Commonwealth Edison
1400 Opus Place
Downers Grove, Illinois 60515

May 6, 1994

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

Attn: Document Control Desk

SUBJECT: Braidwood Station
Unit 1 Cycle 5 Reload
<u>NRC Docket No. 50-456</u>

REFERENCES: See Attachment 3

Dear Mr. Russell:

Braidwood Unit 1 has completed its fourth cycle of operation and is conducting a refueling outage that began March 5, 1994. Braidwood Unit 1 Cycle 4 attained a final cycle burnup of approximately 17,400 MWD/MTU. The Unit is expected to return to service for Cycle 5 on May 9, 1994. This letter summarizes Commonwealth Edison Company's (CECo) evaluation regarding the Braidwood Unit 1 Cycle 5 reload core.

Attachment 1 describes the core reload including a summary of CECo's safety evaluation, performed in accordance with the provisions of 10CFR50.59 as there are no unreviewed safety issues or additional Technical Specification changes.

Attachment 2 provides the Core Operating Limits Report (COLR) for Cycle 5 pursuant to Technical Specification 6.9.1.9. CECo and our vendor (Westinghouse) apply NRC approved reload design methodologies developed by Westinghouse as described in Reference 1. Commonwealth Edison performed the neutronic portion of the reload design using the methods and codes described in References 2 & 4 as approved in References 3 & 5, respectively. Specifically, the Braidwood Unit 1 Cycle 5 reload design, including the development of the core operating limits, was generated by Commonwealth Edison using NRC approved methodologies.

A001
1/1

Please direct any questions regarding this notification to this office.

Very truly yours,

D. M. Saccomando
Nuclear Licensing Administrator

cc: J. D. Martin - Region III Administrator
S. DuPont - Senior NRC Resident Inspector - Braidwood
R. Assa - Project Manager - NRR

k:nla:brdwd:reload:2

ATTACHMENT 1

Braidwood Unit 1 Cycle 5 Reload Description

The Braidwood Unit 1, Cycle 5 reload core was designed to perform under current nominal design parameters, Technical Specifications and related bases, and current Technical Specification set points such that:

1. Core characteristics will be less limiting than those previously reviewed and accepted; or

2. For those postulated incidents analyzed and reported in the Updated Braidwood/Byron Final Safety Analysis Report (UFSAR) which could potentially be affected by fuel reload, reanalyses or reevaluations have demonstrated that the results of the postulated events are within allowable limits.

The Braidwood Unit 1 Cycle 5 core is a "Low Leakage" design. Previously, Commonwealth Edison has successfully developed and operated similar "Low Leakage" designs at Braidwood as well as our Byron and Zion stations.

During the Cycle 4/5 refueling, ninety-two (92) VANTAGE 5 fuel assemblies have been inserted into the core. The Braidwood Unit 1 core now contains a full core of Westinghouse 17x17 VANTAGE 5 assemblies (92 new, 84 once-burned, and 17 twice-burned assemblies). The NRC approved the use of VANTAGE 5 at Braidwood Unit 1 for Cycle 3 operations and thereafter, under the provisions of 10CFR50.90 (Reference 6). The Braidwood/Byron UFSAR describes the compatibility of Westinghouse VANTAGE 5 fuel assemblies in a reload core, and verified compatibility with control rods and reactor internals interfaces. A mixture of Integral Fuel Burnable Absorber (IFBA) rods and Wet Annular Burnable Absorbers (WABAs) will be used as the burnable poison. The IFBA rods contain fuel pellets with an enriched B-10 coating. Both WABAs and IFBAs have successfully been used previously by Commonwealth Edison.

The reload VANTAGE 5 fuel assemblies will incorporate Westinghouse's standardized fuel pellets, reconstitutable top nozzles (RTN), extended burnup design features, modified Debris Filter Bottom Nozzle (DFBN), and snag resistant Intermediate Flow Mixers (IFM) grids. Similar features have been successfully utilized previously in Commonwealth Edison's Byron and Braidwood Units. In addition, mechanical features which have not been previously used at Braidwood Unit 1 have been incorporated as part of the VANTAGE 5 design for Regions 7A and 7B. These changes, which were reviewed by CECo, include: (1) an extended burnup bottom grid spring to counter the effects of extended burnup, (2) a keyless/cuspless top nozzle and modified hold down spring design to eliminate to potential for hold down spring hang-up, (3) standardized alignment of the fuel rods (a manufacturing simplification), (4) a cast composite bottom nozzle (a manufacturing process change), (5) WABA absorber repositioning to align fuel and absorbers, and (6) a protective zirconium dioxide coating over the bottom six inches of the fuel rod to increase level of debris defense.

The Braidwood Unit 1 Cycle 5 core has been designed and evaluated using NRC licensed and approved methods. Commonwealth Edison requested approval to perform the neutronic portion of PWR reload designs using the methods described in Reference 2, and the NRC has approved this request (Reference 3). Specifically, the Braidwood Unit 1 Cycle 5 reload design, including the development of the core operating limits, were generated and verified by Commonwealth Edison using NRC approved methodology.

The reload fuel's nuclear design is evaluated generically in the UFSAR. Braidwood Unit 1 Cycle 5 is a full core of VANTAGE 5 fuel assemblies; as such, the 50°F Peak Clad Temperature (PCT) transition penalty utilized during Cycle 4 was removed. The loading pattern dependent parameters were evaluated in detail in the CECo/Westinghouse reload safety evaluation process. A 100°F PCT penalty will remain in place for Cycle 5 to address the possibility that the Chopped cosine is not the most limiting power shape for the large break LOCA analysis. This PCT penalty will be removed upon the approval of WCAP-12909-P, "Power Shape Sensitivity Methodology." The effect of Economic Generation Control (EGC) including an increase in the temperature deadband uncertainty in Chapter 15 accident analysis, has been evaluated. The results of the evaluations indicated that EGC operation is acceptable in that all applicable safety criteria are met. Specific evaluations for large and small break LOCA resulted in peak clad temperature increases of +4°F and +5°F for large and small break LOCA, respectively.

With the exception of the items discussed below, Commonwealth Edison has determined that all neutronic reload parameters remain within the previously established reload safety and transient Safety Parameter Interaction List (SPIL) limits. These include, but are not limited to, Safety Parameters for UFSAR non-LOCA and LOCA transients.

Safety Parameters 2.9.2B (IFBA Fuel Temperature), 2.9.4B (IFBA Fuel Rod Pressure), and 2.9.6B (IFBA Power Suppression) required additional evaluation and clarification. Typically, ECCS analyses have been performed at a time in fuel rod life equivalent to the time of maximum densification (maximum stored energy). Studies by the vendor have indicated that for fuel rods with low initial backfill pressure, the low pressure can change the limiting time in life for maximum stored energy from that previously assumed. Consequently, systematic studies have been performed which examine other times in life relative to fuel rod pressure and temperature. Results indicate that, for some plants using a low initial fuel rod pressurization, the current Large Break LOCA Evaluation Model ECCS analysis may result in a higher peak clad temperature other than End -of-Life. The vendor considers this issue to be applicable to customers who are utilizing fuel pre-pressurized to less than 200 psig and operating with less than 250 MWD/MTU burnup. For Braidwood Unit 1 Cycle 5, the IFBA fuel rod backfill pressure is 200 psig. The current limits for Safety Parameter 2.9.4B, "IFBA Fuel Rod Internal Pressure versus kW/Ft", were not met; however, this was evaluated to be acceptable since power suppression and sufficient LOCA peak clad temperature margin are available during Cycle 5 operation.

The thermal-hydraulic design for the Cycle 5 reload core has not significantly changed from that of the previously reviewed and accepted cycle design. The FNDH limits of less than 1.65 for VANTAGE 5 assemblies ensures that the DNB ratio of the limiting power rod during Condition I and Condition II events is greater than or equal to the DNBR limit of the DNBR correlation (WRB-2) being applied. The W-3 DNBR Correlation continues to be used for conditions which are outside the WRB-2 Correlation (e.g., steam line break).

Summary

Commonwealth Edison's reload safety evaluation process (SPIL/RSE review) is a verification to ensure that the previously reviewed and approved accident analyses are not adversely impacted by the cycle specific reload core design. CECo's Braidwood Unit 1 Cycle 5 Reload Safety Evaluation relied on previously reviewed and accepted analyses reported in the UFSAR, fuel technology reports, the VANTAGE 5 Reload Transition Safety Report (RTSR), and previous reload safety evaluation reports. A detailed review of the core characteristics was performed to determine those parameters affecting the postulated accident analyses reported in the Braidwood UFSAR. The Operation of the Braidwood Unit 1 Cycle 5 has been analyzed in accordance with NRC approved methodologies and satisfies safety analysis limits. The margin of safety, as defined in the bases of the Technical Specifications, is not impacted or reduced.

Finally, verification of the Braidwood Unit 1 Cycle 5 reload core design will be performed per the standard reload startup physics tests (ANSI/ANS 19.6.1). These tests include, but are not limited to:

1. A physical inventory of the fuel in the reactor by serial number and location prior to the replacement of the reactor head;

2. Control rod drive tests and drop times;

3. Critical boron concentration measurements;

4. Control bank worth measurements using the rod swap technique;

5. Moderator temperature coefficient measurements;

6. Startup power distribution measurements using the incore flux mapping system.

In summary, CECo's use of VANTAGE 5 fuel and use of advanced neutronics methods (as described in References 7 and 2, respectively) have been previously approved by the NRC (References 6 and 3 respectively). Therefore, no additional NRC review and approval of the reload core analyses or application for amendment to the Braidwood Unit 1 operating license is required as a result of the specific reload design for Cycle 5.