Commonwealth Edison
1400 Opus Place
Downers Grove, Illinois 60515

August 24, 1990

Dr. Thomas E. Murley
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Attn: Document Control Desk

Subject: Braidwood Station Unit 2
Revisions to the Operating Limits Report for Cycle 2
NRC Docket No. 50-457

Pursuant to Technical Specification 6.9.1.9, entitled "Operating Limits Report", any mid-cycle revisions or supplements to the Operating Limits Report shall be provided to the NRC Document Control Desk with copies to the Regional Administrator and Resident Inspector. The enclosure provides this information.

Attachments 1 and 2 to the enclosure are the revisions made to the Fxy portion of the Braidwood Unit 2 Cycle 2 Operating Limits Report which were implemented July 20 and July 27, 1990. The July 20, 1990 revision inappropriately removed a grid uncertainty factor which was subsequently reinstated by the July 27, 1990 revision. Although there was no safety impact for this period, a discussion of the apparent cause and corrective actions is provided.

Please address any questions regarding this submittal to this office.

Very truly yours,

S.C. Hunsader

S.C. Hunsader
Nuclear Licensing Administrator

Attachments

cc: A. Bert Davis-RIII
S. P. Sands-NRR
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Braidwood Unit 2 Cycle 2 Operating Limit Report
Revisions of July 20 and July 27, 1990

Description:

On July 18, 1990 a Unit 2 Braidwood Technical Staff Surveillance (2BwVS) 2.2.2-1, Heat Flux Hot Channel Factor Checkout Using Peaking Factors, was performed. The purpose of this procedure is to verify that Fq(Z) will remain within its Technical Specification Limit by performing an evaluation of Fxy at least once every 31 Effective Full Power Days. The Fxy limit values are computed for each core cycle by the Commonwealth Edison Nuclear Fuel Services (NFS) department and are submitted as part of the Operating Limits Report pursuant to Braidwood Technical Specification 6.9.1.9.

Based on data obtained during performance of 2BwVS 2.2.2-1 it was identified that Fq(Z) had exceeded its acceptance criteria by less than one half of one percent for two of the data points. The appropriate Technical Specification Action Statement was entered and complied with. Additionally, NFS was contacted and requested to evaluate the existing Fxy limits and provide additional guidance for plant operation.

On July 19, 1990 after discussions with the Nuclear Steam Supply System (NSSS) vendor, NFS concluded that unnecessary conservatisms had been applied to the Fxy limit for the current cycle. This unnecessary conservatism was identified by the vendor as the use of a penalty factor to account for the smeared grid model used in the NFS calculations. The use of this penalty was deemed unnecessary because the Station was performing actual measurements with the grids included. As a result, NFS issued a revision to the Fxy portion of the Operating Limits Report (Attachment 1) for Station review and approval.

On July 20, 1990 Braidwood Station approved the NFS revision to the Fxy portion of the Operating Limits Report. 2BwVS 2.2.2-1 was reperformed and the results were acceptable. The Technical Specification Action Statement was exited.

On July 25, 1990 NFS contacted the NSSS vendor and requested a more extensive technical basis for the removal of the grid penalty factor.

On July 26, 1990 the NSSS vendor notified NFS that, after further review and based on the code used by NFS to calculate Fxy limits, removal of the grid smear penalty factor was <u>not</u> appropriate, as erroneously indicated to NFS on July 19, 1990.

NFS immediately notified Braidwood Station that the removal of the uncertainty factor was inappropriate and recommended that the Station revise the Fxy portion of the Operating Limits Report to use the values of the original Braidwood 2 Cycle 2 Operating Limits Report.

On July 27, 1990 Braidwood Station completed its review of the NFS recommendation and approved the revision which reinstated the Fxy portion of the Operating Limits Report to the original values. The surveillance performed using the values from the July 20 revision to the Operating Limits Report was reviewed using the "new" (original Unit 2 Cycle 2) Attachment 2 Fxy values. It was determined that the results would also have been acceptable had the original Unit 2 Cycle 2 Fxy values been used.

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Cause:

The apparent cause of the event was inadequate review of the differences associated with the code used by NFS and the similar code now used by the NSSS vendor for Fxy limit calculations. NFS calculates Fxy limits using a code entitled "MERCURY" which was purchased from the NSSS vendor. This code applies a penalty factor for a smeared grid model. The NSSS vendor now uses a code entitled "VENUS" which is an enhanced version of MERCURY. The VENUS code, which has been purchased from the vendor but not yet implemented by NFS, compensates for the smeared grid treatment in a more detailed (axially varying) manner. Therefore, a single penalty factor for the smeared grid effect does not need to be input to the VENUS code. During discussions between NFS and the NSSS vendor it was identified that grid effects are reflected in the measured axial power shape when performing the flux map surveillance, which led to the incorrect conclusion that the penalty factor could be removed (as it appeared to have been for the VENUS model). The review failed to identify that the uncertainty for grid straps is calculated within VENUS as controlled by a separate input and algorithm. Removal of the penalty factor for the MERCURY calculations of the limit values was inappropriate, even though the flux map measurements contain heterogeneous grid effects (depressions at the axial locations of the grids).

Corrective Actions:

1. Procedural improvements, including the establishment of a "Senior Review Team" to provide for additional review of similar core operational matters, are being evaluated by NFS as part of a more detailed root cause evaluation of the inappropriate Fxy adjustment. This action will be tracked to completion by action item 457-200-90-03301.

2. Although MERCURY continues to be acceptable for use in generating in Fxy limits, NFS will proceed with plans to validate and verify VENUS, which will provide additional consistency with the NSSS vendor's methods when implemented in NFS.

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Braidwood Unit 2 Cycle 2
Operating Limit Report-Fxy Portion

This Radial Peaking Factor Limits Report is provided in accordance with Paragraph 6.9.1.9 of the Braidwood Unit 2 Nuclear Plan Technical Specifications.

The F_{xy} limits for RATED THERMAL POWER within specified core planes for Cycle 2 shall be:

a. For the lower core region from greater than or equal to 0% to less than or equal to 50%:

   1. F_{xy}^{RTP} less than or equal to 1.8944 for all core planes containing bank "D" control rods, and

   2. F_{xy}^{RTP} less than or equal to 1.7355 for all unrodded core planes.

b. For the upper core region from greater than 50% to less than or equal to 100%:

   1. F_{xy}^{RTP} less than or equal to 1.8567 for all core planes containing bank "D" control rods, and

   2. F_{xy}^{RPT} less than or equal to 1.7355 for all unrodded core planes.

These Fxy(z) limits were used to confirm that the heat flux hot channel factor FQ(z) will be limited to the Technical Specification values of:

$$F_Q(Z) \leq \left[\frac{2.50}{P}\right] [K(z)] \quad \text{for } P > 0.5 \text{ and,}$$

$$F_Q(Z) \leq [5.00] [K(z)] \quad \text{for } P \leq 0.5$$

Assuming the most limiting axial power distributions expected to result from the insertion and removal of Control Banks C and D during operation, including the accompanying variations in the axial xenon and power distributions as described in the "Power Distribution Control and Load Following Procedures", WCAP-8403, September, 1974. Therefore, these F_{xy} limits provide assurance that the initial conditions assumed in the LOCA analysis are met, along with the ECCS acceptance criteria of 10 CFR 50.46.

See Figure 1 for a plot of $[F_Q^T . P_{R_e}]$ vs. Axial Core Height

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Operating Limit Report-Fxy Portion

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The F_{xy} limits for RATED THERMAL POWER within specified core planes for Cycle 2 shall be:

a. For the lower core region from greater than or equal to 0% to less than or equal to 50%:

   1. F_{xy}^{RTP} less than or equal to 1.860 for all core planes containing bank "D" control rods, and

   2. F_{xy}^{RTP} less than or equal to 1.704 for all unrodded core planes.

b. For the upper core region from greater than 50% to less than or equal to 100%:

   1. F_{xy}^{RTP} less than or equal to 1.823 for all core planes containing bank "D" control rods, and

   2. F_{xy}^{RPT} less than or equal to 1.704 for all unrodded core planes.

These Fxy(z) limits were used to confirm that the heat flux hot channel factor FQ(z) will be limited to the Technical Specification values of:

$$F_Q(Z) \leq \frac{[2.50]}{P} [K(z)] \quad \text{for } P > 0.5 \text{ and,}$$

$$F_Q(Z) \leq [5.00] [K(z)] \quad \text{for } P \leq 0.5$$

assuming the most limiting axial power distributions expected to result from the insertion and removal of Control Banks C and D during operation, including the accompanying variations in the axial xenon and power distributions as described in the "Power Distribution Control and Load Following Procedures", WCAP-8403, September, 1974. Therefore, these F_{xy} limits provide assurance that the initial conditions assumed in the LOCA analysis are met, along with the ECCS acceptance criteria of 10 CFR 50.46.

See Figure 1 for a plot of $[F_Q^T \cdot P_{R_e}]$ vs. Axial Core Height