



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
WASHINGTON, DC 20555 - 0001

ACRSR-2205

August 2, 2006

Mr. Luis A. Reyes  
Executive Director for Operations  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001

SUBJECT: DRAFT NUREG REPORT, "INTEGRATING RISK AND SAFETY MARGINS"

Dear Mr. Reyes:

During the 534<sup>th</sup> meeting of the Advisory Committee on Reactor Safeguards, July 12-13, 2006, we met with representatives of the NRC staff to discuss the draft NUREG report "Integrating Risk and Safety Margins." We also had the benefit of the documents referenced.

#### RECOMMENDATIONS

1. This work could have substantial regulatory benefits by providing an approach to quantify changes in safety margins and defense in depth. It should be pursued in the context of the technology-neutral framework and for future revisions of Regulatory Guide (RG) 1.174.
2. The draft NUREG report is preliminary and exploratory and needs to be substantially revised before it is published to make its purposes, concepts, and conclusions clearer.

#### DISCUSSION

The licensing bases for nuclear power plants are currently established through deterministic analyses. These analyses show that for design basis accidents, a variety of safety limits (reactor coolant system pressure, containment pressure and temperature, peak cladding temperature, 10 CFR Part 100 doses, etc.) are met. Although these limits must be met in all design basis accidents, they will, in fact, be exceeded with some likelihood if a wider range of possible event sequences is considered. If a plant undergoes a modification, such as a power uprate, these limits must still be met in all design basis accidents, but such modifications can reduce margins. The likelihood of event sequences in which these limits will be exceeded increases after the power uprate.

In risk-informed amendments for changes to the licensing basis prepared using the guidance in RG 1.174, the effects for a broad range of event sequences are addressed in terms of core damage frequency (CDF) and large, early release frequency (LERF). Acceptance guidance for  $\Delta$ CDF and  $\Delta$ LERF is provided. As part of the integrated decisionmaking process, the decisionmaker is directed to consider whether the proposed changes maintain sufficient safety margins. However, RG 1.174 does not provide explicit guidance or a methodology for evaluating changes in safety margin.

The draft report is intended to provide a framework to address changes in safety margins. The basic approach is to consider a broad range of event scenarios such as is now done in a probabilistic risk assessment to assess CDF and to determine the frequency with which any safety limits of interest are exceeded after the plant changes. This frequency can then be compared to the comparable frequency of exceedance before the changes were introduced. This comparison could provide a measure of the impact of the change.

In addition to providing an approach to quantifying changes in safety margins, such an approach could provide a way to quantify defense in depth by considering the changes in the failure frequency of individual barriers such as the cladding, the reactor coolant system, and containment independent of whether they, in fact, lead to core damage or large releases of radioactive material. It could also be used to quantify the effect of plant changes on other NRC objectives, such as limiting the frequency of small releases, in a more comprehensive and realistic manner than is currently done through analysis of design basis events.

It is premature to judge whether the approach described to us by the staff can be successful and whether it could be implemented by a reasonable extension of current design basis analyses and probabilistic risk assessments or would require significant additional analysis. The selection of specific safety limits for such analysis will require careful consideration. However, the general approach appears to be worthwhile exploring both in the context of new approaches to regulation such as the technology-neutral framework and for future revisions of RG 1.174. This work should be continued. In the near term, it should focus on the potential for its use as part of the integrated decisionmaking process in RG 1.174 to quantify changes in risk and defense in depth. Specific examples of applications should be developed in order to assess the value of the approach. We would like to continue to hear from the staff about further developments.

The draft NUREG report reflects the preliminary, exploratory nature of the work and needs to be substantially revised before it is published to make its purposes, concepts, and conclusions clearer. During the meeting, members provided detailed comments to the staff for consideration in revising the report.

Sincerely,

**/RA/**

Graham B. Wallis  
Chairman

References:

1. Memorandum from Farouk Eltawila, Director, Division of Risk Analysis and Special Projects, Office of Nuclear Regulatory Research, to John T. Larkins, Executive Director, Advisory Committee on Reactor Safeguards, Subject: ACRS Review of Draft NUREG for Framework Integrating Risk and Safety Margins, dated June 20, 2006.
2. U.S. Nuclear Regulatory Commission Regulatory Guide 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," Revision 1, dated November 2002.

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