Commonwealth Edison Company
Braidwood Generating Station
Route #1, Box 84
Braceville, IL 60407-9619
Tel 815-458-2801

ComEd

March 30, 1997

U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Document Control Desk

Subject: Braidwood Nuclear Power Station Units 1 and 2
NRC Docket Numbers: 50-456 and 50-457

Byron Nuclear Power Station Units 1 and 2
NRC Docket Numbers: 50-454 and 50-455

Supplemental Information Pertaining to the Technical Specification Amendment for "Water Level-Storage Pool" and "Criticality Analysis of Byron and Braidwood Station Fuel Storage Racks"

References:
1. Teleconference dated March 27, 1997, between the Commonwealth Edison Company and the Nuclear Regulatory Commission Regarding the Proposed Technical Specification Amendment for "Water Level-Storage Pool" and "Criticality Analysis of Byron and Braidwood Station Fuel Storage Racks"
2. H. Gene Stanley letter to the Nuclear Regulatory Commission dated November 5, 1996, transmitting Technical Specification Amendment for "Water Level-Storage Pool" and "Criticality Analysis of Byron and Braidwood Station Fuel Storage Racks"

In the Referenced letter the Commonwealth Edison Company (ComEd) submitted to the Nuclear Regulatory Commission (NRC) a request to amend the Technical Specification for "Water Level-Storage Pool" and "Criticality Analysis of Byron and Braidwood Station Fuel Storage Racks." Subsequent to that submittal, ComEd discovered a modeling deficiency related to Boral configuration. As discussed in the Referenced teleconference, ComEd is providing the attached information which discusses

1/1 A001

080099

- Background and Physical Configuration of Boral Panels in Region 1 Fuel Storage Racks
- Supplemental Criticality Analyses
  - Confirmation That k_{eff} Is Less Than Or Equal To 0.95 At 2000 ppm With No Boral And No Boraflex Present
  - Region 1 Fuel Storage Geometry
- Description and Bases for Additional Administrative Controls

The Attachment demonstrates by maintaining a fuel pool concentration of 2000 ppm boron that the k_{eff} is maintained at or below 0.95 in the absence of all Boraflex and Boral material.

In the Reference letter, ComEd requested that the Technical Specification changes be made effective 45 calendar days after issuance of the amendment to ensure that all implementation activities are complete before the revised Technical Specification became effective. ComEd is prepared to implement this amendment at the time of its issuance; therefore, ComEd is requesting the amendment be effective upon issuance. As discussed during the reference teleconference, Braidwood Unit 1 is currently in their Spring 1997 Outage with the full core off load scheduled for April 4th; therefore, ComEd is requesting issuance of the pending Technical Specification amendment as soon as possible.

If you have any questions concerning this correspondence please contact this office.

Sincerely,

Gene Stanley

H. Gene Stanley
Braidwood Site Vice President

Attachment

cc: G. Dick, Byron/Braidwood Project Manager-NRR
C. Phillips, Senior Resident Inspec[illegible]-Braidwood
S. Burgess, Senior Resident Inspector-Byron
A. B. Beach, Regional Administrator-RIII
Office of Nuclear Safety-IDNS

ATTACHMENT
SUPPLEMENTAL INFORMATION
PERTAINING TO THE TECHNICAL SPECIFICATION AMENDMENT FOR
"WATER LEVEL-STORAGE POOL" AND
"CRITICALITY ANALYSIS OF BYRON AND BRAIDWOOD STATION
FUEL STORAGE RACKS"

Commonwealth Edison (ComEd) has identified a modeling deficiency in the criticality analysis CAC-96-248 "Byron and Braidwood Spent Fuel Rack Criticality Analysis with Credit for Soluble Boron" which was performed to support the Technical Specification amendment for "Water Level-Storage Pool" and "Criticality Analysis Of Byron And Braidwood Station Fuel Storage Racks." The deficiency is due to inadequate modeling of the physical configuration of the Boral panels within the Byron and Braidwood Region 1 Fuel Storage Racks.

CAC-96-248 "Byron and Braidwood Spent Fuel Rack Criticality Analysis with Credit for Soluble Boron" contained the following acceptance criteria:

- Assuming no soluble boron, the maximum nominal enrichment of U-235 could be stored and a k_{eff} of less than 1.0 is maintained,
- Taking credit for a minimum concentration of soluble boron, a k_{eff} of less than or equal to 0.95 is maintained, and
- Assuming a postulated accident, including the misloaded fuel assembly, dropped fuel assembly and the SFP water temperature accident, and taking credit for a minimum concentration of soluble boron, a k_{eff} of less than or equal to 0.95 is maintained.

ComEd is providing the following supplemental information to ensure the specified acceptance criteria are met.

- Background and Physical Configuration of Boral Panels in Region 1 Fuel Storage Racks
- Supplemental Criticality Analyses
    - Confirmation that k_{eff} is less than or equal to 0.95 at 2000 ppm with no Boral or Boraflex Present
    - Region 1 Fuel Storage Geometry
- Description and Bases for Additional Administrative Controls

BACKGROUND AND PHYSICAL CONFIGURATION OF BORAL PANELS IN REGION 1 FUEL STORAGE RACKS

The Byron and Braidwood Region 1 Fuel Storage Racks initial design specifications included Boraflex and no Boral. Due to ComEd's concerns regarding Boraflex degradation, Boral panels were placed in the flux traps during initial fabrication. The Boral panels were inserted into the flux traps that exist between each cell within a rack. Figure 1 shows configuration of the Boral panels within a sample Region 1 rack. Each

interior cell has a Boral panel on all four faces (cells labeled 'X'). The peripheral cells do not have Boral panels on their exterior walls. Therefore, the corner cells have two Boral panels on their interior faces (cells labeled 'Z') and the other peripheral cells have three Boral panels on their interior faces (cells labeled 'Y').

The criticality analysis to support the Technical Specification revision, CAC-96-248 "Byron and Braidwood Spent Fuel Rack Criticality Analysis with Credit for Soluble Boron" modeled all the Region 1 cells with Boral panels on all four faces. This analysis did not specifically model the peripheral Region 1 cells that do not have Boral panels on their exterior faces. Therefore, this criticality analysis did not adequately model the actual Boral configuration of the Region 1 fuel storage racks.

SUPPLEMENTAL CRITICALITY ANALYSES

As a result of the modeling deficiency found in the criticality analysis to support the Technical Specification amendment (CAC-96-248), a supplemental criticality analysis was performed. The supplemental criticality analysis was performed to verify that $k_{eff} < 0.95$ with 2000 ppm soluble boron and no Boral and no Boraflex present in the SFP. In addition, analyses were performed to allow limited fuel storage in the Region 1 Fuel Storage Rack peripheral cells.

The original Region 1 criticality analysis performed to support the Technical Specification amendment (CAC-96-248) analyzed for an all cell configuration with Boral on four cell faces. This is described in Section 3 of CAC-96-248.

Supplemental criticality analyses were performed to adequately model the actual configuration of the exterior faces of the Region 1 Fuel Storage Racks. The supplemental criticality analyses utilize the same assumptions, codes, procedures, and uncertainties used to support the Technical Specification amendment (CAC-96-248). The methodology is based on WCAP-14417, "Westinghouse Spent Fuel Rack Criticality Analysis Methodology", June 1995.

To adequately model the actual Boral configurations, two additional cell configurations have been analyzed in the supplemental analyses. These include: 1) a cell with Boral on three faces (cell Y in Figure 1), and 2) a cell with Boral on 2 faces representing the corner cell location (cell Z in Figure 1).

CONFIRMATION THAT $k_{eff} < 0.95$ AT 2000 PPM WITH NO BORAL AND NO BORAFLEX PRESENT

A supplemental criticality analysis was performed using the methodology described above to show that with SFP water at a boron concentration of 2000 ppm and assuming no Boral and no Boraflex present, reactivity will be maintained at less than 0.95 ($k_{eff} < 0.95$).

This analysis is performed assuming all Region 1 cells contain the maximum fresh fuel enrichment. This analysis takes no credit for any administrative controls.

The analysis demonstrated that, with the conditions specified above, k_{eff} = 0.91094 at a 95/95 confidence level. In addition, this analysis showed that for a SFP water temperature accident, k_{eff} < 0.95. The water temperature calculation resulted in a k_{eff} = 0.92055.

REGION 1 FUEL STORAGE GEOMETRY

The supplemental criticality analyses for the two additional Region 1 cell Boral geometries were performed based on the following assumptions:

1. The analyses were performed using the administrative controls specified in Attachment E, Section 7.0 of the Technical Specifications amendment for "Water Level-Storage Pool" and "Criticality Analysis Of Byron And Braidwood Station Fuel Storage Racks."

2. The analyses were performed using the additional administrative controls specified below.

These calculations were performed to demonstrate that with all the administrative controls in place, acceptance criteria can still be met with the adequate modeling of the actual Boral configuration. This will allow placement of fuel assemblies in the peripheral Region 1 cells in accordance with the administrative controls.

To demonstrate this, the two Region 1 cell Boral geometries were modeled using KENO-Va in the following SFP rack geometries:

1. Corner cell of rack facing two concrete walls.
2. Peripheral cell of rack facing one concrete wall.
3. Empty row of cells facing a full row of cells across a Region 1 to Region 1 rack interface.
4. Checkerboard pattern of cells across a Region 1 to Region 1 rack interface.

Calculations were performed for the four rack geometries to verify that with a maximum nominal enrichment of U-235, that k_{eff} is less than 1.0. The analyses ignored the presence of Boraflex and accurately modeled Boral only on the interior rack faces. This calculation was performed with no soluble boron present in the SFP. The resulting reactivities were compared to the all cell k_{eff} calculated in Section 3.2.1 of CAC-96-248. The all cell k_{eff} from CAC-96-248 was verified to be greater than the reactivities calculated for these four rack geometries.

The biases and uncertainties calculated in CAC-96-248 will remain valid for use with the four rack geometries analyzed here. By determining that the all cell k_{eff} in CAC-96-

248 remains bounding, the conclusions of CAC-96-248 are applicable for the four rack geometries analyzed for the following acceptance criteria:

1. Assuming no soluble boron, the maximum nominal enrichment of U-235 could be stored and a k_{eff} of less than 1.0 is maintained,
2. Taking credit for a minimum concentration of soluble boron, a k_{eff} of less than or equal to 0.95 is maintained, and
3. Assuming the SFP water temperature postulated accident and taking credit for a minimum concentration of soluble boron, a k_{eff} of less than or equal to 0.95 is maintained.

Additional cases for the misloaded assembly accident were performed. These cases were calculated at no soluble boron conditions and the resulting reactivities were shown to be less than the all cell k_{eff} from CAC-96-248. The dropped assembly accidents are not affected by the boral configuration.

Therefore, based on the four geometries and the assumptions described above, all criticality analysis acceptance criteria continue to be met.

DESCRIPTION AND BASES FOR ADDITIONAL ADMINISTRATIVE CONTROLS

As a result of this supplemental criticality analyses, the following administrative controls have been implemented in station procedures to assure the acceptance criteria identified in the Technical Specification amendment for "Water Level-Storage Pool" and "Criticality Analysis Of Byron And Braidwood Station Fuel Storage Racks" are met.

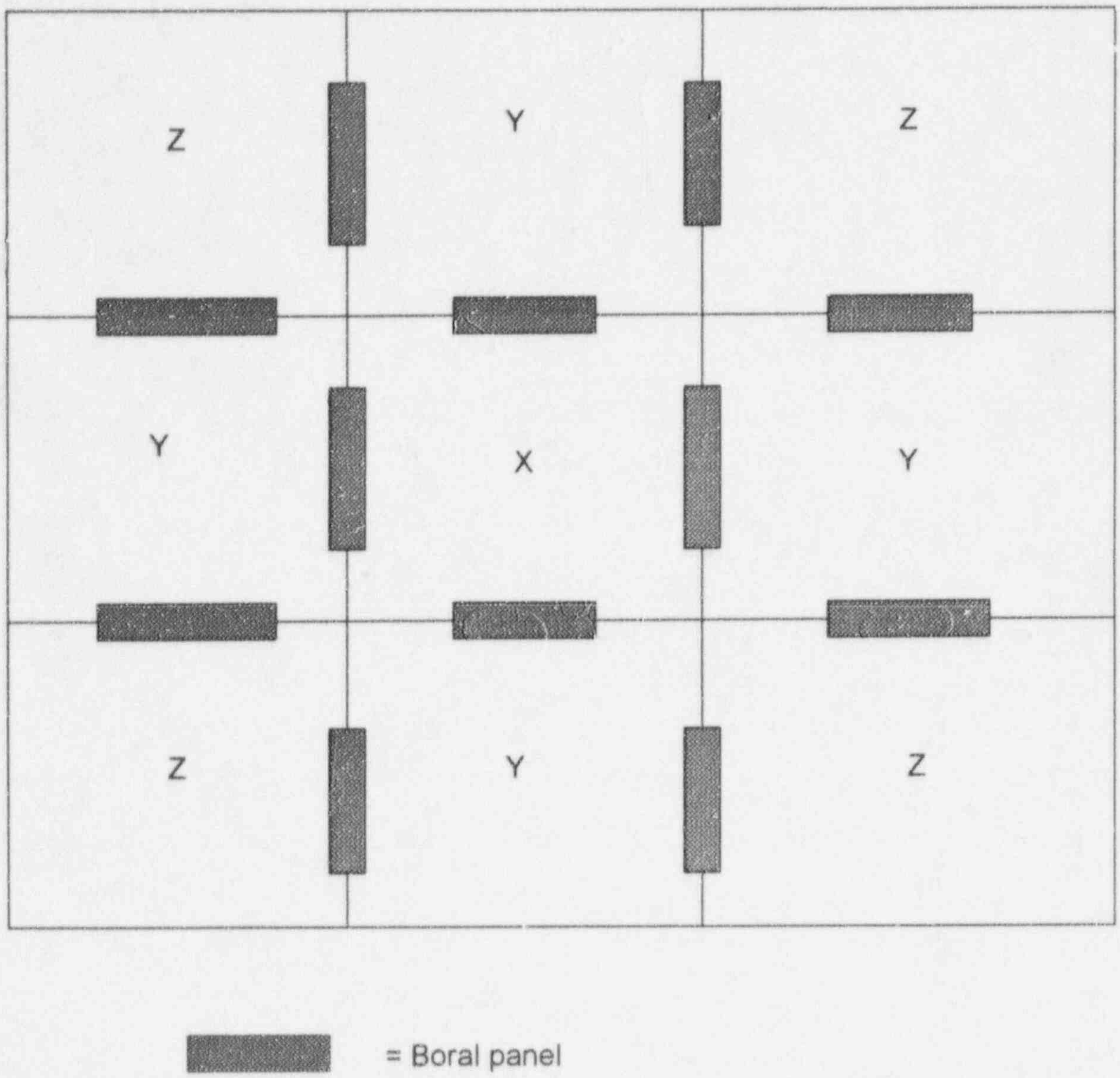
> **No assembly may be placed in a Region 1 rack location face adjacent to another assembly across a Region 1 rack to Region 1 rack interface**.
> (See Figure 2 for example of unacceptable fuel assembly placement.)

The supplemental criticality analyses utilize the methodology used in the Technical Specification amendment for "Water Level-Storage Pool" and "Criticality Analysis Of Byron And Braidwood Station Fuel Storage Racks" demonstrate that compliance with the administrative controls ensures all acceptance criteria continue to be met.

Byron and Braidwood have incorporated the additional administrative controls into plant procedures. Our current configuration complies with these administrative controls.

Figure 1

Sample Region 1 Fuel Storage Rack Boral Configuration



Note: This is an illustrative 3x3 Fuel Storage Rack and does not represent the actual Byron and Braidwood Region 1 Fuel Storage Rack array. An actual Region 1 rack is either 12x8 or 13x8. A 12x8 rack has 60 internal (X) cells, 32 peripheral (Y) cells and 4 corner (Z) cells.

Figure 2

Example Of Region 1 Unacceptable Fuel Assembly Placement