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June 30, 1997

Mr. David Meyer, Chief
Rules Review and Directives Branch
U.S. Nuclear Regulatory Commission
Mail Stop T-6D-69
Washington, DC 20555-0001

Dear Meyer:

Subject: GPU Nuclear (GPUN) Comments on NRC Proposed Bulletin 96-01, Supplement 1:Control Rod Insertion Problems

References:
1. Proposed Generic Communication; Control Rod Insertion Problems, 62 Fed. Reg. 27629, May 20, 1997.
2. B&W Owners Group Letter, OG-1660, Same Subject June 18, 1997.
3. B&W Owners Group Letter, OG-1622, J. A. Selva (BWOG) to Robert C. Jones (USNRC), "CRA Insertion Concerns," October 22, 1996

The Federal Register notice, Reference 1, provided opportunity for comments on the technical and regulatory aspects of the proposed supplement to Bulletin 96-01: Control Rod Insertion Problems. The proposed supplement will request addressees to take actions to ensure the continued operability of control rods in Westinghouse and Babcock & Wilcox designed Pressurized Water Reactor plants. The original bulletin was concerned with a limited number of events concerning incomplete control rod insertions in Westinghouse plants that occurred in certain Westinghouse fuel types at elevated burnup levels. The proposed supplement extends that concern to all small-diameter guide tube PWR fuel designs. Further, the supplement requests the plants to verify full

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insertability and acceptable rod drop times either by testing rods in fuel above specified burnups at intervals of 2500 MWD/MTU or by a rigorous engineering analysis. This letter provides GPUN's comments on the proposed Bulletin 96-01 supplement as it pertains to the Three Mile Island Nuclear Station.

Reference 2 provided the B&W Owners Group comments on the proposed supplement developed by Framatome Cogema Fuels (FCF) Company and the BWOG.GPUN endorses the comments and conclusions of Reference 2 as they relate to the FCF Mark B fuel assembly design employed in the TMI fuel core. Several issues addressed in Reference 2 deserve special emphasis as they relate to TMI. Certain other issues are also addressed.

Mark B Design and Performance

The control rod insertion problem in the Westinghouse fuel assemblies has been attributed to guide thimble distortions caused by excessive compressive loading. Based on design, operational and measured performance information previously provided to the NRC, the FCF Mark B fuel assembly should be excluded from the proposed supplement because there are no indications in any of this information that the Mark B design is susceptible to such guide tube distortions or any other control rod insertion proble..i.

Mark B design features, performance data and analyses supporting this conclusion were discussed with the NRC staff in a meeting on December 18, 1996 with FCF and BWOG representatives. A summary of the meeting information was formally submitted for review on January 31, 1997 by FCF. This information is again summarized in Reference 2. It offers substantial evidence that the Mark B assembly is significantly different than the fuel types that have experienced control rod insertion problems and that the Mark B provides adequate design and performance margins to preclude anomalous guide tube distortion within the licensed burnup limits.

The proposed supplement (62 FR 27631) states that world-wide experience of incomplete control rod insertion problems caused by thimble tube distortion due to excessive compressive loads has been limited to fuel designs that use small-diameter (approximately 0.5-inch) thimble tubes. The focus on a single design feature (small-diameter), albeit a primary one related to tube strength, to categorize fuel designs that may or may not be suspect with regard to control rod insertion capability is inappropriately narrow, particularly given the small database of problem events. As demonstrated in the FCF/ BWOG information previously provided to the NRC, comparison of PWR fuel designs with respect to control rod insertion capability and performance depends on a number of important design features (buckling strength, axial load path, available growth gaps, etc.) and materials behavior characteristics (tube growth, creep rates,

corrosion rates, etc.), and these may have a considerable range of variation from one fuel design to another.

Only an in-depth consideration of all these factors, combined with actual trip performance experience, can provide a proper evaluation of the insertion capabilities of a given design. As shown in the previous information, the FCF Mark B fuel assembly contains many features and behavior characteristics distinctly different than the Westinghouse fuel designs that experienced insertion problems in the Wolf Creek and South Texas Project plants (as well as the Ringhals fuel type). Evaluation of the entire Mark B design, plus its 100% successful insertion record, has shown that the small-diameter thimble tube similarity is insufficient to allow the conclusion that the Mark B is also susceptible to the guide thimble distortion experienced by the other fuel designs.

The control rod insertion events at the Westinghouse plants have been attributed to greater than expected fuel assembly growth (Wolf Creek) and inadequate resistance to buckling loads in the thimble tube dashpot region (South Texas). As far as GPUN is aware, all incomplete insertion events (including Ringhals) occurred in these higher power density, higher outlet temperature plants. Industry data indicates that Zircaloy material under these higher duty conditions may exhibit some enhanced growth or growth-inducing corrosion. However, TMI and the other B&W 177-Fuel Assembly plants are low to moderate duty plants. FCF has demonstrated with measured data that the Mark B fuel design used in these plants does not exhibit enhanced assembly growth through burnups greater than 50,000 MWD/MTU and that the growth rates are within design predictions. No growth-enhancement effect has been observed as a function of burnup. Also, the Mark B, which does not have a reduced diameter dashpot region, has been shown to have adequate buckling margin.

The proposed supplement (62 FR 27631) states that, while the bulk of high drag force data has been in fuel in high-temperature plants, NRC concerns regarding control rod insertability have been extended to low-temperature operation fuel because there have been a number of cases of high drag force test results in fuel from low-temperature plants. However, there is no evidence that these test methods and results are applicable to the FCF Mark B fuel assembly. In fact, the Mark B materials behavior is consistent with lower-temperature operating condition expectations. Therefore, extension of the limited, fuel design-specific low-temperature high drag force data as applicable to the Mark B design has no technical basis and is not justified.

Mark B Insertion Experience

It is significant that the Mark B design and performance data are supported by operational experience. No Mark B fuel assembly at any burnup level has caused a control rod assembly to fail to fully insert or fail to meet Technical Specification drop time criteria. Nor did the Mark B trip time data show any quantifiable increase with burnup. This is based on a total of over 3700 successful control rod trip insertions into Mark B fuel since 1990. Of these, more than 700 have been in fuel above the proposed 35,000 MWD/MTU limit that would be applicable to the Mark B (12-foot length, no Intermediate Flow Mixing(IFM) grids). A significant portion of these successful insertions have been in fuel with assembly burnups in the 40,000 to 50,000 MWD/MTU range with a maximum assembly burnup of over 58,000 MWD/MTU. These data are consistent with the information described above previously provided to the NRC staff, as well as the initial BWOG information submitted on October 22, 1996 in response to NRC requests related to the original concerns of Bulletin 96-01(Reference 3).

Mark B Review

It is our understanding that none of the FCF/BWOG Mark B material provided to the NRC to date related to these control rod insertion issues has been reviewed by the staff. This information strongly supports the conclusion that the FCF Mark B design is not susceptible to the Westinghouse guide thimble distortion problem and has not caused any control rod insertion anomalies. GPUN suggests, therefore, that, at a minimum, the NRC review of the December 18,1996 FCF/BWOG meeting package and the January 31, 1997 FCF submittal should be completed before the proposed supplement is issued. Further, based on this information, the Mark B assembly should not be included in the proposed bulletin.

Licensing Compliance

The proposed supplement (62 FR 27631) states that the requested actions are to assure that adequate shutdown margin is maintained and that the control rods will satisfactorily perform their reactivity control function in accordance with the current licensing basis for each facility. It states further that "In order to meet the current licensing basis for each facility, the ability to insert the control rods needs to be demonstrated for burnups that exceed [certain specified] burnup levels"(ibid.); i.e., the burnups below which significant thimble tube distortion has not been observed. It is GPUN's opinion that the limited control rod insertion problems that have occurred in non-FCF fuel types do not provide sufficient

evidence to invalidate the current TMI licensing basis. The Mark B fuel design evaluations and successful insertion experience demonstrate clearly that the licensing basis continues to be met at burnups significantly higher than 35,000 MWD/MTU and within the currently approved licensed burnup limits. As far as we are aware, there is no directly-applicable technical evidence or data in the industry to contradict this conclusion.

Safety Assessment

The proposed supplement (62 FR 27631) states that the NRC staff considers the recent control rod insertion problems in high burnup fuel a safety issue, and, further, that the safety significance depends on the amount of shutdown margin lost by incomplete rod insertions. It is difficult to understand how these limited events in specific fuel assembly designs constitute a generic safety issue for all PWR fuel designs. Also, even in the Westinghouse assemblies in question, it is our understanding that virtually all of the rod binding occurred in the bottom of the guide thimbles and thus very little shutdown margin would be lost. The Ringhals experience, with S-shape bowing resulting in control rod insertion problems, may have had more potential for axially-higher binding, but that problem also was determined to be caused by design-specific excessive axial compressive forces (over-sized holddown springs). For the FCF Mark B fuel assembly design, which has been demonstrated not to be susceptible to the root-cause phenomena responsible for the Westinghouse insertion events, there is no safety issue.

Of equal concern, as discussed in Reference 2, the test program requested by the proposed supplement represents considerable increased risk for the plant in areas such as: possibility of a plant transient or operator error, wear and tear on plant components and systems (with potential effects on the current licensing basis), fuel failure occurrence or degraded behavior of existing defects and chemistry control. These risk burdens are not warranted by the control rod insertion problems experienced to date, and particularly not for a plant using the Mark B fuel design. It is suggested that, at a minimum, the NRC perform a complete assessment of the risk burden created by the test program before the supplement is issued.

Inappropriate Remedy

As discussed above, GPUN believes the scope of the control rod insertion test program requested by the proposed supplement is an inappropriate and excessively broad remedy for a limited, non-generic fuel performance problem. The excess is particularly inappropriate with regard to the FCF Mark B fuel assembly used at TMI which has exhibited no control rod insertion problems or

even indications of any trends toward potential problems. In addition to the added risk burden discussed above, the periodic plant shutdowns required for rod insertion testing for 2 or 3 days four or five times a year or the potential changes in established cycle design strategies and fuel use economies will result in large cost and operating inefficiencies. The technical basis for the test interval of approximately every 2500 MWD/MTU above 35,000 MWD/MTU also is far from clear and seems overly frequent to detect incipient rod insertion problem trends. These burdens on the industry in general, and on TMI in particular, are not warranted by the control rod insertion events experienced to date.

Rigorous Analysis Alternative

The proposed supplement states that as an alternative to implementing a rod insertion test program, insertability may be demonstrated by a "rigorous engineering analysis"(62 FR 27631). A definition of "rigorous" or a description of the requirements that such an analysis should meet are not provided. As far as GPUN is aware, there are no generic fuel assembly analysis models in the industry that can definitively predict control rod insertion behavior. Various models (e.g., finite element based models) can predict specific structural behaviors in a conservative manner, but we don't believe any available models can mechanistically and reliably predict such holistic and probabilistic effects as guide tube shape changes and control rod insertability. Historically, rod insertability has been ensured using conservative basic effects design models and materials properties data applied to the individual assembly components using consistent design methods. The ultimate success of a given design, particularly with increasing burnup exposures, has always depended on its proper functioning in-reactor and supporting post-irradiation examination data.

This is the approach that has been taken to demonstrate the success of the Mark B assembly design, as discussed above and in Reference 2. GPUN and the other BWOG owners are supporting FCF plans to continue to gather relevant Post Irradiation Examination (PIE) data to monitor high burnup fuel performance. For FCF or the BWOG to embark on a program of indeterminate scope to develop a control rod insertion prediction fuel model that is unlikely in the end to provide predictive results without large uncertainties does not seem to be a useful application of resources, especially with regard to the Mark B assembly for which it has already been demonstrated that no insertability problems exist. It is suggested that, at a minimum, the proposed bulletin clarify what is intended by a "rigorous engineering analysis" and that the staff give some consideration to the feasibility and likely long-term usefulness of this approach.

Conclusion

It is GPUN's position, shared with FCF and the other BWOG members per Reference 2, that the proposed supplement to Bulletin 96-01 inappropriately includes B&W designed plants and the Mark B fuel assembly type. We suggest that, at a minimum, the staff complete its review of the FCF fuel information provided previously on these matters before the supplement is issued. We believe such review will support the exclusion of the Mark B design from the supplement concerns. This conclusion is based on significant beneficial design and performance differences compared to the Westinghouse fuel designs that have had incomplete control rod insertion events and on the 100% successful rod insertion experience of the Mark B fuel assembly.

GPUN does not agree that the limited rod insertion problems described in the supplement constitute a generic safety issue for all small-diameter PWR fuel designs, nor that the phenomenon as understood to date represents a significant safety concern. Particularly, as the FCF/BWOG information demonstrates, there is no safety issue at all concerning the Mark B design. Therefore, GPUN recommends that, before the proposed supplement is issued, the rod insertion test program described in the supplement be reviewed by the staff to compare the perceived benefits of the program against the risk and cost burdens it will impose on the operating plants.

It is GPUN's opinion that the actions described in the supplement to demonstrate acceptable control rod insertability by testing at short intervals during the operating cycle represents an excessive remedy for insertion problems identified to date. This is especially true with regard to the FCF Mark B fuel assembly design used at TMI which has exhibited no rod insertion problems at all.

GPUN and the industry share NRC concerns that technical problems with fuel performance, particularly as higher burnups are achieved, must be adequately understood and appropriately corrected to ensure continued safe operation of TMI and other plants. GPUN will continue to work with FCF, the BWOG and other industry organizations to monitor Mark B fuel control rod insertion capability as well as with the NRC to communicate and develop appropriate fuel design and performance data related to this and other fuel issues.

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