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COMPUTATION OF I-131 DOSE IN HUMAN THYROIDS RESULTING FROM CASTLE FALLOUT IN U.S.

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Dr. Dunning has asked me to compute for you from the available data the I-131 dose in human thyroids resulting from CASTLE fallout in the U. S. I estimate the total dose to have been less than 1.5 rep, as compared with the present maximum permissible dose per year of 15 reps (0.3 rep/wk).

The basis of the calculation was as follows:

Observations on Thyroid Activities

1. LeRoy measured 4 human thyroids from Chicago autopsies by scintillation counting. As of July 12, 1954, activities ranged from 0.5-1.6 x 10^{-4} μc/gm. Judging from half-life, the activity was quite definitely I-131. Dr. Dunham believes the local hospital I-131 contamination might possibly be the source, rather than fallout.

2. Harley measured 1 human thyroid from N. Y. after digestion and chemical separation of I. This technique gave high sensitivity but Harley is not positive of 100% recovery. No I-131 was demonstrated, and an upper limit of activity was estimated at about 2% that observed by LeRoy.

3. Looney and Colodzin at NMRI measured several human thyroids from Washington by scintillation counting. Their results were negative, with an upper limit of about 1/5 LeRoy's value.

4. Hardin Jones has observed I-131 in the urine of some patients in San Francisco, none in other patients. His figures are not yet available to me.

5. Van Middlesworth, Hardin Jones, and others measured the activity of cattle, sheep, hog, and dog thyroids in June. On cattle and sheep their results (extrapolated to July 12, LeRoy's date) were approximately the same as LeRoy's. Van Middlesworth found hogs and dogs to contain much less activity/gm thyroid than cattle and sheep. Hardin Jones found dogs approximately as high as cattle.

REVIEWED BY Jose Diaz 6/2/81 DATE
REVIEWED BY Walbur a. Strauser 6/3/81 DATE
REVIEWED BY Lewis W. Lewis 6/11/81 DATE

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My analysis of the inhalation vs. oral ingestion routes of uptake leads me to believe ingestion is much the more important. Hardin Jones, however, believes inhalation explains his data better. If it is assumed that oral ingestion is dominant, one would expect human activity to be lower than grazing animals'. (However, where milk is an important dietary component, available data on I transmission through milk suggest that human thyroids would not be much lower in activity/gm than the cows'.) LeRoy's data probably give only an upper limit to the average American human thyroid activity; the actual value is quite likely lower by a considerable factor. My calculations are based on LeRoy's values.

Time Scale of I-131 Ingestion

To extrapolate from observed activity in July to integrated dose from the full CASTLE series, an estimate must be made of quantity of ingestion as a function of time. Preliminary data from Lynch on fallout indicate that essentially all I-131 measured in June and July originated from the May 4 shot. Total fallout in the U. S. from CASTLE was about 3 times that from the May 4 shot, such that total thyroid dose from CASTLE would have been three times that from the May 4 shot.

In my calculations I have assumed that all fallout in the U. S. from the May 4 shot occurred on May 15, and that a continuous ingestion of I-131 was thereafter maintained at a constant number of fissions per day. If, on the contrary, I had assumed all thyroid activity observed in June and July was taken up on May 15, total dose would have been higher by a factor of about 5.

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