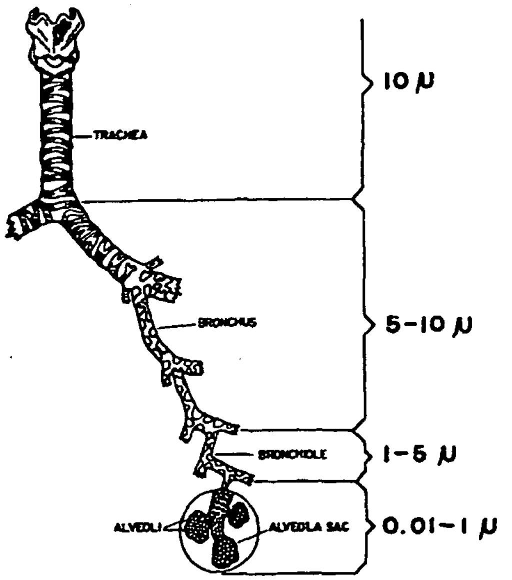

FIG 44-9 – Deposition of materials inhaled into the bronchial tree, according to particle size in microns

Adapted from Atomic Radiation, © 1957 by RCA Service Co, Inc

44-9)

Fortunately, the lung dynamics are such that most of the particles of size greater than 1µ are not retained to any degree, so that the probability of this occurring is low From the standpoint of measuring the concentration in air, the particle size does not enter into the problem because the air sample is only counted for total activity In terms of defining or assessing the hazard though, the particle size is important

Calculations The degree of the risk of the inhalation hazard may be estimated from a calculation of the concentration of the radionuclide together with a knowledge of breathing rates It can be assumed that a man breathes 10,000 liters (10 cu m) of air in eight hours In general, a man breathes 8 liters per minute at rest, 16 while seated, and 24 while walking A single breath equals about one-half liter

One rough estimate of the hazard may be made on the basis that the material released has been uniformly mixed with the air in the room or building An alternate calculation may be made on the assumption that the released material has been limited to a small number of liters of air which the exposed person has then breathed

The radioactivity concentration guides (RCG's) are based upon an *average* concentration over a continuous exposure time (a lifetime of 40 hr per week or working time) The *concentration* at any one location varies over a time period as does the *exposure time* in the particular concentration for employees whose work takes them into many different locations To find the average concentration, it is best to calculate a *time-weighted average concentration* The concentration which has been measured existed for the period of elapsed time represented by the air-sampling time The time-weighted average concentration is the sum of the products (each concentration found multiplied by the associated lapsed time), divided by the total elapsed time of all of the sampling time periods

Similarly, the time-weighted average concentration of a particular employee is the sum of the products (each concentration in which he worked multiplied by the associated time so worked) divided by the total elapsed time of the period in question Thus, a single high exposure for a few minutes may average out to be far below the RCG if most of the remainder of the time period in question had a zero concentration In such calculations, the decay rate of the radionuclide is an important correction factor if there is a long time in terms of half-life period between sample collection and analysis or if there is a very short half-life (See, for example, NBS Handbook 51, p 27, item 27 4)

Guide doses

External sources For whole-body exposure at any age, a person's ***total accumulated*** absorption of ionizing radiation affecting critical organs (in rems) should not exceed five times the number of years beyond age 18, that is 5x(age–18), provided that no 13-week increment exceeds 3 rems

Doses of ionizing radiation should not exceed those values given in Tables 44–C and –D

The Atomic Energy Commission has adopted "Standards of Radiation Protection" which are published in their Manual, Chapter