

## Contents

<b>Foreword</b> .....	<b>ix</b>
<i>I. Lang</i>	
<b>List of Figures</b> .....	<b>xi</b>
<b>List of Tables</b> .....	<b>xiii</b>
<b>Editor's Preface</b> .....	<b>xv</b>
<b>Executive Summary</b> .....	<b>xix</b>
<b>Chapter 1. Environmental Risks</b> .....	<b>1</b>
1.1 What is an Environmental Risk? .....	1
1.1.1 Risk as Hazard .....	1
1.1.2 Risk as Probability .....	1
1.1.3 An Evolutionary View .....	2
1.1.4 Risk as Used in this Report .....	2
1.1.5 Environmental Risks .....	3
1.1.6 Which Environmental Risks are Important? .....	4
1.2 Types of Environmental Risks .....	8
1.2.1 Public Health .....	8
1.2.2 Natural Resources .....	9
1.2.3 Economic Development .....	9
1.2.4 Man-induced and Natural Disasters .....	10
1.2.5 Introduction of New Products .....	10
1.3 The Management of Risks .....	10
1.3.1 Risk Identification .....	11
1.3.2 Risk Estimation .....	11
1.3.3 Risk Evaluation .....	11
1.4 Why We Need Environmental Risk Management .....	11
<b>Chapter 2. Establishing an Overview of the Problem</b> .....	<b>15</b>
2.1 Models, Boundaries and Contexts .....	15
2.2 Modelling the Problem .....	16
2.2.1 Environmental Variability .....	17
2.2.2 Uncertainty in Knowing What to Monitor .....	17
2.2.3 Uncertainty in Knowing Where to Monitor .....	20
2.2.4 Uncertainty in Knowing When to Monitor .....	20
2.2.5 Uncertainty in Knowing How to Monitor .....	20

2.3	Setting Boundaries to the Risk System .....	21
2.3.1	Are Risks from All Sources Included? .....	21
2.3.2	What are the Smallest Effects to be Included? .....	22
2.3.3	What are the Longest Term Effects to be Included? .....	23
2.3.4	Are Risks to the Environment, Other than to Man, Included? .....	24
2.4	Putting the Risk into Comparative Context .....	26
2.4.1	Elevated Risk: Comparison with Background Levels .....	28
2.4.2	Balanced Risk: Comparison of Alternatives .....	29
2.4.3	Comparative Risks: Analysis of Other Risks .....	30
2.4.4	Benefit-Risk: Consideration of Benefits .....	36
<b>Chapter 3.</b>	<b>Identifying and Estimating Risks .....</b>	<b>41</b>
3.1	The Selection of Techniques .....	41
3.2	Environmental Monitoring and Health Surveillance .....	44
3.3	Testing and Screening .....	45
3.4	Modelling .....	48
3.4.1	Technological Models .....	50
3.4.2	Links to Environmental and Behavioural Models .....	50
3.4.3	A Perception-Behaviour Model .....	51
3.5	Environmental Models .....	53
3.5.1	Non-quantitative Models and Probabilistic Models .....	53
3.5.2	Global Models of Biogeochemical Cycles .....	55
3.5.3	Persistent Substances in Food Chains .....	55
3.6	Establishing the Relationship between the Dose and the Effect ....	61
3.6.1	Dose-effect relationships .....	62
<b>Chapter 4.</b>	<b>Risk Evaluations and National Policy .....</b>	<b>67</b>
4.1	Policy Considerations .....	67
4.1.1	What Alternatives are Available? .....	67
4.1.2	Urgency .....	68
4.1.3	Accidents .....	69
4.1.4	Other Factors .....	69
4.2	Legislative Considerations .....	70
4.2.1	Scientific Criteria .....	72
4.2.2	The No Risk Principle: Zero Exposure .....	74
4.2.3	Best Practical Means .....	78
4.2.4	Efficacy .....	81
4.3	Legal Considerations .....	82
4.3.1	Reasonableness .....	82
4.3.2	Nuisance and Negligence .....	83
4.3.3	Assumption of Risk .....	84
4.3.4	Professional Liability .....	84
4.3.5	Probability of Harm .....	85
4.3.6	Magnitude of Consequences .....	85
4.3.7	The Degree of Benefit .....	85

4.3.8 Knowledge of Risk .....	86
4.3.9 Changes in Legal Interpretations of Policy .....	86
4.4 Economic Considerations .....	87
4.4.1 Cost-Benefit Analysis .....	89
4.4.2 Risk-Benefit Analysis .....	91
<b>Chapter 5. Managing Environmental Risks .....</b>	<b>95</b>
5.1 Developing a National Risk Profile .....	96
5.2 Institutional Arrangements .....	98
5.2.1 Super-agencies .....	105
5.2.2 Coordination between Agencies .....	105
5.2.3 Organizational Alternatives to Functional Structure .....	106
5.3 Risk Management Tasks .....	109
5.3.1 Research and Monitoring .....	110
5.3.2 Legislation .....	113
5.3.3 Standard Setting .....	116
5.3.4 Regulation and Enforcement .....	121
5.3.5 Emergency Response .....	123
<b>Chapter 6. International Collaboration in Risk Management .....</b>	<b>125</b>
6.1 Environmental Links .....	125
6.1.1 Trans-border Problems .....	127
6.1.2 Global Hazards .....	131
6.2 Socio-economic Links .....	134
6.2.1 International Trade .....	134
6.2.2 International Aid .....	136
6.2.3 Risks to Internationally Valued or Unique Sites .....	138
6.2.4 Exchange of Information and Scientific Knowledge .....	139
6.3 Common National Problems .....	141
6.4 Emerging Needs and Suggested Actions .....	141
6.4.1 National Risk Management Institutions .....	142
6.4.2 International Activities .....	142
<b>References .....</b>	<b>145</b>
<b>Appendix A .....</b>	<b>150</b>
<b>Index .....</b>	<b>153</b>

