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NUCLEAR POWER SYSTEMS DIVISION

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Secretary of the Commission
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Attention: Docketing and Service Branch

Gentlemen:

SUBJECT: 10CFR PART 50 - PROPOSED RULEMAKING ON FRACTURE TOUGHNESS REQUIREMENTS FOR NUCLEAR POWER REACTORS

Reference: Federal Register/Volume 45, Number 222/Friday, November 14, 1981/Proposed Rules

The purpose of this letter is to transmit General Electric's comments on the proposed amendments to the fracture toughness requirements for nuclear power reactors. The amendments would clarify the applicability of these requirements to old and new plants, modify certain requirements, and shorten and simplify these regulations by more extensively incorporating by reference appropriate National Standards.

General Electric strongly disagrees with the proposed changes that require the temperature of nozzles and flanges be at least 150°F above RT_{NDT} when the core is not critical. As the rule now stands, the proposed temperature requirement will significantly penalize boiling water reactors in general and would be even more severe for older operating plants since actual NDT values are not always known for these plants. We believe there is no basis for requirement of 150°F and 190°F above RT_{NDT} over a substantive part of the heat-up/cool-down curves. The proposed revision adds excessive margin at the lower BWR operating pressures but do not add any margin at the higher pressures (PWR regime). Clearly such a change is arbitrary and adds margin where it is not needed. Moreover, by proposing a restrictive limit based on temperature alone, the requirement penalizes the BWR vessels with smaller thickness. We suggest it seems more appropriate to require minimum temperatures to be RT_{NDT} + 60°F when the core is not critical and RT_{NDT} + 100°F when the core is critical.

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Acknowledged 1/27/81

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Appendix G, Paragraph IV.A.1.

The proposal defines vessel beltline Charpy toughness upper shelf energy requirements of 75 ft-lb initially and 50 ft-lb minimum at end-of-life (EOL). Clarification should be made as to whether these values are the average of three specimens, consistent with definitions in ASTM E185-[illegible] paragraph 4.18 and Reg. Guide 1.99 Rev. 1 paragraph B.5, or if they apply to each specimen.

We recommend that the average value of three specimens must meet the required value, and that no single specimen values can be lower than an arbitrary amount (such as 5 or 10 ft-lb) below the specified requirement.

Appendix G, Paragraph IV.A.2 & 3

These changes require that when the pressure exceeds 20% of the system hydro test pressure, the temperature of nozzles, flanges, etc. should be at least, (i) 150°F above RT_{NDT} when the core is not critical and, (ii) 190°F above RT_{NDT} when the core is critical. We strongly disagree with these proposed changes for the reasons given below.

(1) The impact of the proposed evision is severe.

Under the proposed revisions, the requirement of 150°F and 190°F above RT_{NDT} would govern over a substantial part of the heat-up/cool-down curves. The impact of the proposed change is significant for new plants. For example, at 20% of the system hydrotest pressure - approximately 300 psig for a BWR - the new revisions would require a minimum temperature of about 200°F.

The impact of the proposed changes would be even more severe for older operating plants since specified drop weight NDT's for nozzle and flange materials could be as high as 40°F. The actual NDT values are not always known for these plants. All that we know is that the actual NDT is lower than the specified limits. For such plants even with good materials, minimum temperatures of 190°F may be required when the core is not critical.

(2) The proposed changes are overly restrictive

Considering a quarter thickness (1.5 in.) nozzle corner flaw at 300 psi, the minimum temperature to assure the factor of two margin on primary stresses required by ASME Code Appendix G is RT_{NDT}. On the other hand, the proposed revisions would require 150°F + RT_{NDT}. At pressures above 1000 psi, the code limits are governing. Between 300 and 1000 psi the new revisions would add additional but decreasing margins over current limits. It is seen that the revisions add excessive margin at the lower pressures but do not add any margins at the higher pressures.

For a postulated flaw in the flange weld the bolt up is the most critical condition and again the proposed changes do not add any margin where it is most beneficial.

(3) <u>By proposing a restrictive limit based on temperature alone the requirement penalizes vessels with lower thickness.</u>

For the same applied stress level, and a quarter thickness postulated flaw, the proposed revision impose more stringent limits on vessels with smaller thicknesses. Therefore, a BWR (thickness ~ 6 in.) would be required to follow more conservative limits compared to a PWR (thickness ~ 9 in.). The additional penalty of higher temperature becomes more important when one considers the fact that the BWR's cannot use pump heat during a startup as effectively as in a PWR. A fracture mechanics approach based on applied stress intensity factors and available toughness is more reasonable.

(4) <u>The proposed changes are not uniform</u>

The proposed changes would require a higher margin for nozzles and flange regions compared to that for a belt-line flaw. The requirement on safety margins for flaws should be more uniform.

The proposed changes would add fracture margins during the beginning of design life. Towards the end of design life, the radiation shift would make belt-line curves more governing and, therefore, the changes would not have any effect on them. The changes would not add margin towards the end of life when the possibility of flaws is greater (due to fatigue, corrosion, etc.). On the other hand, it would add margins in a relatively new vessel where flaws are less likely.

<u>In view of the above comments the following changes are suggested in place of those proposed:</u>

(a) Require minimum temperatures to be RT_{NDT} + 60°F when the core is not critical and RT_{NDT} + 100°F when the core is critical. This would make it more consistent with the requirements based on belt-line flaw.

(b) Prescribe postulated flaws for discontinuity regions so that uniform fracture margins can be maintained. This should satisfy the concerns on flaws in discontinuity areas expressed in the proposed revisions.

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Appendix H, Paragraph II.B

This paragraph references ASTM E185-79 which will result in increasing the current three capsules for surveillance specimens to four capsules for some BWRs. This is caused by the requirement in ASTM E105-79 to evaluate the adjusted reference temperature at the inside of the reactor pressure vessel (RPV) instead of the current requirement of evaluation at quarter thickness (1/4 T) from the inside surface.

Calculations comparing the current and proposed methods are shown in Attachment A for a BWR/6 218-inch RPV. Based on copper and phosphorous limits given in the existing purchase specifications, four capsules would be required by the proposed method. This would impose extra cost and possible design hardship to fit the extra capsule in the RPV. An alternative is to reduce the specified copper and phosphorous limits but again this would add to costs. Although the proposed Appendix H (Paragraph II.B.1) does not affect RPVs purchased to ASME Code editions prior to July 1979, it would affect any RPVs purchased to later Code editions.

Finally, the proposed change is inconsistent with ASME Code Section III, Appendix G and Regulatory Guide 1.99 Revision 1. The Code requires that radiation effects be assessed at the tip of the deepest assumed flaw (1/4 T). Paragraph C.3 of the Guide requires that the predicted adjusted reference temperature be evaluated at the 1/4T position in the vessel.

We recommend that the surveillance capsule requirements be retained as currently specified in 10CFR50 Appendix H until such time that ASTM E185-79, Table 1 can be revised to reflect the preceding considerations.

If there are any questions on the above, please contact Richard L. Gridley (Extension 53732) or Howard T. Watanabe (Extension 52306) of my staff.

Sincerely,

J. F. Quirk for
G. G. Sherwood, Manager
Safety & Licensing Operation

GGS:pes/572-575

cc: Dr. P. N. Randall
Office of Standards Development
U. S. Nuclear Regulatory Commission
Washington D. C. 20555

L. S. Gifford, GE - Bethesda

ATTACHMENT A

Comparison of Current and Proposed Surveillance Capsule Quantity Requirements for Limiting BWR/6 Standard Plant (218-624)

I. Current (10CFR50 Appendix H):

Three capsules if adjusted EOL $RT_{NDT} \leq 100^oF$; four if $100^oF < RT_{NDT} \leq 200^oF$. Calculate EOL RT_{NDT} at quarter thickness (1/4T) from inside surface of vessel.

	Spec. Limit wt. % Max. Cu	P	1/4 T Fluence n/cm.^{2}	1/4 T* ΔRT_{NDT}, ^oF	Spec. Max. Start RT_{NDT} ^oF	EOL RT_{NDT} ^oF
Beltline Weld	.10	.025	$5x10^{18}$	102	-20	82
Beltline Plate	.12	.015	$5x10^{18}$	74	+10	84

84^oF EOL $RT_{NDT} \leq 100^oF$, ∴ 3 capsules

II. Proposed (ASTM E185-79, Referenced by 10CFR50 Appendix H):

Three capsules if shift in RT_{NDT}, ΔRT_{NDT}, $\leq 100^oF$; four if $100^oF < \Delta RT_{NDT} \leq 200^oF$. Calculate ΔRT_{NDT} at inside surface of vessel.

	Spec. Limit wt. % Max. Cu	P	Surface Fluence n/cm.^{2}	Surface* ΔRT_{NDT}, ^oF
Beltline Weld	.10	.025	$9x10^{18}$	138
Beltline Plate	.12	.015	$9x10^{18}$	100

$\Delta RT_{NDT} = 138^oF > 100^oF$, ∴ 4 capsules

*Predicted by NRC Reg. Guide 1.99 Rev. 1 Methods