



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO AMENDMENT NO. 206 TO FACILITY OPERATING LICENSE NO. NPF-3

TOLEDO EDISON COMPANY

CENTERIOR SERVICE COMPANY

AND

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

DAVIS-BESSE NUCLEAR POWER STATION, UNIT NO. 1

DOCKET NO. 50-346

1.0 INTRODUCTION

By letter dated June 1, 1995, as supplemented on October 20, 1995, December 13, 1995, and January 26, 1996, the Toledo Edison Company, Centerior Service Company and The Cleveland Electric Illuminating Company (the licensees) requested an amendment to Operating License NPF-3 which would revise the Davis-Besse Nuclear Power Station (DBNPS) Technical Specifications (TS) 3/4 8.1, "A.C. Sources - Operating" and TS Bases 3.0.5. The October 20, 1995, December 13, 1995, and January 26, 1996, submittals provided clarification only and, as discussed in the evaluation below, the information provided was not outside the scope of the original no significant hazards determination. The proposed change to TS 3.8.1.1 modifies Action "a" to relocate references to diesel generators to revised Action statement "b"; adds a revised Action "b" to address the diesel generators and the new 7-day allowed outage time (AOT); and changes previous Action "b" to "c," which addresses the action to take if one offsite power source and one diesel generator are inoperable by adding a requirement to restore the inoperable diesel generator within 7 days from the time of initial loss. The licensees propose to revise Bases 3.0.5 to reflect the 7-day AOT. The increased AOT will allow greater flexibility in scheduling the performance of preventive maintenance (PM) consistent with ensuring the reliability of the diesel generators required by TS which are also called the emergency diesel generators (EDG). The approach used for the probabilistic risk assessment performed in support of this license amendment was reviewed.

2.0 EVALUATION

This evaluation describes the current design of ac power sources at DBNPS, describes the impact of the proposed changes on the commitments to address station blackout per the requirements of 10 CFR 50.63, provides the rationale for proposing the change to the AOT, describes the PRA analysis and provides our review of the administrative program to ensure PRA impacts are known, and provides the results of the overall review of the proposed changes.

2.1 Background

The normal electrical power sources at Davis-Besse Nuclear Power Station (DBNPS) consist of three offsite power sources (Startup Transformers 1 and 2, and the Unit Auxiliary Transformer) and two onsite power sources (Diesel Generators 1 and 2). Offsite power is supplied to the DBNPS switchyard by three 345 kV lines. Two electrically and physically separated circuits from the switchyard provide ac power through the startup transformers to the 4.16 kV Engineered Safety Features (ESF) busses. The ESF busses also can be powered from the switchyard through the Unit Auxiliary Transformer by removing the main generator disconnecting links. Onsite power is supplied by two redundant EDGs. One EDG is connected to ESF bus C1 and the other EDG is connected to ESF bus D1. In the event of a loss of offsite power, the EDGs are automatically connected to the ESF busses in sufficient time to safely shutdown the reactor or to mitigate the consequences of a design bases accident (DBA).

In addition to the two electrical circuits powered from the switchyard and the two onsite EDGs, DBNPS has installed a station blackout diesel generator (SBODG). This non-Class 1E 4.16 kV SBODG meets the definition of an alternate ac (AAC) power source under the requirements of 10 CFR 50.63. Preoperational testing of the SBODG was completed during DBNPS's eighth refueling outage in 1993. The staff evaluated the SBODG for compliance with the requirements of 10 CFR 50.63 and found it acceptable as documented in a safety evaluation dated March 7, 1991.

2.2 Proposed Technical Specification Changes

The licensees have proposed a change in the Limiting Condition for Operation (LCO) from 72 hours to 7 days AOT for performing EDG maintenance. In evaluating compliance with the requirement in 10 CFR Part 50, Appendix A, General Design Criteria 17 and 18 for reliable onsite power sources, the staff reviewed previous approvals of amendments extending the AOT for EDGs to plants belonging to one of the following two special cases: (1) multi-unit plants that have added an AAC power source to satisfy the requirements of 10 CFR 50.63 and have TS that require more than one unit to shut down when an EDG is declared inoperable; and (2) plants that are coping with a station blackout (SBO) event with dc power only, but either have added or already had an offsite (e.g., gas turbine, diesel generator) or an onsite (excess redundancy EDG) power source which could be used as an AAC power source to cope with an SBO event as an alternate means. The reasoning implicit in these two special cases is that if a nuclear power plant has excess and diverse power sources available to cope with a loss of offsite power event (e.g., excess AAC power sources) and these power sources can be temporarily used to compensate for an EDG out of service without significantly increasing the risk of an SBO, then under certain controlled conditions it is acceptable to perform on-line maintenance intended to improve EDG reliability.

The staff has developed the criteria stated below to evaluate a licensee's proposal to extend the EDG AOT. The staff has reviewed DBNPS's request to extend its EDG AOT from 72 hours to 7 days against these criteria as documented. It is the staff's view that conformance to these criteria is

necessary in order to ensure that a licensee has not significantly increased the likelihood of a core damage accident given an SBO event due to the performance of EDG preventive maintenance during power operations.

1. The licensee should verify that the required systems, subsystems, trains, components, and devices that depend on the remaining diesel generator as a source of emergency power are operable before removing an EDG for preventive maintenance. In addition, positive measures should be taken to preclude subsequent testing or maintenance activities on these systems, subsystems, trains, components, and devices while an EDG is inoperable.

These verification requirements are contained in TS and the licensees' probabilistic safety assessment (PSA) approach to risk management. The licensees' PSA approach to risk management is designed to provide reasonable assurance that unacceptable plant equipment outage configurations do not occur while an extended AOT exists. Prior to entry into the proposed extended EDG AOT, the status of key associated systems and trains will be reviewed for safety impact. The licensees have generated a risk-significant system configuration matrix which can be used to identify a large number of prohibited plant configurations.

2. The AAC power source should have a capacity equal to or greater than the capacity of the EDG that will be out for the extended AOT. The licensee should verify, before taking one EDG out for an extended period, that the AAC power source is functional (i.e., it is verified that the AAC power source is capable of starting and achieving steady-state voltage and frequency in sufficient time); verify that the AAC power source is capable of being connected to the safety bus associated with the inoperable EDG; and verify this capability of being connected to the safety bus every 8 hours thereafter.

The licensees have available onsite an AAC power source which can be used as a compensatory measure while an EDG is out of service. This AAC power source is the SBODG. The SBODG has a continuous power rating of 2865 kW, which is greater than the capacity of the EDG that would be out of service during the proposed extended AOT. The licensees have stated in their January 26, 1996, submittal that prior to preventive maintenance of the EDG: (1) the SBODG will be demonstrated by test, within the previous 30 days, to start and achieve steady-state voltage and frequency in sufficient time and (2) the AAC power source will be verified as capable of being connected to the safety bus associated with the inoperable EDG, and will verify this capability of being able to connect to the safety bus every 8 hours thereafter. This position is consistent with the licensees stated purpose to maintain alternate power sources available during on-line EDG PM activities, and is also consistent with the staff criteria in this regard.

3. The calculated core damage frequency (CDF) for station blackout (SBO) sequences with the extended EDG AOT should be acceptable when compared to the SBO risk reduction goal contained in the SBO statements of consideration.

The staff's review and evaluation of the licensees' PRA findings is included in Section 2.4. In its December 13, 1995, letter to the staff, the licensees

stated that 20% of its baseline CDF was due to SBO events. This equates to a current CDF from SBO events of 1.3×10^{-5} /year (0.20 times 6.6×10^{-5}). The licensees also stated that with the proposed 7-day EDG AOT, the CDF due to SBO events would only increase to 21% of its baseline CDF. This equates to 1.4×10^{-5} /year (0.21 times 6.6×10^{-5}).

4. The overall unavailability of the EDG should not exceed the value that was used in the probabilistic risk assessment (PRA) supporting the proposed AOT. Also, the EDG unavailability should be monitored and controlled in accordance with the maintenance rule performance criteria.

The licensees used an overall unavailability value of 1.5 percent for each EDG in the PRA that supports the proposed AOT extension, and has established this value as its 10 CFR 50.65 Maintenance Rule, performance criterion.

5. Any component testing or maintenance that increases the likelihood of a plant transient should be avoided; plant operation should be stable during the EDG AOT. (This could include consideration of degraded or out-of-service balance-of-plant equipment.)

The licensees' PSA approach to risk management is designed to provide reasonable assurance that unacceptable plant equipment outage configurations do not occur while an extended AOT exists, including the control of maintenance activities in the switchyard. Prior to entry into the proposed extended EDG AOT, the status of key associated systems and trains will be reviewed for safety impact. The licensees have generated a risk-significant system configuration matrix which can be used to identify a large number of prohibited plant configurations.

6. Voluntary entry into a Limiting Conditions for Operations (LCO) action statement should not be scheduled when adverse weather is expected.

The licensees stated in their December 13, 1995, letter that consideration of adverse weather conditions on power supplies is an integral part of the decision process required for safe operation of the DBNPS. The licensees further stated that consideration of the potential impact of adverse weather conditions when selectively removing equipment from service is being added to the DBNPS work process guidelines.

2.3 Rationale for Extended AOT

A licensee may take equipment out of service to perform PM during power operation of the facility if it expects that the online PM will improve safety by making equipment more reliable even though it may increase the unavailability of the equipment. The licensee should be able to justify any such expectation of improved safety according to the following conservative safety principles:

1. The licensee should not abuse the allowance to perform a PM action online by repeatedly entering and exiting LCO action statements. The licensee should carefully plan the PM action to prevent such abuse.

2. The PM action should be scheduled and well planned in advance to minimize the amount of time the equipment is off-line.
3. While performing an online PM action, the licensee should avoid removing other equipment from service. Confidence in the operability of the independent equipment that is redundant (or diverse) to the affected equipment should be high.
4. While performing an online PM action, the licensee should avoid performing other testing or maintenance that would increase the likelihood of a transient. The licensee should have reason to expect that the facility will continue to operate in a stable manner.

Our review of the licensees' submittals determined that the above principles are met. Furthermore, based on an average availability factor of 84 percent over the last six years for DBNPS, the EDG unavailability criterion (i.e., 1.5 percent per EDG) yields approximately 110 hours or 4.6 days per year. The licensees expect to utilize up to 2/3 of the unavailability goal (or approximately 3.7 days per year assuming 100 percent unit availability) based on the anticipated work load. The licensees expect that the most extensive preventive maintenance for the six-year interval will require a maximum of four days. Therefore, the accepted risk is consistent with 10 CFR 50.63 for the DBNPS onsite ac power source.

In accord with the above review of this amendment and the requirements in 10 CFR 50.65, the licensees will: (1) verify that the onsite station blackout diesel generator has passed an operability surveillance test within the last 30 days; (2) verify it is capable of being connected to the safety bus associated with the EDG out of service, and (3) reverify this capability once every 8 hours until the inoperable EDG is returned to service.

2.4 PRA Considerations

The Davis-Besse PRA utilizes large fault tree/small event tree modeling. Fault tree linking is used to quantify core damage sequences. Fault tree models were developed for top events depicted in the event trees, with the systems and support systems also modeled by fault trees. CAFTA software was used for development and quantification of top event probabilities and sequence frequencies.

PRA data collection was conducted through 1990 for the most important components with the exception of various valves for which 1985 data was used. Generic data was used for the two turbine-driven auxiliary feedwater pumps. For the station blackout diesel generator (SBODG), the licensees used failure and maintenance data for the other two emergency diesel generators, since the design and function of the SBODG is similar in nature. Demand and time-related failures were both addressed. Sources of plant-specific failure data included maintenance work orders, transient assessment program (TAP) reports, and licensee event reports (LERs). Operator logs and tag-out logs were consulted for test and maintenance unavailability data. Plant-specific component failure rate data were used to perform Bayesian updates on generic data.

Internal PRA reviews included independent licensee reviews involving engineering departments, licensing engineers, training personnel, operations and maintenance personnel, and previously licensed senior reactor operators. External peer review was performed by outside engineering consultants.

The licensees used the PRA to evaluate the impact of the AOT on the plant CDF. The baseline CDF was estimated to be 6.6×10^{-5} /reactor-year. This is based on a 0.75 percent unavailability for each EDG. Because the AOT extension will increase the unavailability to near 1.5 percent per EDG, sensitivity calculations were performed. These calculations indicate that there would be an increase in the baseline plant risk of less than 2.5 percent of the total baseline to 6.8×10^{-5} /reactor-year. Additionally, the large early release frequency (LERF) was approximated under modified AOT conditions, to understand the impact of the amendment on containment performance. The LERF was found to be less than 10% of the CDF.

The low vulnerability of Davis Besse to station blackout (SBO) stems from two somewhat unique features: (1) redundancy in the steam driven auxiliary feedwater pumps, and (2) the recently installed station blackout diesel generator (SBODG). DBNPS auxiliary feedwater system maintains a motor-driven pump in addition to the two turbine-driven pumps, with instructions in place to support manual control of the turbine-driven pumps if a loss of dc power were to occur. The required actions have been performed in training exercises and in response to past transients. The SBODG provides AAC power source redundancy following a postulated loss of offsite power. The SBODG can be started from the control room or locally, and can supply power to either of the two safety-related essential buses. The SBODG is housed in a separate building from the emergency diesel generators and has its own battery supply, fuel supply, ventilation, and cooling system to ensure a 4-hour full load run capability. Credit for both the excess auxiliary feedwater capability, and redundant SBODG substantially reduces the susceptibility of Davis-Besse to SBO risk. Based on the above, the staff agrees with the licensees' findings that the risk from SBO at Davis Besse is small, and that the AOT extension will not change the overall assessment that the SBO risk is small at Davis-Besse.

2.5 Summary Findings

The increase in the EDG AOT period from 3 days to 7 days to allow the licensees to perform on-line preventive maintenance intended to improve EDG overall reliability is acceptable. Based on the licensees' determination that the SBODG can compensate for an EDG to be taken out of service for the purpose of performing preventive maintenance and based on the review of the licensees' submittals, the staff's evaluation of licensee's compliance with 10 CFR 50.63 with an EDG AOT extension has determined this AOT extension to be acceptable. Because the total amount of time an EDG can be unavailable will be limited by licensees' procedures for implementing 10 CFR 50.65, the overall risk associated with the AOT extension is minimal. The proposed AOT extension to permit the performance of the infrequent (i.e., six-year) PM activities will improve overall diesel generator reliability and performance and continues to meet the requirement of 10 CFR 50.36(c)(2), to establish LCOs for safe operation of the facility, which allows remedial actions to ensure the health and safety of the public.

Other TS changes being made involve the rewording of action statements and the bases section as documented in Section 1.0 are consistent with the extension of the EDG AOT and, therefore, are acceptable.

3.0 STATE CONSULTATION

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

4.0 ENVIRONMENTAL CONSIDERATION

This amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 or changes a surveillance requirement. The staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluent 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 amendment involves no significant hazards consideration and there has been no public comment on such finding (60 FR 39453). Accordingly, the amendment meets 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 amendment.

5.0 CONCLUSION

The staff has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributors: R. Jenkins
M. Wohl
V. Beaston
L. Gundrum

Date: February 26, 1996