Commonwealth Edison
1400 Opus Place
Downers Grove, Illinois 60515

July 26, 1994

William T. Russell, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Document Control Desk

Subject: Supplement to Amendment to Facility Operating Licenses:

Byron Station Units 1 and 2
(NPF-37/66; NRC Docket Nos. 50-454/455)

Braidwood Station Units 1 and 2
(NPF-72/77; NRC Docket Nos. 50-456/457)

"Positive Moderator Temperature Coefficient and Reduced Thermal Design Flow"

Reference: J. A. Bauer letter to W. T. Russell dated March 23, 1994 transmitting a proposed Byron and Braidwood license amendment addressing "Positive Moderator Temperature Coefficient and Reduced Thermal Design Flow"

Dear Mr. Russell:

Commonwealth Edison Company (ComEd) requests a supplemental change to the proposed Technical Specification amendment addressing positive moderator temperature coefficient and reduced thermal design flow submitted in the above referenced letter. Implementation of a positive moderator temperature coefficient will yield significant fuel cost savings while the thermal design flow reduction is needed to support an increase in the steam generator tube plugging limit to 15%.

In the original submittal, footnotes were added to the affected Technical Specification pages to address implementation of the changes on a unit and cycle specific basis. It was later identified that the appropriate unit and cycle specific footnotes were inadvertently omitted from some of the affected Tech Spec pages. This supplemental change adds these footnotes for clarification.

A detailed description of the proposed supplemental changes is presented in Attachment 1. The revised Technical Specification pages are contained in Attachment 2.

The proposed changes have been reviewed and approved by the On-site and Off-site Review Committees in accordance with ComEd procedures. ComEd has reviewed this proposed amendment in accordance with 10 CFR 50.92(c) and has determined that no significant hazards consideration exists as documented in Attachment 3. The attached significant hazards evaluation has been enhanced based on conversations with your staff and therefore supersedes the previously submitted evaluation in it's entirety. The Environmental Assessment submitted with the original amendment has not been altered and therefore is not included with this transmittal.

ComEd is notifying the State of Illinois of this supplement to the subject amendment by transmitting a copy of this letter and the associated attachments to the designated State Official.

Commonwealth Edison Company again respectfully requests that this proposed amendment be reviewed and approved in time for implementation during the next Byron Unit 1 refueling outage, scheduled to begin on September 9, 1994.

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 CECo employees, contractor employees, and/or consultants. Such information has been reviewed in accordance with company practice, and I believe it to be reliable.

Please address any comments or questions regarding this matter to this office.

Respectfully,

Joseph A. Bauer

Joseph A. Bauer
Nuclear Licensing Administrator

Attachments

cc: G. F. Dick, Byron Project Manager - NRR
R. R. Assa, Braidwood Project Manager - NRR
H. Peterson, SRI - Byron
S. G. Dupont, SRI - Braidwood
B. Clayton, Branch Chief - Region III
Office of Nuclear Facility Safety - IDNS

ATTACHMENT 1

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

Commonwealth Edison Company (ComEd) requests a supplemental change to the proposed Technical Specification amendment addressing positive moderator temperature coefficient and reduced thermal design flow previously submitted in March of 1994. Implementation of a positive moderator temperature coefficient will yield significant fuel cost savings while the thermal design flow reduction is needed to support an increase in the steam generator tube plugging limit to 15%. In the original submittal, footnotes were added to the affected Technical Specification pages to address implementation of the changes on a unit and cycle specific basis. It was later identified that the appropriate unit and cycle specific footnotes were inadvertently omitted from some of the affected Tech Spec pages. This supplemental change adds these footnotes for clarification.

1. Description of the Proposed Change:

ComEd requests changes to the original submittal to more appropriately address implementation in the following areas:

a. Reactor Core Safety Limit Curve

b. Reactor Coolant System Flowrate Reduction

c. Refueling Operations Boron Concentration

<u>Reactor Core Safety Limit Curve</u>

ComEd requests a change to the original submittal to amend the Technical Specifications (TS) Safety Limits section and the associated bases. The original submittal replaced the Reactor Core Safety Limit curve with a new curve that reflects the revised analyses to support the positive moderator temperature coefficient (PMTC) and reduced thermal design flow (TDF) amendment. However, the applicability of the revised Reactor Core Safety Limit curve coincides with implementation of the proposed Technical Specification changes on each unit. Therefore, the original

Reactor Core Safety Limit curve has been reinserted since it remains applicable until implementation of the proposed amendment. Footnotes have been added to the figures to address applicability.

The bases are being revised to clarify applicability of the Safety Limit curves and the Departure from Nucleate Boiling Ratio (DNBR) limits. A change in Thermal Design Procedure is incorporated in the revised analyses and resulted in changes in design and safety analysis DNBR limits.

Reactor Coolant System Flowrate Reduction

ComEd also requests changes to amend Table 2.2-1, "Reactor Trip System Instrumentation Trip Setpoints" and Technical Specification 3/4.2.3, "RCS Flow Rate and Nuclear Enthalpy Rise Hot Channel Factor" where the reduction in RCS flow has been identified. Currently, as proposed by the original submittal, the minimum measured flow limit would be reduced from 97,600 gpm per loop to 92,850 gpm per loop effective immediately upon approval of this amendment from the NRC. However, the safety analyses performed to support this license amendment request considered the effects of reduced TDF as a result of increased SG tube plugging levels in concert with a positive moderator temperature coefficient. Therefore, the minimum measured RCS flow should be effective at the same time as the change in moderator temperature coefficient and all other consequent changes, i.e. boron concentrations, OTDT/OPDT setpoint changes, etc. Footnotes have been added to Table 2.2-1 and TS 3/4.2.3 to address implementation of the reduction in RCS flow.

Similarly, the associated Bases section has been revised to clarify applicability of the revised safety analyses.

Refueling Operations Boron Concentration

ComEd also requests a change only to Byron TS 3/4.9.1, "Boron Concentration," for Refueling Operations and the associated bases. This change will make the adjustment in RCS boron concentration required for the positive MTC cycle specific for each unit at Byron. This change is consistent with the Braidwood change proposed in the original amendment request and provides operational flexibility.

Copies of the actual Technical Specification and bases pages with the changes indicated are included in Attachment B of this submittal.

2. Description of Current Requirements:

The current requirements for the Reactor Core Safety Limit Curve, Reactor Coolant System Flowrate, and Refueling Operations Boron Concentration are as follows:

Reactor Core Safety Limit Curve

a. Technical Specification 2.1, "Safety Limits", states that the combination of thermal power, pressurizer pressure and the highest loop Tavg cannot exceed the limits shown in Figure 2.1-1. The graph and references in TS 2.1.1 are based on the reactor coolant system flow and are not designated cycle or unit specific.

b. Technical Specification Bases 2.1.1 provides the design and safety analysis DNBR limits for a typical cell and a thimble cell; these values were not designated cycle or unit specific.

Reactor Coolant System Flowrate Reduction

a. Technical Specification Table 2.2-1, "Reactor Trip System Instrumentation Trip Setpoints", denotes the minimum measured RCS flow as being 97,600 gpm, and is not designated cycle or unit specific.

b. Technical Specification 3.2.3, "RCS Flow Rate and Nuclear Enthalpy Rise Hot Channel Factor", requires the RCS total flowrate to be > 390,400 gpm, and is not designated cycle or unit specific.

c. Technical Specification Bases 3.2.3 provides information related to the determination of design and safety analysis DNBR limits. These limits were revised as a result of utilizing a different Thermal Design Procedure. This information was not designated as cycle and unit specific.

Refueling Operations Boron Concentration

a. Technical Specification 3.9.1, "Boron Concentration", and associated bases, currently requires a minimum boron concentration in the refueling cavity of 2000 ppm during Mode 6. This information was not designated as cycle and unit specific.

3. Bases for the Current requirements:

The bases of the Reactor Core Safety Limit Curve, Reactor Coolant System Flowrate, and Refueling Operations Boron Concentration are as follows:

Reactor Core Safety Limit Curve

The basis for the requirements of Table 2.2-1 "Reactor Trip System Instrumentation Trip Setpoints", is to prevent overheating of the fuel and possible cladding perforation which would result in the release of fission products to the reactor coolant. Overheating of the fuel cladding is prevented by restricting fuel operation to within the nucleate boiling regime where the heat transfer coefficient is large and the cladding surface temperature is slightly above the coolant saturation temperature. Operation above the upper boundary of the nucleate boiling regime could result in excessive cladding temperatures because of the onset of departure from nucleate boiling (DNB) and the resultant sharp reduction in heat transfer coefficient. DNB is not a directly measurable parameter during operation. A correlation exists between DNB and the combination of thermal power and reactor coolant temperature and pressure. This relation has been used to predict the DNB flux and the location of DNB for axially uniform and non-uniform heat flux distributions. The local DNB heat flux ratio (DNBR) is defined as the ratio of the heat flux that would cause DNB at a particular core location to the local heat flux, and is indicative of the margin to DNB.

In meeting this design basis, uncertainties in plant operating parameters, nuclear and thermal parameters and fuel fabrication parameters are considered statistically such that there is at least a 95% confidence that the minimum DNBR for the limiting rods is greater than or equal to the DNBR limit. The uncertainties in the above plant parameters are used to determine the plant DNBR uncertainty. This DNBR uncertainty, combined with the correlation DNBR limit, establishes a design DNBR value which must be met in plant safety analysis using values of the input parameters without uncertainties.

The design DNBR values are 1.34 and 1.32 for a typical cell and a thimble cell, respectively, for Optimized Fuel Assemblies (OFA) fuel, and 1.33 for a typical cell and 1.32 for a thimble cell for VANTAGE 5 fuel. In addition, margin has been maintained in both designs by meeting safety analysis DNBR limits of 1.49 for a typical cell and 1.47 for a thimble cell for OFA fuel, and 1.67 and 1.65 for a typical cell and a thimble cell, respectively, for VANTAGE 5 fuel.

The curves of Figure 2.1-1, "Reactor Core Safety Limit Curve", show the loci of points of thermal power, reactor coolant system pressure and average temperature for which the minimum design DNBR is no less than the design DNBR value, or the average enthalpy at the vessel exit is less than the enthalpy of saturated liquid. This curve is based on an assumed reactor coolant system flow rate.

<u>Reactor Coolant System Flowrate Reduction</u>

The limits on the heat flux hot channel factor, RCS flowrate, and nuclear enthalpy rise hot channel factor, ensure the design limits on peak local power density and minimum DNBR are not exceeded, and in the event of a LOCA, the peak fuel clad temperature will not exceed the 2200 °F ECCS acceptance criteria limit.

The current RCS flowrate requirement of greater than 390,400 gpm is based on the loop minimum measured flow of 97,600 gpm which is used in the Improved Thermal Design Procedure described in UFSAR Sections 4.4.1 and 15.0.3.

Refueling Operations Boron Concentration

The limitations on reactivity conditions during refueling ensure that the reactor will remain subcritical during core alterations and that a uniform boron concentration is maintained for reactivity control in the water volume having direct access to the reactor vessel.

The limitation on K_{eff} of no greater than 0.95 is sufficient to prevent reactor criticality during refueling operations and includes a 1% $\Delta k/k$ conservative allowance for uncertainties. Similarly, the boron concentration value of 2000 ppm or greater includes a conservative uncertainty allowance of 50 ppm. These limitations are consistent with the initial conditions assumed for the boron dilution incident in the safety analyses.

4. Description of the Need for Amending the Technical Specifications:

The proposed Technical Specification changes are required to ensure appropriate implementation of the original amendment requesting approval of the increased SGTP/RTDF/PMTC analysis program submitted to the NRC in March of 1994. With the reduction in total RCS flow, the Reactor Core Safety Limit Curve for four loop operation was revised for the new flow rate. A change is needed to identify the addition of a revised figure for "Reactor Core Safety Limit - Four Loops in Operation" and the reinsertion on the original Reactor Core Safety Limit. A new page 2-2a, containing Figure 2.1-1a, will be added to the TS. The original safety limit curve will remain valid until the completion of the refueling operations that incorporates the SGTP/TDF/PMTC amendment request. Byron and Braidwood are revising the RCS flow rates added to the TS to make them unit and fuel cycle specific.

The adjustment in RCS boron concentration required for the PMTC will be denoted for fuel cycle and unit applicability at Byron. This change is consistent with the Braidwood requested change in the original amendment and provides some operational flexibility.

5. Description of the Proposed Amendment:

Reactor Core Safety Limit Curve

a. The "Reactor Core Safety Limits Curve", Figure 2.1-1, was revised in the original submittal to reflect the revised analysis which supported the increased SGTP/RTDF/PMTC amendment. The revised Reactor Core Safety Limits Curve for four loop operation accounts for the reduced core flow. This curve will apply to the Byron and Braidwood units as they implement the reduced TDF/SGTP/PMTC analysis which incorporates the Revised Thermal Design Procedure. The original Safety Limits Curve will remain in the Technical Specifications as shown in Attachment B. The original Reactor Core Safety Limit Curve will remain valid until completion of the refueling to load the reactor core designed to incorporate the SGTP/TDF/PMTC change for each unit. Footnotes were added to Figure 2.1-1 and the new page 2-2a, Figure 2.1-1a, to address the unit and cycle implementation period.

b. The bases for Technical Specification 2.1.1 have been revised to reflect the change in DNBR limits associated with the revised safety analysis supporting the SGTP/RTDF/PMTC program. The revised design and safety analysis DNBR limits are 1.25 and 1.50 for both a typical and a thimble cell, respectively. The original DNBR limits for the OFA and Vantage 5 fuel will remain in the bases until final implementation of the SGTP/RTDF/PMTC core design. The DNBR limits will be designated unit and cycle specific.

   The current and revised Safety Limit curve will be designated unit and cycle specific to clarify applicability. The Optimized Fuel Assemblies (OFA) will also be defined in an additional footnote.

<u>Reactor Coolant System Flowrate Reduction</u>

a. Technical Specification Table 2.2-1, "Reactor Trip System Instrumentation Trip Setpoints", will be revised to 92,850 gpm per loop. This revised flow rate will be designated unit and cycle specific by footnotes to address the implementation period.

b. In Technical Specification 3.2.3, "RCS Flow Rate and Nuclear Enthalpy Rise Hot Channel Factor", the RCS total flow rate is revised to 371,400 gpm for the implementation of the reduced TDF/SGTP analysis. This revised flow rate will be designated unit and cycle specific by footnotes to address the implementation period designated to incorporate the SGTP/TDF/PMTC analysis program for each unit.

c. Technical Specification bases 3.2.3 for the RCS flow rate provides the safety analysis limit for DNBR. The core thermal limits have been revised to reflect the utilization of the Revised Thermal Design Procedure (RTDP) DNB methodology and the reduction in RCS flow. The design and safety analysis DNBR limits associated with the SGTP/RTDF/PMTC implementation are 1.25 and 1.50 for both a typical cell and a thimble cell, respectively. The original DNBR limits for OFA and Vantage 5 fuel will remain in the bases until final implementation of the new core design. The DNBR values will be designated unit and cycle specific.

The maximum RCS flow measurement uncertainty for Byron and Braidwood Units 1 and 2 has been increased to 3.5% from the 2.2%. The FSAR reference in this section will be corrected to specify the UFSAR. The revised flow measurement uncertainty value will be designated unit and cycle specific in the bases section to clarify applicability.

Refueling Operations Boron Concentration

a. Byron TS 3/4.9.1 "Boron Concentration", for Refueling Operations and the associated bases, will add a requirement to have the RCS boron concentration greater than or equal to 2300 ppm. This change will be noted as unit and cycle specific.

An administrative change to index page III is also requested. The change identifies the addition of a revised figure for "Reactor Core Safety Limit - Four Loops in Operation" and the reinsertion on the original Reactor Core Safety Limit. A new page 2-2a and Figure 2.1-1a will be identified in the index page.

6. Bases of the Proposed Amendment:

The bases of the proposed supplemental change are consistent with the bases in the original amendment request and are summarized as follows:

Reactor Core Safety Limit Curve

The core thermal limits have been revised to reflect the utilization of the Revised Thermal Design Procedure (RTDP) DNB methodology and the requested reduction in RCS flow. ComEd performed the statistical calculations to determine the operating parameter uncertainty inputs utilized in the Revised Thermal Design Procedure. These uncertainty values were then used by Westinghouse to determine the DNBR values and the core limits using NRC approved codes as discussed in WCAP 13964. The proposed Technical Specification changes ensure appropriate implementation of the SGTP/RTDF/PMTC amendment. Footnotes were added to the affected Technical Specifications to address the implementation period omitted from the original TS amendment specifying unit and cycle applicability.

Reactor Coolant System Flowrate Reduction

The RCS flow reduction reflects a conservatively low RCS flowrate so that flow margin is available over that assumed in the analysis of the systems and components of the NSSS, the LOCA and non-LOCA transients and the fuel. This margin can be used to accommodate reductions in RCS flow such as with increased steam generator tube plugging. The safety analyses verified that the units can operate safely at a reduced RCS flow. The revised flow rate will be implemented on a unit and cycle specific basis.

Refueling Operations Boron Concentration

The change in refueling operations boron concentration is required to maintain adequate shutdown margin as a result of implementing a PMTC. The change in refueling operations boron concentration ensures that: (1) the reactor will remain subcritical during core alterations, and (2) a uniform boron concentration is maintained for reactivity control in the water volume having direct access to the reactor vessel. This change will make the adjustment in RCS boron concentration required for the PMTC unit and cycle specific.

7. Impact of the Proposed Change:

A review of the Significant Hazards Consideration was performed with respect to the provisions of 10CFR50.92. The proposed changes have no impact on the conclusions reached in the original Evaluation of Significant Hazards Consideration.

8. Schedule Requirements:

Commonwealth Edison requests that the review and approval of the proposed amendment be completed as soon as possible, to support implementation during the Byron Unit 1 refueling outage, scheduled to begin September 9, 1994.