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Tel. 301/415-8200 (Tuesday, July 11, 1995)

NOTE TO EDITORS:

The Nuclear Regulatory Commission has received the attached report from its Advisory Committee on Nuclear Waste. The report, in the form of a letter, provides comments on regulatory issues related to the NRC's performance assessment program for low-level radioactive waste.

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Attachment:
As stated

ACNWR-0106

June 28, 1995

The Honorable Ivan Selin
Chairman
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Dear Chairman Selin:

SUBJECT: REGULATORY ISSUES IN LOW-LEVEL RADIOACTIVE WASTE DISPOSAL PERFORMANCE ASSESSMENT

As a continuation of the Advisory Committee on Nuclear Waste (ACNW) review of the Low-Level Radioactive Waste (LLW) Performance Assessment (PA) program, and consistent with its program plan, the NRC staff briefed the Committee on March 16, 1995, on recent LLW PA activities. The staff emphasized its response to comments received from the public on the preliminary draft Branch Technical Position (BTP) on LLW PA, including input from the LLW Performance Assessment Workshop on November 16-17, 1994. The Committee will review the draft BTP when it is available.

The NRC staff sought ACNW's advice on its proposed resolution of public comments on four regulatory issues:

(1) Consideration of Site Conditions, Processes, and Events in Performance Assessment

(2) Performance of Engineered Barriers

(3) Time Frame for Performance Assessment

(4) Treatment of Sensitivity and Uncertainty in Low-Level Waste Performance Assessment

CONSIDERATION OF SITE CONDITIONS, PROCESSES, AND EVENTS IN PERFORMANCE ASSESSMENT

The Committee agrees with the staff's preferred approach of developing a reference natural setting for performance assessment based on anticipated conditions, processes, and events. It is a reasonable approach to define the natural setting on the basis of information about the site, taking into consideration conclusions about future changes in the site. To the extent that the site information suggests it is important to consider such phenomena as earthquakes, climate changes, volcanic activity, etc., then it is also appropriate to include such threats in the definition of the natural setting. We caution the staff not to preclude "direct" or explicit consideration of certain events that may in fact be realistic, based on site information. From the risk perspective, if there is evidence that such threats could become a reality, then it is also important to address the issue of occurrence frequency as a function of severity based on all the evidence from the site. In terms of what should be considered and what should not, the Committee believes in the principle of completeness, where completeness means if there is evidence of a significant contribution to risk, it should be considered; if not, that contribution to risk need not be analyzed further. The exception would be those events or scenarios that are already accounted for through regulatory siting or design considerations.

PERFORMANCE OF ENGINEERED BARRIERS

The Committee has some concern about the consistency of the staff's approach to the performance assessment of engineered barriers. On the one hand, the staff adopts the view that one should demonstrate the performance of engineered barriers for any time frame, while on the other hand, they indicate that it will be assumed that beyond 500 years the barriers are in a degraded state. Although the staff indicates that an applicant may take credit for a longer period of time than 500 years, there is certainly a lack of incentive for the applicant given the staff position. The applicant should have the latitude to take credit for engineered barriers that can be demonstrated through analysis and competent design. The selection of an arbitrary point in time appears to be without technical basis. The thrust of the staff position that seems to put most of the reliance for safety performance on site characteristics to assure containment is not an adequate basis for limiting the utility of a creative and convincingly designed engineered barrier. Some would argue that there is much more confidence in the state of knowledge of the containment capacity of a quantitatively specified

engineered system than of a natural system based on the more difficult task of quantitative site characterization. In the end, the underlying criterion should be the health and safety consequences of the overall disposal facility. A reasonable interpretation of the 500-year requirement is that it be a minimum for engineered barrier integrity, and the BTP should reflect this approach.

TIME FRAME FOR PERFORMANCE ASSESSMENT

The Committee believes there is merit in choosing a generic maximum time frame for analyzing the safety of an LLW facility. We do caution the staff against letting time-frame limits detract from focus on the actual performance of a site-specific LLW facility. One important attribute of the LLW field is the variability in the radionuclide content of LLW. For example, much larger quantities of long-lived radionuclides are being disposed of as low-level waste than was previously anticipated. The result is that at some sites, peak doses will occur at times longer than 10,000 years. We believe the application of peak dose calculations to be an important issue and plan to report to you on this subject after a timely review of this topic. Again, the Committee urges the principle of completeness by assessing first the safety of a specific facility and then being satisfied that it is in compliance with the regulations. Nevertheless, the BTP should identify a time period such as 10,000 years, for which performance assessment of an LLW site should be completed and beyond which such analyses should not be required.

TREATMENT OF SENSITIVITY AND UNCERTAINTY IN
LLW PERFORMANCE ASSESSMENT

The Committee appreciates the difficulties the staff is having in adopting a probabilistic methodology in performance assessment. We agree with the staff's observation made in their March 16, 1995, presentation to the ACNW that the "treatment of uncertainty (is) a necessary component in a credible performance assessment." We believe the BTP should include requirements for the evaluation of uncertainties and sensitivities by probabilistic methods. The

Committee reiterates its strong support of probabilistic methods as indicated in its letter of June 3, 1994.

On a more technical note, the staff identifies three types of uncertainties: (1) scenario uncertainty, (2) model uncertainty, and (3) parameter uncertainty. The Committee agrees that these are all important components of uncertainty, but suggests that the first two be considered together as they both are really part of the modeling process. A performance assessment model can be viewed as a structured set of scenarios, thus making the scenarios an integral part of the modeling; that is, the means of coupling specific physical processes. The coupling of the physical processes with the scenarios and their attendant uncertainties needs to be explicitly visible.

Another technical issue that adds some confusion to uncertainty analysis as discussed by the NRC staff in its March briefing on the BTP is the reference by the staff to "conservative point values to bound parameter ranges." It is the "to bound parameter ranges" part of this statement that is confusing. The staff appears to be suggesting that the probability distributions should be conservative. If so, this is a contradiction in logic. For the distributions to have meaning, they have to represent the analyst's full state of knowledge about the parameter or issue in question. The opportunity then exists to choose conservative values within that distribution, an example of which is that the 95th percentile of the distribution is below 100 mrem per year. Also, there is nothing to prevent selection of a point value outside the distribution. However, such choices should not be confused with the actual quantification of the uncertainty — a very important reference. The use of conservative bounding points amounts to artificially stretching out the distribution to represent a level of uncertainty that cannot be supported by the evidence.

In summary, the Committee generally supports the staff's approach to each of the four issues listed above. Our concerns are mainly in the interpretation of the approaches and in the progress by the NRC staff toward the implementation of a probabilistic methodology for performance assessment and especially in the treatment of uncertainty. We recommend that the staff be more focused on the

final result (i.e., the bottom-line safety performance measures), even though we recognize the attempt to encourage the defense-in-depth philosophy by focusing on such intermediate results as time frames for the assumed degradation of engineered barriers. We believe compliance with the regulations should not be at the expense of blurring the analysis of the overall performance of a specific low-level waste site.

Sincerely,

Martin J. Steindler
Chairman, ACNW