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M. Chatterton
J. Shapaker
W. Baxter

Wisconsin Electric POWER COMPANY

231 W Michigan, PO Box 2046, Milwaukee, WI 53201-2046

(414) 221-2345

NPL 97-0357

June 19, 1997

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

Dear Mr. Meyer:

COMMENTS ON NRC BULLETIN 96-01 SUPPLEMENT 1:
CONTROL ROD INSERTION PROBLEMS

Wisconsin Electric (WE) is pleased to respond to your notice of opportunity for public comment on the proposed generic communication "Control Rod Insertion Problems" published in the Federal Register on May 20, 1997 (Volume 62, Number 97, Pages 27629-27632).

WE operates the Point Beach Nuclear Plant, a two unit Westinghouse designed PWR currently using 12 ft. long 14x14 Optimized Fuel Assemblies (OFA) without intermediate flow mixing (IFM) grids. The proposed generic communication requires that WE, as a licensee of a Westinghouse designed plant, submit a response. The response must indicate when the requested actions will be taken or describe an alternative course of action, including the basis for the acceptability of the proposed alternative course of action. The requested action is to verify the full insertability and rod drop times by testing control rods in fuel assemblies with burnups greater than 35,000 MWD/MTU upon first reaching the limit and approximately every 2,500 MWD/MTU until the end of cycle. In addition, end-of-cycle rod drop time tests and drag testing of all rodded fuel assemblies should be performed.

We agree that maintaining adequate shutdown margin and ensuring control rods perform their intended function are important. The issue of incomplete control rod insertion must be investigated and addressed. The ability to insert control rods must be demonstrated.

Point Beach Nuclear Plant has not experienced any problems with incomplete insertion. Control rod insertability is currently demonstrated by hot rod drop testing each refueling or after maintenance that could affect proper functioning. Fuel and core designs have not changed substantially and testing has not indicated an impending problem with incomplete insertion.

Performing the requested actions to demonstrate insertability will have a significant negative impact on operations at the Point Beach Nuclear Plant. Forced outages have a negative impact on plant safety and economics. We believe that the probability of an incomplete insertion is low and that the consequences would be negligible. Therefore, we are recommending several changes to the bulletin supplement to make it more effective in demonstrating control rod insertability.

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Economic Impact

The estimated shutdown time to perform the testing described in the required actions is 36 hours per test. WE expects to test every two months after an assembly exceeds the limit. Based on projected operating schedules for current core designs, there will be three tests in 1997 and five tests in 1998. The additional production costs for these tests is estimated to be $1,502,000. The economic impact for future cycles is not available at this time.

Safety Impact

The probability of an accident is increased slightly by cycling the plant from at power to shutdown and back. Plant specific Probabilistic Safety Assessment shows an increase in core damage frequency of about 0.4% per test.

Cycling the plant makes Boron and Xenon control more difficult. More waste is generated by processing more water. The consequences of a reactivity insertion accident (rod ejection) may increase. Peaking factors may be affected which could increase reactor vessel fluence.

Probability is Low

The probability of an incomplete insertion at Point Beach Nuclear Plant is small. WE has done extensive testing to demonstrate the ability to insert the rods. That testing includes the following:

Unit 1 End of cycle 23 drop test (3/30/96)
Unit 1 End of cycle 23 drag test (May 1996)
Unit 1 Beginning of cycle drag test (4/11/96)
Unit 1 Beginning of cycle drop test (4/22/96)
Unit 2 End of cycle drop test (10/5/96)
Unit 2 End of cycle drag test (October 1996)

Additional drag tests were performed on high burnup fuel assemblies in the Spent Fuel Pool.

All tests conducted were on OFA fuel. Burnups ranged from 0 to 52,000 MWD/MTU. All test results were reported to the NRC in accordance with Bulletin 96-01.

The tests showed that generally RCCA guide tube and dashpot drags increase slightly with burnup. Likewise, there is a small increase in rod drop times with increasing burnup. In no case, however, did the rod drop times exceed (or even approach) the Technical Specifications limit.

Based on the testing results, there is no indication that high burnup fuel assemblies of the type used at Point Beach will experience rod insertion problems similar to those experienced at the plants described in Bulletin 96-01.

Consequences are Negligible

The consequences of an incomplete insertion of the magnitude experienced at other plants would be negligible at Point Beach Nuclear Plant. Point Beach Nuclear Plant has a significant amount of excess shutdown margin. Over the last six cycles on each unit the smallest shutdown margin is 3.54%$\Delta\rho$

(U2C17) compared to a required shutdown margin of 2.77%Δρ. The excess is more than 27% of the required shutdown margin. These shutdown margin calculations account for one stuck rod, rod worth uncertainties and reactivity insertion from HFP to HZP conditions. The worth of the uninserted portion of the rods at South Texas and Wolf Creek is small compared to the excess shutdown margin at Point Beach Nuclear Plant.

Recommended Changes

1. Increase the burnup limit for 12 foot fuel assemblies without IFMs.

   The proposed burnup limit is much lower than the burnups at which 12 foot assemblies have experienced incomplete insertions. There have been no incomplete insertions below 42 GWD/MTU, with the exception of Ringhals 3/4 in Sweden. The Ringhals plant uses a fuel design with a higher hold down force which may lead to guide tube distortion at a lower burnup. Investigation has shown that other factors, such as power history and operating temperature, also influence control rod insertability. The vast majority of assemblies have complete insertions. Even at burnups in excess of 50 GWD/MTU the probability of an incomplete insertion is low. Point Beach Nuclear Plant has been operating annual fuel cycles with low-low leakage loading patterns for many years and has experienced no incomplete insertions.

   "Disturbing drag measurements" at some plants is given as the reason for setting such an extremely low burnup limit. Most of these "disturbing drag measurements" were taken after an assembly spent an extended period of time in the spent fuel pool where assemblies tend to bend and twist more freely. In the core, where the control rods are required to perform their intended function, the assemblies are more restrained. Drag measurements taken in the core tend to be lower. Most of the assemblies with "disturbing drag measurements" also have burnups much higher than the proposed limit. The fact is that these measurements should not be disturbing at all because none of these assemblies experienced an incomplete insertion.

   The safety significance of an incomplete insertion is based on speculation that control rods would stick high in the core. There is no evidence to support this speculation. All of the incomplete insertions have had the majority of the control rod in the core and practically all of the negative reactivity inserted. We should not be establishing regulatory policy based on unsupported speculation. Forcing plant outages for data collection will do nothing to provide supporting information for this speculation, especially at such low burnup values.

2. Decrease the testing frequency.

   There is no basis for the testing interval, every 2500 MWD/MTU, requested in the bulletin supplement. The Westinghouse Owners Group proposed a 2500 MWD/MTU minimum burnup increment for performing a second test required by the original bulletin. A second test would not be required if the plant were to experience a second forced outage in the same cycle a short time after the first test. 2500 MWD/MTU seemed to be a reasonable burnup interval over which conditions would not be expected to change significantly and additional test results would not be useful. It is completely inappropriate to use the same burnup interval to force plant outages for testing.

A more appropriate test interval would be based on measured drag data and predictions of control rod insertability. A great deal of drag data have been collected and plotted as a function of burnup. It is possible to use these data to establish a more reasonable burnup limit for each fuel type. Predictive models are being developed which account for burnup and other factors that influence drag. We should be allowed to use these predictive models to establish a burnup limit at which an assembly may be susceptible to incomplete insertion. Testing at regular intervals after the assembly exceeds a limit based on measured drag data or predictions is a more appropriate approach.

The test interval should also account for the number of assemblies susceptible to incomplete insertion compared to the available shutdown margin. It is not reasonable to force a plant to shutdown for testing when a single assembly exceeds its burnup limit and sufficient shutdown margin exists to account for two adjacent control rods stuck in the fully withdrawn position. This is an extreme example but not impossible for plants with a center assembly under a control rod. The requirements for testing should consider the safety significance of the specific situation to avoid an unnecessary forced outage.

3. Obtain more data on high burnup assemblies.

The bulletin supplement forces utilities to collect, summarize and submit drop test data for assemblies with relatively low burnup. Although it is useful information for confirming complete insertion, it is of limited use in resolving the issue.

The ability to insert control rods must be demonstrated. But it is not reasonable to believe that Point Beach Nuclear Plant control rods in assemblies at a burnup of 35,000 MWD/MTU will stick. It is even less reasonable to believe that they will stick in sufficient number or in locations that will threaten shutdown limits. Point Beach Nuclear Plant has a long history of completely inserting control rods into assemblies at all warranted burnups. Fuel designs and core loading patterns have not changed significantly over the last several years to support any new concerns for the current cycles.

We are more interested in collecting data to support an industry effort to understand and resolve the incomplete rod insertion issue. End of cycle drag testing is probably the most useful data to collect. Drag tests can characterize the magnitude and location of guide thimble distortion. Testing at end of cycle maximizes the assembly burnup and more data are needed at high burnup values. Drag testing could even be done on high burnup assemblies in non-rodded locations.

The bulletin supplement should be changed to focus industry resources on identifying the cause and changing fuel assembly design to eliminate incomplete insertions.

4. Provide for closure of the issue.

The only mechanisms for closure of the issue in the bulletin supplement are to avoid exceeding the burnup limits or perform a rigorous engineering analysis. Without closure, the requirement to test frequently at low burnups continues to decommissioning.

Closure by not exceeding the proposed burnup limit does not appear to be feasible for Point Beach Nuclear Plant. Not exceeding the burnup limit would restrict core designs and most likely increase the number of fuel assemblies in each reload. We have already taken steps to minimize the burnup of assemblies under RCCAs. These steps also minimize any negative impact on other safety issues such as reactor vessel fluence and the amount of spent fuel created. Unfortunately, they do not eliminate the need for forced outages to test at the proposed burnup limit.

The requirements for closure by rigorous engineering analysis are not very clear in the bulletin supplement. The WOG and Westinghouse have done a significant amount of data collection and analysis, but it does not appear to be achieving closure of the issue. Instead, as described in the preceding paragraphs, the data are being used inappropriately to establish new and unreasonable burnup limits and testing requirements.

The bulletin supplement should be changed to provide an incentive for resolution of the issue. It could provide more details of what the NRC considers a rigorous engineering analysis. It could provide a date at which the testing requirements of the bulletin would end and the need for additional testing would be re-evaluated.

Wisconsin Electric has taken an active role in working with the NRC to resolve the incomplete rod insertion issue. Adequate shutdown margin must be maintained and the ability to insert control rods must be demonstrated. We are concerned that performing the requested actions in the proposed bulletin supplement will have a significant negative impact on plant safety and economics. The probability of an incomplete insertion at Point Beach Nuclear Plant is low and the consequences of a reasonably anticipated incomplete insertion are negligible. Therefore, we have recommended several changes to the bulletin supplement for your consideration to make it more effective in managing the incomplete rod insertion issue.

Sincerely,

Rick Kohrt
Senior Engineer

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cc: NRC Regional Administrator
NRC Resident Inspector
Public Service Commission of Wisconsin
Public Service Commission of Wisconsin (Attn: Paul Kitzenbel)