Review: 'Influence of Dose and its Distribution in Time on Dose-Response Relationships for Low-LET Radiations'. National Council on Radiation Protection and Measurements (NCRP) Report 64. (pp 216 + vi). Washington, USA.

The objective of this report is to examine the available radiobiological data to recommend numerical values which describe the genetic and carcinogenic effects in man due to exposure to ionising radiation. The scientific committee of NCRP responsible for this report had in mind the needs of those charged with developing basic radiation protection criteria.

The report consists of eleven chapters and an appendix in which a low dose is defined as less than 20 rads and a low dose rate as less than 5 rads per year while those greater than 200 rads and 5 rads per minute are defined as high. The main text begins by considering the effects of dose and dose-rate in a simple biological system, namely Tradescantia, which has been well studied. The discussion of dose response leads to the conclusion that a linear-quadratic relationship is compatible with models and theories regarded as acceptable. This conclusion is the same as that reached in the BEIR III report now available in a typescript version.

Genetic effects are discussed with special emphasis on chromosome aberration studies. These studies are not suggestive of any correlation between radiation-induced cytogenetic lesions and any clinically apparent effects. The genetic changes in germ cells of the mouse indicate a strong dependence on the age of the animal (particularly the female) and on dose rate. Cell mutation and survival in plants is discussed for a range of LET irradiations.

Prenatal irradiation can injure the embryo or the foetus but analysis of the effects in terms of dose rate has not been helpful in understanding

the response since the diversity of types of damage leads to a highly complex sequence of events between insult and outcome. The discussion on changes to life span associated with exposure to radiation concludes that the data on man is inadequate to demonstrate any reduction in life expectancy through effects other than induced neoplasms. An interesting summary of the state of knowledge on the effect of dose rate on tumourigenesis in animals rejects the possibility of the existence of a simple dose-rate effect factor which is applicable to all tumour types.

Clearly the important chapter and the objective of the document is that dealing with tumourigenesis in man. This is presented in sections which deal separately with leukaemia, breast cancer, thyroid cancer and all cancers. Considering the central nature of this topic, the discussions are rather sparse compared with the space devoted to other chapters. However if we recognise that this has been comprehensively reviewed elsewhere (for example by UNSCEAR and BEIR) this is not too serious a shortcoming. In a final discussion limitations are faced; these include inadequate data, models used for interpretation, variations in relative biological effectiveness for radiations of different quality and the existence of sensitive subgroups. There is also a brief summary of reports which claim to demonstrate large effects induced by low doses but which are not accepted a valid contribution to the evidence.

This NCRP report is a compact book and taken together with the 24 pages of references of its source material makes a useful review of low-LET radiation-induced effects by bringing together the radiobiological plant and animal experiments with the human data to arrive at dose response relationships for use in radiological protection.

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