

# CONTENTS

1.	INTRODUCTION .....	1
	1.1. Background .....	1
	1.2. Objective .....	1
	1.3. Scope .....	2
	1.4. Structure.. .....	2
2.	SELECTION OF SAMPLES AND METHODS OF ANALYSIS .....	3
	2.1. Introduction .....	3
	2.2. Biological and physical samples .....	3
	2.3. Methods of analysis .....	5
3.	BIOLOGICAL SAMPLES .....	15
	3.1. Introduction .....	15
	3.2. Urine .....	16
	3.3. Faeces .....	18
	3.4. Breath .....	19
	3.5. Blood .....	19
	3.6. Other biological samples .....	20
	3.7. Sample collection and transport .....	21
4.	PHYSICAL SAMPLES .....	22
	4.1. Introduction .....	22
	4.2. Static samplers .....	22
	4.3. Personal air samplers .....	23
	4.4. Surface contamination measurements .....	24
	4.5. Superficial contamination of workers .....	24
5.	TECHNIQUES OF ANALYSIS .....	25
	5.1. Introduction .....	25
	5.2. Radiochemistry .....	25
	5.2.1. Sample preparation and <b>preconcentration</b> .....	26
	5.2.2. Radionuclide separation .....	26
	5.2.3. Preparation of the source for counting .....	27

5.3.	Detection methods	28
5.3.1.	Radiometric techniques	28
5.3.1.1.	Alpha particle counting	28
5.3.1.2.	Beta particle counting	29
5.3.1.3.	Photon counting	30
5.3.2.	Non-radiometric techniques	31
5.3.2.1.	Luminescence methods	31
5.3.2.2.	Delayed neutron counting	32
5.3.2.3.	Inductively coupled plasma/mass spectrometry (ICP/MS)	32
5.4.	Determination of sample activity	32
6.	ACTIVITY CALCULATION AND STATISTICAL CONSIDERATIONS	34
6.1.	Calculation of sample activity	34
6.2.	Detection limits	34
6.3.	Errors and uncertainties	36
7.	QUALITY ASSURANCE	38
7.1.	Quality assurance programme	38
7.2.	Quality assurance techniques	39
7.3.	Performance assessment	41
8.	RECORDS AND REPORTS	42
8.1.	Laboratory record keeping	42
8.2.	Reporting of results	43
	REFERENCES	44
	NOTE ON THE ANNEXES	47
ANNEX I.	MEASUREMENT OF GAMMA EMITTING RADIONUCLIDES IN BIOLOGICAL SAMPLES	49
ANNEX II.	ANALYSIS FOR BETA EMITTING RADIONUCLIDES IN URINE BY LIQUID SCINTILLATION COUNTING	56
ANNEX III.	ANALYSIS FOR STRONTIUM ISOTOPES IN URINE	61

ANNEX IV. ANALYSIS FOR <sup>226</sup>Ra, <sup>228</sup>Ra AND <sup>210</sup>Pb IN BIOLOGICAL SAMPLES . . . . . 66

ANNEX V. ANALYSIS FOR URANIUM IN URINE BY FLUORIMETRY . . . . . 73

ANNEX VI. ANALYSIS FOR THORIUM IN SAMPLES . . . . . 75

ANNEX VII. ANALYSIS FOR PLUTONIUM, AMERICIUM AND CURIUM IN URINE AND FAECAL SAMPLES BY ALPHA SPECTROMETRY . . . . . 81

ANNEX VIII. ANALYSIS FOR TRITIUM AND <sup>14</sup>C BY COMBUSTION TECHNIQUES . . . . . 93

ANNEX IX. DETERMINATION OF CREATININE IN URINE SAMPLES . . . . . 95

GLOSSARY . . . . . 97

CONTRIBUTORS TO DRAFTING AND REVIEW . . . . . 99