TABLE 42-E

MAXIMUM PERMISSIBLE FLUX FOR OCCUPATIONAL EXPOSURE TO VARIOUS TYPES OF IONIZING RADIATIONS*

Type of Radiation	RBE	Average Exposure Rate† (mrad/wk)	Approximate Flux to Give a Maximum Permissible Exposure in an 8-hr Day‡
X- and gamma rays	1	100	$\frac{1{,}400}{E}$ photons/sq cm/sec in free air at 0 deg C (error < 13 per cent for $E = 0.07$ to 2 Mev)
Beta rays and electrons	1	100	$\frac{4.3 \times 10^7}{(\mathrm{RBE})P}$ electrons or beta rays/sq cm/sec incident on tissue (≃23 electrons or 15 β/sq cm/sec of 1 Mev energy)
Thermal neutrons	2.5	40	700 thermal neutrons/sq cm/sec incident on tissue
Fast neutrons	10	10	19 neutrons of 2-Mev energy/sq cm/sec incident on tissue
Alpha particles	10	10	$\frac{4.3 \times 10^7}{(\mathrm{RBE})P}$ alpha particles/sq cm/sec incident on tissue (≃ 0.005 alpha of 5 Mev/sq cm/sec)
Protons	10	10	$\frac{4.3 \times 10^7}{(\mathrm{RBE})P}$ protons/sq cm/sec incident on tissue (≃ 0.06 protons of 5 Mev/sq cm/sec)
Heavy ions	20	5	$\frac{4.3 \times 10^7}{(\mathrm{RBE})P}$ heavy ions/sq cm/sec (≃ 0.0002 oxygen ions of 5 Mev/sq cm/sec)

FOOTNOTES

*Values of flux corresponding to dose values as recommended in 1959 by the National Committee on Radiation Protection and by the International Commission on Radiological Protection

†Average occupational exposure rate permissible to blood-forming organs (essentially total body exposure), gonads, and eyes of persons of age 18 or over. These values may be averaged over a year, provided the RBE dose in any thirteen weeks does not exceed 3 rem (rem = RBE × rad). All values in columns 3 and 4 may be increased by a factor of 6 if the exposure is primarily to the skin, thyroid, or bone. They may be increased by a factor of 3 if the exposure is limited to organs other than blood-forming organs, gonads, or eyes

‡Maximum permissible exposure rate based on a 20-mrem RBE dose delivered to tissue in an 8-hr day (= 2.5/RBE mrad/hr) and assuming $W = 35$ for alpha and 34 for beta and secondary electrons. The rad in soft tissue is considered to correspond to an energy absorption of 100 ergs/gm. The P is the stopping power in units of electron volts/gm/sq cm of soft tissue.

From A. H. Snell, *Nuclear Instruments and Their Uses*, New York City, John Wiley & Sons, Inc., 1962