## External and Internal Dose to Individuals After $^{131}$I Outpatient Therapy

**TO THE EDITOR:** I would like to comment on the article by Coover et al. (*1*) on a simplified method to comply with federal regulations 10CFR35.75 during outpatient treatment with $^{131}$I. The method presented in this paper closely follows the method described in Nuclear Regulatory Commission Regulatory Guide 8.39 (*2*). Unfortunately, 8.39 has been misconstrued by Coover et al. and by other authors, leading to inappropriate neglect of internal dose when performing calculations to comply with 10CFR35.75. Coover et al. state, ". . .studies show that those exposed to patients receiving $^{131}$I therapy incur relatively little internal radiation contamination and that it may be overlooked. . . ." To support this statement, Coover et al. cite Regulatory Guide 8.39; however, 8.39 does not support the neglect of internal dose in thyroid cancer patients.

Appendix B to 8.39 outlines procedures for calculating doses based on patient-specific factors and presents 4 sample calculations. Examples 1 through 3 are sample calculations of external dose, and Example 4 is a sample calculation of internal dose. At the end of the sample calculation in Example 4, Regulatory Guide 8.39 says, "Internal doses may be ignored in the calculations if they are likely to be less than 10 percent of the external dose. . . ." This sentence has been widely misconstrued to mean that internal doses may be ignored in calculations; but in the case of thyroid cancer patients, internal doses are *not* usually less than 10% of the external dose, and should not usually be ignored. To illustrate this point, Example 2 in Appendix B calculates the external dose to individuals exposed to a patient who is postthyroidectomy and has been treated with 200 mCi $^{131}$I. With the standard assumptions for uptake, clearance, and occupancy factors, the external dose to individuals calculated in Example 2 is 0.453 rem. Using the method of Example 4 to calculate the internal dose to individuals exposed to this patient, with the standard assumptions for ingested fraction and Dose Conversion Factor, the result is 0.106 rem internal dose. For standard postthyroidectomy conditions, and using the methods presented in Regulatory Guide 8.39, the internal dose is not less than 10% of the external dose, and should not be ignored.

The calculated values for external and internal doses to individuals have large uncertainties and depend on patient behavior, which is difficult to control or predict. However, using the methods and assumptions presented in Regulatory Guide 8.39 for individuals exposed to thyroid cancer patients, the internal dose is not always less than 10% of the external dose, and cannot be automatically ignored. In these patients, the internal dose should be calculated and added to the external dose, and the total should be compared to the 5 mSv limit. This is not a burdensome task, because the calculation of internal dose by the method of 8.39 is far simpler than the calculation of external dose. Furthermore, the result of the internal dose calculation is expressed as Effective Dose Equivalent, which can be simply added to the external dose (*3*). In practice, the inclusion of the internal dose offers another advantage. If there will be children exposed to the patient, the dose conversion factor for children increases as the age of the child decreases (*4*). This provides a rational method to partially estimate an increased risk to children who may be exposed to the patient.

It could be argued that both the internal and external dose calculations, as presented in Regulatory Guide 8.39, are overly conservative. If, however, the methods and assumptions presented in Regulatory Guide 8.39 are not challenged, then we are obliged to include internal dose as well as external dose in calculations to comply with 10CFR35.75 for thyroid cancer patients.

### REFERENCES

1. Coover LR, Silberstein EB, Kuhn PJ, Graves MW. Therapeutic $^{131}$I in outpatients: a simplified method conforming to the Code of Federal Regulations, Title 10, Part 35.75. *J Nucl Med*. 2000; 41:1868–1875.
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4. International Commission on Radiological Protection. *ICRP Publication 53: Radiation Dose To Patients from Radiopharmaceuticals*. Tarrytown, NY: Pergamon Press; 1988.

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**REPLY:** The authors appreciate the comments of Dr. Wooten, as they allow us to elucidate some important facts. In our model, *relative* exposure is being considered. The exposure Wooten refers to in Example 4 of the Regulatory Guide is the *absolute* exposure secondary to $^{131}$I that has been excreted by the patient and then internalized by the exposed individual. Example 4 arbitrarily multiplies the calculated internal dose to the exposed individual by a factor of 10. This serves to exemplify a conservative estimate of the maximum absolute dose the exposed individual would reasonably be expected to receive secondary to internal exposure.

When considering the relative contribution of internal dose, multiplying the contribution from internal dose by a factor of 10 is no more appropriate than multiplying the contribution from external exposure by a factor of 10. For example, if external exposure secondary to a patient treated with 30 mCi $^{131}$I for toxic multinodular goiter were arbitrarily multiplied by a factor of 10, patient hospitalization would be mandated in most cases.

Additionally, for perspective, even if we did accept the exaggerated hypothetical model used in Example 4 (which we do not), the internal dose suggested by Wooten is less than the background radiation received by most Americans in less than 4 months.

Minimizing the internal dose to others through patient education is very important. Discussing appropriate radiation safety measures with the patient should always be performed before dose administration.

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