
CONTENTS

PREFACE	iii
CONTENTS	v
1 GENERAL INTRODUCTION	1
1.1 Introduction	1
1.2 The discovery of ionising radiation and its consequences	3
1.3 Radiation research and related policies in the Netherlands	8
1.4 Thesis outline	12
2 QUANTITIES AND UNITS IN RADIATION PROTECTION	15
2.1 Introduction	15
2.2 Basic concepts of radiation protection	17
2.3 Dosimetric quantities related to external radiation fields	20
2.4 Exposure to radon and short-lived decay products	24
3 RADIATION SOURCES, DOSES AND DOSE	
DISTRIBUTIONS IN THE NETHERLANDS	29
3.1 Introduction	29
3.2 Average radiation dose and dose range	29
3.3 Radiation dose due to natural radiation	30
3.4 Radiation dose due to enhanced natural radiation	36
3.5 Radiation dose due to artificial radiation sources	39
3.6 Total radiation dose to the population in the Netherlands	41
3.7 Conclusions and discussion	44
4 DESCRIPTION OF PROCESSES	45
4.1 Introduction	45
4.2 Radioactive decay of a radionuclide in a decay series	45
4.3 Production and transport of radon in soil	48
4.4 Horizontal and vertical transport of radon in the atmosphere	53

4.5	Dose rate from (natural) radioactivity in soil or on the soil surface	59
4.6	Radiation from radionuclides in air	71
4.7	Cosmic radiation and cosmogenic radionuclides	72
5	INSTRUMENTATION: THE DUTCH NATIONAL RADIOACTIVITY MONITORING NETWORK	75
5.1	Introduction	75
5.2	Global network specifications	76
5.3	Suitability of the Bitt RS02/RM10E for environmental radiation research	85
5.4	The FAG FHT59S gross- α/β -activity monitor applied to time-resolved measurements of ^{222}Rn progeny in air	98
6	VARIATIONS IN AMBIENT DOSE RATE	115
6.1	Introduction	115
6.2	Temporal variations in ambient dose rate	117
6.2.1	<i>Dry periods</i>	118
6.2.2	<i>Washout and rainout of ^{222}Rn progeny</i>	127
6.2.3	<i>A dynamic compensation method for the natural background</i>	136
6.3	Source-dependent probability densities to explain frequency distributions of ambient dose rate in the Netherlands	147
6.4	Spatial variation in the terrestrial dose-rate component and its correlation with soil type	164
7	VARIATIONS IN EQUILIBRIUM-EQUIVALENT DECAY PRODUCTS OF ^{222}Rn	175
7.1	Introduction	175
7.2	Site description	177
7.3	Concentrations of airborne ^{222}Rn decay products	177
7.4	Meteorological variables, soil type and <i>EEDC</i>	183
7.5	A time-resolved illustration	194
7.6	Conclusions and discussion	197

8	A MODELLING APPROACH	199
8.1	Introduction	199
8.2	Methods	200
8.3	Process description	203
8.4	Results	210
8.5	Conclusions and discussion	215
9	SUMMARY AND OUTLOOK	217
9.1	Introduction	217
9.2	Instrumentation	218
9.3	Data analysis	219
9.4	Modelling results	222
	APPENDICES	229
	App. 1: Soil_Rad input data	229
	App. 2: Soil types and dose rate	231
	REFERENCES	239
	NEDERLANDSE SAMENVATTING	253
	CURRICULA VITAE	260
	NAWOORD	261