

RS-06-010

January 27, 2006

U.S. Nuclear Regulatory Commission
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Braidwood Station, Units 1 and 2
Facility Operating License Nos. NPF-72 and NPF-77
NRC Docket Nos. STN 50-456 and STN 50-457

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

Subject: Response to NRC Request for Additional Information With Respect to Request for License Amendment Related to Application of Alternative Radiological Source Term

Reference: Letter from K. R. Jury (Exelon Generation Company, LLC) to NRC, "Request for License Amendment Related to Application of Alternative Radiological Source Term," dated February 15, 2005

In the referenced submittal, Exelon Generation Company, LLC (EGC) requested an amendment to Appendix A, Technical Specifications (TS), of Facility Operating License Nos. NPF-72, NPF-77, NPF-37, and NPF-66 for Braidwood Station, Units 1 and 2, and Byron Station, Units 1 and 2, respectively. The proposed amendment was requested to support application of an alternative source term methodology in accordance with 10 CFR 50.67, "Accident Source Term."

During a conference call on January 10, 2006, NRC technical reviewers and EGC personnel discussed aspects of the referenced submittal that required additional information to be provided for NRC review. The attachment to this letter provides the EGC response to the NRC request for information discussed during this conference call.

The information provided in this letter does not affect the supporting analysis for the original license amendment request as described in referenced submittal. No other information submitted with the referenced submittal is affected by this additional information. The No Significant Hazards Consideration and the Environmental Consideration provided in Attachment 1 of the referenced letter are not affected by this additional information.

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In accordance with 10 CFR 50.91(b), "State consultation," EGC is providing the State of Illinois with a copy of this letter and its attachment to the designated State Official.

If you have any questions about this letter, please contact David Chrzanowski at (630) 657-2816.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 27th day of January 2006.

Respectfully,


Patrick R. Simpson
Manager – Licensing

Attachment: Response to NRC Request for Additional Information

Attachment

BRAIDWOOD STATION
UNITS 1 AND 2

Docket Nos. STN 50-456 and STN 50-457
License Nos. NPF-72 and NPF-77

and

BYRON STATION
UNITS 1 AND 2

Docket Nos. STN 50-454 and STN 50-455
License Nos. NPF-37 and NPF-66

Response to NRC Request for Additional Information

Attachment

Response to NRC Request for Additional Information

Question:

Provide the power history for the limiting high burnup fuel rods which exceed the stipulation in the Regulatory Guide 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," footnote 11. The response should include the number of fuel rods and the number of assemblies beyond this limit.

The release of fission products into the pellet-to-clad gap is dependent on power history. These releases are most sensitive at higher burnups when the fuel experienced a higher linear heat generation rate (LHGR.)

Response:

As agreed upon during the January 10, 2006, conference call between NRC technical reviewers and EGC personnel, the response to the above question may be based on a representative, qualitative fuel cycle assessment. A detailed evaluation of the Byron Station and Braidwood Station power histories was not required and therefore not performed. To support the qualitative assessment, a calculation was performed using the NRC-approved Advanced Nodal Computer Code, (ANC) to determine best estimate fuel rod average burnups and powers for a typical 18-month Byron/Braidwood fuel cycle design depleted to a core exposure that bounds actual fuel cycle designs.

This calculation was used to determine how many fuel assemblies would be expected to exceed the criteria for using the gap release fractions listed in Table 3, "Non-LOCA Fraction of Fission Product Inventory in Gap," of Regulatory Guide 1.183. The Table 3 release fractions are intended for use with light water reactor fuel limited to a peak burnup up to 62,000 megawatt-days per metric ton Uranium (MWD/MTU) provided that the maximum linear heat generation rate does not exceed 6.3 kilowatts per foot (kW/ft) peak rod average power for burnups exceeding 54 gigawatt-days per metric ton Uranium (GWD/MTU).

As discussed in the subject conference call, an initial review of maximum rod average burnups and maximum rod average powers indicated that up to 40 fuel assemblies would exceed the "54/6.3" criteria from approximately 425 effective full power days (EFPD) to the End-of-Cycle (approximately 533 EFPD). This assessment approach is conservatively bounding as it assumes that the maximum power rod is also the maximum burnup rod.

Subsequent to the January 10th discussion, a more detailed review of the rod power/burnup data was performed by extracting pin-by-pin edits from the ANC run described above. This data provides a better estimate of the number of fuel rods that would be expected to exceed the "54/6.3" criteria for the Byron Station and Braidwood Station 18-month fuel cycles. The results of this review indicate that a smaller population of assemblies would exceed the "54/6.3" criteria. The following tables provide representative ANC results over the period in the cycle when the "54/6.3" criteria is projected to be exceeded.

Attachment

Response to NRC Request for Additional Information

ANC Results for 450 EFPD				
Eighth-Core Location	Number of Assemblies Exceeding "54/6.3" Criteria	Number of Rods Exceeding "54/6.3" Criteria per Assembly	Maximum Rod Average Burnup at ~450 EFPD (GWD/MTU)	Maximum Rod Average Power at ~450 EFPD (kW/ft)
3,3	4	2	~54	~6.3
4,4	4	51	~55	~6.6
5,3	8	12	~55	~6.6
5,5	4	14	~55	~6.5
Total	20	364		

ANC Results for 520 EFPD				
Eighth-Core Location	Number of Assemblies Exceeding "54/6.3" Criteria	Number of Rods Exceeding "54/6.3" Criteria per Assembly	Maximum Rod Average Burnup at ~520 EFPD (GWD/MTU)	Maximum Rod Average Power at ~520 EFPD (kW/ft)
4,2	8	20	~56	~6.5
4,4	4	60	~58	~6.5
5,3	8	114	~58.5	~6.7
5,5	4	8	~58	~6.4
6,2	8	10	~56	~6.5
Total	32	1,424		

The above detailed pin-by-pin ANC data shows that between 20 and 32 fuel assemblies would contain fuel rods that exceed the "54/6.3" criteria during the last several months of full power operation at End-of-Cycle, and only a fraction of the 264 fuel rods in each assembly exceed the "54/6.3" criteria. The rod average burnups of these rods do not exceed 58.5 GWD/MTU and the rod average powers do not exceed 6.7 kW/ft.

The following conservative factors related to high power/ high burnup fuel rods were applied in the Byron Station and Braidwood Station Alternative Source Term license amendment submittal.

- For non-LOCA accidents with fuel damage, gap release fractions were doubled for all rods in all affected fuel assemblies to compensate for the fact that the "54/6.3" criteria may be exceeded.
 - The data above indicates only 1,424 of 50,952 fuel rods (i.e., <3%) in the core exceed the "54/6.3" criteria.
 - For the fuel handling accident where all fuel rods in one fuel assembly are assumed to be damaged, the data above indicates that the worst case assembly would see 114 fuel rods (i.e., <50%) exceed the "54/6.3" criteria. In addition, this high burnup assembly is assigned a radial peaking factor of 1.7.
- A radial peaking factor of 1.7 was applied in non-LOCA accidents resulting in fuel damage. For high burnup fuel, a 1.7 radial peaking factor is extremely conservative. As seen in the table above, the maximum fuel rod power for rods that exceed the "54/6.3" criteria is 6.7 kW/ft, which equates to a radial peak of 1.17.

These conservative factors are considered sufficient to offset the fact that gap release fractions are not explicitly calculated for fuel rods that exceed the "54/6.3" criteria.