



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION  
RELATED TO AMENDMENT NO. 250 TO FACILITY OPERATING LICENSE NO. DPR-52  
AND AMENDMENT NO. 209 TO FACILITY OPERATING LICENSE NO. DPR-68

TENNESSEE VALLEY AUTHORITY

BROWNS FERRY NUCLEAR PLANT, UNITS 2 AND 3

DOCKET NOS. 50-260 AND 50-296

1.0 INTRODUCTION

On June 19, 1997, the Tennessee Valley Authority (the licensee) proposed revisions to the Technical Specifications (TS) for the Browns Ferry Nuclear Plant (BFN) Units 2 and 3. The proposed amendments permit a temporary extension of the emergency diesel generator (EDG) allowed outage time (AOT) from 7 to 14 days so that upcoming vendor-recommended 12-year mechanical and electrical preventive maintenance (PM) activities can be performed. By performing these PM activities within a single EDG outage under a 14-day AOT instead of two outages under the 7-day AOT, the licensee expects to improve overall EDG unavailability and to reduce the potential for work-related errors.

On August 15, 1997, the licensee provided additional information requested by the Nuclear Regulatory Commission (NRC) staff on July 17, 1997. The additional information provided by the licensee on August 15, 1997 does not affect the NRC staff's proposed finding of no significant hazards consideration.

2.0 EVALUATION

All EDGs installed at BFN were manufactured by General Motors Electromotive Division (EMD) and the 12-year PM program is based on EMD's recommendations. This PM program consists of:

1. Extensive diesel engine disassembly, removing pistons, cylinder liners, and connecting rods; and
2. Refurbishment or replacement of any mechanical or electrical components found to be excessively worn or damaged.

Enclosure 3

Plant auxiliary power for each unit at BFN is provided by the main generator through each unit's station service transformers during normal plant operation. If the unit is not operating, the plant power is provided from the 500-kV switchyard (immediate offsite power source) through the main transformer and the unit station service transformers. Power is also available from the 161 kV system via the two common station service transformers (delayed offsite power source). In the event that all preferred offsite circuits from the 500-kV switchyard become unavailable, then it will result in an automatic transfer of safety-related loads to the common station service transformers. When no offsite power is available, safety-related loads will transfer to the EDGs.

Modifications to BFN Unit 2 TS Limiting Condition for Operation (LCO) 3.9.B.3 and BFN Unit 3 TS LCO 3.9.B.2

Currently, TS LCO 3.9.B.3 for Unit 2 states: "When one of the units 1 and 2 diesel generator is INOPERABLE, continued REACTOR POWER OPERATION is permissible during the succeeding 7 days, provided that 2 offsite power sources are available..."; while TS LCO 3.9.B.2 for Unit 3 states: "When one unit 3 diesel generator (3A, 3B, 3C, or 3D) is inoperable, continued reactor operation is permissible during the succeeding 7 days, provided that two offsite power sources are available..."

The licensee proposed to modify this 7-day AOT for an inoperable EDG to a one-time AOT extension to 14 days by inserting the following sentence at the end of the preceding LCO provision for each unit:

[Temporary Change: The preceding 7-day LCO time limit may be extended to 14 days to support completion of maintenance activities during the time period from January 1, 1998, to February 1, 1999, after which time this temporary change is no longer valid. This allowance can be used only once for each individual diesel generator.]

Industry experience with EMD diesels indicates that the 12-year PM cycle for each diesel is estimated to require 13 days on a "two 8 hour shift per day" work schedule. This is equivalent to a 10 day around-the-clock shift schedule. Since in-house experience with the 12-year PM activities is limited by the infrequency of performance, the licensee believes that the predicted schedule duration has considerably more uncertainty than routinely conducted activities and could encounter unexpected delays, thus raising the potential for exceeding the LCO. The licensee believes that a one-time extension of the 7-day EDG AOT to 14 days gives extra time for completing the task, thus reducing the risk of a reactor shutdown as a result of exceeding the 7-day LCO.

The licensee also believes that partitioning the 12-year EDG mechanical PM and electrical PM into two maintenance activities is not desirable from an overall EDG availability perspective, since this approach removes the EDGs from service for a longer period of time than if the maintenance could be performed as a combined activity. Conducting maintenance within a single outage eliminates duplicative activities, such as set-up, restoration, and post-maintenance testing. The licensee estimates that the proposed combined outage approach can save 58 hours of outage time per EDG. For the eight EDGs, this is equivalent to a total of 464 hours (19.3 days), which represents a significant increase in overall EDG availability. With the



proposed one-time extension of an EDG AOT by a combined EDG PM, the EDG is available sooner to mitigate an accident, thus reduces the overall plant risk.

The licensee has provided a list of PM activities and PM duration to show the validity of its request. The staff has reviewed the list and concurs with the licensee that the overall EDG AOT is less by combining two separate (mechanical and electrical PMs) 7-day EDG AOTs together into one 14-day AOT, increasing total EDG availability.

To support its contention that the duration of the extended period does not increase the plant risk significantly, the licensee provided the following justifications:

I. BFN's offsite power supply system

Offsite power is delivered to BFN via seven 500-kV and two 161-kV transmission lines, and the 500-kV switchyard is designed to minimize the effects of the failure of any single 500-kV line that would not prevent other 500-kV lines from providing offsite power. Transmission system transient stability studies have been performed periodically to show the offsite power transmission system remains stable. Considering the large number of diverse generating units and strong transmission lines and interconnections, offsite power at BFN is highly reliable and stable; this, in turn, reduces the likelihood of the transmission system causing the loss of all offsite power. In fact, BFN has not experienced a complete loss of offsite power, a factor that further reduces the reliance on EDG power sources.

II. BFN onsite auxiliary and standby power systems

The BFN emergency onsite power system consists of eight EDGs and their associated distribution and transfer systems. The EDGs are arranged so that four provide standby power to Units 1 and 2, and four are in standby service for Unit 3. Through the use of 4-kV Shutdown Boards 1 and 2, and the 4-kV Bus Tie Boards, any EDG can be cross-connected with any 4-kV Shutdown Board and this alignment can be performed from the control room. The arrangement provides considerable flexibility in supplying emergency ac power. Since BFN Unit 1 is in an indefinite non-operational status and will not be in service for the duration of the proposed temporary TS, the facility can essentially be treated as a two-unit plant, each with four EDGs available for service. Therefore, the onsite power system at BFN has adequate redundancy and is capable of compensating for the EDG that is out of service.

In addition, the licensee has made the following modifications to enhance the onsite power system distribution:

1. completion of Limestone 161-kV substation, improving the stability and capability of the 161 kV offsite power supply;
2. installation of load tap changers on the common station service transformers, providing better voltage regulation on the plant onsite power distribution system;

3. replacement of load tap changers on the unit station service transformers, recovering voltage faster during motor starting transients and regulating voltage better;
4. addition of Watts Bar Unit 1, adding more generating capacity; and
5. replacement of 250-V dc safety-related power batteries, improving BFN's shutdown capability, and installation of two new non-safety-related batteries, enabling transfer of non-safety loads previously fed from safety batteries.

### III. Usage of proceduralized risk-based scheduling maintenance

For planning maintenance activities, BFN uses a probability safety assessment based on a dual unit maintenance matrix. The matrix identifies combinations of equipment that would increase risk above a predetermined criterion, if they are out-of-service simultaneously. These controls are proceduralized in the site work control procedure, Site Standard Practice (SSP)-7.1, "Work Control." Application of the maintenance matrix provides an additional administrative control to restrict removal of risk sensitive equipment from service beyond the restrictions in TS, minimizes equipment AOTs, and carefully controls other maintenance and testing activities during equipment outages.

### IV. Implementation of compensatory measures

To limit other activities to minimize the potential for a loss of offsite power sources, and to maximize the availability of other onsite sources, the licensee has implemented the following compensatory measures during the EDG maintenance outages:

1. Make an extra offsite power source available to the affected unit, above and beyond the two offsite sources TS required by the TS;
2. Restrict any work activities that could affect the ability to cross-tie the opposite EDG unit to the 4-kV shutdown board;
3. Restrict work activities on the 500-kV switchyard;
4. High risk switchyard maintenance will not be scheduled. Emergent high risk work must be approved by the Plant Manager and Operations Manager. The licensee defines a high risk activity as an activity that if a single error or problem occurs, a full reactor scram, transient requiring a reduction in reactor power, and/or an unplanned engineered safety features actuation requiring a report to the NRC within 4 hours, could occur.

Considering: (1) BFN's electrical offsite and onsite power system design; (2) BFN's use of a proceduralized risk based scheduling maintenance; (3) modifications made to the onsite distribution system; and (4) implementation of compensatory measures, the staff finds that the proposed (temporary) change to TS LCOs 3.9.B.3 and 3.9.B.2 for Units 2 and 3, to allow a one-



time extension of the AOT for the inoperable EDG from 7 days to 14 days, would not increase the risk significantly. Therefore, the change is acceptable.

Modification to BFN Unit 2 and Unit 3 TS LCO 3.9.D.1 for Unit 2

Currently, TS LCO 3.9.D.1 (diesel generators required for Units 1, 2, and 3 shared systems) for Units 2 and 3 states:

Whenever standby gas treatment is required to be OPERABLE in accordance with Specification 3.7.D and/or control room emergency ventilation is required to be OPERABLE in accordance with Specification 3.7.E, the associated diesel generator aligned to supply emergency power to that equipment shall be OPERABLE.

- a. Standby gas treatment train A and/or control room emergency ventilation train A - Diesel generator 1/2A or 1/2B.
- b. Standby gas treatment train B - Diesel generator 1/2D or 1/2B.
- c. Standby gas treatment train C - Diesel generator 3D.
- d. Control room emergency ventilation train B - Diesel generator 3C or 3B.

The TS requires that certain EDGs be operable in order to consider standby gas treatment and control room emergency ventilation trains to be operable. In cases (a), (b), and (d), either of two EDGs can fulfill this function. In case (c), only EDG 3D can be used in order to consider standby gas treatment train C to be operable. With one train of standby gas treatment inoperable, TS LCO 3.7.B.3 allows reactor power operation and fuel handling to continue only for the succeeding 7 days. Therefore, even if the AOT for EDG 3D (i.e., TS LCO 3.9.B) is granted to 14 days, it appears that TS LCO 3.7.B.3 could still be applicable, in which case the reactor power operation would not be allowed beyond 7 days.

For the preceding circumstances, the licensee's submittal explained that TS (Definitions Section) 1.C.2 would be applicable, where it states that, when a system, subsystem, train, components, or device is determined to be inoperable solely because its onsite power source (i.e., EDG) is inoperable, it allows the time limits for the reactor operation to be governed by the EDG LCO. Thus, in accordance with TS 1.C.2, the requested 14-day AOT extension of an EDG per TS 3.9.B would be directly governed for the shared systems listed in TS LCO 3.9.D.1, e.g., the standby gas treatment system train C would be considered operable during the 14 days when the EDG 3D is made inoperable to perform the 12-year maintenance. Should a loss of offsite power event occur during the 14 days when an EDG is out, the onsite power system at BFN has adequate redundancy where any EDG can be cross-connected through the use of 4-kV Shutdown boards and the 4-kV Bus Tie Boards.

During its review of the proposed TS amendment, the staff indicated that the existing wording in TS LCO 3.9.D.1 was not entirely clear in supporting the application of TS 1.C.2 with regard to the proposed extended AOT for the shared EDGs. To address the issue, the licensee has

agreed to clarify TS LCO 3.9.D.1 by explicitly referring TS 1.C.2 for the purposes of operability determinations for the affected equipment. The licensee, by letter dated August 15, 1997, submitted the following supplemental changes to be added at the end of TS LCO 3.9.D.1 for Units 1 and 2:

[Temporary Change: When the aligned diesel generator is inoperable on a unit that is not in cold shutdown, refueling, or defueled, then TS 1.C.2 applies for the purpose of operability determinations for the above affected equipment. This change is valid during the time period from January 1, 1998, to February 1, 1999].

The staff has reviewed the proposed supplemental change and finds that the preceding change clearly delineates the application of TS 1.C.2 for inoperable EDGs on operating units in TS LCO 3.9.D.1, therefore, it is acceptable.

### 3.0 License Condition for Compensatory Measures

As noted above, the NRC staff accepts the temporary extension of the EDG AOT, in part due to the licensee's commitment to certain compensatory measures during the 12-year EDG PM activities. These compensatory measures will be incorporated into license conditions for each unit: section 2.C.(15) of the BFN Unit 2 license, and section 2.D.(5) of the BFN Unit 3 license. These conditions will read as follows:

a. When emergency diesel generators are removed from service for up to 14 days for preventive maintenance under the provisions of Amendment No. XXX, the licensee shall:

1. Require another offsite power source be available in addition to the requirements of Technical Specification 3.9.A.1.c that two offsite sources be available.
2. Restrict work activities affecting the ability to cross-tie the associated Unit 3 [Unit 1/2 for the Unit 3 license condition] emergency diesel generator to the 4-kV shutdown board for the emergency diesel generator that is out of service.
3. Restrict work activities on the 500-kV switchyard cross-tie breakers supporting the affected unit.
4. No high risk switchyard maintenance will be scheduled while the emergency diesel generator is out of service. If emergent conditions require performance of such high risk activities, such activities shall be approved by the Plant Manager and the Operations Manager. "High risk switchyard maintenance" is defined as an activity that if a single error or problem occurs, a full reactor scram, transient requiring a reduction in reactor power, and/or an unplanned engineered safety features actuation requiring a report to the NRC within 4 hours, could occur.



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- b. These provisions apply during the time period from January 1, 1998 to February 1, 1999, or completion of preventive maintenance under the provisions of Amendment No. XXX, whichever occurs first.

"Amendment No. XXX" refers to license amendment number implementing the temporary EDG AOT extension for Unit 2 and Unit 3, respectively (Amendment No. 250 for Unit 2 and No. 209 for Unit 3).

The provisions of this license condition are consistent with the licensee's compensatory measures commitments required as part of the NRC staff's acceptance of the temporary EDG AOT extension. These conditions were discussed with the licensee, who agrees they are acceptable.

#### 4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Alabama State official was notified of the proposed issuance of the amendment. The State official had no comments.

#### 5.0 ENVIRONMENTAL CONSIDERATION

The amendments change requirements with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 and changes the surveillance requirements. The NRC staff has determined that the amendments involve no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendments involve no significant hazards consideration, and there has been no public comment on such finding (62 FR 40858). Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments.

#### 6.0 CONCLUSION

The Commission has concluded, based upon the considerations discussed above, that: (1) the amendments do not (a) significantly increase the probability or consequences of an accident previously evaluated, (b) create the possibility of a new or different kind of accident from any previously evaluated, or (c) significantly reduce a margin of safety; (2) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner; (3) such activities will be conducted in compliance with the Commission's regulations; and (4) issuance of these amendments will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributors: P. Kang and J. Williams

Dated: December 22, 1997