VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

W. L. STEWART
VICE PRESIDENT
NUCLEAR OPERATIONS

November 5, 1985

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
Attn: Mr. Steven A. Varga, Chief
Operating Reactors Branch No. 1
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Serial No. 85-136
NO/JDH:acm
Docket Nos. 50-280
50-281
License Nos. DPR-32
DPR-37

Gentlemen:

VIRGINIA ELECTRIC AND POWER COMPANY
SURRY POWER STATION UNIT NOS. 1 AND 2
REQUEST FOR PARTIAL EXEMPTION FROM GENERAL DESIGN CRITERION 4

Virginia Electric and Power Company, pursuant to 10 CFR 50.12(a), requests an exemption from General Design Criterion (GDC) 4 to the extent that protection against the dynamic effects of postulated pipe rupture on primary system components and piping may be eliminated. This request is applicable to Surry Power Station Unit Nos. 1 and 2. The scope and justification for the request is provided in an Attachment which addresses the NRC concerns identified in Generic Letter 84-04.

NRC Generic letter 84-04, dated February 1, 1984, informed licensees that NRC had completed its review of several Westinghouse reports dealing with elimination of postulated pipe breaks in PWR primary main loops. The Westinghouse reports had been submitted to address asymmetric blowdown loads on PWR primary systems that resulted from a limited number of discrete break locations as stipulated in NUREG-0609, the NRC staff's resolution of Unresolved Safety Issue A-2. The generic letter stated that an acceptable technical basis had been provided so that the asymmetric blowdown loads resulting from double-ended pipe breaks in main coolant loop piping need not be considered as a design basis for certain plants (including Surry Units 1 and 2) provided two conditions were met.

In addition, Generic Letter 84-04 stated that NRC authorization to remove protection against asymmetric dynamic loads would require an exemption from General Design Criterion (GDC) 4. Licensees were required to justify such exemptions on a plant-by-plant basis. Guidance was provided regarding information that licensees should provide when requesting such an exemption.

Recently, the NRC has proposed (50 FR 27006) to revise GDC 4 to allow demonstration of piping integrity by analyses to serve as a basis for excluding consideration of dynamic effects associated with certain pipe ruptures. In a letter dated August 30, 1985 (Serial No. 85-549), we submitted several comments on the proposed rule. The primary thrust of

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our comment was that snubbers installed to protect primary system components and piping against the dynamic effects of a primary system large bore pipe rupture should be explicitly included in the discussion of the proposed rule.

Based on subsequent discussions with the NRC Surry Project Manager, we understand that a substantial number of comments have been received on the proposed GDC-4 revision and that additional time may be required before the Commission can take further action on the rule.

It had been our intent to make use of the relief offered in Generic Letter 84-04 or, alternately, through the revision to GDC-4, for the 1986 Surry refueling outages (currently scheduled for 6/6/86-7/24/86 (Unit 1) and 10/17/86-12/11/86 (Unit 2)). Because resolution of the comments regarding GDC-4 and issuance of a final rule appear to be delayed, we have concluded that requesting an exemption from GDC-4 is appropriate at this time.

It is our desire to utilize this potential relief during the 1986 Surry refueling outages to remove eighteen large-bore snubbers per unit. Final documentation of the evaluations of the three topics of concern discussed in the Attachment is still underway. Submittal of these evaluations to the NRC will be made by November 29, 1985.

To assure that the information being developed for these submittals is consistent the NRC requirements to fully address the issues, we propose to meet with you prior to completing our submittals. We will contact the NRC Surry Project Manager to work out specific arrangements for this meeting.

To take advantage of the relief offered through Generic Letter 84-04 during the 1986 Surry refueling outages, your approval of the exemption request by early February, 1986 is requested. If you have any questions or require additional information to support this effort, please contact us immediately.

Pursuant to 10 CFR 170, an Application Fee of $150 is also enclosed.

Very truly yours,

W. L. Stewart

Attachments:

1. Scope and Justification for Exemption Request
2. Application Fee

cc: Dr. J. Nelson Grace
Regional Administrator

Mr. D. J. Burke
NRC Resident Inspector
Surry Power Station

ATTACHMENT

Scope and Justification for
Exemption Request

ATTACHMENT
REQUEST FOR EXEMPTION FROM A PORTION OF 10CFR50, APPENDIX A,
GENERAL DESIGN CRITERION 4

SCOPE OF EXEMPTION REQUEST

Based on Generic Letter 84-04 (Reference 1), the Virginia Electric and Power Company requests exemption, pursuant to 10 CFR 50.12(a), from a portion of General Design Criterion 4 (GDC-4) for Surry Power Station Units 1 and 2. Specifically, we request exemption from that portion of GDC-4 which requires protection of the reactor coolant system (RCS) from the dynamic effects associated with rupture of RCS primary piping.

Approval of this exemption will eliminate the need for consideration of postulated breaks in the RCS primary loop piping and its associated dynamic and other effects such as pipe whip, jet impingement, asymmetric pressure loading, primary component sub-compartment pressurization.

Approval of this request will allow us to eliminate snubbers which are required solely to mitigate a pipe rupture event. Specifically:

- Eliminate two snubbers per loop which are parallel to the reactor coolant cold leg at the reactor coolant pump support.
- Eliminate four snubbers per loop which are parallel to the reactor coolant hot legs at the steam generator lower support ring.
- Eliminate the LOCA pipe rupture loads postulated for the four snubbers per loop which are at Steam Generator upper support ring.

Granting this exemption request would not affect:

- ECCS design basis.
- Reactor building and compartment design basis.
- Equipment qualification basis.
- Engineered safety feature systems response.

JUSTIFICATION FOR REQUEST

This request is based upon the use of advanced fracture mechanics technology as applied to primary system piping in Westinghouse Electric Corporation topical reports WCAP-9558, Revision 2 (Reference 2, proprietary) and WCAP-9787, Revision 0 (Reference 3, proprietary) and is in response to Generic Letter 84-04.

Generic Letter 84-04 provided the NRC staff Safety Evaluation Report for analysis of materials submitted for a group of utilities operating PWR's to resolve generic issue A-2. The staff evaluation concluded that provided certain conditions were met, an acceptable technical basis exists so that asymmetric blowdown loads resulting from large breaks in main coolant loop piping need not be considered as a design basis for the sixteen domestic plants for which the analysis applies.

Westinghouse topical reports WCAP-9558, Revision 2, and WCAP-9787, Revision 0, in association with the other references provide a substantial and adequate basis for limiting postulated design basis flaws in stainless steel reactor coolant system piping.

The bases for the request for Surry Units 1 and 2 are as follows:

1. Extensive operating experience has demonstrated the integrity of the PWR reactor coolant system primary loop including the fact that there has never been a leakage crack.

2. Pre-service and in-service inspections performed on the RCS piping minimize the possibility of flaws existing in such piping. The application of advanced fracture mechanics has demonstrated that if such flaws exist they will not grow to a leakage crack when subjected to the worst case loading condition over the life of the plant.

3. If a large through-wall flaw is postulated, large margins against unstable crack extension exist for the stainless steel primary coolant piping even if subjected to the safe shutdown earthquake in combination with the loads associated with normal operation.

The evaluation in the Westinghouse reports includes structural and fracture mechanics analyses using generic bounding data (loads and material properties) for all sixteen of the A-2 plants. The bounding loads and properties assumed are such that even with removal of the subject large bore snubbers, Surry Units 1 and 2 are still bounded by the Westinghouse generic reports.

In accordance with Generic Letter 84-04, additional information will be submitted addressing loading evaluation, leakage detection systems evaluation, and safety balance assessment. These are summarized below.

1. Loading Evaluation:

   It is understood that high margins must be retained in the primary component supports. This is indicated in the ACRS letter of June 14, 1983, and is based upon the findings of NUREG/CR-2189. However, it is our understanding that these margins are not to protect against the effects of pipe rupture, but rather to protect against other effects, particularly seismic.

   The snubbers to be eliminated are parallel to the loop piping, and the axial stiffness of the snubbers is small compared to that of the parallel loop piping. Seismic analyses of the primary coolant system with the modified support design demonstrate that acceptable stress levels are maintained.

   A complete loading evaluation will be submitted by November 29, 1985. To satisfy the first condition stipulated in Generic letter 84-04, this evaluation in addition to demonstrating adequate seismic margins will confirm that maximum moment in the pipe resulting from the elimination of the designated snubbers is still within the envelope moment considered in the safety evaluation provided in Generic Letter 84-04.

2. Leakage Detection Systems Evaluation

The second condition of Generic Letter 84-04 requires that leakage detection systems exist to detect postulated flaws utilizing guidance from Regulatory Guide 1.45, with exception of seismic equipment qualification for the airborne particulate monitor.

The Surry systems for Reactor Coolant leakage detection are described in UFSAR Section 4.2.7. Surry Units 1 and 2 each have several leak detection systems with at least one that is capable of detecting a one gallon per minute leak in four hours. Conservative calculations of leakage from flaws shown to be stable in WCAP-9558, Revision 2 and WCAP-9787, Revision 0, indicate that leak flow rates one to two orders of magnitude greater than one gallon per minute can be expected if these flaws exist in reactor coolant piping (Reference 4). The equipment provided for leak detection, the means of quantifying reactor coolant system leakage and leak detection operability requirements are delineated in Section 3.1 of the Surry 1 and 2 Technical Specifications. Because the Technical Specifications require the operability of leak detection systems and because these systems, with margin, are capable of detecting leakage from postulated through-wall flaws, adequate leak detection capability exists to satisfy the conditions of approval.

A more complete evaluation of Leakage Detection Systems will be submitted by November 29, 1985.

3. Safety Balance Assessment

The NRC staff Safety Evaluation Report (SER) attached to Generic Letter 84-04 assessed the relative costs and public risks of using advanced fracture mechanics techniques to justify revised design bases for several operating PWR's. The results of the assessment indicate that the effects of loss-of-coolant accidents which occur as a result of the postulated pipe ruptures, and which have been previously analyzed, are little changed. Only a small reduction in core melt frequency (1×10^{-7} events/reactor year) and only a small reduction in public risk ($3\frac{1}{2}$ man-Rem total for the nominal case for all 16 plants considered) would be achieved if modifications to the plants were required in lieu of using the advanced fracture mechanics techniques. WCAP-9558, Revision 2, and WCAP-9787, Revision 0, established that there is a large margin against unstable extension of a crack in reactor coolant system piping.

A detailed value-impact analysis was performed by Pacific Northwest Laboratory (PNL) and provided with Generic Letter 84-04. This analysis assessed the relative costs of using advanced fracture mechanics techniques to justify design bases for several operating PWR's instead of modifying these plants to conform to piping restraint designs used in more recent plants. This analysis clearly establishes that the costs, both in dollars and radiation exposure, are greater for modifying the plants than are the money and radiation exposure costs due to pipe ruptures considering the low probability of such events. We support the conclusions reached in this analysis.

The PNL value-impact analysis is not specific for each of the evaluated plants, but the analysis inputs are reasonable. Estimates of occupational radiation exposure rates conservatively correspond with dose rates that are experienced at Surry Units 1 and 2 in locations where modifications would be required. Portions of the estimates of modification costs and manhours of occupational exposure are based on estimates from utilities with operating PWR's and thus should be realistic. It should be noted, however, that the cost estimates are no longer current and are, therefore, probably low. The estimates of guillotine pipe break frequency contained in the analysis are probably too high. The estimates are based on data which is not specific to guillotine breaks of large diameter, stainless steel, nuclear grade piping double-ended pipe ruptures. All of these factors lead to the conclusion that the PNL analysis result is correct, but that the analysis understates the relative value of using deterministic techniques to define design bases for the affected plants. The value-impact analysis clearly establishes that advanced fracture mechanics analysis is an acceptable alternative to designing and installing plant modifications to mitigate the consequences of unrealistically postulated double-ended guillotine breaks.

The safety balance review performed by PNL reviewed only the impact of not installing pipe rupture restraints and jet impingement shields; elimination of large bore snubbers which serve only as restraints for pipe rupture was not considered. However, our experience indicates that even more dramatic savings in man-Rem exposure are possible through their elimination. Currently, our experience indicates that removal and reinstallation of a single pair of large bore snubbers on the reactor coolant pump support can result in as much as 100 man-Rem of exposure during a single refueling outage. When a number of these large bore snubbers are removed for functional testing and maintenance, they can account for as much as one-fifth of the total radiation exposure received during a refueling outage, as well as a maintenance expense in the millions of dollars.

The Surry Technical Specifications require periodic removal of hydraulic snubbers, which are considered active components, for functional tests and implementation of a seal service life program. Large bore snubbers were not designed for quick removal, ease of inspection, or for minimizing radiation exposure during removal/inspection activities. The man-Rem burden associated with maintenance of these large bore snubbers is extremely high due to their location in the highest radiation areas of the plant and their massive size. Because of plant equipment congestion, removal of other permanent plant equipment often occurs in the process of removing these snubbers.

An additional contribution to unnecessary radiation exposure, cost, and reduced plant availability is the possibility of visual inspections resulting in an incorrect conclusion that the large bore snubber hydraulic systems are not functional. While this type of incorrect conclusion for small bore snubbers can easily be resolved by functional testing, such on-site functional testing is not possible for large size major equipment support snubbers due both to physical size and test load capacity. Therefore, more frequent visual

inspections are required resulting in more frequent plant outages, with resulting additional exposure.

When these factors are taken into account, the safety balance will show the dramatic benefits of eliminating the large bore snubbers in accordance with this exemption request. A more definitive safety-balance assessment specific to Surry including the removal of the eighteen large bore snubbers per unit will be submitted by November 29, 1985.

References:

1. Generic Letter 84-04, February 1, 1984, "Safety Evaluation of Westinghouse Topical Reports Dealing with Elimination of Postulated Pipe Breaks in PWR Primary Main Loops."

2. WCAP-9558, Revision 2 (May 1981) "Mechanistic Fracture Evaluation of Reactor Coolant Pipe Containing a Postulated Circumferential Through-wall Crack."

3. WCAP-9787 (May 1981) "Tensile and Toughness Properties of Primary Piping Weld Metal for Use in Mechanistic Fracture Evaluation."

4. Letter Report NS-EPR-2519, E.P. Rahe to D. G. Eisenhut (November 10, 1981) Westinghouse Response to Questions and Comments Raised by Members of ACRS Subcommittee on Metal Components During the Westinghouse Presentation on September 25, 1981.