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

ComEd

November 5, 1996

United States Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D. C. 20555-0001

Subject: Application for Amendment to Appendix A, Technical Specifications 3.9.11, "Water Level - Storage Pool", 5.6.1.1, "Criticality," 6.9.1.10, "Criticality Analysis of Byron and Braidwood Station Fuel Storage Racks," for:

Byron Nuclear Power Station, Units 1 and 2
Facility Operating Licenses NPF-37 and NPF-66
NRC Docket Nos. 50-454 and 50-455

Braidwood Nuclear Power Station, Units 1 and 2
Facility Operating Licenses NPF-72 and NPF-77
NRC Docket Nos. 50-456 and 50-457

Ladies and Gentlemen:

Pursuant to Title 10, Code of Federal Regulations, Part 50, Section 90 (10 CFR 50.90), Commonwealth Edison Company (ComEd) proposes to amend Appendix A, Technical Specifications, for Facility Operating Licenses NPF-37 and NPF-66 for Byron Nuclear Power Station Units 1 and 2 and Facility Operating Licenses NPF-72 and NPF-77 for Braidwood Nuclear Power Station Units 1 and 2. ComEd proposes to revise Technical Specifications (TS) 3.9.11, 5.6.1.1, and 6.9.1.10 to allow ComEd to take credit for soluble boron in the spent fuel storage pool water in maintaining an acceptable margin of subcriticality. ComEd will provide appropriate controls to ensure the dissolved boron concentration in the spent fuel storage pool water is adequately maintained. These changes are temporary in nature and are required to compensate for the degradation of the boraflex panels in the spent fuel storage cells.

The proposed changes in this license amendment request have been reviewed and approved by both On-site and Off-site Review in accordance with ComEd procedures. A detailed description and a safety analysis of the proposed changes are presented in Attachment A. The proposed changes to Appendix A, Technical Specifications, are presented in Attachment B. ComEd has reviewed this proposed license amendment request in accordance with 10 CFR 50.92(c) and has determined that no significant hazards consideration exists. This evaluation is documented in Attachment C. An Environmental Assessment has been completed and is contained in Attachment D. A copy of the Westinghouse criticality analysis forming the basis for this amendment is included as Attachment E.

ComEd is notifying the State of Illinois of our application for this license amendment request by transmitting a copy of this letter and its attachments to the designated State Official.

Furthermore, ComEd respectfully requests that the USNRC Staff review and approve this license amendment as soon as possible.

A001/1

To the best of my knowledge and belief, the statements contained in this document are true and correct. In some respects these statements are not based on my personal knowledge, but on information furnished by other ComEd employees, contractor employees, and/or consultants. Such information has been reviewed in accordance with company practice, and I believe it to be reliable.

Please direct any questions to Marcia Lesniak, Nuclear Licensing Administrator, at (630) 663-6484.

Sincerely,

Harold Gene Stanley for
Site Vice President
Braidwood Generating Station

Attachment A:	Description and Safety Analysis of the Proposed Changes
Attachment B:	Proposed Changes to Appendix A, Technical Specifications
Attachment C:	Evaluation of Significant Hazards Considerations
Attachment D:	Environmental Assessment
Attachment E:	CAC-96-248, Byron and Braidwood Spent Fuel Rack Criticality Analysis with Credit for Soluble Boron, October 1996

TWS/PB/fb

cc: W. A. Beach, Regional Administrator - Region III
G. F. Dick, Byron Project Manger - NRR
R. R. Assa, Project Manager - NRR
S. D. Burgess, Senior Resident Inspector - Byron
C. J. Phillips, Senior Resident Inspector - Braidwood
Office of Nuclear Facility Safety - IDNS

Signed before me

on this 8th day of November, 1996

by Jacqueline Serena
Notary Public

"OFFICIAL SEAL"
JACQUELINE A. SERENA
NOTARY PUBLIC, STATE OF ILLINOIS
MY COMMISSION EXPIRES 5/14/97

ATTACHMENT A

DESCRIPTION AND SAFETY ANALYSIS OF
PROPOSED CHANGES TO APPENDIX A
TECHNICAL SPECIFICATIONS OF
FACILITY OPERATING LICENSES
NPF-37, NPF-66, NPF-72, AND NPF-77

A. DESCRIPTION OF THE PROPOSED CHANGE

Commonwealth Edison (ComEd) proposes to revise Byron and Braidwood Technical Specifications (TS) 3.9.11, "Water Level-Storage Pool," 5.6.1.1, "Criticality," and 6.9.1.10 "Criticality Analysis of Byron and Braidwood Station Fuel Storage Racks." These revisions will allow ComEd to take credit for soluble boron in the spent fuel storage pool water in maintaining an acceptable margin of subcriticality, and will provide appropriate controls to ensure the dissolved boron concentration in the spent fuel storage pool water is adequately maintained. These changes are temporary in nature and are required to compensate for the degradation of the Boraflex panels in the spent fuel storage cells while long term corrective actions for this problem are implemented. These changes will be in effect for a maximum of 1 year.

These proposed changes are discussed in detail in Section E of this attachment. The affected TS pages showing the proposed revisions are included in Attachment B of this request.

B. DESCRIPTION OF THE CURRENT REQUIREMENT

TS 3.9.11 requires at least 23 feet of water be maintained over the top of the irradiated fuel assemblies seated in the spent fuel storage pool whenever irradiated assemblies are in the storage pool. If this requirement is not satisfied, action "a" of TS 3.9.11 requires that all movements of fuel and crane operations with loads in the fuel storage areas be suspended and the water level returned to normal within 4 hours.

TS 5.6.1.1 requires, in part, that the spent fuel storage racks be maintained with a K_{eff} less than or equal to 0.95 when flooded with unborated water.

TS 6.9.1.10 references the current Byron and Braidwood criticality analysis for fuel enrichment limits and analysis methodologies.

C. BASES FOR THE CURRENT REQUIREMENT

With regard to TS 3.9.11, the minimum water level in the spent fuel storage pool meets the assumptions of Regulatory Guide (RG) 1.25, (Safety Guide 25), "Assumptions Used for Evaluating the Potential Radiological Consequences of a Fuel Handling Accident in the Fuel Handling and Storage Facility for Boiling and Pressurized Water Reactors." The resultant 2 hour thyroid dose per person at the exclusion area boundary is a small fraction of the Title 10 Code of Federal Regulations Part 100 (10CFR100) limits.

RG 1.25 assumes there is 23 feet of water between the top of a damaged fuel bundle and the fuel pool surface during a fuel handling accident. Therefore, by requiring that 23 feet of water be maintained over the top of the fuel assemblies stored in the storage pool, the assumptions of RG 1.25 can be used directly. In practice, TS 3.9.11 preserves this assumption for the bulk of the fuel in the storage racks. In the case of a single bundle lying horizontally on top of the spent fuel racks, there may be less than 23 feet of water between the top of the fuel bundle and the surface. To offset this small non-conservatism, the analysis assumes that all rods fail, although analysis shows that only the first few rows fail from a hypothetical maximum drop.

The requirements of TS 5.6.1.1 are designed to prevent inadvertent criticality in the spent fuel storage areas of Byron and Braidwood. The K_{eff} value of 0.95 was chosen to include margins for uncertainty in reactivity calculations and in mechanical tolerances. These uncertainties are statistically combined such that the true K_{eff} will be less than or equal to 0.95 with a 95% probability at a 95% confidence level. To assure that the true reactivity will always be less than the calculated reactivity, the following conservative assumptions were made:

1. Moderator is pure, unborated water at a temperature corresponding to the highest reactivity.

2. No credit is taken for axial or radial neutron leakage except in the assessment of certain abnormal/accident conditions.

3. Neutron absorption in minor structural members is neglected.

TS 6.9.1.10 restricts the enrichment of fuel assemblies which can be stored in the SFP, and specifies which analysis methodologies may be used to determine maximum fuel enrichments to ensure that all applicable limits of the safety analysis are met.

D. NEED FOR REVISION OF THE REQUIREMENT

In August and September of 1996, analysis results of Neutron Attenuation (blackness) test data were received at Braidwood and Byron Stations respectively. These results indicated Boraflex shrinkage and gaps in the spent fuel racks. The largest gaps have a width greater than four inches. A gap of greater than four inches in any Boraflex panel exceeds that assumed in the current criticality analysis.

The Spent Fuel Storage Pools (SFP) at Byron and Braidwood Stations have fuel racks installed that use sheets of Boraflex for reactivity suppression. Boraflex is constructed of an organic polymer with a silica filler and neutron absorbing boron carbide interspersed within the silica filler.

In 1987, ComEd first identified gamma radiation induced damage of the Boraflex polymer. The damage progresses through two stages. During the first stage, the Boraflex cracks and shrinks, producing gaps. The second phase occurs after the polymer has sustained significant damage, and consists of the Boraflex becoming brittle and susceptible to dissolution in the SFP cooling water.

The reactivity effects associated with the first stage have been characterized in the "Byron and Braidwood Spent Fuel Rack Criticality Analysis Considering Boraflex Gaps and Shrinkage," Westinghouse report, dated June 1994, supplemental criticality analysis. Sufficient margin exists within this supplemental criticality analysis to accommodate the anticipated levels of cracking and gapping associated with the first stage of degradation.

The recent blackness testing campaigns at Byron and Braidwood indicate progress into the second stage of damage has occurred, and that the maximum gap width allowed in the current criticality analysis has been exceeded.

Both Byron and Braidwood already have large numbers of storage locations in the second stage of degradation. The degradation mechanism associated with the second stage proceeds slowly; however, it is both difficult to predict and measure the extent of damage. Although blackness testing is useful for measuring cracks, gaps, and wastage, it does not measure an overall reduction in boron density. Therefore blackness testing provides incomplete information regarding the current state of a given storage location. An approved methodology to measure boron areal density does not currently exist for pressurized water reactors.

Therefore, the gaps recently found at Byron and Braidwood Station may not represent the full extent of Boraflex degradation.

When assessing the current state of the storage racks, the following factors, along with others, are considered: the slow nature of the degradation process, the continued presence of some Boraflex, the successful performance of the surveillance coupon program (coupons show no adverse signs of degradation), the inclusion of Boral in the Region 1 rack design, and the potential for additional reactivity margins due to burn-up.

Based on the recent blackness test data, and considering the factors mentioned above, it cannot be stated with certainty that the Technical Specification 5.6.1.1 requirement for maintaining K_{eff} less than or equal to 0.95 when flooded with unborated water will be met in some limiting rack locations.

In order to return Byron and Braidwood Stations to compliance with TS 5.6.1.1, this temporary TS change is necessary until long term corrective actions can be completed. The long term corrective actions being evaluated by ComEd are as follows:

1. Submit a permanent license amendment to allow soluble boron to be credited in maintaining the SFP K_{eff} less than or equal to 0.95,

2. Evaluate the feasibility of inserting reactivity suppression devices into the fuel assemblies stored in the SFP racks to compensate for the depletion of the Boraflex. This may include the rearrangement of and credit for the rod cluster control assemblies currently in the Byron and Braidwood SFPs,

3. Evaluate the feasibility of replacing the current SFP racks with racks which do not contain Boraflex, and

4. Evaluate the feasibility of dry cask storage at Byron and Braidwood.

E. DESCRIPTION OF THE REVISED REQUIREMENT

TS 3.9.11 will be revised to ensure that the SFP boron concentration is maintained at the correct level. The title of the specification will be revised to reflect the fact that TS 3.9.11 has been changed to address boron concentration as well as water level. The Limiting Condition for Operation (LCO) will be revised to include the SFP boron concentration limits. To accomplish this the following requirement will be added to the LCO:

"The dissolved boron concentration of the water in the storage pool shall be maintained at greater than or equal to 2000 ppm.*"

Action "a" of TS 3.9.11 will be changed to restrict its applicability to the low water level condition. Action "a" will now read:

"a. With the water level requirements of the above specification not satisfied, suspend all movement of fuel assemblies and crane operations with loads in the fuel storage areas and restore the water level to within its limit within 4 hours."

A new action "b" will be added to TS 3.9.11 to address the low boron concentration condition. The new TS 3.9.11 action "b" will read:

"b. With the boron concentration requirements of the above specification not satisfied, suspend all movement of fuel assemblies and crane operations with loads in the fuel storage areas and immediately take action to restore the dissolved boron concentration to within its limit as soon as possible. *"

The current action "b" of TS 3.9.11 will be redesignated action "c".

The changes to TS 3.9.11 will include an asterisk which will refer to a footnote which states that these requirements will be in effect until December 31, 1997.

Surveillance requirement 4.9.11.a will be added to TS 3.9.11 to require that the SFP boron concentration shall be determined to be greater than or equal to 2000 parts per million (ppm) at least once per 24 hours.

TS 5.6.1.1 will be changed to allow Byron and Braidwood Stations to take advantage of the boron dissolved in the SFP water to maintain K_{eff} less than or equal to 0.95. An asterisk will be added to TS 5.6.1.1 which will refer to a footnote which reads:

"Until December 31, 1997, the spent fuel storage racks shall be maintained with a K_{eff} of less than or equal to 0.95 when flooded with water containing a minimum of 2000 ppm soluble boron.

In addition to the burnup requirements currently contained in Specification 5.6.1.1, the requirements of CAC-96-248, "Byron and Braidwood Spent Fuel Rack Criticality Analysis with Credit for Soluble Boron," will be satisfied."

TS 6.9.1.10 will be revised to reflect the use of Westinghouse document CAC-96-248 in addition to the current criticality analysis. A footnote will be added to TS 6.9.1.10. This footnote will read:

> "* In addition to the burnup requirements contained in the currently approved criticality analysis, the requirements of CAC-96-248, "Byron and Braidwood Spent Fuel Rack Criticality Analysis with Credit for Soluble Boron," will be satisfied. These requirements will be in effect until December 31, 1997."

F. BASES FOR THE REVISED REQUIREMENT

The design method which ensures the criticality safety of fuel assemblies in the fuel storage racks is described in WCAP-14417, "Westinghouse Spent Fuel Rack Criticality Analysis Methodology," June 1995. This report describes the computer codes, benchmarking, and methodology used to calculate criticality safety limits. This WCAP was used as the basis for report CAC-96-248, "Byron and Braidwood Spent Fuel Rack Criticality Analysis With Credit for Soluble Boron," October 1996, which is used as the basis for this amendment. CAC-96-248 is included in this amendment request as Attachment E.

This criticality analysis was done to allow storage of Westinghouse 17x17 Optimized Fuel Assemblies (OFA) with nominal enrichments of up to 4.95 weight percent Uranium 235 using soluble boron credit to ensure that K_{eff} will remain less than or equal to 0.95. The analysis ignored the presence of any Boraflex in the spent fuel racks.

The goal of this analysis was to determine a minimum soluble boron concentration necessary to ensure there is a 95% probability at a 95% confidence level that K_{eff} of the stored fuel assembly array will be less than or equal to 0.95.

To achieve this, the analysis was done in several parts. For each region, a given storage configuration was assumed. For example, in Region I, an all cell storage configuration was analyzed; for Region II, an all cell configuration, 3 out of 4, and 2 out of 4 checkerboard arrangements were analyzed. Initially, each of these configurations was analyzed assuming no soluble boron to determine the maximum enrichment that could be stored in these locations and still keep K_{eff} less than 1.0. To increase the allowed enrichment above this no soluble boron limit to the 4.95% level, reactivity credit or equivalencing methods were used. For Region I, this analysis was done using Integral Fuel Burnable Absorber (IFBA) credit reactivity equivalencing. This concept is predicated upon the reactivity decrease associated with the addition of IFBAs. IFBAs consist of neutron absorbing material applied as a thin ZrB_2 coating on the outside of the UO_2 fuel pellet. As a result, the neutron absorbing material is a non-removable or integral part of the fuel assembly once it is manufactured. For Region II, an analysis was done taking credit for the reactivity decrease associated with fuel depletion. A minimum soluble boron concentration necessary to lower K_{eff} from the 1.0 limit of the analyses described above to less than or equal to 0.95 was determined for each of the storage configurations.

Finally, an analysis of possible fuel handling accidents was done. The accidents considered were: fuel assembly drop on top of the rack, fuel assembly drop between rack modules, fuel assembly drop between rack modules and the SFP wall, change in SFP water temperature, and misload of an assembly into a cell for which the restrictions on location, enrichment, or burnup are not satisfied. It was determined that the only two accidents which could cause an increase in K_{eff} were the change in SFP temperature and the misload of an assembly.

For the change in SFP temperature accident, a temperature range of 32^{0}F to 240^{0}F was considered. It was assumed the temperature change could occur at any time during operation of the SFP. Calculations were performed for the Byron and Braidwood SFP water temperature outside the normal range (50^{0}F to 160^{0}F). The results of these calculations demonstrated that in all cases additional reactivity margin is available to the 0.95 K_{eff} limit to allow for temperature accidents.

For the misloaded assembly accident, calculations were performed to determine the largest reactivity increase caused by a 4.80 weight percent enriched 17x17 OFA fuel assembly misplaced into a storage cell for which the restrictions on location, enrichment or burnup are not satisfied. The misloaded assembly event can occur only during fuel handling operations in the SFP. From these analyses a minimum soluble boron concentration was determined for the no fuel handling and the fuel handling condition.

The most conservative of all the minimum soluble boron concentrations from the above analyses was then chosen to be the minimum boron concentration for the SFP. This concentration was 1800 ppm from the misloaded assembly accident analysis, fuel handling condition. For added conservatism, ComEd increased this to 2000 ppm.

The sampling frequency for spent fuel pool boron concentration was chosen conservatively based on the sampling frequency for reactor shutdown margin in Mode 5, Cold Shutdown. This frequency is based on preventing a loss of shutdown margin as a result of a dilution of the reactor coolant system (RCS). A dilution of the SFP would take a much longer time than an RCS dilution since the SFP volume is much larger than the RCS volume, and the turnover rate of water in the SFP would be much less due to the lack of large dilution sources for the SFP. Thus, a 24 hour periodicity for measuring SFP boron concentration was determined to be prudent and conservative.

In addition to the technical bases listed above, Byron and Braidwood will take the following compensatory measures to ensure that SFP K_{eff} remains less than or equal to 0.95:

1. Appropriate procedures will be changed to reflect the requirement to maintain a minimum of 2000 ppm soluble boron in the SFP.

2. Use of the Reverse Osmosis Unit for silica removal has been restricted to slow the rate of Boraflex dissolution.

3. SFP level loss procedure will be revised to clearly state that non-borated emergency makeup sources must be used only as a last resort.

Also, some checkerboarding of spent fuel assemblies in both the Byron and Braidwood SFPs will be undertaken in accordance with CAC-96-248 to ensure that SFP K_{eff} will remain less than 1.0 without credit for soluble boron.

In addition to the compensatory measures mentioned above, SFP level and temperature are checked at least daily at both Byron and Braidwood.

G. IMPACT OF THE PROPOSED CHANGE

The changes proposed in this request deal with maintaining SFP boron concentration at a minimum level. Boron has always been present in the SFP as a reactivity suppressor. This change places restrictions on the minimum concentration of soluble boron in the SFP, and provides controls and compensatory measures to ensure the minimum soluble boron concentration is maintained at all times. Thus, this change will not introduce any new operating modes for the SFP, nor any new equipment. No existing equipment will be modified.

SFP K_{eff} will remain less than or equal to 0.95 under the provisions of this amendment even assuming that all the Boraflex in the SFP has been removed. Further, some degree of checkerboarding will be undertaken to ensure that K_{eff} remains less than 1.0 without credit for soluble boron.

Thus, this proposed amendment will have no significant negative impact on any system or operating mode.

H. SCHEDULE REQUIREMENTS

ComEd requests that these proposed changes be approved as expeditiously as possible. ComEd also requests that these changes be made effective 45 calendar days after issuance to ensure that all implementation activities are complete before the new TSs become effective.