January 24, 2002

MEMORANDUM TO: Cynthia Carpenter, Chief
Generic Issues, Environmental, Financial,
and Rulemaking Branch
Office of Nuclear Reactor Regulation

FROM: Michael T. Markley, Senior Staff Engineer
Advisory Committee on Reactor Safeguards

SUBJECT: QUESTIONS ON NEI 00-04, "OPTION 2 IMPLEMENTATION GUIDELINE," AND RELATED MATTERS

During the December 4 meeting of the Subcommittee on Reliability and Probabilistic Risk Assessment (RPRA) and subsequent December 5-8, 2001 ACRS meeting, several Committee members expressed the desire to offer questions for consideration by the NRC staff concerning risk-informing the special treatment requirements of 10 CFR Part 50. In particular, the members expressed the desire to discuss, in more detail, issues related to proposed industry guidance in NEI 00-04, "Option 2 Implementation Guideline." Below is a compilation of the questions submitted by individual ACRS members. These questions do not reflect Committee views. They are offered for the sole purpose of making discussions more effective and efficient during the February 22, 2002 RPRA Subcommittee meeting.

Risk-Informed Safety Class (RISC)

1. Why are there to be four instead of three RISCs? That is, why are important-to-safety-but-not-risk-significant items not entirely the same as items that are not risk significant and not important to safety?

Use of CDF and LERF as Sole Criteria

2. Is there a logical inconsistency between the safety criteria used in the licensing of the existing plants (effectively, a frequency vs. consequences curve) and the criteria used in Option 2 that are based on core damage frequency (CDF) and large, early release frequency (LERF)?

3. The current safety analysis has used a graded approach, in which relatively frequent events cannot fail any of the barriers to the release of radioactivity, while relatively infrequent events are allowed some fuel damage, but these releases must be within 10 CFR Part 100 limits. Equipment implemented to deliver this graded plant performance can be viewed as providing layers of

protection that are part of the defense-in-depth features of the plant, thus, they are generally classified as being important to safety.

4. Option 2, as developed to date, uses as criteria CDF and LERF only. Any component that does not have a role in preventing or mitigating core damage ends up being not risk significant. So, many components that are part of those intermediate layers of protection implemented through the safety analysis will be classified as not risk significant and will end up in the RISC-3 box. Stripping some of these components of their category-one quality requirements may, in fact, degrade defense in depth.

5. How does staff ensure that structures, systems, and components (SSCs) deemed not risk significant are not essential for addressing acts of terrorism and sabotage? How does the staff know that the SSCs are not crucial to address human errors of commission?

PRA Quality

6. How can the suitability of a plant's PRA for use in Option 2 be judged? Some plants have better developed PRAs (e.g., South Texas Project), but not all plants do. What are the shortcomings of the industry-sponsored peer review process grading system in NEI 00-02? How does it address the issue of scope?

7. The peer review process has evolved as more plant PRAs have completed "certification" reviews. Are PRAs graded early in the peer review process comparable to those graded more recently? Are the grades really even over time? Please describe staff plans to independently assess plant PRA certifications. How would staff address an Option 2 application from a plant that seems to have an Individual Plant Examination (IPE) and an Individual Plant Examination of External Events (IPEEE) that is orthogonal to the rest of the industry (e.,g., Susquehanna)?

Quantification of Uncertainties

8. Can the staff be more explicit in requesting that uncertainties in the PRA inputs and, in fact, uncertainties in all the inputs to the expert panel be quantified? In cases where people argue that the uncertainties are not quantifiable, can the staff request the applicant to perform research needed to quantify these uncertainties? How will the staff ensure regulatory decision making is technically sound from a risk perspective and that regulatory decisions are consistent across a broad range of Option 2 applications?

9. Why is sensitivity analysis used as a substitute for uncertainty analysis? Are the insights gained from performing the sensitivity studies suggested in Table 2.4-1 of NEI 00-04, Rev. B, as useful as a rigorous uncertainty analysis? What kinds

of insights does one gain by increasing all human error basic events to their 95th percentile values or by setting all maintenance unavailability terms to 0.0?

10. Importance measures are uncertain, since both CDF and LERF are uncertain. Therefore, there is a probability that the corresponding thresholds for SSC categorization will be exceeded. Would probability be a better indicator of which RISC an SSC belongs to rather than arbitrary sensitivity analyses?

Expert Panel

11. Concerns over the Option 2 processes are normally addressed through assurance that the expert panel will take these concerns into consideration. How does one know that they do and that they do this well? Can this be done and still make the Option 2 process speedy? The time spent on South Texas Project (STP) license amendment requests will not be acceptable for some plants. How does the staff have confidence that the expert panel has a complete list of the concerns? Does the staff has a complete list?

12. The staff has been assured that the expert panel takes into consideration safety analysis commitments that, for example, are intended to prevent 10 CFR Part 100 type releases (see also comments 3 and 4). Nevertheless, how does the staff ensure that the expert panel will not miss some important sequence and degrade defense in depth? Should Option 2 have an explicit decision-making process designed to ensure that equipment implemented to deal with lesser consequences than core melt may still be recognized as safety significant in certain cases?

13. The deliberations of the expert panel in NEI 00-04 do not appear to be as well structured as those of the panel in the STP application. Is this correct and, if so, why?

Evaluation of Recommended Changes

14. Section 4.4 of NEI 00-04, Rev. B, acknowledges that the importance measures used to classify SSCs are based on “one-at-a-time” analyses, while changes proposed under Option 2 would affect groups of SSCs. A sensitivity analysis is recommended in NEI 00-04 to investigate the group effect. The unreliability of RISC-3 SSCs would be increased by a factor of 2 to 5 in this analysis. This is smaller than the factor of 10 that the STP used. Why is this reduction acceptable?

15. The justification that the factor of 2 to 5 is appropriate because it is representative of the change in reliability between a mean value and the 95th percentile is not clear. An uncertainty analysis is not required. Thus, it is not apparent whether the point estimates used in the PRA are mean values or some

low or high percentile. How is it known that a change in requirements does not shift the entire distribution? Is the justification still valid considering these observations?

16. How will shutdown, fire, and external-event risks be factored quantitatively into the evaluations?

17. Should Figures 3.1-1(based on fire PRA) and 3.1-2 (based on the FIVE code) use similar criteria for classifying SSCs? In particular, which part of Fig. 3.1-2 corresponds to the criteria Fussell-Vesely (F-V) $\geq$ 0.005 and Risk Achievement Worth (RAW) $\geq$ 2 of Fig. 3.1-1?

The Calculation of Importance Measures

18. Why is the F-V importance of a component the sum of the F-V importances for the relevant failure modes of the component (section 2.4.2.1 of NEI 00-04, Rev. B)? How are common-cause failures treated in this context?

19. Why is the RAW importance the maximum of the RAW values computed for basic events involving the component?

20. Why aren't common-cause failures considered when RAW is calculated?

21. The common-cause failures are usually modeled in PRAs using parametric models such as the Multiple Greek Letter model or the Alpha Factor model. Thus, the failure rate of a component appears in both the "random-failure" basic events and the events representing common-cause failures. How does this observation affect the evaluation of F-V and RAW?

22. Please explain in detail the results shown in the table on page 29 of NEI 00-04, Rev. B.

Lack of Rigor

23. It appears that a number of the assessments in Option 2 are based either on calculations that lack sufficient justification or on arbitrary sensitivity studies. The expert panel is expected to do the "right thing" and correct the deficiencies of the assessment process. Why is this acceptable to the staff? Should the staff request that state-of-the-art uncertainty analyses be done and that all the methods for evaluation be subjected to scrutiny? If a method is proposed as an approximate method, then this should be documented as such. If there is a need for further investigations, how will the staff address the need for risk information not offered by licensees?

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