. When this backfeed is established, the load

on the backfeeding EDG will be less than 800 kW. The magnetizing current (no-load loss) of the emergency auxiliary transformer, which was included in all SBO and EAC load tabulations (Reference Note "@" in Table 1 and Note (4) in Table 2 of the April 24, 1991 submittal), will have virtually no effect on the EDG voltage and frequency.