TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401

400 Chestnut Street Tower II

June 8, 1981

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr. Denton:

In the Matter of the	)	Docket Nos. 50-259
Tennessee Valley Authority	)	50-260
		50-296

In response to D. G. Eisenhut's February 25, 1981 letter to All Licensees of Operating Nuclear Power Reactors and Applicants for Operating Licenses regarding emergency procedures and training for station blackout events (Generic Letter 81-04), we have enclosed the results of our review of the design bases, safety systems, emergency procedures and the training program. In addition, we have investigated previous loss of offsite power events at other plants throughout our system to determine an experience base for recovery from such events. Finally, we are assisting the NRC through the Oak Ridge National Laboratory's (ORNL) severe accident sequence analysis (SASA) program on a station blackout scenario at Browns Ferry Nuclear Plant unit 1.

Regarding our design, we have never been required to consider a concurrent loss of offsite and onsite ac power as a design basis event. We have always maintained the philosophy of operating our offsite and onsite ac power in a reliable and safe manner. The operating history of our offsite ac power supplying our nuclear plants is one of high reliability due to our location and the design of the power grid. Therefore, our design, emergency procedures, and training have not specifically addressed this scenario. We have, however, presented in the FSAR a discussion of limitations on RCIC and HPCI operation in responses to AEC's questions 4.8 and 4.9 dated March 25, 1971.

The Browns Ferry Nuclear Plant generators are connected into an existing network supplying large load centers. The three generating units are tied into TVA's 500-kV transmission system via six existing 500-kV transmission lines. A seventh line, Browns Ferry-Cordova, will be added in June 1981. The 161-kV switchyard is supplied by two 161-kV transmission lines.

These sources have sufficient capacity to supply the total required power to the plant's electrical auxiliary power system under normal, shutdown, and loss of coolant accident (LOCA) conditions for any single transmission contingency. Power reaches units 1 and 2 auxiliary loads from the 500-kV system through the main transformers and the unit station service transformers (USSTs) and from the 161-kV system over two physically independent 161-kV transmission lines through the common station service transformers (CSSTs). Auxiliary power is supplied to unit 3 for shutdown and LOCA conditions from the 161-kV system over the two physically independent 161-kV transmission lines through the cooling tower transformers (CTTs). These sources have sufficient capacity to supply all loads regardless of plant conditions. Separation of the lines, the protection systems, and a strong transmission grid minimize the probability of simultaneous failures of offsite power sources. Steady-state studies show these offsite sources to be capable of supplying the onsite power system when all nuclear units are simultaneously removed from service.

In summary, we would like to reiterate that a station blackout scenario was not a design basis event for Browns Ferry Nuclear Plant. Hence, there was no design, procedures, or training consideration specifically given to this event. However, we believe that, given the event, sufficient training and guidance are provided to mitigate the event and allow restoration of either onsite or offsite ac power. We will continue to consider this event and revise procedures as we believe appropriate based upon the review.

TVA has been cooperating with NRC and ORNL in the SASA program, which deals explicitly with station blackout. We recommend that NRC delay further regulatory action on this issue pending completion of that study.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

L. M. Mills

L. M. Mills, Manager
Nuclear Regulation and Safety

Sworn to and subscribed before me this 8th day of June 1981

Paulette H. White
Notary Public

My Commission Expires 9-5-84

Enclosure

ENCLOSURE
RESPONSE TO D. G. EISENHUT'S FEBRUARY 25, 1981 LETTER
EMERGENCY PROCEDURES AND TRAINING FOR STATION BLACKOUT EVENTS
(GENERIC LETTER 81-04)
BROWNS FERRY NUCLEAR PLANT
(DOCKET NOS. 50-259, -260, -296)

Item A

The actions necessary and equipment available to maintain the reactor coolant inventory and heat removal with only dc power avilable, including consideration of the unavailability of auxiliary systems such as ventilation and component cooling.

TVA Response

With only dc power available, the RCIC system, HPCI system, and ADS safety relief valves (SRV's) are available. Key instrumentation is available as follows:

A. Two channels of reactor vessel water level

B. Two channels of reactor vessel pressure

C. Drywell pressure

D. Drywell temperature

E. Suppression pool water level

F. Suppression pool water temperature

G. Control rod position indication

H. Relief valve solenoid power indication

I. Condensate storage tank level

J. Main steamline flow

K. Feedwater flow

Automatic action following the station blackout includes a turbine trip, reactor scram, and main steam isolation valve (MSIV) closure. Emergency operating instructions (EOI's) require manual initiation of both HPCI and RCIC with the SRV's operated to control vessel pressure between 1100 and 900 psig. Following the initial transient, RCIC would be intermittently used or throttled to maintain a stable water level. Present EOI's require depressurization of the reactor when the torus temperature reaches 120°F, and the proposed symptomatic emergency procedures guidelines (EPG's) require depressurization upon the drywell temperature reaching 300°F. This action limits the drywell temperature to approximately 300°F. The pressure is then maintained at approximately 100 psig which is sufficient to allow continued operation of RCIC or HPCI to control water level. More than adequate water supply is available for coolant inventory makeup through use of the condensate storage tank or the suppression pool.

Auxiliary cooling water is not required for the pump operation since all necessary bearing cooling is provided through pump discharge water. Additionally, auxiliary ventilation is not required since the ambient temperatures are not expected to exceed the design conditions within the time frame of the scenario.

Item B

The estimated time available to restore ac power and its basis.

TVA Response

The time available to restore ac power is based upon two considerations, the time to drain the dc battery supply and the time to exhaust all water supply for HPCI and RCIC.

With the dc batteries providing power to all normal dc equipment following shutdown, the time to exhaust the power is approximately 2-1/3 hours. As stated in response to AEC's questions 4.8 and 4.9 of March 25, 1972, with no accident, all batteries available, RCIC operating, and the operator's ability to prudently minimize dc loads, the batteries could be expected to last 4-6 hours.

The loss of dc power to the HPCI and RCIC controls does not, however, totally preclude their use. Due to the design of the electrical and hydraulic control system, upon loss of dc power the HPCI turbine will speed up and cause a mechanical overspeed trip. Upon slowing, this mechanical trip will reset and the turbine will again speed up. The turbine will continue this cycling until failure of the mechanical overspeed trip mechanism. It must be stressed, though, that at any time before this failure two hydraulic jacks can be placed by maintenance personnel and used to operate the turbine control valves and maintain the turbine speed within the normal operating range. In essence, the HPCI pump can be operated locally with no dc power available. The case with the RCIC turbine is similar but easier in the fact that only one hydraulic jack is required. The only requirement for use of HPCI or RCIC in this manual mode is that the system be lined up and in operation when the batteries drain down.

Regarding the water supply for injection by HPCI or RCIC, the initial system lineup takes suction from the condensate storage tank. The tank has sufficient capacity to provide makeup water for eight hours at hot standby conditions. However, when the condensate storage tank decreases to a low level or the suppression pool level increases to a high level, the HPCI pumps suction automatically switches to the suppression pool. Additionally, the RCIC pump suction can also be changed to the suppression pool manually. At any time later, the HPCI and RCIC suction lineup may be changed manually either in the control room if dc power is available or locally using the handwheels on the valves. This is important since there are operational considerations on the suction water temperature. First, the required NPSH of the RCIC and HPCI pumps cannot be met if the suction water temperature from the suppression pool is greater than 185°F. Second, the oil coolers on the RCIC and HPCI turbines have a maximum water and oil inlet temperature; and as presented earlier, the cooling water is supplied by the pump discharge. Exceeding these limits will cause subsequent bearing failures and pump failure. This phenomenon of bearing failure due to loss of cooling water to the oil has not been fully investigated; so an exact time to failure is unknown.

Summarizing the above, the batteries will drain down in 2-1/3 to 6 hours, but the limiting time is 8 hours base upon the amount of water in the condensate storage tank and the boiloff rate at hot standby conditions.

Items C&D

(C) The actions for restoring offsite ac power in the event of a loss of the grid.

(D) The actions for restoring offsite ac power when its loss is due to postulated onsite equipment failures.

TVA Response

The restoration of offsite ac power is highly dependent upon the exact sequence of events and resultant damage to equipment. Each of the events would be unique and each would require unique operator action to restore power. Our present training program and operator experience with offsite power activities provide the necessary basis for prudent operator action. Additionally, we have general operating instructions concerning restoration of offsite power to BFNP in the event of a system malfunction or loss of the grid.

Item E

The actions necessary to restore emergency onsite ac power. The actions required to restart diesel generators should include consideration of loading sequence and the unavailability of ac power.

TVA Response

Current operating procedures exist for manual startup of the diesel generators; however, as stated in (d) above, events causing a station blackout are unique and would require unique resolution if automatic starting fails.

Our preliminary analysis indicates that no operator action is required concerning loading of the diesel generators. All essential 4-kV loads that were energized before the blackout will remain tied to the diesel generators. Therefore, no additional procedures or training are required. The operator has the provision for manually adding 4-kV and 480-V loads to the diesel generators as plant conditions warrant.

Item F

Consideration of the availability of emergency lighting, and any actions required to provide such lighting, in equipment areas where operator or maintenance actions may be necessary.

TVA Response

Currently, two hours of emergency lighting is provided in all areas required for a safe shutdown of the plant. The lighting is initiated automatically and no operator action is required. However, as indicated in our May 11, 1981 response to NRC, we have committed to provide an 8-hour emergency lighting capacity by November 19, 1981, which satisfies the requirements of Section III.J to Appendix R of 10 CFR Part 50. For equipment areas where maintenance may be required, portable handheld lighting can be used. Therefore, no additional training or procedures are required.

Item G

Precautions to prevent equipment damage during the return to normal operating conditions following restoration of ac power. For example, the limitations and operating sequence requirements which must be followed to restart the reactor coolant pumps following an extended loss of seal injection water should be considered in the recovery procedures.

TVA Response

Preliminary investigations indicate that no additional precautions are required to prevent equipment damage during restoration of ac power. Before returning to normal power operation, however, potentially damaged equipment will be assessed and repaired in a normal manner. Therefore, no additional training or procedures are required.