Online Regulatory Guide Errors

TO THE EDITOR: I would like to draw attention to a discrepancy between 2 versions of the Nuclear Regulatory Commission (NRC) Regulatory Guide 8.39, "Release of Patients Administered Radioactive Materials." Originally, Regulatory Guide 8.39 was available in print form only (*1*); now, however, an online version of the Regulatory Guide is available on the NRC Web site (*2*). This online version contains an error in Equation B-5 that is not present in the print version of the document. There is also an incorrect factor used in an example that illustrates the use of this equation, which similarly disagrees with the printed document.

Equation B-5 is used to determine whether or not an individual administered an amount of radioactive material can be safely released from confinement. It is used to calculate the total effective dose equivalent (TEDE) to any other individual from exposure to the released individual who had been administered the radioactive material. Such an individual could be released if this dose were calculated to be ≤5 mSv (500 mrem).

On the NRC Web site, Equation B-5 appears as follows:

$$D(\infty) = \frac{34.6 \Gamma Q_0}{(100 \text{ cm})^2} \{E_1 T_p (0.8)(1 - e^{-0.693(0.33)/T_p}) +$$

$$e^{-0.693(0.33)/T_p} E_2 F_1 T_{1\text{eff}} + e^{-0.693(0.33)/T_p} E_2 F_1 T_{2\text{eff}}\}.$$

The last expression of the equation, $e^{-0.693(0.33)/T_p} E_2 F_1 T_{2\text{eff}}$ contains an error, and should instead be written: $e^{-0.693(0.33)/T_p} E_2 F_2 T_{2\text{eff}}$, where F_2 refers to thyroidal uptake fraction (not the extrathyroidal uptake fraction, F_1). The printed version of the NRC Regulatory Guide 8.39 contains the correct equation for B-5.

Fortunately, from a radiation-safety standpoint, the online equation errs on the conservative side. In other words, calculation of TEDE using the erroneous equation when treating thyroid cancer would suggest that even a therapeutic dose as low as 1,295 MBq (35 mCi) [131]I would be enough to disallow release from confinement. Using this calculation, such a dose would erroneously result in a TEDE to another individual of 5.04 mSv (504 mrem), which is greater than the 5-mSv (500 mrem) allowable limit for release from confinement. Using the correct equation, the 1,295-MBq dose would actually yield a TEDE of only 0.79 mSv (79 mrem). Given the right circumstances, patients administered as much as 7,400 MBq (200 mCi) [131]I have been able to be released from confinement with supporting calculations using the correct equation.

When treating hyperthyroidism, however, inclusion of this error in the calculation could result in the release of patients who would not ordinarily be legally released. Fortunately, here, the threshold for release would be reached at the unusually high treatment dose of >2,094 MBq (56.6 mCi). Such a dose should result in a TEDE

to another individual of 5.00 mSv (500 mrem). Instead, because of the error, the online equation would yield a TEDE of only 1.73 mSv (173 mrem), which is considerably below the legal threshold. Hypothetically, ablation treatment doses as great as 5,550 MBq (150 mCi) would still allow release of the treated individual, according to the online equation; use of the correct equation factor, however, would yield a TEDE to another individual of 13.26 mSv (1,326 mrem)—2.7 times the legal limit.

The second error in the online Regulatory Guide 8.39 is in the example illustrating the performance of calculations using Equation B-5. Example 2, Thyroid Cancer, uses an F_2 of 0.5 instead of the correct factor of 0.05, as specified in the printed document (*2*). Because the value is off by a factor of 10, one cannot reach the same result as the example until one recognizes that the factor used is erroneous.

The NRC was notified of these errors, but, as of this writing, they have yet to correct them. I am concerned because Equation B-5 on the online Regulatory Guide has already been cited (*3*), and it will most likely continue to be used by those who are not aware of these errors. Such use can result in patients either mistakenly being confined (along with the accompanying degradation of quality of life, cost, and risk issues surrounding such confinement) or, worse, being mistakenly released in a condition that places the public at increased risk.

REFERENCES

1. Nuclear Regulatory Commission. Release of patients administered radioactive materials. Regulatory Guide 8.39. Washington, DC: U.S. Government Printing Office; 1997.
2. Nuclear Regulatory Commission. Release of patients administered radioactive materials. Regulatory Guide 8.39. Available at http://www.nrc.gov/nrc/rg/08/index.html.
3. Tuttle WK, Brown PH. Applying Nuclear Regulatory Commission guidelines to the release of patients treated with sodium iodine-131. *J Nucl Med Technol.* 2000;28:275–279.

Frank P. Dawry
Department of Veterans Affairs Medical Center
Miami, Florida

Editor's Note: Mr. Dawry's letter was received on April 6 and accepted for publication on May 2. Having simultaneously contacted the NRC regarding the error described in his Letter to the Editor, Dawry was later notified by the NRC, who thanked him for pointing out the error and assured him that the error had been corrected. Although this notification occurred during the production process of Dawry's letter and, hence, before publication, we feel that his letter should be published in its entirety.