

LETTERS TO THE EDITOR



COMMENTS ON "APPLICATION OF SIMPLIFIED RELIABILITY METHODS FOR RISK ASSESSMENT OF NUCLEAR WASTE REPOSITORIES"

I would like to offer the following comments on the paper by Pritzker and Gassmann.¹ The approach suggested by Pritzker and Gassmann is intended to be useful in the early design and site evaluation phase of a waste repository. There are two difficulties with the suggested approach. First, it may, in some cases, be quite inappropriate to characterize failure of natural and man-made barriers using exponential probability density functions (pdf's). The form of the pdf is likely to significantly affect the results. Given the difficulty in estimating a pdf for a barrier, a simpler and more reliable approach would be to adopt a deterministic model. The paper's results, which show the relative importance of various barriers, could all have been derived by assuming fixed failure times.

The second difficulty with the approach is that the relative comparisons are based on the *peaks* of the risk curves. This peak is *not* equal to the expected value of the peak release rate, the quantity of significance in evaluating repository performance. A low peak expected release rate does *not* imply that no individuals receive large doses. This difficulty could be removed by using an alternative performance measure, the integrated release rate. The integral of the probable release rate curve over time gives the expected release and can be related to net health effects.

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July 8, 1980

REFERENCE

1. A. PRITZKER and J. GASSMANN, "Application of Simplified Reliability Methods for Risk Assessment of Nuclear Waste Repositories," *Nucl. Technol.*, **48**, 289 (1980).

REPLY TO "COMMENTS ON 'APPLICATION OF SIMPLIFIED RELIABILITY METHODS FOR RISK ASSESSMENT OF NUCLEAR WASTE REPOSITORIES' "

We do not claim that our method¹ is sufficient for the risk assessment of nuclear waste repositories, nor do we think that it should not be further improved. However, we still believe that it is a relatively simple approach that allows a fast and *preliminary* judgment of repository concepts. The usefulness of the application of reliability methods has to be discussed, of course, and therefore we are grateful to Koplik for his comment.²

We agree that the relative importance of the single barriers could be evaluated in a deterministic way. However, taking into account the uncertainty of existing models, a large amount of combinations of fixed barrier failure times have to be considered in order to cover the entire time axis. The advantage of the probabilistic approach is that it yields these results directly and in a closed form, by means of a pdf that takes into account all possible failure times.

The exponential pdf may indeed be inappropriate. Here it can be considered only as a first approximation. Our approach is the following: The mean time to failure of a single barrier is estimated in a deterministic way. Under normal circumstances we can assume, for example, a normal pdf around this value. However, since there are many possible influences that can change such a pdf, we assume random failures and therefore use the exponential pdf, which we believe to be conservative. In contrast to Koplik,² we think that at this stage uncertainty and a lack of information are best handled by using a relatively rough probabilistic approach. Other pdf's are being examined, but they require more refined models. Such models are also needed for reliable, extensive, and detailed deterministic calculations, which we think *cannot* be replaced by our approach.

As to the second difficulty mentioned in the comment, we agree in principle with Koplik. However, the probable discharge rate in function of time should not be integrated for itself, but should be introduced into a biosphere transport model, from which the actual accumulation of a nuclide in the recipient area would be obtained. We tried to indicate this by estimating, for the peak values of the

probable discharge rate, the minimum required surface water flow that would keep the released activity below some limit. Since our approach does not include biosphere transport, we did not go further.

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August 4, 1980

REFERENCES

1. A. PRITZKER and J. GASSMANN, "Application of Simplified Reliability Methods for Risk Assessment of Nuclear Waste Repositories," *Nucl. Technol.*, **48**, 289 (1980).
2. C. M. KOPLIK, "Comments on 'Application of Simplified Reliability Methods for Risk Assessment of Nuclear Waste Repositories,'" *Nucl. Technol.*, **52**, 319 (1981).