

DUKE POWER COMPANY
OCONEE UNIT 1

Report No.: RO-269/76-11

Report Date: July 7, 1976

Occurrence Date: June 23, 1976

Facility: Oconee Units 1, 2 and 3, Seneca, South Carolina

Identification of Occurrence: Reactivity balance procedure to determine the subcriticality margin not in conformance with the FSAR

Conditions Prior to Occurrence: Not Applicable

Description of Occurrence:

On June 23, 1976, following a review of the reactivity balance procedures currently in use at Oconee Nuclear Station, it was identified that the shutdown margin calculation procedure to determine the subcriticality margin when the reactor is shutdown did not provide for excluding the reactivity worth of the most reactive control rod from the reactivity worth of the inserted control rods and therefore it was not in conformance with the assumptions of Section 14.2.2.2.1 of the FSAR.

Apparent Cause of Occurrence:

The apparent cause of this occurrence was a deficiency in the preparation, review and approval process for the applicable procedure.

Analysis of Occurrence:

Section 14.2.2.2.1 of the FSAR states that when the reactor is subcritical the boron concentration in the core is maintained at a level which ensures that the reactor is at least 1 percent subcritical, with the control rod of greatest worth fully withdrawn from the core. Although this assumption was valid for Oconee 1 during Cycle 1 operation due to the fact that the control rod of greatest worth was in Group 1 and that Group 1 is normally withdrawn to 50 percent when the reactor is in shutdown mode, it was not valid for Units 2 and 3 and subsequent cycles of Unit 1 when the control rod of greatest worth was not necessarily in Group 1.

A 1% $\Delta k/k$ shutdown margin with the most reactive control rod fully withdrawn has been required when the reactor is subcritical to prevent a nuclear excursion in the unlikely event of a control rod ejection resulting from the failure of a control rod drive mechanism pressure boundary. A review of the available shutdown margins at hot zero power conditions for Cycles 2 and 3 of Oconee 1 and Cycle 1 of Oconee 2 and 3 indicates that the available shutdown margins, with the control rod of highest worth fully withdrawn from the core, are in excess of the minimum required 1% $\Delta k/k$. Since the

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boron concentration in the core is not reduced when the reactor is maintained at hot shutdown conditions, the available subcriticality margins prior to significant xenon decay would have been sufficient to maintain the reactor subcritical had the most reactive control rod been ejected.

The last Unit 3 normal shutdown and cooldown has been evaluated, and the results indicated that the reactor would have remained shutdown with no xenon, with the most reactive control rod withdrawn, and with Group 1 50 percent withdrawn. In the actual time frame of the shutdown and cooldown, a 1% $\Delta k/k$ shutdown margin existed with xenon and with the most reactive control rod fully withdrawn. These margins are approximately valid for Oconee 2 also because of the similarity of the two cores. It appears that the failure to include the worth of the most reactive control rod in the subcriticality margin calculation could have resulted in inadequate shutdown margin in Oconee 1, Cycle 2 during cold and hot shutdown with no xenon. While the reactor is at cold shutdown, the probability of a rod ejection is negligible because the system is depressurized, and periods when the reactor remains at hot shutdown until the no-xenon conditions are reached have occurred infrequently and are of relatively short duration. Therefore, it is felt that the probability of a rod ejection accident involving the most reactive control rod is sufficiently low so that the total period of time in which the Oconee units were in possible nonconformance with FSAR Section 14.2.2.2.1 did not pose a significant threat to the safety of operations and that this incident did not affect the health and safety of the public.

Corrective Action:

The reactivity balance procedures for determining the core subcriticality margins have been revised to require that the reactivity worth of the inserted control rods be reduced by an amount equal to the worth of the most reactive control rod to assure that the reactor is at least 1 percent subcritical, with the control rod of greatest worth fully withdrawn from the core. The unit startup and shutdown procedures will be revised to be consistent with the revised reactivity balance procedures. In addition, all operating and test procedures which utilize core physics parameters will be reviewed to assure conformance with FSAR and Technical Specification bases. These actions will be completed by July 21, 1976.

Also, it has been re-emphasized to personnel involved in the preparation, review, and implementation of procedures that applicable reference material, particularly the station's FSAR and Technical Specifications, must be reviewed and pertinent provisions thereof incorporated into each procedure.