3. A. G. GIBBS, "The Time-Dependent First Flight Escape Probability for an Infinite Cylinder," submitted to *Nucl. Sci. Eng.*

Response to "Time-Dependent Escape Probabilities and Chord Distribution Functions"

In his Letter to the Editor, Gibbs[1] obtains a general expression for the time-dependent first-flight escape probability in terms of the chord distribution function. As he points out, the calculations via the chord distribution function do indeed provide an alternative method for obtaining the time-dependent escape probabilities (a method that we did not investigate) and may be a more suitable method for the simple uniform source cases considered in Ref. 2. We thank him for bringing this to our attention.

Nevertheless, there are two points in his presentation that require clarification. First, the limits of integration of the chord distribution function integral are not necessarily from 0 to ∞ but are over the minimum and maximum chord lengths in the body. Hence, in Eq. (1) of his letter, the limits of integration should be R_{min} to R_{max}, and in Eqs. (2) through (5) the limits are X_{min} to X_{max}. Second, we note that Eq. (6) does not contain any step functions even though the solutions given in Ref. 2 contain them. To clarify this, we write his Eq. (5) as

$$\tilde{P}(s) = v \cdot \int_{X_{min}}^{X_{max}} \left\{ \frac{1 - \exp[-(\Sigma v + s)(\langle R \rangle x/v)]}{\Sigma v + s} \right\} g(x)\, dx \ . \tag{1}$$

The inverse transform of the above equation is

$$P(t) = v \cdot \exp(-\Sigma v t) \times \int_{X_{min}}^{X_{max}} \left[H(t) - H\left(t - \frac{\langle R \rangle x}{v}\right)\right] g(x)\, dx \ . \tag{2}$$

Expanding the solution in Eq. (2) yields

$$P(t) = v \cdot \exp(-\Sigma v t) \left[\int_{X_{min}}^{X_{max}} g(x)\, dx\, H(t) - \int_{vt/\langle R \rangle}^{X_{max}} g(x)\, dx\, H\left(t - \frac{\langle R \rangle X_{max}}{v}\right) + \int_{vt/\langle R \rangle}^{X_{min}} g(x)\, dx\, H\left(t - \frac{\langle R \rangle X_{min}}{v}\right)\right] , \tag{3}$$

where

$$X_{min} = \frac{R_{min}}{\langle R \rangle} \quad \text{and} \quad X_{max} = \frac{R_{max}}{\langle R \rangle} \ .$$

From the expression given in Eq. (3), we do note the importance of the integration limits and their appearance in the arguments of the step function. The step functions relate the time t to characteristic lengths (chords) of the body under consideration. Using Eq. (3), the slab and solid sphere uniform source solutions in Ref. 2 are easily reproduced.

D. L. Henderson
C. W. Maynard

Oak Ridge National Laboratory
P.O. Box X, Bldg. 6025
Oak Ridge, Tennessee 37831

December 18, 1987

REFERENCES

1. A. G. GIBBS, *Nucl. Sci. Eng.*, **99**, 365 (1988).

2. D. L. HENDERSON and C. W. MAYNARD, *Nucl. Sci. Eng.*, **97**, 203 (1987).