LETTERS TO THE EDITOR

ON LIMIT-LINE CURVES IN RISK EVALUATION

Farmer[1,2] proposed the use of a limit line relating acceptable release and probability per year for a single accident sequence, and he estimated overall risk (i.e., curies released per year) on the assumption that only a few accidents would be near the limit line. Others[3-5] have chosen to integrate such a limit line to assess the overall risk to the public, with the specification that each and every detailed accident chain should lead to a combination of release magnitude and recurrence interval such that the point falls below the limit line. However, in Ref. 5 the authors also state that "a single nuclear accident is represented by a point on the Farmer limit line." Farmer[6] questioned aspects of Ref. 5, but does not take issue specifically with the above quote.

It appears that the approach of integrating a limit line per Ref. 5 affords potential difficulties in that, at least in principle, it can underestimate the overall risk from the totality of accident chains. More directly, an individual accident sequence, having some frequency of occurrence and some associated consequence (release) does not correspond to a point on the limit line. If integration of the limit line is to be limiting, an additional condition must be met, namely,

$$\sum_{\text{all } i} C_i P_i \le \int_0^{C_{\max}} L(c)dc = \int_{f_{\min}}^{f_{\max}} \mathcal{L}(f)df \quad ,$$

where

C_i = curies released in each specific i

P_i = frequency of specific event i, yr^{-1}

$L(c)$ = "limit line" drawn on a plot of frequency (f) versus release (c) that envelopes points corresponding to events i. [Reference 5 sets the release = $\int \mathcal{L}(f)df$].

In other words, there may be so great a density of points (i.e., events) lying near the limit line that the above condition is not met.

This problem should not arise (in principle) if one defines[3]

$$dP(c) = g(c)dc \quad ,$$

where $dP(c)$ is the number of events per unit time that give a release between c and $c + dc$, and where $g(c)$ is a "probability distribution" that has been determined from a detailed analysis of reactor system faults, and presumably reflects the actual situation.

Then

$$P(C_2) - p(C_1) = \int_{C_1}^{C_2} g(c)dc$$

is the probability per unit time that a release between C_1 and C_2 will occur. The total release per unit time is given by

$$R = \int_0^{C_{\max}} cg(c)dc = \sum_{\text{all } i} C_i P_i \quad .$$

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COMMENTS ON "TOTAL ENERGY INVESTMENT IN NUCLEAR POWER PLANTS"

In their recent paper,[1] Rombough and Koen purport to calculate the total amount of energy required to construct and operate a 1000-MW(e) light water reactor (LWR) for 30 yr. We agree with the authors that an energy accounting system is superior to an economic one and, therefore, applaud the effort their paper