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September 2, 1982

Mr. Darrell G. Eisenhut
Director of Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Subject: Pressurized Water Reactor Steam Generators
Comments on Proposed Generic Requirements

Dear Mr. Eisenhut:

At a meeting in Bethesda on July 29, 1982, owners of PWR units were offered a chance to comment on the draft set of new generic requirements for steam generators. Attached are the comments of Duke Power Company on these new requirements.

We appreciate the opportunity to comment on these requirements. The NRC and the utilities have a mutual interest in the improvement of steam generator performance, and we consider the cooperative spirit which the NRC has exhibited in soliciting our comments in this manner to represent a significant step forward.

We would be pleased to meet with you to discuss these comments or other aspects of steam generator regulation. Questions on these comments may be directed to W. A. Haller (704) 373-8506.

Very truly yours,

Hal B. Tucker by WAH

Hal B. Tucker

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Attachment

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Comments on Proposed Changes to Regulatory Requirements

Concerning Steam Generators

II.1 Prevention and Detection of Loose Parts and Foreign Objects

1. Any required visual inspection of the steam generator secondary should consider the geometric differences between recirculating and once through steam generators. In the OTSG, an orifice plate in the lower downcomer restricts access from the downcomer to the tube bundle; therefore, loose parts originating in the downcomer area are unlikely to come in contact with the tubes. The area between the inside of the tube shroud and the outside of the tube bundle is very restricted, and a complete visual inspection around the bundle periphery, as would be required for recirculating steam generators, may not be possible in a OTSG.

2. It is our understanding that a complete secondary inspection is to be required only once, with the ingress of foreign objects to be controlled thereafter by procedure and inspection following work inside the steam generators. It should be stated that inspection following steam generator maintenance is limited to the appropriate area. For example, one would not perform an inspection of the top of the tubesheet if maintenance were performed on the steam separators.

3. The addition of steam generator secondary side loose parts monitoring cannot be justified on a cost/benefit basis. Ample warning of the presence of a loose part at Ginna was available from the number and progression of eddy current signals. It took over six years of relatively heavy interaction between the loose parts and the tubes, then ultimately the complete failure of a tube, before a tube rupture occurred. Duke Power Company has installed two different types of steam generator tube vibration monitoring devices on the steam generators at McGuire 1. These devices are similar to currently used loose parts monitoring devices. Neither type of device successfully detected the tube to tube support plate impacts which we now know occur in all such steam generators at high power. Indeed, the devices were rendered almost unusable due to the high levels of noise in a steam generator caused by highly turbulent flow and the boiling process. It is apparent from the industry experience that the other new requirements proposed by NRC are sufficient, specifically

   a. Visual inspections of steam generator secondaries when appropriately coupled with tight controls on the ingress of material which could become or create loose parts, and

   b. prompt followup action for any eddy current signal which could be associated with the presence of a loose part and with which no previously identified degradation mechanism can be associated.

   Had these two actions been followed at Ginna and Prairie Island, the tube ruptures due to foreign objects would have been prevented. Complex electronic monitoring is therefore unnecessary and should not be required.

II.2 Stabilization and Monitoring of Degraded Tubes

Duke Power has had a policy of stabilizing damaged tubes in conjunction with removing them from service if the damage mechanism is such that such stabilization is advisable. It should be noted that, except for the case of loose part interaction, very few damage mechanisms are progressive to the point of threatening adjacent tubes. Out of over 20,000 tubes plugged in the industry, we know of no case other than at Ginna when a previously plugged tube became a problem. The wear indications which have been observed at McGuire in the preheat steam generators do not fall into the catagory of tubes requiring stabilization because the damage mechanism cannot create a severed tube. In summary, we have no specific objection to a stabilization requirement except that we would expect it to have very limited application and therefore may not be justified for inclusion in Standard Technical Specifications. Incidently, the circumferential cracking on the tube lane which has led to our use of stabilizers in plugged tubes at Oconee has never occurred lower than the fifteenth tube support plate vice the fourteenth as stated in the draft requirements.

II.3 Inservice Inspection Program

We conclude that the new inservice inspection requirements have several serious deficiencies which will tend to produce the opposite effect from that intended by NRC. Specifically,

1. The jump from category C1 directly to category C3 creates a very heavy burden on a utility. Eddy current inspection costs and time required will increase by a factor of 10 if C3 is required. This is such a large disincentive that no utility would ever consider inspecting more than the absolute minimum number of tubes required. At Oconee, we have traditionally selected much larger initial sample sizes (typically 12% - 50%) because of our concern for accurate characterization of the condition of the steam generator tube bundle. As long as some intermediate inspection step between C1 and C3 existed, the risk we took by performing a more thorough inspection than the minimum required (that is, the risk of having to inspect all tubes) was justified by the increased confidence gained by larger sample sizes. We will now be unable to take the risk of inspecting beyond the minimum required sample size, even when we conclude that a 3% sample is not adequate. If the conclusion of NRC is that category C2 must be eliminated, we recommend the following changes be made to the requirement:

   a. In selecting the 3% random sample for inservice inspection, we be allowed to exclude all tubes found to be degraded at the last inspection. All previously degraded tubes would be placed in a separate group and receive 100% inspection.

   b. If we elect to inspect a larger random sample, or to do a concentrated inspection in a particular region of the steam generator, only the first 3% of the random sample would be

counted as applying toward determination of a jump from C1 to C3. All additional tube inspections would be considered for diagnostic purposes only and should any pluggable indications be found in tube sampling beyond the initial 3%, they would be plugged without resulting in additional inspection requirements.

NRC should recognize that every utility has an incentive to avoid shutdowns and inspections due to tube leakage. It is for that reason that utilities will make reasonable efforts to determine the condition of their steam generator tubes with a high degree of confidence. The requirements for ISI should reinforce this utility goal, not detract from it by removing the incentive for adequate tube bundle inspection. We urge that NRC reconsider their proposed change to the steam generator ISI requirement.

2. There appears to be inconsistency in the ISI requirements as written when comparing various types of units. At Oconee, where there are 30,000 steam generator tubes, a 3% sample of one steam generator is approximayely 450 tubes. At McGuire, with approximately 18,000 steam generator tubes, a 3% sample of one steam generator is approximately 140 tubes. It would appear to be more logical to base initial inspection sizes on percent of tube population rather than percent of one steam generator. This will avoid an unnecessary penalty on plants with two loops.

3. The eddy current techniques now in common use are adequate for the detection and characterization of denting. This is proven by the recent experience at Sequoyah 1 where minor denting was detected during a routine eddy current inspection. It is only in the case of severe denting, wherein a conventional eddy current probe cannot be passed through the tube, that a more sophisticated form of inspection such as profilometry is needed. Severe denting has affected very few units in this country, and the worst cases have now been replaced. The results of research on denting have identified the causes and cures - one result has been the development of the EPRI Secondary Water Chemistry Guidelines. Serious denting can therefore be considered a thing of the past, and no useful purpose would be served by incorporating specific requirements for denting into Standard Technical Specifications.

   It should also be noted that other phenomena, such as water hammers and manufacturing defects, can create diametral distortion of steam generator tubes. Any requirements should distinguish carefully between corrosion induced denting as seen at Surry and Turkey Point and the myriad of other forms of tube degradation phenomena which may result in deviation from circular cross section.

4. The new requirement for steam generator ISI following any shutdown for tube leakage represents a substantial burden when coupled with the proposed deletion of intermediate sampling categories. During an outage for leak repair, all unit downtime is critical path time. It is very important, therefore, to minimize the amount of steam generator inspection required consistent with an accurate assessment of tube bundle condition. We recommend the following actions which we believe will be adequate to accomplish this objective:

   a. In a leaker repair outage, inspection should be required only in the particular steam generator in which the leak occurred.

   b. If the leaker belongs to a generic group of tubes, such as those which were found to be degraded in previous inspections, an adequate inspection would consist of 100% of that generic group.

   c. In the case where b. above does not apply, the basis for selection of the 3% sample should exclude tubes found to be degraded in previous inspections. All previously degraded tubes would receive 100% inspection.

5. It should be clarified to what extent reporting is required prior to restart. It generally takes several weeks to characterize completely a set of eddy current data tapes. The first available report can, at best, be just a listing of the field calls made by the inspector and in indication of which tubes were plugged. We have no objections to furnishing such a report, but NRC should recognize the limitations of the information available during the outage and prior to a more thorough review of the eddy current data.

In order for NRC to assess the impact of changes in ISI requirements, we provide the following impact estimates: Eddy current inspection of 100% of the tubes at Oconee or McGuire (operating plant) $500K, 50 days, and 60 man-rem (these are minimums - if any pluggable indications are found, these numbers increase substantially); analysis to establish the maximum allowable number of tube failures in conjunction with design basis events, $300K plus plant specific analysis.

II.4 Improved Eddy Current Techniques

1. We question whether it is appropriate for NRC to regulate the specific application of eddy current techniques in a generic manner. There is a wide variety of eddy current techniques available, some proven over years of use and others of a more experimental nature. The propriety of the use of a particular technique depends on many factors; among these are metallurgical characteristics of the steam generator tubing, composition of chemical and metallic deposits on the steam generator secondary, nature and extent of the degradation mechanisms active in the steam generator, and specific steam generator

characterizations desired, such as sludge depths. These factors vary from plant to plant and even between steam generators at the same plant. Rather than require generic application of specific eddy current techniques, we recommend that NRC require each utility to establish a program of eddy current inspection using techniques appropriate to their situation and needs. This program would tend to change over the years as good experience or bad experience would dictate more related or more stringent requirements. Eddy current technology remains both art and science, but is progressing through an exciting stage of technical development. We believe that any attempt by NRC to regulate or restrict the application of eddy current would have the doubly adverse effect of forcing many utilities to perform more complex, and therefore more costly, inspections than is necessary while inhibiting the progress of eddy current development by adversely impacting the incentive to adopt and apply the latest techniques as they become available.

2. The general use of any eddy current standard other than that of ASME can be justified only if the ASME standard is proven inadequate. It is only in the case of the circumferential wear occurring in preheat steam generators that Duke Power has found another type of standard to be useful. A wear standard was used at Oconee in the early days but later discontinued because it was not representative of the types of tube degradation found. In any case, the use of the drilled hole ASME standard for the McGuire tube wear pattern resulted in conservative errors. We conclude that any changes to the eddy current calibration standard should be as a result of action by the appropriate Section XI code committee; NRC should not interfere in the voluntary standard development process in this way.

II.5 Primary to Secondary Leakage Limits

No comments.

II.6 Not included in material given to utilities at July 29, 1982, meeting.

II.7 Secondary Water Chemistry Program

Duke agrees in general with the new requirement. It should be noted that the guidelines represent what the committee concluded would need to be achieved in a secondary chemistry program in order to protect the steam generators and main turbine from damage due to corrosion. Strict adherence to the guidelines does not guarantee that these components will be corrosion free; neither will taking exception to the guidelines in some places doom a utility to suffer significant corrosion damage. Every utility is interested in ensuring 40 years of service for their steam generators. The best way NRC can help to improve secondary chemistry programs is through flexibility in its requirements and a spirit of cooperation in dealing with problems.

II.8 Condenser Inservice Inspection Program

Duke has no objections to this program as long as frequency and extent of inspection is tied to condenser performance. Any program of condenser inspection should allow for reduction in the frequency and extent of inspection as experience improves.

II.9 Inspection Ports

Installation of inspection ports in new steam generators appears to be unjustifiable on the basis of cost/benefit. The costs of adding steam generator ports in the field are substantial - recent work by both B&W and Westinghouse is around $100K per steam generator. In the absence of degradation mechanisms, we can ascertain no particular benefits. There are no known steam generator tube degradation mechanisms, other than extreme cases of denting, for which an quantitative assessment may be made by use of any inspection port. In all cases of of known degradation mechanisms, including severe denting, non destructive examination techniques such as eddy current and profilometry have proven to be adequate to assess tube condition and identify damaged tubes for timely removal from service. Installation of inspection ports in a new steam generator without knowledge of any specific degradation mechanism, is likely to result in the location of the ports in the wrong place or in making them the wrong size. All penetrations of the steam generator shell represent a risk in terms of the introduction of debris and foreign objects or the possibility of a pressure boundary leak. We recommend that NRC require the installation of inspection ports if and only if inspection ports would be necessary in the assessment of the nature and extent of an ongoing tube degradation mechanism. This is the course of action followed at Ginna and ANO-1. NRC should also not overestimate the impact of later installation of inspection ports at the time they are needed as opposed to installation in a new unit. Once a steam generator has been installed, there is not a significant additional impact in cutting a hole in the shell later after operation has begun. Actually, because operational units typically have much better cleanliness control and available layup systems, operational units are better prepared to install inspection ports than units under construction. We recommend that NRC drop the requirement for steam generator inspection ports in new steam generators.