Robertson,
Any comments
an answer is needed
I guess.
Gene

DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE

IN REPLYING, ADDRESS THE

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Dr. E. P. Cronkite
Medical Department
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Dear Gene:

I recently read with great interest, the publication "Some Effects of Ionizing Radiation on Human Beings," TID 5358, July 1956.

In the conclusion of the article it is stated that internal contamination certainly could not have contributed to the acute medical picture. It is stated on page 76 of the article that "the total amount of radioactive material in the G.I. tract at one day post detonation was estimated to be 3 mc in people from Rongelap."

It occurred to me that this may have been a sufficient quantity to have contributed to the gastrointestinal syndrome. I estimate that based on an equation of K. Z. Morgan (page 37 of June 1954 Nucleonics) parts of the G.I. tract would have received over 200 rad. I would appreciate your comments on this matter.

Incidentally, in the event you do not recognize my name, you and I commuted together between Edgewood and Silver Spring, Maryland for a short course some six or seven years ago.

Sincerely yours,

A. Wolff

Arthur Wolff, Sr. Veterinarian
Clinical Services

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[illegible] is assumed the average [illegible] is 2,200 cm³ of water and [illegible] m³ of air. Values of T, E, [illegible]ed to obtain the data in the [illegible] obtained from Table IV of [illegible]al Dose Handbook (5).

[illegible] exposure results from a single [illegible] a radioisotope, the critical [illegible] often is not the same as for [illegible] chronic exposure; frequently [illegible] of ingestion it is the gastro-[illegible] (GI) tract, and in case of [illegible] it is either the respiratory or the GI tract. When a portion of the GI tract is the critical tissue, the amount of the radioisotope in the critical organ, $q f_2$, as given by Eq. 1 is replaced by the amount present at any [illegible] the critical portion of the GI [illegible] $e^{-0.693t/T_r}$, and the average dose [illegible], W, is integrated from the time of arrival, h_0, to the time of departure, h_1, of the radioactive material from the critical portion of the GI tract. The [illegible] dose, D, is given by

$$D = \frac{93}{100}\int_{h_0}^{h_1} \frac{W\,dt}{7}$$

$$= \frac{93/100\, I_0 \Sigma(\mathrm{RBE})E}{2.6 \times 10^{-3} \times 7m'}\int_{h_0}^{h_1} e^{-0.693t/T_r}\,dt \qquad (7)$$

$$D = \frac{51.1\, I_0 \Sigma(\mathrm{RBE})E(h_1 - h_0)}{m'G} \qquad (8)$$

where $G = 1$ when the radioactive half-life $T_r \gg 1$. G is given by

$$G = \frac{0.693(h_1 - h_0)}{(e^{-0.693h_0/T_r} - e^{-0.693h_1/T_r})T_r} \qquad (9)$$

If it is assumed the mass of the material, m', in the critical portion of the GI tract irradiates the intestinal wall from half the solid angle for fraction $h_1 - h_0$ of a day, the maximum permissible concentration in water is given by

$$(\mathrm{MPC})_w^{GI} = \frac{2I_0}{f_w 2{,}200} = \frac{1.8 \times 10^{-5} m'DG}{(h_1 - h_0)f_w\Sigma(\mathrm{RBE})E} \qquad (10)$$

In this case f_w is the fraction reaching the critical portion of the GI tract and is given by $f_w = (1 - f_1)$ where f_1 is the fraction going from the GI tract to the blood.

Usually, when a radioisotope is inhaled, some of it is swallowed. If a considerable portion enters the blood stream from the GI tract and is deposited in some organ, Eq. 6 must be used to find the $(\mathrm{MPC})_a$. If a portion of the GI tract receives the largest dose so that it is the critical tissue, Eq. 10 must be modified as follows

$$(\mathrm{MPC})_a^{GI} = \frac{2{,}200 f_w}{2 \times 10^7 f_a}(\mathrm{MPC})_w^{GI} = \frac{2 \times 10^{-9} m'DG}{(h_1 - h_0)f_a\Sigma(\mathrm{RBE})E} \qquad (11)$$

where $f_a = 0.62\,(1 - f_1)$ is the fraction retained in the critical GI tissue, and the other terms are as defined previously. In most cases, i.e., where $T_r > 1/2$ day, the lower large intestine

Maximum permissible intake of a radioisotope in a single exposure

Whereas values of maximum permissible body burden and maximum permissible concentration in air and water for the equilibrium condition have been given in the Internal Dose Handbook (5) for some 70 radioisotopes, no maximum permissible single-exposure values have been published by the National Committee on Radiation Protection. Therefore, the single-exposure values published here—in the table—do not have official status. However, many persons are working with radioactive materials under conditions in which an accident could lead to a single exposure; it would be convenient to have available tables of values that apply in such a case. It was with this in mind that an effort was made to determine and list in the table the maximum permissible single-exposure values for the radioisotopes considered in the Internal Dose Handbook (5).

[illegible]

$D = (93.6\,f\,I_0\,\Sigma(\mathrm{RB}$ [illegible]

where D = total [illegible] to the critical [illegible] X rad)* delivered in [illegible] I_0 = total amount [illegible] taken into body by [illegible] tion in a single [illegible] calculation [illegible] of not more than 1 [illegible] mum permissible [illegible] $(\mathrm{MPC})_w$ and [illegible] sumption during [illegible]

[illegible]