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Charles J. Haughney, Acting Director
U.S. Nuclear Regulatory Commission
Spent Fuel Project Office
Mail Stop O-6F18
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Dear Dr. Haughney:

I have recently become aware of your draft document, NUREG-1609, Standard Review Plan for Transportation Packages for Radioactive Material, and am providing comments thereon. I realize that it is dated November, 1997 and hope that these comments arrive in time for your consideration in this first issuance. Also, document NUREG/CR-6551, "Recommendations for Preparing the Criticality Safety Evaluation of Transportation Packages," was referenced in NUREG-1609, but I had not been aware of its existence. Thus, I have only now reviewed it and provide belated comments thereon.

Permit me also to introduce myself so that it will be apparent where my interests lie. I am the Group Leader of the Nuclear Criticality Safety Group at Los Alamos National Laboratory and am also the chairman of American National Standards Subcommittee 8, Operations with Fissionable Materials Outside Reactors. With two exceptions, transportation and nuclear waste disposal, the consensus standards promulgated by Subcommittee 8 provide the criticality safety guidance which all NRC licensees and DOE contractors follow, and provide the basis for regulatory compliance in criticality safety. Thus my interests and comments are limited to nuclear criticality safety.

ISSUE

NUREG-1609, Chapter 6, "Criticality Review," is generally very well written and references all appropriate sections of 10 CFR 71. While quite detailed, the guidance is written in general language such that there is latitude for both an author and a reviewer to reach a reasoned, professional judgment as to how much detail is sufficient. Generous use of words such as "appropriate," "sufficient," and "properly" are found throughout. My concern lies with the reference document, NUREG/CR-6551 and, specifically, whether or not the minimum, administrative, subcritical margin of 0.05 is a requirement or not.

This report uses the word "recommendations" in the title and numerous other places throughout, and there is also frequent use of the word "should" when referring to

subcritical margins, in particular the value 0.05. The ANS-8 standards define "should" as meaning a recommendation, not a requirement. I now list from NUREG/CR-6551 those sections which refer to an "administrative subcritical margin."

1.3 SUMMARY RECOMMENDATIONS

6. . . . the NRC position is that transportation packages SHOULD have a minimum administrative subcritical margin of 0.05 Δk.

7. . . . demonstrate that the effective neutron multiplication factor . . . is limited to 0.95.

5 VALIDATION OF CALCULATIONAL METHOD

. . . The validation process SHOULD . . . and SHOULD justify that . . . will ensure an actual package $k_{eff} < 0.95$.

4. . . . . The NRC currently regards 0.05 Δk as the minimum administrative margin of subcriticality that SHOULD be considered for transportation packages.

5.4 ESTABLISHMENT OF ACCEPTANCE CRITERIA

Δk_m = a REQUIRED margin of subcriticality (minimum of 0.05 for applications of approval for packaging);

7. SUMMARY

. . . the minimum margin of subcriticality ACCEPTED by the NRC for transportation packages is 0.05 Δk.

From my past interactions with the NRC in the SARP arena, my recent involvement with 10 CFR 60 and spent fuel disposition issues, and some of the words quoted above, my concern is that a minimum Δk of 0.05 is considered mandatory by the NRC staff. If this is indeed the case, then I would like to argue that this is (1) inconsistent with NRC practice with essentially all other licensee operations with fissile material, (2) inconsistent with IAEA packaging and transportation regulations, (3) inconsistent with cost-effective regulation, and (4) not technically defensible. Permit me to elaborate on each of these issues.

Standard ANSI/ANS-8.1 provides general guidance for the establishment of subcritical limits for operations involving fissile materials. It makes no distinction between transportation operations and all others. While an additional subcritical margin in excess of the bias determined during the code benchmarking process is always used in practice, it is only mentioned explicitly in ANSI/ANS-8.17 in this regard, but it will be also in the forthcoming revision of ANS-8.1. However, the magnitude of this margin is left to the judgment of the analyst.

This discretion is appropriate, since the closeness with which the actual operation or credible upset conditions approximate actual critical experiments (in important neutronic features) is both variable and not accurately quantifiable. In the past, the IAEA has chosen to recommend a minimum Δk of 0.03 for transportation analyses. This possesses the same philosophical dilemma as 0.05, but does not carry with it the same magnitude of potential cost implications to the taxpayer due to its much lesser value. The international standard which is the equivalent of ANS-8.1, ISO 1709, is much less definitive than ANS-8.1 in regards to requiring margins of subcriticality.

While there are troubling issues associated with any mandated, minimum administrative subcritical margin, as mentioned above, there is an additional one associated with transportation of fissile material. The risk to workers is inherently much less in any credible criticality accident (transportation) scenario than in plant process operations. This statement has a dual basis.

First, the determination of the TI has built into it many conservatisms not routinely included in the criticality analyses for process operations: 10 CFR 71 requires that one analyze (1) "most reactive arrays" when, in reality, the array sizes dictated by truck dimensions result in much less reactive arrays; (2) optimum interspersed moderation (arrays) and water flooding of the containment vessel (single units); and (3) conservatism factors of 5 and 2 associated with normal and accident conditions when determining the transport index. These three are all individually significant conservatisms and they are additive.

I can conceive of no credible SST accident scenario which could result in anything remotely approaching the "most reactive array" upon which the TI is based. Perhaps in this day of exclusive use of SSTs for truck transport of significant quantities of fissile materials we have lost sight of the goal of these regulations: to facilitate the "safe AND efficient" conduct of business. "Safe" will never be an absolute, and "how safe" must always be tempered by the realities of cost.

The second part of the risk equation is consequence. A criticality accident in transportation would seem to have much less consequence, as measured by radiation exposures, than it would in a process plant. One must conjecture transportation accident scenarios; they always seem to revolve around either submersion or water associated with fire-fighting. I realize that there is the often expressed concern for public exposures during transport; but we should not delude ourselves; this is a red herring in any practical sense. I can conceive of no scenario where a member of the public would be allowed to be within a hundred feet (more likely several hundred feet) of a serious SST accident involving either fire-fighting or underwater recover actions. This assures that there would be no significant prompt dose to any member of the public. Now let us reflect on "worker" exposures.

In a fire scenario, the fire-fighters are the closest "workers." However, there are only two possibilities; either the fire is large, in which case the firefighters will not be within any credible lethal range from the prompt neutrons and gamma rays from the hypothesized criticality accident, or the fire is small, in which case no significant thermal damage will be done to the packages and no significant water (e.g., hand-held fire extinguishers) will be used in the fire-fighting. In this latter case no criticality accident scenario can be

envisioned. In any case, the process plant "worker" is at greater risk from the prompt radiation from any credible criticality accident, and yet the regulations are stricter for control of transportation risks. This appears to be inconsistent from both regulatory and actual risk viewpoints.

I am enclosing copies of two recent papers presented at American Nuclear Society meetings that touch on this subject. In addition, I note and heartily endorse the recently released draft, "Regulatory Guide 3013," which removes most of the remaining gaps between NRC regulations in nuclear criticality safety and ANS-8 standards.

I hope that your response to this letter will not only answer my specific question as to the mandatory nature of the 0.05 Δk, but will also lead to a deeper discussion on the issues I raise. As safety professionals, our goal is protection of people (and the environment), but always with actual risks and costs in mind.

Thank you for asking for comments on NUREG-1609 and I await your reply.

Sincerely,

Tom

Thomas P. McLaughlin

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