



POLICY ISSUE

(Information)

January 10, 1984

SECY-84-9

FOR: The Commissioners

FROM: William J. Dircks
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SUBJECT: REPORT ON THE LONG TERM APPROACH FOR DEALING WITH
STRESS CORROSION CRACKING IN BWR PIPING

PURPOSE: To inform the Commission of the staff progress in
developing a long term approach for dealing with
stress corrosion cracking in BWR piping, and to
discuss future staff actions and the schedule for
completion of staff recommendations.

DISCUSSION: The issue of intergranular stress corrosion cracking
(IGSCC) in BWR piping has been the subject of recent
papers for the Commission, SECY 83-267, -267A, -267B
and -267C, and Commission meetings held on July 14,
July 15, August 24, October 3, and November 9, 1983.
Following the meeting of November 9, the Commission
requested an additional meeting to discuss the
staff's long term approach to dealing with the pipe
crack issue. This and other related issues have
been identified for discussion by memoranda from
Chilk to Dircks dated November 30, 1983, and Chairman
Palladino to Dircks dated December 12, 1983.

The staff also met with the ACRS on November 17 and
December 15, 1983 and with an ACRS subcommittee on
December 7, 1983 to discuss BWR pipe crack matters.
Following these meetings with the staff, the ACRS
reported to the Commission on BWR pipe crack issues
by letter dated December 19, 1983.

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The NRC Piping Review Committee and its Task Group on BWR Pipe Cracking have reviewed the inspection techniques, the UT examiner qualifications and performance, short term crack repair techniques, crack evaluation methods, leak detection systems and leakage limits. This was reported to the Commission in SECY 83-267C. In addition to these reviews, this Task Group is preparing recommendations for a long term approach to the BWR pipe cracking issue.

This effort is focused on reviewing the adequacy of currently available replacement materials and the adequacy of features which could mitigate IGSCC, such as hydrogen water chemistry control, induction heating stress improvement (IHSI) which produces a favorable compressive stress in the piping, and similar remedies which have been proposed and tested by industry. The review activities include:

- (a) the evaluation of all long term fixes with respect to their effectiveness and value-impact considerations;
- (b) the possible need to change current ASME Code Section XI inspection methods, frequencies and extent;
- (c) the review of piping system design criteria for replacement piping; and
- (d) detailed coordination with domestic industry representatives and interaction with other countries relative to BWR pipe crack issues.

It is likely that the staff will need to evaluate and take a position on a number of long term solutions to the BWR pipe cracking issue, including:

- (a) replacement of all or part of the susceptible piping;
- (b) IHSI of piping for recently-licensed plants;
- (c) IHSI of piping for older plants where cracking has not been detected;

- (d) the use of hydrogen water chemistry along or in combination with other mitigating measures;
- (e) long term operation with shallow cracks and/or crack repairs; and
- (f) combinations of the above which may be appropriate to a specific plant condition.

As part of its evaluation of the acceptability of these possible long term solutions, alone or in combination, consideration will be given to the relevant test results and field experience, the reliability of current and future inspection techniques, and future requirements on leakage detection and water chemistry control. For example, replacement of piping with non-susceptible material and good water chemistry control might allow a reduction in inspections to normal Section XI intervals; whereas mitigation of piping in older plants by INSI and/or hydrogen water chemistry control might require augmented inspection for the plant lifetime with its attendant cost, downtime and exposure of UT examiners.

It is our plan to anticipate all likely long term solutions that might be proposed by BWR licensees and be prepared with positions on their acceptability and conditions which might accompany acceptability. The Task Group on Pipe Cracks is scheduled to complete its draft report on long term recommendations in February, 1984. After review by the NRC Piping Review Committee, these recommendations will be sent to the Director, NRR. The staff positions on these long term solutions would be discussed with the Commission and subsequently be available to industry for use in their planning.

Foreign position on many of these same issues will be discussed at a Committee for Safety of Nuclear Installations, (CSNI) meeting to be held in Paris on February 7-9, 1984, with participation by Japan, United States, and the European BWR Community. Sessions on Operating Experience, Non-Destructive Examinations, Fracture Mechanics, and Mitigation and Fixes are planned.

The Commission also requested information on the relative reliability of automated and manual ultrasonic testing techniques for detection of BWR pipe cracking. The staff discussed this issue with EPRI and concludes that data is not yet available to make a valid quantitative comparison. We require each

level 2 and level 3 examiner to demonstrate adequate performance capability on IGSCC samples at the EPRI NDE Center. This equates to a detection efficiency of at least 80 per cent for cracks and a low level of false calls. The various "automatic" systems range from automatic scrubbing of the pipe and data accumulation, with interpretation by an examiner, to full automation including interpretation of the signals by computer, with gradations in between. Each system is "qualified" by testing the man-machine combination and procedures in the same manner as the manual tests are conducted.

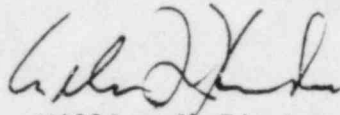
Three topics were also raised by OPE following the Commission meeting of November 7, 1983. These topics dealt with the risk attributable to IGSCC, taking into account uncertainties in crack detection and growth and leakage detection, the value impact of the proposed reinspection program, and the plans for reevaluation of ASME Section XI ultrasonic examination requirements.

The staff is not currently able to provide a realistic estimate of the risk attributable to IGSCC in BWRs. Work currently underway at Lawrence Livermore Laboratory on degraded pipe failure probabilities, as well as a proposed data analysis on historical experiences, would have to be completed prior to a meaningful realistic risk assessment. However, the staff has completed a sensitivity study on IGSCC effects to gain an understanding on the importance of the issue.

While the results are probably conservative, there are considerable uncertainties in the final results. In general, the results indicate that very large increases in random pipe break frequencies must be assumed before any significant increase in plant risk is observed. With consideration to transient-induced single and multiple LOCAs, this sensitivity study indicated that a quite high conditional probability of LOCA following a transient must occur, in most cases, before risk addition would be significant. Operating experience probably does not support the existence of conditional probabilities of this magnitude. One area, multiple large LOCAs,

does suggest some possible risk contribution. Finally, seismically-induced LOCAs do not appear to offer a large potential for risk contribution. The staff has not yet performed a quantitative value impact assessment of the proposed reinspection program, balancing the benefits of reduction in plant risks and uncertainty against the costs required.

The ASME Section XI task group on stress corrosion cracking in piping met on November 15, 1983 to discuss a uniform national standard for the detection, the sizing and the analysis of stress corrosion cracks in operating nuclear power plants. This group has proposed that Section XI be revised to provide more emphasis on crack detection, sizing evaluation rules and procedures for the analysis of crack propagation. The task target date of June, 1984 has been set for presentation to the ASME. In addition, the ASME Section XI Subgroup on Water Cooled Systems has established a working group, in which NRC participates, to draft an appendix on personnel and procedure qualification.



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