July 21, 1987

MEMORANDUM FOR: Edward L. Jordan, Chairman, CRGR Robert M. Bernero, NMSS James H. Sniezek, NRR Denwood F. Ross, RES T. T. Martin, RI Joseph Scinto, OGC

THRU: John E. Zerbe Assistant for CRGR Operations, AEOD

FROM: James H. Conran Senior Program Manager, AEOD

SUBJECT: SUMMARY AND ISSUE IDENTIFICATION CRGR AGENDA ITEM, MEETING NO. 119

Enclosed for your information and use is a CRGR Staff summary for the following CRGR review item:

Proposed Revision to GDC-4, Appendix A, 10CFR50 (Broad Scope Leak-Before-Break Rule)

This matter is scheduled for CRGR review at Meeting No. 119 on Wednesday, July 22, 1987 in Room P-422, 1-3 p.m.

Original Signed by:

James H. Conran CRGR Staff

Enclosure: As stated

cc w/enclosure: V. Stello

Distribution: CRGR CF CRGR SF J. Zerbe T. Cox J. Conran

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Summary and Issue Identification for CRGR Agenda Item - Meeting No. 119 July 21, 1987

IDENTIFICATION

Proposed Final Broad-Scope Rule to Modify General Criterion (GDC) 4 of Appendix A, 10CFR50.

OBJECTIVE

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The staff has requested that CRGR review, and recommend to the EDO in favor of issuing in final rule form, an amendment to GDC-4 that would allow exclusion of dynamic effects of postulated pipe ruptures in all high energy piping in all LWRs, if the piping meets certain rigorous acceptance criteria. (This action would expand the scope of an interim change to GDC-4 approved by the Commission in April 1986, which applied only to primary piping in PWRs.)

BACKGROUND

The documents submitted for CRGR review by the sponsoring office (RES) in this matter were transmitted by memorandum dated June 10, 1987, E. S. Beckjord to E. L. Jordan; the review package included the following documents:

- 1. Proposed Commission Paper (undated), "Final Broad Scope Rule to Modify General Design Criterion 4 of Appendix A, 10 CFR Part 50."
- Three prior related Federal Register Notices (FR 50 27006, FR 50 12502, and FR 51 26383).
- Package of 28 Public Comment Letters. (NRC staff evaluation of and response to comments is given in "Issues Analysis" section of FRN at pp. 10-26.)
- 4. Proposed Federal Register Notice for Broad Scope GDC-4 Modification.
- 5. Proposed Standard Review Plan (SRP) Section 3.6.3, "Leak-Before-Break Evaluation Procedures," dated March 1987.
- Proposed Letter to Congressman Udall informing oversight committee of rule change.
- Regulatory Analysis, dated March 29, 1985, "Assessment of Value-Impact Associated with the Elimination of Postulated Pipe Ruptures from the Design Basis for Nuclear Power Plants," a report by LLNL (NRC contractor).

 "Summary of Proposed Generic Requirements For CRGR Review", dated June 1, 1987. (Provided in accordance with the requirements of the CRGR Charter - see attachment to this Issue Sheet.)

DISCUSSION/ISSUES

The Committee reviewed this proposed rule package at the draft rule stage in Meetings Nos. 84 & 85 on January 24, 1986 and February 5, 1986. The staff's cost-benefit evaluation of the proposed modification to GDC-4 has not changed from that provided in the draft rule package reviewed earlier by the Committee. Briefly, the staff estimates cost savings of \$186 million for a population of 85 PWRs with associated dose reductions of 34,000 man-rem to plant operating personnel; and cost savings of \$30 million for a population of 38 BWRs, with associated dose reductions of 8,600 man-rem to plant personnel. These benefits accrue largely from elimination of unnecessary piping supports and reduced inspection times due to such elimination. Public risk is not quantified, but adverse effects are judged to be insignificant, if any; the staff's best judgment is that, on balance, safety is improved due to enhanced inspection conditions and decreased likelihood of piping failures due to inadvertent interferences and stresses which can result from improperly installed support devices intended to prevent dynamic effects of postulated pipe ruptures. No requirements are imposed on licensees/applicants by this rule; application to individual plant is completely voluntary. The rule change is a so-called "permissive" rule change in that regard.

Twenty-eight letters of comment were received and evaluated by the staff on the proposed rule. The staff boiled the total comments received down into 21 issue areas; 17 of these issues were felt to be consistent with content and intent of the proposed and required no changes to package. Four issues raised by commenters were accommodated, after evaluation by the staff, by (proposed) changes to positions taken by the staff in the proposed rule package; these are addressed in the discussion of Issues 4, 9, 10 and 13, in the "Issues Analysis" section of the FRN. A brief statement of these four Issues, and the proposed changes to the previous staff positions involved, is as follows:

Issue 4 - Use of leak-before-break considerations to relax EQ
requirements.

- Staff Position The staff proposes to allow licensees/applicants to use leak-before-break to justify relaxation of EQ requirements in some circumstances, i.e., on a case-by-case basis. Burden is completely on the licensee/applicant to convince the staff in such instances.
- Issue 9 Use of generic lower bound materials data in lieu of extensive testing of archival material or three heats of material having the same material specs.
- Staff Position Acceptable if archival materials are not available, or if actual plant material properties cannot be defined cost effectively. Industry groups are encouraged to assemble and use reliable generic data bases.

- Issue 10 750°F temperature limitation should not be used for evaluation of creep failure.
- Staff Position The temperature limitation of 750°F is revised as follows: 700°F for ferritic steel piping; 800°F for austenitic steel piping.
- Issue 13 The load limit analysis procedures in ASME Code, Section XI, Winter Addenda, should be allowed.
- Staff Position The Commission has concluded that the evaluation method in Appendix C of Section XI are acceptable when performing leak-before-break analyses for austenitic steel piping, provided the margins in the discussion of Issues 1 & 2 (FRN) are met. Leak-before-break analysis for ferrilic will continue on a case-by-case basis until approved Code procedures are available.

The changes in staff positions summarized above have not resulted in changes to the wording of the proposed GDC-4 modification itself; the text of the final rule is identical to the text of the proposed rule. Two of the changes in staff position indicated above (i.e., Issues 9 and 10) are reflected explicitly in the wording of the new SRP Section 3.6.3 accompanying the rule package.

With the background summarized above, the Committee may wish to pursue the following specific questions/issues:

- How does the staff propose to review relaxations proposed by licensees/applicants to EQ requirements based on application of leak-before-break technology? What review criteria will be used? Shouldn't the intended review criteria be included SRP 3.6.3 (or some other); and shouldn't these be considered by CRGR?
- Is the ASME Code, Section XI, Appendix C revision referenced in Issue 13 above already endorsed formally by NRC? Must this be done by rule amendment? Can/should this guidance be included in SRP 3.6.3?
- 3. The proposed Commission Paper states explicitly (under "Purpose") the applicability of this proposed rule change to high energy piping. The staff's response to Issue 13 (FRN at p. 21) seems consistent with the Commission Paper in that regard. Shouldn't the SRP wording be similarly (i.e., explicitly) consistent. Also, shouldn't a definition of "high energy" piping be included in all the documents of this package, if that is the scope intended by the staff?
- 4. Subparagraph (i) on p. 5 of the proposed Commission Paper refers to a "Regulatory Analysis" that has been performed. Is this the LLNL report identified as Enclosure 6 to the Commission Paper? If so, is it appropriate to refer to a contractor product as a "Regulatory" analysis.

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without an indication of formal endorsement of its content and conclusions by the staff? Perhaps the LLNL report should be identified as a "NRC contractor value-impact study"; the term Regulatory Analysis implies a NRC staff work product.

As a more general point in the area of Regulatory Analyses, in its earlier review of this package at the draft rule stage, the Committee raised questions and concerns regarding the adequacy of the LLNL value-impact study as a basis for an expanded scope GDC-4 rule. The Committee may wish to pursue that question anew at this time.

- 5. The FRN at p. 6 offers additional useful guidance with regard to the term "extremely low" probability of pipe rupture (i.e., on the order of 10E-6 per reactor year). Shouldn't this additional guidance be reflected in SRP 3.6.3 at p. 3.6.3-2?
- 6. To reflect a previous CRGR comment, the wording of the last sentence of the first paragraph under "II. ACCEPTANCE CRITERIA" in SRP 3.5.3 (p. 3.6.3-2) should be changed to indicate "A deterministic evaluation can also satisfy thecriterion." (Delete use of the word "assume.")
- 7. To reflect a previous CRGR comment, the term "as built" should be clarified with respect to its applicability to future plants.
- 8. In paragraph 2, on p. 3.6.3-3 of the SRP, what does "...an evaluation of <u>fabrication</u> wall thinning..." mean? Is this simply an editorial error; or does it require more detailed clarification?

As a more general point in the area of pipe wall thinning, the Committee may wish to discuss with the staff how this GDC-4 effort is coordinated with the lessons learned results from the Surry pipe rupture incident investigations and their implications with regard to more detailed SRP 3.6.3 review criteria, etc.

- 9. The draft package addressed explicitly the conditions under which licensees/applicants could apply leak-before-break to piping in non-Seismic Category structures. Is there some reason that this guidance was deleted from the final package, or was this an oversight? Should it be included in the final package explicitly, e.g., in the SRP?
- 10. The SRP (at p. 3.6.3-9) refers to NUREG-1061 for "additional guidance" on fracture mechanics evaluations. Should the intended guidance be excerpted and included explicitly in the SRP?
- 11. In the SRP, in the last line on p. 3.6.3-10, and in the FRN at p. 22, the staff states that "In heavy support redesign.... improved functional reliability must be demonstrated for any changes implemented." Why must improved reliability be demonstrated? What is the justification for this more stringent requirement?

SUMMARY OF PROPOSED GENERIC REQUIREMENTS FOR CRGR REVIEW OFFICE OF NUCLEAR REGULATORY RESEARCH

DATE: June 1, 1987 RES TASK NO.: MS 402-1 RES TASK LEADER: John A. O'Brien TELEPHONE: 301-443-7854

Title of Proposed Action:

Broad Scope Modification of General Design Criterion 4 Requirements for Protection Against Dynamic Effects of Postulated Pipe Ruptures.

Type of Action:

Final Rule

Category:

This paper covers a major policy issue. Resource estimates, Category I, preliminary.

Statement of the Problem:

A limited scope modification of General Design Criterion 4 requirements for protection against dynamic effects of postulated pipe ruptures, applicable to only the primary loops of PWRs, has been effective since May 12, 1986.

Advances in techno' gy have led to the acceptance by NRC staff of procedures that estimate the likelihood of ruptures in nuclear reactor piping. However, General Design Criterion 4 (GDC-4) does not allow use of this new technical approach in piping outside the primary loops of PWRs except by exemption granted pursuant to 10 CFR 50.12. Rulemaking is therefore needed to generally accommodate this engineering development.

Prior to the last few years, there was no sound technical basis for excluding certain pipe ruptures from the design basis. Now it is certain that it is possible to defend the exclusion of pressurized water reactor primary loop doubleended guillotine pipe ruptures, and the scope may be extended to other piping, including piping in boiling water reactors. This rulemaking action will promote investigations to determine which other situations will permit the removal of pipe whip restraints and jet impingement barriers and other related changes. Acceptance criteria for generally applying these results pertaining to leak-before-break have been published by the NRC staff in "Report of the U.S. Muclear Regulatory Commission Piping Review Committee", NUREG-1061, Volume 3, and are being proposed by the American Nuclear Society in ANS-58.2. In summary, the requirements of GDC-4 have led to a situation where protective devices have been added to nuclear power plants to forestall events which are now regarded as extremely unlikely. These protective devices reduce safety and increase worker radiation exposures. A need exists to allow exclusion other than by exemption from compliance with General Design Criterion 4 requirements when supported by acceptable analyses.

Objectives:

To obtain Commission approval to publish a notice of final rulemaking which would expand the scope of affected piping in a recent interim modification to GDC-4 (See SECY-85-108) to include all high energy piping systems in all reactors meeting rigorous acceptance criteria. This amendment to GDC-4 would permit a potentially much more extensive removal of pipe whip restraints, jet impingement shields and large bore hydraulic snubbers originally designed to mitigate the dynamic effects of postulated instantaneous pipe ruptures. Other related changes would also be permitted.

Alternatives and Decision Rationale:

1. Maintain the status quo

This effectively would continue to require the placement of pipe whip restraints and jet impingement barriers on all piping except the primary main loops of PWRs. This alternative is rejected because analyses have shown that substantial cost savings can be realized when these protective devices are removed. Additionally, total ORE man-rem exposures will be reduced significantly. Finally, safety would be enhanced since misalignment or not maintaining tolerances when installing or reinstalling pipe whip restraints actually increases the probability of pipe ruptures. The effectiveness of inservice inspection would be improved.

2. Reinterpret the existing text of GDC-4

For more than fifteen years the staff has interpreted GDC-4 to require the placement of pipe whip restraints and jet impingement barriers near nuclear reactor piping other than primary loops of PWRs. Rulemaking is necessary to justify the departure from long standing past practices.

3. Use Exemptions to Accomplish the Removal of Pipe Whip Restraints, Jet Impingement Barriers and Large Bore Hydraulic Snubbers

While rulemaking has recently been implemented for the primary loops of PWRs, the use of plant specific exemptions to the regulations on a system unique basis would be needed for other piping and entails significant allocation of NRC resources. The use of repeated GDC-4 exemptions amounts to an amendment to a fundamental NRC rule in the absence of rulemaking procedures, leading to potential legal difficulties. For these reasons, this alternative is also rejected.

Based on this evaluation, the staff recommends that the NRC proceed with the final rulemaking because:

1. It firmly secures the legal basis for staff actions.

 It removes impediments to the application of new technology in the licensing arena, thereby allowing the realization of improved safety, lower costs and reduced worker exposures.

Consequences:

Although the rule change itself will, in principle, be applicable to all piping systems, the detailed value-impact assessment has been limited to the main reactor coolant loop (RCL) piping in PWR plants and to recirculation piping in BWR plants. The results of this assessment are summarized below:

Impact (\$)
-186E+6 -277E+6
-87E+6
-30E+6
-65E+6 -15E+6

In this table, "value" represents reduction in occupational radiation exposure (ORE). The nominal estimates of cost and radiation dose indicate that substantial reductions in both would result from implementation of the proposed action. For new plants, the Broad Scope modification to GDC-4 would reduce costs by approximately \$100 million per unit, and reduce ORE almost 500 man-rem per unit. These value-impacts are based on considering only pipe whip restraints and jet impingement barriers. Even larger value-impacts can be expected when large bore hydraulic snubbers are considered as well.

Implementation:

SECY-85-108 dated March 26, 1985, covered the primary circuits of PWRs and allowed schedular exemptions for operating plants, plants under construction and future plant designs. General Electric in a April 26, 1985 letter to the Director, Division of Licensing submitted a draft amendment supporting leakbefore-break for GESSAR II. More than twenty-five SERs covering more than forty PWRs have been written allowing the removal of pipe whip restraints and jet impingement barriers from primary loop piping. Three units are also operating with large bore hydraulic snubbers removed from heavy components. One unit (Beaver Valley, Unit 2) has been granted an exemption to the present GDC-4, and has already implemented this Broad Scope modification to GDC-4. Additional licensing actions are pending in these and other categories.