

November 20, 1996

Mr. James M. Taylor  
Executive Director for Operations  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555-0001

Dear Mr. Taylor:

SUBJECT: PROPOSED RULE ON STEAM GENERATOR INTEGRITY

During the 436th meeting of the Advisory Committee on Reactor Safeguards, November 7-9, 1996, we reviewed the technical bases for the proposed steam generator integrity rule and an associated regulatory guide. During the 432nd meeting of the ACRS, June 12-14, 1996, and meetings of the Joint Subcommittees on Materials & Metallurgy and on Severe Accidents, June 3-4 and November 5-6, 1996, we heard presentations on subjects related to this matter. During these reviews, we had the benefit of discussions with representatives of the staff, the Nuclear Energy Institute, and the Electric Power Research Institute, as well as the author of a differing professional opinion. We also had the benefit of the documents referenced.

The proposed steam generator integrity rule is intended to provide a risk-informed and performance-based regulation to replace an existing prescriptive regulation. In its present form, the rule is a performance-based regulation almost completely divorced from any direct relation to risk objectives. Such a performance-based rule proliferates the incoherence problems of the present deterministic approach. The proposed rule preserves a tenuous connection between "design-basis space" and "risk space" without clearly articulating the risk objectives.

Some of the characteristics exhibited in the development process of the rule and regulatory guide include the following:

- . difficulty in reaching agreement on the performance criteria,
- . incomplete and sometimes perfunctory analyses required to provide an assessment of relative risk,
- . reliance on core-damage frequency alone as an indicator of risk, and
- . recourse to defense-in-depth without specific criteria for its use.

We believe that more direct consideration of risk could have

avoided some of these difficulties.

A controversial element of the proposed rule and regulatory guide is the introduction of severe accident issues into an area that has been exclusively resolved by using a design-basis analysis. This extension of the scope of accident analysis is necessary to make risk-informed regulatory decisions and is part of the cost of moving toward risk-informed regulation. Since licensees have done risk-informed analyses for the Individual Plant Examination (IPE) process, we believe that the analysis for addressing severe accident events should not be overly burdensome to them.

Steam generator tube ruptures are small contributors to the total core-damage frequency, but may be risk significant due to containment bypass effects. In previous analyses, the staff performed limited assessments of primary side fission product attenuation and neglected secondary side attenuation. The regulatory guide now proposes that the licensees deal with the risk of a thermally induced tube failure either by demonstrating that the frequency of the initiating events is sufficiently low (10<sup>-6</sup>/reactor year) or by demonstrating that the conditional probability of tube failure, given that an initiating event has occurred, is low (on the order of 0.1). We believe that licensees should also be given the option to demonstrate that, even if thermally induced tube ruptures occur, the associated risk is low when a more realistic treatment of fission product attenuation is made.

We are concerned that the proposed regulatory guide, as presented, could send the wrong message to licensees that risk-informed and performance-based requirements are add-ons to the traditional design-basis accident approach and can only result in an additional burden. We believe that to be risk informed and performance based, the regulatory guide should begin with a clear statement of its objectives, followed by a statement of the performance criteria and the guidelines for meeting the criteria. We note that the staff has stated that the proposed performance criteria have been derived from risk analyses, but we have not seen these analyses. Rewriting the regulatory guide is not a trivial task, but could result in a regulatory framework that could be used as a model for future risk-informed and performance-based rulemaking efforts.

In other applications of performance-based regulation such as the Maintenance Rule, the licensees have been permitted to determine appropriate performance criteria and have been given more flexibility in developing the methodology used to determine whether the criteria have been met. For the steam generator rule, the staff has concluded that it should approve the performance criteria that are proposed by licensees to implement the steam generator rule. We agree with the decision of the staff that it should approve the criteria. Industry, however, should be provided more flexibility to propose alternative performance criteria supported by an appropriate risk analysis. We would like to review all of the supporting documentation before commenting on the specific criteria that have been proposed in the regulatory guide.

The demonstration that the criteria have actually been satisfied

requires a complex process of nondestructive examination and evaluation of structural integrity and leakage during operation and design-basis accidents. The methodology required for these evaluations is not well established. Thus, the staff has felt constrained to provide a great deal of detail in the proposed regulatory guide to describe the characteristics of an acceptable methodology. Although we are not yet prepared to endorse the regulatory guide, we believe that the present immaturity of the methodology and the importance of the results justify such an approach.

The staff position is that the regulatory guide provides sufficient guidance for developing an acceptable methodology and that formal review of industry-developed repair criteria and procedures will not be required. We would like to review the results of a "trade study" of the preapproval approach vs. the post-implementation inspection approach to methodology acceptance.

Industry has questioned whether safety factors proposed in the steam generator rule are more conservative than those required by the ASME code. We encourage the staff to consider the industry's arguments.

Industry accepts the performance criterion proposed by the staff for primary-to-secondary leakage. Industry stated that this leakage criterion ought not be ipso facto a trigger for inspection or enforcement of regulations concerning the steam generator rule. This is a valid concern. Excessive leakage does not necessarily indicate a failure of the steam generator program. Adequate opportunities for staff action are available if failures of the program are discovered following a plant shutdown due to excessive primary-to-secondary leakage.

We are looking forward to reviewing the staff NUREG report concerning the staff's treatment of thermally induced tube failure. We are especially interested in the treatment of elevated temperatures resulting from flow through leaking tubes, and coupling between aerosol deposition and thermal hydraulics.

A differing professional opinion (DPO) was filed on July 11, 1994. We have reviewed the contentions in that DPO and summarized them in the attachment. We also note that Generic Safety Issue (GSI)-163, "Multiple Steam Generator Tube Leakage," identified in 1992 has yet

to be prioritized and resolved. Both the DPO and the GSI are directly related to the proposed rulemaking. We urge the staff to prepare a point-by-point response to the issues in the DPO and to prioritize and resolve GSI-163 before implementing the steam generator integrity rule.

Dr. William J. Shack did not participate in the Committee's deliberations regarding this matter.

Sincerely,

/s/

T. S. Kress  
Chairman

Attachment:  
Summary of Differing Professional Opinion  
Issues - Presented to the ACRS on  
November 7, 1996

References:

1. Memorandum dated October 25, 1996, from Brian Sheron, Office of Nuclear Reactor Regulation, to John Larkins, Executive Director, ACRS, Subject: ACRS Review of the Proposed Steam Generator Rule [forwarding the proposed steam generator rule and draft steam generator regulatory guide]
2. Memorandum dated May 1, 1996, from James M. Taylor, Executive Director for Operations, NRC, to Joram Hopenfeld, Office of Nuclear Regulatory Research, NRC, Subject: Resolution of Differing Professional Opinion Regarding Voltage-Based Repair Criteria for Steam Generator Tubes, dated July 13, 1994
3. Memorandum dated July 15, 1994, from James M. Taylor, Executive Director for Operations, NRC, to John T. Larkins, Executive Director, ACRS, Subject: ACRS Review Of Proposed Generic Letter 94-XX, Voltage-Based Repair Criteria for Westinghouse Steam Generator Tubes [forwarding Differing Professional Opinion]
4. Report dated September 12, 1994, from T. S. Kress, Chairman, ACRS, to Ivan Selin, Chairman, NRC, Subject: Proposed Generic Letter 94-XX, "Voltage-Based Repair Criteria for Westinghouse Steam Generator Tubes"
5. Memorandum dated September 30, 1994, from Joram Hopenfeld, Office of Nuclear Regulatory Research, NRC, to John T. Larkins, Executive Director, ACRS, Subject: Comments On ACRS Review Of Generic Letter "Voltage Based Repair Criteria for Westinghouse Steam Generator Tubes"

SUMMARY OF DIFFERING PROFESSIONAL OPINION ISSUES  
PRESENTED TO THE ACRS ON NOVEMBER 7, 1996

The DPO author estimates core-damage frequency with containment bypass to be  $1 \text{ E-4}$  to  $3.4 \text{ E-4}$  events/year. He stated that the uncertainties associated with characterizing steam generator tube defects and severe accident phenomena are not sufficiently understood to properly model tube rupture events. Tubes may fail before the surge line due to:

- . crack networking and characterization of flaws not being adequately determined by nondestructive examinations,
- . increased heat transfer caused by flow through tube cracks,
- . cracks in tubes opening due to increased pressure,

- . cracks in tubes unplugging at elevated pressure, and
- . jets from tube cracks eroding adjacent tubes.

The DPO author stated that the staff should document the assumptions and models used to study hidden uncertainties.