LETTERS TO THE EDITOR

Thyroid Contamination from Airborne I-131

Airborne iodine-131 contamination associated with the clinical use of liquid sodium radioiodide has been reported previously in the literature (*1,2*). Quantification of this contamination by Browning et al. (*3*) is a welcome addition. We wish to draw attention to a misinterpretation and an error in the paper and then to mention an observation that we have made.

First, the misinterpretation. The authors state that the maximum permissible *thyroid* burden of I-131 is 0.7 μCi. In fact, 0.7 μCi is the maximum permissible *body* burden (MPBB) (*4*) and represents the amount of I-131 distributed throughout the total body that will result in the maximum permissible dose rate to the thyroid. The fraction of the total-body I-131 assumed to be in the thyroid is given as 0.2 in Table 12 of Ref. 3. Thus the "permissible" thyroid burden is, apparently, 0.14 μCi. These burden values are set to limit the weekly dose received by the thyroid to 0.6 rem per week. Thus the 0.14 μCi is the thyroid burden averaged over 1 wk and not simply the burden present on a single day. It must be pointed out that these burdens come from the *recommendations* of the International Commission on Radiological Protection (ICRP) (*4*) and are not *regulations* listed in the Federal Register (10 CFR 20) (*5*). However, the maximum permissible concentration values for I-131 in air and water listed in 10 CFR 20 (Appendix B, Table I) imply that these ICRP burdens are in effect. To confuse the situation even more, a careful inspection of the ICRP recommendations reveals that, although the MPBB for I-131 was calculated based on a maximum permissible *dose rate* of 0.6 rem per week, the actual maximum permissible *dose* to the thyroid is expressed per calender quarter and not per week and is 8 rem per 13 wk. Assuming an absorbed dose of 1.3 rad per μCi administered (*6*), does this mean that a radiation worker can legally ingest 6 μCi of I-131 every 13 wk?

The problem with applying the MPBB concept is that it is based on chronic uptake situations rather than on the acute uptakes normally encountered in the nuclear medicine laboratory. Of course, the proper approach is to keep exposures as low as reasonably achievable, but it must be remembered that licensees are legally obligated to report overexposures to the United States Nuclear Regulatory Commission (see 10 CFR 20). Just what represents a "reportable" thyroid burden has been a source of confusion (*7*) and still is. Regardless of this confusion, 0.7 μCi should not be held to be the maximum permissible thyroid burden.

The formula for calculating the I-131 in the thyroid is,

$$\text{Activity in thyroid } (\mu\text{Ci}) = \text{Activity of known standard } (\mu\text{Ci}) \times \frac{\text{cpm}_{\text{neck}} - \text{cpm}_{\text{thigh}}}{\text{cpm}_{\text{std.}} - \text{cpm}_{\text{phantom bkg.}}}$$

and not as given on page 1079 of Ref. 3. The error there is obviously just a typographic one, since the values reported in the article indicate that the correct equation was used.

We have observed thyroid burdens of up to 0.18 μCi at 24 hr following participation in the administration of I-131 for the treatment of thyroid carcinoma. Moreover, we have found that the amount of contamination is related to the supplier of the I-131. With I-131 obtained from one manufacturer, thyroid contamination is routinely observed in personnel administering treatments for hyperthyroidism and thyroid carcinoma. With another manufacturer, for the same limited counting interval, no I-131 thyroid activity is detected above background. We believe that the difference in observed volatility results from the difference in pH between the two commercial preparations.

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REFERENCES

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Reply

We welcome the comments made by Carey and Swanson regarding our paper on Airborne Concentration of I-131 in a nuclear medicine laboratory.

The maximum thyroid burden of 0.7 μCi of I-131 as mentioned in our paper was quoted from Reference 6. The same reference quotes the maximum permissible body burden to be equal to 50 μCi. However, we do agree that the permissible thyroid burden would be of the order of 0.14 μCi.

The correct formula for determining the activity in the thyroid gland of the technician as mentioned on page 1079 of our paper was a typographic error, and we apologize for the error.

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Safe Handling of Radioiodine

I would like to comment on the paper of Browning, Banerjee, and Reisinger (*1*) concerning airborne radioiodine. Several years ago, I wrote a paper (*2*) on safe practice in the handling of radioactive iodine. In it, I pointed out that iodine is a very special material both because of its chemistry and because of the avidity of the thyroid for iodine.