

CONTENTS

| | |
|---|-----|
| RADIOLOGICAL CONSEQUENCES..... | 1 |
| 4. INTRODUCTION | 1 |
| 4.1. RADIOACTIVITY IN THE ENVIRONMENT..... | 2 |
| 4.1.1. The natural environment around the Fukushima Daiichi NPP | 3 |
| 4.1.2. Releases of radionuclides to the atmosphere and radioactivity in the terrestrial environment..... | 5 |
| 4.1.3. Deposition and releases to the marine environment and radioactivity in the aquatic environment..... | 32 |
| 4.1.4. Levels of radionuclides in terrestrial and aquatic foods | 51 |
| 4.1.5. Levels of radioactivity worldwide..... | 65 |
| 4.1.6. Summary | 68 |
| 4.1.7. Observations and lessons..... | 70 |
| 4.2. RADIATION EXPOSURE | 70 |
| 4.2.1. Occupational exposures..... | 71 |
| 4.2.2. Public exposures..... | 91 |
| 4.2.3. Summary | 123 |
| 4.2.4. Observations and lessons..... | 125 |
| 4.3. RADIATION PROTECTION | 126 |
| 4.3.1. International organizations, recommendations and standards | 127 |
| 4.3.2. Radiation protection regulations in Japan at the time of the accident | 135 |
| 4.3.3. Aspects of radiation protection relevant to the response | 137 |
| 4.3.4. Reactions to the situation for radiation protection in Japan and globally..... | 143 |
| 4.3.5. Social issues associated with protective actions | 143 |
| 4.3.6. Summary | 145 |
| 4.3.7. Observations and lessons..... | 146 |
| 4.4. HEALTH CONSEQUENCES..... | 147 |
| 4.4.1. Previous international assessments..... | 148 |
| 4.4.2. Post-accident health surveys in Japan | 151 |
| 4.4.3. Evidence of observable health effects | 154 |
| 4.4.4. Studies of effects on the thyroid..... | 156 |
| 4.4.5. Inference of future risk..... | 159 |
| 4.4.6. Non-radiation effects: Mental health..... | 163 |
| 4.4.7. Summary | 166 |
| 4.4.8. Observations and lessons..... | 167 |
| 4.5. CONSEQUENCES FOR NON-HUMAN BIOTA..... | 168 |
| 4.5.1. Background to the assessment..... | 169 |
| 4.5.2. Dose assessment approaches, end points and benchmarks..... | 170 |
| 4.5.3. The dose assessment of non-human biota in the vicinity of the Fukushima Daiichi NPP..... | 172 |
| 4.5.4. The radiological consequences for non-human biota | 182 |
| 4.5.5. Review of relevant studies on modelling of doses and field observations of effects in proximity to the Fukushima Daiichi NPP | 185 |
| 4.5.6. Summary | 187 |
| 4.5.7. Observations and lessons..... | 188 |
| APPENDIX I: MAPS OF LEVELS OF RADIOACTIVITY AND RADIONUCLIDES IN THE ENVIRONMENT | 189 |
| APPENDIX II: STATISTICAL ANALYSIS OF INDIVIDUAL DOSE DATA..... | 197 |

| | |
|--|-----|
| REFERENCES | 221 |
| CONTENTS OF CD-ROM | 243 |
| ABBREVIATIONS | 244 |
| CONTRIBUTORS TO DRAFTING AND REVIEW | 246 |
| INTERNATIONAL TECHNICAL ADVISORY GROUP | 249 |
| MEETINGS | 250 |