

## CONTENTS

1.	INTRODUCTION .....	1
1.1.	Background .....	1
1.2.	Objective .....	2
1.3.	Scope .....	3
1.4.	Structure .....	4
2.	APPLICATION OF THE STANDARDS TO WORK INVOLVING MINERALS AND RAW MATERIALS .....	5
2.1.	Excluded exposures .....	5
2.2.	Applicability of requirements .....	5
2.2.1.	Practice or intervention? .....	5
2.2.2.	Material containing radionuclides of natural origin ...	6
2.2.3.	Radon .....	7
2.3.	Graded approach to regulation .....	7
2.3.1.	Introduction .....	7
2.3.2.	Exemption .....	8
2.3.3.	Notification .....	9
2.3.4.	Authorization .....	10
3.	INDUSTRIAL ACTIVITIES MOST LIKELY TO REQUIRE REGULATORY CONSIDERATION .....	11
3.1.	Industry sectors .....	11
3.1.1.	Extraction of rare earth elements .....	12
3.1.2.	Production and use of thorium and its compounds ...	12
3.1.3.	Production of niobium and ferro-niobium .....	13
3.1.4.	Mining of ores other than uranium ore .....	14
3.1.5.	Production of oil and gas .....	15
3.1.6.	Manufacture of titanium dioxide pigments .....	15
3.1.7.	The phosphate industry .....	16
3.1.8.	The zircon and zirconia industries .....	17
3.1.9.	Production of tin, copper, aluminium, zinc, lead, and iron and steel .....	18
3.1.10.	Combustion of coal .....	18
3.1.11.	Water treatment .....	19
3.2.	Materials .....	19

3.3.	Activity concentration as an indicator of dose from exposure to gamma radiation and to dust .....	19
3.4.	Exposure to radon .....	24
3.5.	Shortlist of industrial operations based on current occupational exposure data .....	24
4.	<b>PRACTICAL TECHNIQUES FOR DETERMINING RADIONUCLIDE ACTIVITY CONCENTRATIONS .....</b>	<b>27</b>
4.1.	Introduction .....	27
4.2.	Sampling of material .....	27
4.3.	Measurement accuracy and quality assurance .....	28
4.4.	Analytical techniques .....	28
5.	<b>EXAMPLE OF AN ASSESSMENT PROCEDURE .....</b>	<b>32</b>
5.1.	Identification of industry sectors .....	32
5.2.	First level of assessment .....	32
5.2.1.	General .....	32
5.2.2.	Underground mines and other workplaces with similar characteristics .....	34
5.3.	Second level of assessment .....	34
5.4.	Other work situations .....	35
	<b>APPENDIX I: URANIUM AND THORIUM DECAY SERIES ....</b>	<b>36</b>
	<b>APPENDIX II: CHARACTERIZATION OF INDUSTRIAL PROCESSES .....</b>	<b>38</b>
	<b>APPENDIX III: DOSE PER UNIT ACTIVITY CONCENTRATION RECEIVED BY A MINERAL PROCESSING WORKER EXPOSED TO GAMMA RADIATION AND TO DUST .....</b>	<b>43</b>
	<b>REFERENCES .....</b>	<b>52</b>
	<b>CONTRIBUTORS TO DRAFTING AND REVIEW .....</b>	<b>55</b>