4. Radiation Units

With the introduction of the Ionising Radiations Regulations 1999, it has been obligatory to adopt the International System of Units (S1) for use with ionising radiations. These will be used throughout the local rules, and the only conversion factors to the old units will be found below in this section.

4.1. Activity

The SI unit of activity is the Becquerel, and is equal to one disintegration per second. This is a very small unit in relation to the Curie, which is the activity of 1g of radium, equivalent to 3.7×10^{10} dps.

4.2. Absorbed Dose

When ionising radiations pass through matter, some or all of the energy they possess is given up, and the absorbed dose is a measure of this energy deposition. In the SI units, 1 gray (Gy) is defined as the energy deposition of 1 joule per kilogram.

4.3. Equivalent Dose

For the same absorbed dose of radiation, some types of ionising radiations have a greater biological effectiveness. To allow for this, radiation weighting factors have been introduced which reflect the ability of different ionising radiations to cause damage, and if we multiply the absorbed dose by the appropriate factor, we arrive at what is called the Equivalent Dose. This is measured in Sieverts. For work with beta, gamma and X-ray emissions, this factor has been assigned a value of 1 and, therefore, will be of no concern to most people. A summary of radiation weighting factor values is given below.

Type of radiation	Radiation Weighting Factor
Beta Gamma & X-ray emissions	1
neutrons	2.5-20
protons	2
alpha particles	20

4.4 Summary of Units

Quantity	New SI Unit	Old Unit
Activity	becquerel - Bq (1 disintegration s^{-1})	curie - Ci (3.7×10^{10} dps)
Absorbed Dose	gray - Gy (1 $J.kg^{-1}$)	rad - (0.01 $J.kg^{-1}$)
Equivalent Dose	sievert - Sv (Gy x weighting factor)	rem - (rad x weighting factor)

Prefixes used with SI Units

Factor	Prefix	Symbol
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n

Some useful conversions

Dose		Activity	
1 Sv = 100rem		1 μCi = 37 kBq	
50mSv = 5 rem		1 mCi = 37 MBq	
200 μSv = 20 mrem		1 Ci = 37 GBq	
7.5 $μSv.h^{-1}$ = 0.75$mrem.h^{-1}$		1 kBq = 27 nCi	
		1 MBq = 27 μCi	
		1 GBq = 27 mCi	