Consumers Power Company

General Offices: 212 West Michigan Avenue, Jackson, Michigan 49201 • Area Code 517 788-0550

July 6, 1978

Director, Nuclear Reactor Regulation
Att: Mr Dennis L Ziemann, Chief
Operating Reactors Branch No 2
US Nuclear Regulatory Commission
Washington, DC 20555

DOCKET 50-255 - LICENSE DPR-20 -
PALISADES PLANT - POTENTIAL BORON
DILUTION INCIDENTS

The NRC in a letter dated September 26, 1977 (but not received until April 7, 1978) described a limited boron dilution incident at an operating PWR facility. The same letter requested additional analysis specific to the Palisades Plant to determine the consequences of unanalyzed boron dilution incidents. The following provides the requested information:

In addition to the boron dilution incidents analyzed in the Palisades Plant FSAR, Section 14.3, there is the potential for an accidental dilution by transfer of the contents of the Iodine Removal System to the Primary Coolant System. The Iodine Removal System contains two unborated water storage tanks: The Hydrazine Storage Tank (T-102) and the Sodium Hydroxide Storage Tank (T-103). During cold shutdown or refueling modes, the contents of either of these tanks could enter the Primary Coolant System via the Shutdown Cooling System if an isolation valve on either tank were accidentally opened. The worst case would be one in which an isolation valve on T-103, the larger of the tanks, was opened. The Sodium Hydroxide Tank must contain a minimum of 3,900 gallons of caustic solution per the plant Technical Specifications and has a rated maximum of 6,000 gallons; the Hydrazine Tank is limited to 270 ± 17 gallons of solution.

Three situations were considered with conservative sets of conditions. The first of these involved a refueling outage with a new core installed, all control rods inserted, shutdown cooling in service, the primary system drained to the minimum volume for reactor vessel head removal (3,300 ft^3 per FSAR 14.3) with a boron concentration of 1,720 ppm. Mixing the maximum contents of T-103 into the Primary Coolant System would reduce the boron concentration to 1,380 ppm. Per the FSAR, Section 14.3, the boron could be reduced to approximately 1,170 ppm with <u>all rods removed</u> before the reactor would go critical.

A001 S 1/0

The second situation involved a cold shutdown with a relatively new core, the primary system full with the exception of the pressurizer for a volume of 9,220 ft^3 (per FSAR 14.3), all control rods are inserted except the rod of highest worth and the Shutdown Cooling System is in service. The highest concentration of boron expected to assure a 2% shutdown margin is assumed to be 1,150 ppm boron; the maximum boron worth at cold conditions is estimated to be 57 ppm/%$\Delta\rho$. Mixing the maximum contents of T-103 into the Primary Coolant System would reduce the boron concentration to 1,057 ppm. A small margin would remain before criticality would occur at 1,036 ppm.

The third situation considered a cold shutdown in which the primary system was drained down to the hot leg level. All conditions outlined in the second case apply except for volume; the volume of 3,300 ft^3 from the first case was assumed. Total mixing under these conditions would be expected to yield 925 ppm boron which is below the expected critical concentration of 1,036 ppm.

Tank T-103 is equipped with a low-level alarm. In view of the fact that a minimum content of 3,900 gallons is required per Technical Specifications, a level alarm setting corresponding to this volume is always operable. Therefore, less than 2,100 gallons of unborated water would be lost from T-103 before an alarm would be tripped by the decreasing volume. For this third case, adding 2,100 gallons of unborated water to the primary system would reduce the boron concentration from 1,150 ppm to 1,060 ppm, providing a small margin to the predicted criticality condition. The amount of time available for operator corrective action is dependent on the alarm set point and the rate at which T-103 is being drained into the shutdown cooling loop.

To eliminate the possibility of a single failure creating the third situation, administrative controls were initiated in Cycle 2 (November 1977) to provide assurance that the Iodine Removal System is isolated from the Shutdown Cooling System during outages. These additional controls have provided the necessary protection to eliminate any potential boron dilution incident that could result from the inadvertent transfer of the contents of T-103 or T-102 to the Primary Coolant System.

Eilish McKnight for

David P Hoffman
Assistant Nuclear Licensing Administrator

CC: JGKeppler, USNRC