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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 78 TO FACILITY OPERATING LICENSE NO. DPR-44

AND

AMENDMENT NO. 77 TO FACILITY OPERATING LICENSE NO. DPR-56

PEACH BOTTOM ATOMIC POWER STATION, UNITS 2 AND 3

PHILADELPHIA ELECTRIC COMPANY

DOCKETS NOS. 50-277 AND 50-278

## I. INTRODUCTION

By letter dated January 9, 1981, Philadelphia Electric Company (licensee) submitted an application for amendment to Facility Operating Licenses Nos. DPR-44 and DPR-56 for the Peach Bottom Atomic Power Station, Units Nos. 2 and 3. The request consisted of Technical Specification (TS) changes to permit reactor operation with a recirculation loop out of service.

## II. EVALUATION

### Accidents (Other than Loss of Coolant Accident (LOCA) and Transients Affected by One Recirculation Loop Out of Service

#### 1. One Pump Seizure Accident

The licensee states that the one-pump seizure accident is a relatively mild event during two recirculation pump operation. Similar analyses were performed to determine the impact this accident would have on one recirculation pump operation. These analyses were performed using NRC approved models for a large core BWR/4 plant. The analyses were conducted from steady-state operation at the following initial conditions, with the added condition of one inactive recirculation loop. Two sets of initial conditions were assumed:

a. Thermal Power = 75% and core flow = 58% of rated

b. Thermal Power = 82% and core flow = 56% of rated

These conditions were chosen because they represent reasonable upper limits of single-loop operation within existing Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) and Minimum Critical Power Ratio (MCPR) limits at the same maximum pump speed. Pump seizure was simulated by setting the single operating pump speed to zero instantaneously.

The anticipated sequence of events following a recirculation pump seizure which occurs during plant operation with the alternate recirculation loop out of service is as follows:

a. The recirculation loop flow in the loop in which the pump seizure occurs drops instantaneously to zero.

b. Core voids increase which result in a negative reactivity insertion and a sharp decrease in neutron flux.

c. Heat flux drops more slowly because of the fuel time constant.

d. Neutron flux, heat flux, reactor water level, steam flow, and feedwater flow all exhibit transient behaviors. However, it is not anticipated that the increase in water level will cause a turbine trip and result in scram.

It is expected that the transient will terminate at a condition of natural circulation and reactor operation will continue. There will also be a small decrease in system pressure.

The licensee concludes that the MCPR for the pump seizure accident for the large core BWR/4 plant was determined to be greater than the fuel cladding integrity safety limit; therefore, no fuel failures were postulated to occur as a result of this analyzed event. These results are also applicable to Peach Bottom Units 2 and 3.

2. Abnormal Transients

a. Idle Loop Startup

Inadvertent restart of the idle recirculation pump would result in a neutron flux transient which would exceed the flow reference scram. The resulting transient with scram is less severe than the rated power/flow case documented in NEDE-24011 P-A.

b. Flow Increase

For single-loop operation, the rated condition steady-state MCPRs limit is increased by 0.01 to account for increased uncertainties in the core total flow and Traversing In-core Probe (TIP) readings. The MCPRs will vary depending on flow conditions. This leads to the possibility of a large inadvertent flow increase which could cause the MCPR to decrease below the Safety Limit MCPR for a low initial MCPR at reduced flow conditions. Therefore, the required MCPR must be increased at reduced core flow by a flow factor, $K_f$. The $K_f$ factors are derived assuming both recirculation loops increase speed to the maximum permitted by the scoop tube position set screws. This condition maximizes the power increase and hence the $\Delta$MCPR for transients initiated from less than rated conditions. When operating on one loop the flow and power increase will be less than associated with two pumps increasing speed, therefore, the $K_f$ factors derived from the two-pump assumption are conservative for single-loop operation.

c. Rod Withdrawal Error

The rod withdrawal error at rated power is given in the Final Safety Analysis Report (FSAR) for the initial core and in cycle dependent reload supplemental submittals. These analyses are performed to demonstrate that, even if the operator ignores all instrument indications and the alarm which could occur during the course of the transient, the rod block system will stop rod withdrawal at the MCPR which is higher than the fuel cladding integrity safety limit. Correction of the rod block equation and lower initial power for

single-loop operation assures that the MCPR safety limit is not violated.

Single-loop operation results in backflow through 10 of the 20 jets while the flow is being supplied into the lower plenum from the 10 active jet pumps. Due to backflow through the inactive jet pumps, the present rod block equation is conservatively modified for use during single-loop operation because the direct active-loop flow measurement may not indicate actual flow above about 35% recirculation driven flow without correction. The licensee has modified the two-loop rod block equation and Average Power Range Monitor (APRM) settings that exist in the TS for single-loop operation and we have found them acceptable.

We find that single-loop transients and accidents other than recirculation pump seizure accident and LOCA, which is discussed below, are bounded by the two-loop operation analysis and are, therefore, acceptable.

3. Loss of Coolant Accident (LOCA)

The licensee has contracted General Electric (GE) to perform single-loop operation analysis for Peach Bottom 2 and 3 LOCA. The licensee states that preliminary evaluation of these calculations (that are performed according to the procedures outlined in NEDO-20566-2) indicates that multipliers shown in Table 5-1 of the licensee's submittal should be applied to the MAPLHGR limits for single-loop operation of Peach Bottom 2 and 3.

We have reviewed the assumptions used by the licensee to determine MAPLHGR multipliers and find them to be acceptable.

4. Thermal-Hydraulics

The licensee has confirmed that analysis uncertainties are independent of whether flow is provided by two loops or single loop. The only exception to this are core total flow and TIP reading. The effect of these uncertainties is an increase in the MCPR by .01, which is more than offset by the $K_f$ factor required at low flows. The steady state operating MCPR with single-loop operation will be conservatively established by multiplying the $K_f$ factor to the rated flow MCPR limit.

5. Stability Analysis

The previous reload stability results are bounding for single-loop and the results continue to be acceptable. The licensee has committed to operate in master manual to reduce the effects of instabilities.

III. SUMMARY ON SINGLE LOOP OPERATION

In order to ensure an adequate margin of safety, the licensee has committed to the following during single-loop operations.

A. The idle recirculation loop pump is electrically disarmed and the motor is inoperable precluding operation of the pump or injection of a cold slug of water into the vessel.

B. The recirculation controls will be placed in the master manual eliminating the need for control system analyses.

C. The settings for the block monitor, ARPM rod block trip, and flow bias scram will be modified as necessary to provide for single-loop operation.

D. MAPLHGR reduction factors will be imposed.

E. The licensee will administratively limit power level to 50% pending NRC final approval of the NEDO-20566-2 Rev. 1 document.

We conclude that single-loop operation of Peach Bottom Units 2 and 3, up to a power level of 50% and in accordance with the proposed TSs, will not exceed the accident and transient bounds previously found acceptable by the NRC staff and is therefore acceptable.

## IV. ENVIRONMENTAL CONSIDERATIONS

We have determined that the amendments do not authorize a change in effluent types or total amounts nor an increase in power level and will not result in any significant environmental impact. Having made this determination, we have further concluded that the amendments involve an action which is insignificant from the standpoint of environmental impact and, pursuant to 10 CFR §51.5(d)(4), that an environmental impact statement, or negative declaration and environmental impact appraisal need not be prepared in connection with the issuance of these amendments.

## V. CONSIDERATIONS

We have concluded, based on the considerations discussed above, that: (1) because the amendments do not involve a significant increase in the probability or consequences of accidents previously considered and do not involve a significant decrease in a safety margin, the amendments do 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 these amendments will not be inimical to the common defense and security or to the health and safety of the public.

Dated: May 15, 1981