

Volume 2 No. 3/4 1979

Annals of the ICRP

RA
1231
.R26
I55
no.30
Pt.1
c.3

ICRP PUBLICATION 30

PART 1

Limits for Intakes of Radionuclides by Workers



Pergamon Press OXFORD · NEW YORK · FRANKFURT

LIBRARY, ARGONNE NATIONAL LABORATORY

RADIATION PROTECTION

ICRP PUBLICATION 30

PART 1

Limits for Intakes of Radionuclides by Workers

A report of Committee 2 of the
International Commission on Radiological Protection

ADOPTED BY THE COMMISSION IN JULY 1978

This report supersedes ICRP publication 2

Need ICRP 30 supp 1

PUBLISHED FOR

The International Commission on Radiological Protection

by

PERGAMON PRESS

OXFORD: NEW YORK: FRANKFURT

171231
26155
no 30
p. 1
c. 3

CONTENTS

	Page
Preface	v
Appreciation—W. S. Snyder	vi
Glossary of terms	vii
1. Introduction	1
References	4
2. Basic Limits for the Control of Internal Dose	5
2.1. Introduction	5
2.2. Dose-equivalent limits for occupational exposure	5
2.3. Limits for the intake of radioactive materials by workers	6
2.4. Restrictions on the rate of intake of radioactive materials	7
Reference	7
3. Secondary and Derived Limits for the Control of Internal Dose	8
3.1. Reference Man	8
3.2. Committed dose equivalent (H_{50})	8
3.3. Annual limit on intake (ALI)	8
3.3.1. Application of annual limits on intake	8
3.4. Derived air concentration (DAC)	9
3.5. Derived air concentration for submersion, DAC (Submersion)	10
3.5.1. DAC (Submersion) for elemental tritium	10
3.5.2. DAC (Submersion) for a radioactive noble gas	10
Reference	11
4. Committed Dose Equivalent (H_{50}) and Annual Limit on Intake (ALI)	12
4.1. Introduction	12
4.2. Quantities and units	12
4.2.1. Activity	12
4.2.2. Dose equivalent	12
4.3. Committed dose equivalent (H_{50})	12
4.4. Cellular distribution of dose	14
4.5. Specific effective energy (SEE)	15
4.5.1. Decay schemes	16
4.5.2. Masses of organs in the body	16
4.6. Number of transformations in a source organ over 50 years	17
4.6.1. Build-up of radioactive daughters	18
4.7. Annual limit on intake (ALI)	20
4.8. Derived air concentration (DAC)	20
4.9. Values in the dosimetric data	21
References	21
5. Dosimetric Model for the Respiratory System	23
5.1. Introduction	23
5.2. Deposition and retention model	23
5.3. Transfer of a radionuclide from the lungs directly to body fluids or to the gastrointestinal tract	27
5.4. Calculation of committed dose equivalent, H_{50} , in the lung	28
5.5. Particle size correction	29
References	29
6. Dosimetric Model for the Gastrointestinal Tract	30
6.1. Introduction	30
6.2. Dosimetric model	30
6.3. Activity transferred from the respiratory system	31
6.4. Activity transferred to body fluids	32
6.5. Calculations of committed dose equivalent, H_{50} , to sections of the gastrointestinal tract	32
References	34

	Page
7. Dosimetric Model for Bone	35
7.1. Introduction	35
7.2. Calculation of committed dose equivalent, H_{50} , to cells on bone surfaces and active red bone marrow	35
7.2.1. Estimates of absorbed fractions in skeletal tissues	35
7.2.1.1. Photon emitters	37
7.2.1.2. α emitters uniformly distributed throughout the volume of mineral bone	37
7.2.1.3. α emitters assumed to be on bone surfaces	38
7.2.1.4. β emitters uniformly distributed throughout the volume of bone	39
7.2.1.5. β emitters assumed to be on bone surfaces	41
7.2.1.6. Fission fragments and recoil atoms	42
7.2.1.7. Summary of values of absorbed fractions	42
7.2.2. Estimates of the number of transformations in trabecular and cortical bone	43
7.2.2.1. Parent radionuclides	43
7.2.2.2. Radioactive daughters	43
7.3. Committed dose equivalent, H_{50} , to cells near bone surfaces and active red bone marrow	45
7.3.1. Photon emitters	45
7.3.2. α and β emitters	45
References	46
8. Dosimetric Model for Submersion in a Radioactive Cloud	47
8.1. Introduction	47
8.2. Relative magnitudes of dose-equivalent rates from external and internal radiation	47
8.2.1. Tritium	47
8.2.2. Radon and thoron	48
8.2.3. The noble gases	48
8.2.3.1. Daughter radionuclides	48
8.3. Dose-equivalent rates in body tissues from submersion	49
8.3.1. Photon emitters	49
8.3.2. Electron and β emitters	49
8.4. Derived air concentrations (DAC) for submersion	50
References	50
9. Use and Limitations of the Dosimetric Data	51
9.1. Introduction	52
9.2. Assumptions concerning chemical and physical form	52
9.3. Assumptions concerning metabolic models	52
9.4. Assumptions concerning daughter radionuclides	52
9.5. Assumptions concerning the exposed individual	52
9.6. Assumptions concerning chemical toxicity	53
9.7. Exposure to a mixture of radionuclides by inhalation, ingestion and submersion	53
References	53
Bibliography concerning estimation of dose equivalent from radionuclides in people of different ages	54
Appendix	54
Exact and Approximate Solutions of the Compartmental Models used in this Report	
A.1. Integrated activities in the compartments of a two compartment chain	56
A.2. Total number of transformations of an inhaled radionuclide in the tracheobronchial region of the lung	57
A.3. Total number of transformations of a daughter radionuclide in the pulmonary region	58
A.4. Approximate expressions for total numbers of transformations in the various compartments of the lung and gastrointestinal tract	59
A.4.1. Inhaled and ingested radionuclides	60
A.4.2. Radioactive daughters of inhaled and ingested radionuclides	60
References	61
Metabolic Data	62
	63

In 1967 the Commission on Permissible Dose for Man. It was recognized that the task given by the task force of the tissues in bone marrow. The Commission's basic recommendation is:

The following were members of the Commission's report:

J. Vennart (Chairman)
 Feinendegen; W. J. Snyder (died June 1967)

In addition, the following participated in discussions about the report:

B. Chr. Christensen
 K. Z. Morgan; J. M. Turner

Committee 2 wishes to thank Mrs E. Henry for who materially assisted during the preparation of the report.

The dosimetric calculations were done under the chairmanship of:

W. S. Snyder (died 1967)
 R. Ford; J. W. Posner

Committee 2 wishes to thank for completing this report in the face of an untimely death.