



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 168 TO FACILITY OPERATING LICENSE NO. DPR-56

PHILADELPHIA ELECTRIC COMPANY  
PUBLIC SERVICE ELECTRIC AND GAS COMPANY  
DELMARVA POWER AND LIGHT COMPANY  
ATLANTIC CITY ELECTRIC COMPANY

PEACH BOTTOM ATOMIC POWER STATION, UNIT NO. 3

DOCKET NO. 50-278

1.0 INTRODUCTION

By letter dated November 21, 1991, the Philadelphia Electric Company, Public Service Electric & Gas Company, Delmarva Power and Light Company and Atlantic City Electric Company (the licensees) submitted a request for changes to the Peach Bottom Atomic Power Station, Unit No. 3, Technical Specifications (TS), on an emergency basis. The requested changes would change the Technical Specifications (TS) to allow fuel loading to take place without all control rods fully inserted into the core. The proposed amendment would be in effect until the tensioning of the reactor vessel head bolts during the Cycle 8 refueling outage.

2.0 DISCUSSION

During the Peach Bottom Atomic Power Station, Unit 3, Cycle 8 refueling outage, inspections were conducted on a number of fuel bundles which were determined to have incurred fuel failures during Cycle 8 operation. The inspections revealed debris inside the fuel bundles. The majority of the fuel bundle failures appeared to be debris induced. In addition, it was determined that the bottom head drain was clogged and it was presumed that the drain was clogged with the same type of debris.

In order to ensure that additional debris induced fuel failures did not occur during Cycle 9 operation, a program was devised to inspect and clean the debris from all fuel bundles that had been reinserted into the core after Cycle 8 operation. In order to clear the bottom head drain, a program was devised to clean and inspect the bottom head drain and inspect the bottom of the reactor vessel. The inspection of the bottom head drain requires that the four fuel assemblies, the control rod and control guide tube, the control rod housing thermal sleeves and the fuel support piece for several fuel cells in the vicinity of the bottom head drain be removed. The removal of these items will clear a path for the insertion and operation of the bottom head drain inspection and cleaning apparatus.

In order to minimize the time required to conduct these activities, the licensee plans to conduct these operations in parallel. Such operation would make it necessary to remove, inspect and reload fuel while several fuel cells are disassembled, including having their control rods removed. The licensee contends that performance of these cleaning and inspection activities in parallel would reduce the number of days the outage must be extended.

### 3.0 EVALUATION

#### A. CHANGES REQUESTED

The licensee has requested four changes to the Technical Specifications to allow the loading of fuel while all control rods are not inserted. These changes would allow the reloading of fuel associated with cleaning and inspecting of fuel bundles to occur while the fuel cells disassembled to support the cleaning of the bottom head drain have their control rods removed.

#### B. CHANGE TO LCO 3.10.A.1

The first requested change revises Limiting Condition for Operation (LCO) 3.10.A.1. LCO 3.10.A.1 specifies that the reactor mode switch must be locked in the Refuel position and that the refueling interlocks shall be operable during core alteration operations except as allowed under certain other LCO's. The change to 3.10.A.1 references the circumstances of LCO 3.10.A.2 as one of the allowable exceptions. This change adds an additional exception to LCO 3.10.A.1 and, of itself, is a change in reference only. The licensee's proposal is, therefore, acceptable.

#### C. FUEL LOADING WITH CONTROL RODS REMOVED

The second change requested would allow the bypassing of the refueling interlock that specifically prevents fuel from being loaded while any control rod is withdrawn. The licensee proposes certain conditions be imposed before this interlock is bypassed. The revised Technical Specification 3.10.A.2 requires for any cell that has its control rod removed, the four fuel assemblies in that cell must be removed before the refueling interlock is bypassed. In addition, the change to LCO 3.10.A.2 requires that for any cell which has its control rod removed, the control rods in the cells face and diagonally adjacent to it must be fully inserted and have their directional control valves electrically disarmed before the refueling interlock is bypassed.

The requirement to remove the four fuel bundles from any cell that has its control rod removed results in a less reactive core and increases the margin to criticality. The licensee contends that with all four fuel bundles removed, a single fuel loading error resulting in the inadvertent insertion of a single fuel assembly in this cell cannot result in inadvertent criticality. In order to cause inadvertent criticality, the licensee contends that several fuel assembly errors would be necessary, such that several fuel bundles were

misloaded into one of the cells with its control rod removed. A combination of procedures require the verification that a control rod is inserted in a cell before loading a fuel bundle into it. The licensee contends that strict procedural compliance and the visual indications of a withdrawn control rod make a single bundle loading error unlikely. The combination of errors necessary to result in multiple bundle loading errors is even less likely.

The requirement to electrically disarm the directional control valves for the control rods in the face and diagonally adjacent cells increases the shutdown margin in the event of a fuel assembly insertion error for one of the defueled cells. The licensee performed a fuel bundle misloading analysis which demonstrated that inadvertent criticality cannot occur due to a single fuel insertion error. The effect of such an error on shutdown margin would be to shift the location of the highest worth rod to the vicinity of the error. The rods that would see the effect of this error most strongly would be the face adjacent rods followed by the diagonally adjacent rods. The requirement to insert and disable these rods allows them to be eliminated from consideration as possible highest worth rods in determining shutdown margin. The licensee contends the effect of the single insertion error on rods outside the adjacent rods is negligible and will have minimal effect on overall shutdown margin. This requirement will add to the margin of safety by ensuring that the withdrawal of a control rod following the original loading error will still not result in an inadvertent criticality.

The staff has reviewed the compensatory measures proposed by the licensee, as discussed above, and finds them adequate. The licensee's proposed change is, therefore, acceptable.

#### D. ANALYTICAL DETERMINATION OF SHUTDOWN MARGIN

The third proposed change adds Surveillance Requirement 4.10.A.3 which requires that prior to loading fuel into the core without all control rods fully inserted, it shall be demonstrated analytically that the core is subcritical with a margin of at least 1.0% delta k assuming a single fuel loading error into a cell with the control rod withdrawn.

The analytical demonstration would be used by the licensee to demonstrate that the margin of safety required by the technical specification Bases is met. The basis of Technical Specification 3.10.A.2 is that inadvertent criticality be prevented by the use of both administrative controls and refueling interlocks. The fuel bundle misload analysis is used to ensure that inadvertent criticality will not occur in the event that a single assembly insertion error occurs. The Peach Bottom Updated Final Safety Analysis Report (UFSAR) states that a single fuel assembly insertion error will not result in inadvertent criticality because the nuclear design of the core requires a shutdown margin of 1.00% delta k with the highest worth rod withdrawn. The licensee contends that a bundle misload analysis performed to support this proposed change showed that the Peach Bottom Unit 3 Cycle 8 core would remain subcritical by at least 1.00% following a single assembly insertion error.

The staff has reviewed the licensee's submittal and concludes that the licensee's proposed analysis of shutdown margin for a single fuel insertion error is adequate. The licensee's proposal is, therefore, acceptable.

#### E. CHANGE IN TECHNICAL SPECIFICATION BASES

The fourth proposed change modifies the Technical Specification Bases 3.10 which describes that all control rods are required to be fully inserted when loading fuel into the core. The change suspends this requirement until the completion of tensioning the reactor vessel head bolts for the Unit 3 Cycle 8 refueling outage. The licensee has used this milestone to define the end of the fuel movement portion of the refueling outage and hence, the end of the need to load fuel without all control rods inserted.

The staff finds this proposed change of the Technical Specification Bases consistent with the other proposed Technical Specification changes. The licensee's proposal is, therefore, acceptable.

#### 4.0 EMERGENCY CIRCUMSTANCES

In its November 21, 1991 letter, the licensee requested that its application for license amendment be processed as an emergency change per 10 CFR 50.91(a)(5). By letter dated November 22, 1991, the licensee requested that a Temporary Waiver of Compliance be issued until the license amendment was approved.

During the Peach Bottom Atomic Power Station, Unit 3, Cycle 8 refueling outage, inspections were conducted on fuel bundles which had incurred fuel failure during Cycle 8 operation. The inspections revealed debris inside the fuel bundles and that the majority of the failures were debris induced. In addition, it was determined that the reactor bottom head drain was clogged and was presumed to be clogged with the same type of debris.

In order to ensure that additional debris-induced failures did not occur during Cycle 9 operation, the licensee devised a program to clean and inspect all fuel bundles that had been reinserted after Cycle 8 operation. In order to clear the bottom head drain, the licensee developed a plan to inspect and clean the bottom head drain and inspect the bottom of the reactor vessel. The inspection of the bottom head drain requires that the four fuel assemblies, control rod guide tube, control rod, and fuel support piece for several fuel cells in the vicinity of the drain be removed from the vessel. The removal of these items will clear a path for insertion and operation of the bottom head drain inspection and cleaning apparatus.

In order to minimize the time required to conduct these operations, the licensee proposes to conduct them in parallel. Such operation would make it necessary to remove, inspect and reload fuel while the cells in the vicinity of the drain are disassembled with their control rods removed. The bottom head drain inspection and cleaning is expected to take from several days to several weeks. The fuel bundle cleaning is expected to take several weeks.

Conducting these operations in series, as the current technical specifications would require, would extend the current refueling outage by a period of several days to several weeks.

The NRC staff conducted a preliminary review of the licensee's request and concluded that the compensatory measures proposed by the licensee were adequate to ensure that safe margins to inadvertent criticality were maintained. On November 25, 1991, the staff granted a Temporary Waiver of Compliance from Technical Specification 3.10.A.2. The waiver was effective immediately and remained in effect until the proposed license amendment was issued. The staff has reviewed the circumstances associated with the licensee's request for an emergency technical specification change. Without the proposed change, Peach Bottom Unit 3 would be forced to extend the current refueling outage by a period of several days to several weeks. Additionally, this condition could not have been reasonably foreseen prior to this time as it is a direct result of the fuel inspections done as a course of the Cycle 8 refueling outage. It is therefore concluded that this change satisfies the criteria of 10 CFR 50.91(a)(5).

#### 5.0 FINAL NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION

The Commission's regulations in 10 CFR 50.92 state that the Commission may make a final determination that a license amendment involves no significant hazards consideration if operation of the facility in accordance with the amendment would not:

- (1) Involve a significant increase in the probability or consequences of an accident previously evaluated; or
- (2) Create the possibility of a new or different kind of accident from any accident previously evaluated; or
- (3) Involve a significant reduction in a margin of safety.

The licensee proposed that the proposed technical specification change did not involve a significant hazards consideration. Based on a review of the licensee's determination, the staff has determined the following:

1. With the implementation of the licensee's proposed compensatory measures, the loading of fuel without all control rods fully inserted is not considered to increase the probability of a previously evaluated accident. The removal of fuel assemblies from cells with their control rods removed and the insertion and disarming of control rods adjacent to such cells provide additional assurance that an inadvertent criticality would not occur in the event of a single fuel insertion error. Based on a review of the facility's updated final safety analysis report and of the compensatory measures proposed by the licensee, it was concluded that the proposed loading of fuel with several control rods removed from the core does not increase the probability or consequences of inadvertent criticality resulting from a single fuel insertion error.

2. The updated final safety analysis report discusses three types of accidents that may be associated with fuel handling activities. The accidents are those which have the potential to increase reactivity, those which have the potential to cause fuel damage and those which cause a decrease in reactor coolant.

A fuel assembly insertion error will cause an increase in reactivity and may lower core shutdown margin. The licensee's proposed analysis will demonstrate that a single fuel bundle loaded into a cell with its control rod removed will result in a subcritical margin of at least 1.00% delta k. The proposed requirement to maintain adjacent control rods fully inserted with directional control valves disarmed ensures that rod withdrawal from a cell adjacent to the projected bundle loading error will not occur, thus ensuring the margin to inadvertent criticality.

The licensee has analyzed a potential fuel drop accident and has proposed that the results of that accident are bounded by the UFSAR. The proposed accident would not lead to fuel damage in excess of that analyzed in the UFSAR. The fuel drop accident into a cell with its control rod and fuel support piece removed is not expected to breach primary integrity.

Based on a review of the facility's updated final safety analysis report and the proposed compensatory measures, it was concluded that the proposed fuel handling without all control rods fully inserted would not create the possibility of a new or different kind of accident from one previously evaluated.

3. The nuclear design of the core is required in the UFSAR to ensure that the  $k_{eff}$  of the core is less than or equal to 0.99 with the highest worth rod withdrawn during the shutdown condition. The licensee's proposed analysis and compensatory actions will ensure that this margin is maintained for a single fuel insertion error. Based on a review of the updated final safety analysis report and proposed compensatory measures, it was concluded that the proposed fuel handling without all control rods inserted would not involve a significant reduction in a margin to safety.

Based on the above discussion, the staff concludes that this amendment meets the criteria and therefore, does not involve a significant hazards consideration.

#### 6.0 STATE CONSULTATION

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

## 7.0 ENVIRONMENTAL CONSIDERATION

The 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. The NRC staff has determined that the amendment involves 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 made a final no significant hazards finding with respect to this amendment. 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.

## 8.0 CONCLUSION

The staff has concluded, based on the considerations discussed above, that: (1) the amendment does not (a) significantly increase the probability or consequences of an accident previously evaluated, (b) increase the possibility of a new or different kind of accident from any previously evaluated or (c) significantly reduce a safety margin and, therefore, the amendment does not involve a significant hazards consideration; (2) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner; and (3) such activities will be conducted in compliance with the Commission's regulations, and the issuance of this amendment will not be inimical to the common defense and security nor to the health and safety of the public.

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Date: November 29, 1991