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62 FR 26729
May 20, 1997

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SIEMENS

June 18, 1997
HDC:97:059

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

Dear Sir:

Comments on Proposed Generic Communication: Control Rod Insertion Problems

Ref.: 1. Federal Register, Vol. 62, No. 97, "Proposed Generic Communication: Control Rod Insertion Problems," May 20, 1997, pp. 27629-27632.

The referenced Federal Register notice published a proposed NRC Bulletin 96-01, Supplement 1, "Control Rod Insertion Problems" for comment. Comments were requested by June 19, 1997.

We at Siemens Power Corporation have reviewed the draft supplement and have the attached comments.

If you have any questions, or if additional information is needed, please contact me at (509) 375-8563.

Very truly yours,

H. Donald Curet, Manager
Product Licensing

/smg

Attachment

cc: Ms. M. S. Chatterton (USNRC)
Mr. E. Y. Wang (USNRC)

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Attachment

In the Description of Circumstances section of the Supplement, the South Texas and Wolf Creek events were cited. There was also an event in Europe with Fragema designed fuel. The common behavior in all of these occurrences was the distortion of the guide tubes sufficient to impede control rod insertion. In all cases, the source of the distortion resulted from the inability of the guide tubes to withstand, without distortion, the compressive axial loads that occurred.

In a PWR the compressive loads on the fuel assembly, and thus the guide tubes, results from the fit of the fuel assembly between the upper and lower core support plates. In most PWRs, the fuel assembly is designed with springs on the top of the assembly so that when positioned between the core support plates, there will be some deflection of the springs, thereby creating a compressive load on the assembly. As irradiation occurs, the assembly length increases. The result of this length increase is an increase in the compressive load on the fuel assembly structure.

Therefore, although the control rod insertion problem appears at elevated exposures (i.e., with increased growth), the root cause of the problem is the design, not irradiation exposure. The design should be capable of withstanding the holddown loads that will occur during the design lifetime. For the European event, the holddown springs were too strong. Thus, when deflection of the springs occurred, the guide tubes could not withstand the added load. The South Texas event, as noted in the draft Supplement, occurred due to "inadequate resistance to buckling in the fuel assembly design under required loads and burnup." For the Wolf Creek event, the compressive axial load also exceeded the buckling strength of the guide tubes. This occurred because of inadequate design allowance for assembly growth at the design burnups, or inadequate strength of the guide tubes for the compressive loads, or excessive forces applied by the holddown springs, or due to a combination of these design variables. Thus for all of these events, the design evaluation was inadequate to account for axial compressive loads on the guide tubes that existed during the design life of the fuel.

If control rod insertion delays are evaluated as a compressive load problem, the occurrence can be avoided using appropriate, conservative design models. Sufficient guide tube buckling resistance and appropriate compressive holddown spring loads to preclude the problem can be demonstrated. This evaluation must be based on material performance models that are developed for specific vendor fuel designs from applicable out-of-reactor and in-reactor test data. The appropriateness of the test data includes assurance that the resulting performance model is conservative for the conditions for which it will be used.

Specific comments on the text of the draft Supplement are:

1. Information about the European experience should be included.

2. In the Discussion Section the Supplement states: "...all designs that incorporate small-diameter thimble tubes need to be examined, since these small-diameter thimble tubes appear to be susceptible to distortion and thus susceptible to control rod binding problems at high burnup levels." SPC agrees that the small-diameter thimble tube designs need to be examined for the capability to withstand the compressive loads for

its design lifetime. However, the burnup levels are not necessarily high burnup, as demonstrated by the South Texas and European experience. This difficulty is not a high burnup problem but a guide tube structural design (compressive force) problem. Therefore the phrase "at high burnup" should be deleted.

3. In the Discussion Section the Supplement states: "...The drag measurements resulted in dashpot drag above the criteria in three plants and higher than normal drag in an additional six plants. Thimble tube measurements were above the criteria in six plants and high in three other plants. In addition, during measurements in the spent fuel pool control rods could not be fully inserted under their own weight in several plants." This information relates to a specific vendor's design, and the criteria referred to are not NRC criteria, but vendor criteria that may or may not be applicable to other designs. In general, these indications support the discussion above that the insertion difficulties are a design issue, not a high burnup issue.

4. In the Safety Assessment Section, the Supplement states: "The staff considers the potential for thimble tube distortion caused by high burnup and excessive compressive loads...a safety issue." Based on the instances where the events occurred, the potential for thimble tube distortion is caused by excessive compressive loads, not by high burnup. At South Texas, the distortion occurred at less than 30 GWd/MTU which is not in the high burnup region. The reference to high burnup causing the distortion should be deleted.

5. In the Safety Assessment, the NRC notes that the problem has only occurred in Zircaloy tubes, but that other materials may be susceptible. SPC agrees with this assessment because we consider the problem to be due to inadequacy in the design methods and performance models, not due to an inadequacy in the materials of construction.