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OFFICE OF THE MEDICAL SECTION
P. O. Box 287, Station 43
Rochester 7, New York

3201 (12)

March 13, 1945

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The District Engineer
U. S. Engineer Office
Manhattan District
Post Office Box E.
Oak Ridge, Tennessee

Attention: Lt. Col. H. L. Friedell 27748

Dear Col. Friedell: Subject: Postum Tolerance

For your information I am including in this letter calculations that may be useful to you in arriving at a possible tolerance or permissable dose figures for postum in plant personnel urine and in plant air.

Tolerance of postum in human urine:

Assumptions:

1. 40 microcuries postum per kilo is 50% lethal to rats in 20 days.
2. 100 r per day for twenty days is 50% lethal to rats in 20 days.
3. 0.1 r per day is tolerance for gamma radiation in man.
4. Postum is metabolized in man quantitatively as in the rat.
5. The ratio of alpha to gamma ray tolerance is the same in man as in the rat.
6. Man as well as the rat excretes 0.05% or 5×10^{-4} of the postum in the body daily in the urine.

Calculations:

a. $70 \times 40 = 2800$ microcuries = 20 days 50% lethal dose in 70 kilo rat.

b. $0.1/100 = 1 \times 10^{-3}$ = ratio of tolerance dose of gamma radiation in man to the daily dose 50% lethal in 20 days.

c. 1 microcurie $= 2.2 \times 10^{6}$ disintegrations per minute.

d. $2.8 \times 2.2 \times 10^{6} = 6 \times 10^{6}$ disintegrations per minute in body is tolerance.

e. $6 \times 10^{6} \times 5 \times 10^{-4} = 3 \times 10^{3}$ disintegrations per minute, the maximum permitted value in 24 hour collection of human urine.

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Assumption 1 is the result of preliminary experiments carried out at Rochester. This figure probably does not differ from the true value by more than 20%. Dr. Boche feels that the figure for assumption number 2 cannot be at all accurately evaluated with present data. His best estimate would be slightly below 100 r. He states that experimental determination of this figure can be carried out with relative ease and asks whether this should be done. What is your opinion?

Tolerance of Postum in plant air:

The basis of this tolerance figure was developed in a discussion with Mr. Silverman at Dayton.

Assumptions:

1. 10 cubic meters of air breathed daily.

2. The postum from 5 cubic meters is absorbed daily.

3. Tolerance in body is 6×10^6 disintegrations per minute.

4. Since there will be other sources of postum intake to be assumed, permitted tolerance in body of postum absorbed from air assumed to be 1/5 of above, or 1.2×10^6 disintegrations per minute.

5. Postum is lost from body at the rate of 1% per day by combined excretion and disintegration.

6. Postum concentration in lungs is not a limiting factor in setting tolerance.

Calculations:

a. Amount that may be absorbed daily equal amount excreted daily with 1.2×10^6 disintegrations per minute in body, equals $.01 \times 1.2 \times 10^6 = 1.2 \times 10^4$ disintegrations per minute.

b. Amount permitted in 10 cubic meters air $= 2 \times 1.2 \times 10^4$ equals 2.4×10^4 disintegrations per minute.

c. Amount permitted in 1 cubic meter air $= 2.4 \times 10^3$ disintegrations per minute. This is equivalent to

$$\frac{2.4 \times 10^3}{2.2 \times 10^6} = 1.1 \times 10^{-3} \text{ microcuries per cu. meter.}$$

or 1.1×10^{-15} curies per cubic cm.

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It may be noted that this is 37 times greater than the tolerance figure suggested in Clinton report CH-2587 of 3×10^{-17} curies / cc. air.

Remarks on Assumptions:

Assumption 2. Work is under way in Rochester to give a figure for this assumption based upon experiment.

Assumption 5. This is based upon results of rat experiments.

Assumption 6. Experiments conducted at Rochester indicate that postum deposited in lungs as dust is 80% removed in 1 day and practically all removed in 10 days. The total amount retained in the body behaves as though 30% were swallowed and the remainder absorbed directly from the lungs.

One may note that if exposure is entirely by inhalation the permissable concentration figure may be increased by a factor of 5.

Full scale on the least sensitive scale of the alpha surface meter used at Dayton is about 1 microcurie postum, or 10^6 counts per minute under 50% geometry conditions. Therefore, concentrations on the laboratory tables in the Unit 4 laboratory were the order of 1 microcurie per square 6 inches on a side, or greater, and on the floor 1/3 to 2/3 of this amount.

Sincerely yours

/s/ William F. Bale

William F. Bale

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