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Comments on Draft Regulatory Guide DG-1077, *Guidelines for Environmental Qualification of Microprocessor-based Equipment Important to Safety in Nuclear Power Plants*, September 2001 version

1. Section B, Page 5, Category B and Category C Location Discussions. The cutoff level of 4 x 10^2 rads between qualification levels is arbitrary and not supported by the discussions which state failure levels at 1 krad. The cutoff level should be carefully considered in that the radiation calculations for US plant have a lower level of <1000 rads below which calculations have not been performed. Identifying zones with doses between 420 and 1000 rad will require additional assessments. What is the basis of dropping the level from 1000 rads to 420 rads? The discussion of page 3 of the draft regulatory guide does not support use of a 420 rad cutoff.

2. Page 7, Item 2, EMI/RFI testing. EMI/RFI testing is important and necessary. However, there is no need to place this testing in the sequence of the environmental qualification. There is no indication that EMI/RFI exposure causes aging or is effected by aging. Nor is there indication that EMI/RFI during normal service will cause adverse effect on accident performance. Accordingly, EMI/RFI testing should be required but the choice of testing of separate devices or the qualification specimen in sequence should be left to the organization testing the component.

3. Page 7, Item 3, Qualified Life. While IEEE Std 383-1983 requires the development of a qualified life, the standard provides no guidance on how to precondition digital electronics. In essence, one attempts thermal and radiation exposures. The radiation exposure is not difficult. However, there is no useful thermal aging model for digital electronics and one ages the components based on the activation energy derived for a circuit capacitor or a nylon mounting device. In reality, the thermal aging has no direct relationship to the life of the electronic device. Rather than requiring a thermal preconditioning for the electronic components, operational extremes temperature testing followed by radiation exposure would provide a useful qualification without requiring preconditioning that has no real basis for digital electronics. Arrhenius aging has a basis for polymers used in other harsh environment components. However, there is no basis for its application to integrated circuits and other solid state components.

4. Page 8, Item 8. Section 3 on page 7 requires preconditioning in the qualification sequence. Section 8 is redundant and unnecessary and not in accordance with industry qualification standards for safety equipment. This required data will not be available for the subcomponents for most devices. In addition, such data for the subcomponents, while reassuring to an engineer in some ways, provides no indication of the overall functionality of the assembled, as-manufactured device that is being qualified.

5. Page 8, Section 9. The title of the Regulatory Guide is Guidelines for Environmental Qualification. Section 9 details how to design and seal a device. This information may be useful if the industry chooses to have components built from scratch.

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However, in most cases existing industrial equipment will be qualified for use in nuclear plants. This section should be placed at the beginning of the document and modified to indicate that these are design considerations only and not firm requirements that must be employed in all digital devices.

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