

CHAPTER 1

SOURCES OF RADIATION

1.1 Introduction

The radiation to which humans are exposed varies widely in :

- type and energy distribution,
- geographical distribution, and with
- occupation.

The main sources of radiation can be categorized as follows :

Category	Source/Machine	Radiation
Environmental	Cosmic Rays	neutrons, protons, electrons, photons
	Radioactivity	α - and β - particles, γ -rays, neutrons
Artificial	orthovoltage X-rays	kV X-rays
	linac/betatron	MV X-rays, electrons and radioactivity
	Van de Graaff and Cyclotron	protons, neutrons and radioactivity
	Synchrotron	electrons, protons, X-rays, uv photons
	Nuclear Reactor	neutrons, γ -rays, residual radioactivity

The minimum requirements for a full understanding of radiation action are :

- the energy spectrum of the incoming radiation,
- the energy-dependent cross-sections of the medium,
- the density and atomic number of the medium.

Table (1.1) Terrestrial sources of radiation averaged over the UK population [1]. The unit of exposure ($\mu\text{Sv yr}^{-1}$) is defined in section 7.1. Large differences from these means are received by certain population groups (see chapter 11). Data for 1994 come from [1] in chapter 11.

Category	Main source	1986	1994
nuclear power	^{235}U fission products, ^{90}Sr , ^{137}Cs	2	0.4
occupational exposure	X-rays, isotopes	8	7
weapons tests	^{235}U , ^{239}Pu fission products	10	5
everyday sources	coal, tobacco, air travel	10	0.4
medical tests	X-rays, radioisotope scans	250	370
cosmic rays	protons, electrons, neutrons	300	260
food	^{40}K , ^{137}Cs , ^{14}C , ^{131}I	370	300
rocks and buildings	^{238}U , ^{235}U , ^{232}Th	400	350
atmosphere	^{222}Rn , ^{137}Cs	800	1300
TOTAL		2150	2593

This chapter considers the energy spectra from some of the most important sources of radiation and, in the case of artificial sources, its dependence on the means of production. In the consideration of background radiation, Table (1.1) shows that there are contributions from both natural and man-made sources.

The natural environment accounts for ~ 80% of the radiation exposure of the UK population. Of this, α -particle emissions from atmospheric radon are by far the most important. Some building materials contain long-lived actinide elements in small quantities while traces of naturally occurring isotopes (^{40}K and ^{12}C) are present in all of us. More detailed figures are given in Chapter 11.