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SUBJECT: Comments on proposed Rev 2 to Reg Guide 1.99, "Radiation Damamge to Reactor Vessel Matls." Calculational methods of rev should be restructured to be consistent w/conservative methods of 10CFR50.61 re pressurized thermal shock.

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Office of Administration
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Washington, D.C. 20555

Gentlemen:

Docket 50-305
Operating License DPR-43
Kewaunee Nuclear Power Plant
<u>Comments on Proposed Revision 2 to Regulatory Guide 1.99</u>

Reference: 1) Letter from D. C. Hintz (WPSC) to G. E. Lear (NRC) dated January 23, 1986

WPSC has reviewed proposed Revision 2 to Regulatory Guide 1.99, "Radiation Damage to Reactor Vessel Materials" and encourages the consideration of the following comments. It is very important that the NRC maintain its regulations and guidance documents current with accepted improvements in the understanding of nuclear related phenomena whether they concern radiation damage to vessels or accident source terms. Therefore, it was heartening to see an effort made to improve the NRC guidance on predicting radiation damage to reactor vessel materials. However, it is unfortunate when this guidance is inconsistent with a regulation, especially when the regulation is of a very recent vintage.

Radiation damage to reactor vessels is determined by the reference temperature (RT_{NDT}) of the vessel material. As the reactor vessel is irradiated, the RT_{NDT} for its materials increases. The increase in RT_{NDT} means the material will exhibit non-ductile characteristics at a higher temperature than when the material was unirradiated. The purpose of both proposed Revision 2 and 10 CFR 50.61, the pressurized thermal shock rule, is to predict the shift in RT_{NDT} for reactor vessel materials based on fluence and the vessel material content. This predicted shift in RT_{NDT} is then added to the initial, unirradiated value of RT_{NDT} plus a margin to determine the adjusted reference temperature (ART) for the vessel material. Both proposed Revision 2 and 10 CFR 50.61 use similar methods for determining the initial value of RT_{NDT}, the margin required for

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additional conservatism, and the shift in RT_{NDT}. However, while the methods may be similar, for certain ranges of vessel material contents, the ART based on proposed Revision 2 is considerably larger than the ART based on 10 CFR 50.61. A specific example of the extreme differences between the two methods is described below for the Kewaunee Nuclear Power Plant (KNPP) circumferential beltline weld. The chemical contents of this weld are provided for your information as Attachment A to this letter.

Per your request stated in the introduction of proposed Revision 2, WPSC has calculated the effect of using the methods of proposed Revision 2 in place of the current methods in 10 CFR 50.61. The calculations have shown that for the limiting beltline weld the proposed Revision 2 gives an ART approximately 40°F higher than the ART calculated by the current 10 CFR 50.61. The current 10 CFR 50.61 compares the calculated ART to a screening criteria and when the ART exceeds the screening criteria, extensive study and analysis is required to justify continued operation. Therefore, using proposed Revision 2 in place of 10 CFR 50.61 means the KNPP reactor vessel will reach the screening criteria approximately 20 years earlier.

While this is a specific example for the KNPP reactor vessel, it would also apply to all other reactor vessels with material contents similar to those of the KNPP reactor vessel. Therefore, WPSC feels it is extremely important that the NRC take another look at the calculational methods of proposed Revision 2. As presented by SECY-82-465, 10 CFR 50.61 uses a method that conservatively envelops existing surveillance data. In addition, both 10 CFR 50.61 and proposed Revision 2 are based on the same work, that of G. L. Guthrie at Hanford Engineering Development Laboratory. Yet, proposed Revision 2 results in an extremely larger ART when compared to 10 CFR 50.61 at material values similar to those of the KNPP reactor vessel. Since 10 CFR 50.61 already conservatively predicts the radiation damage for reactor vessels (as was shown by SECY-82-465), proposed Revision 2 should not incorporate any additional conservatism. Therefore, WPSC proposes the methods of proposed Revision 2 be restructured to be consistent with 10 CFR 50.61. This should be done by revising the method for calculating the shift in RT_{NDT} as this is the area in which the two methods differ considerably. Particularly, the chemistry factors used by each method in the calculation of the shift in RT_{NDT} vary a great deal, specifically at material values similar to those of the KNPP reactor vessel.

One additional area related to reactor vessel chemistry should also be addressed by proposed Revision 2. In response to 10 CFR 50.61, WPSC has researched the manufacturing of weld wire and the use of this wire in reactor vessel welds. This research has shown that copper-coated weld wire was often used in vessel welds made in the same time frame the KNPP vessel was manufactured. However, the weld wire manufacturer did not tightly control the amount of copper coating added to the weld wire. Therefore, two welds could be made with the same welding materials and procedures and yet have different copper contents due to the variation in the copper coating on the weld wire. The bottom line is that the surveillance weld for a specific reactor vessel may not have exactly the same copper content as the actual reactor vessel weld. In the case of the KNPP reactor vessel, WPSC has determined a best estimate copper content for the actual vessel weld by analyzing numerous data points from welds made with copper coated wire. (For the details of this analysis, see reference 1.) However, this best estimate copper content is different from the measured copper content of the KNPP reactor vessel surveillance weld. Therefore, WPSC proposes that Revision 2 include guidance on the use of surveillance data when the copper content of the surveillance weld is different than the best-estimate of the copper content of the actual vessel weld. This guidance should allow the extrapolation of surveillance data for one copper content (that of the surveillance weld) to another copper content (that of the vessel weld) as long as the surveillance data is judged to be credible based on the existing criteria in proposed Revision 2. This guidance should address cases where the surveillance weld has a higher copper content than the actual vessel weld and vice versa.

WPSC would also like to take this opportunity to encourage the NRC to proceed with revisions to Regulatory Guide 1.99 concerning the prediction of the decrease in upper shelf energy as fluence increases. The current method used in the proposed Revision 2 overpredicts the decrease in upper shelf energy at higher fluences. Increasingly, studies have indicated that the upper shelf energy will stop decreasing at fluences around 1×10^{19} n/cm^2. Therefore, Regulatory Guide 1.99 should be brought into agreement with the current technical understanding of the upper shelf energy phenomenon.

In conclusion, WPSC encourages the consideration of the following comments:

1) The calculational methods of proposed Revision 2 be restructured to be consistent with the already conservative methods of 10 CFR 50.61.

2) Guidance be included in proposed Revision 2 concerning the use of surveillance data when the copper content of the surveillance weld differs from the best estimate copper content of the actual vessel weld.

3) Regulatory Guide 1.99 be updated in the area of predicting the decrease in upper shelf energy.

Should you have any questions on the comments expressed by this letter, please feel free to get in touch with me or my staff.

Very truly yours,

D. C. Hintz
Manager - Nuclear Power

KAH/jms

Enc.

cc - Mr. G. E. Lear, US NRC
Mr. Robert Nelson, US NRC

Attachment A

To

Letter from D. C. Hintz (WPSC) to NRC Rules and Procedures Branch

Dated

April 11, 1986

Material Information for Critical Circumferential Weld

Table A-1

Material Information for Critical Circumferential Weld

Initial Reference Temperature (From Generic Data Base)	-56°F
Standard Deviation of Initial Reference Temperature	17°F
Copper Content	0.24 w/o
Nickel Content	0.78 w/o