

# Contents

List of Illustrations, ix

List of Instruction Sheets, xiv

Preface, xvi

Acknowledgements, xviii

Units and Abbreviations, xix

## **Part 1 Introduction**

Chapter 1 Occupational Hygiene and Risk Assessment, 3

- 1.1 Introduction, 3
- 1.2 Hazard and risk, 7
- 1.3 Risk assessment, 7
- 1.4 The stages of a risk assessment, 8
- 1.5 Who should carry out risk assessment, 12

Chapter 2 Identifying Hazards, 13

- 2.1 Introduction, 13
- 2.2 Identifying hazards, 13
- 2.3 Example of hazard identification, 15
- 2.4 Conclusions arising from a hazard assessment, 16

Chapter 3 Exposure, Exposure Routes and Biological Monitoring, 18

- 3.1 Introduction, 18
- 3.2 Measuring exposure, 21
- 3.3 Biological monitoring, 22
- 3.4 Exposure assessment: what the legislation requires, 22
- 3.5 Conclusions, 23

Chapter 4 The Exposure Context, 25

- 4.1 Context for measurement, 25
- 4.2 Sources of hazardous substances, 25

- 4.3 Dispersion through the workroom, 27
- 4.4 Receptor, 29
- 4.5 Jobs and tasks, 29

Chapter 5 Why Measure?, 31

- 5.1 Introduction, 31
- 5.2 Reasons for undertaking monitoring, 31

Chapter 6 How to Carry Out a Survey, 34

- 6.1 Introduction, 34
- 6.2 Planning the survey, 34
- 6.3 Workplace monitoring, 35
- 6.4 Monitoring strategies, 37
- 6.5 Quality assurance and quality control, 39
- 6.6 Survey checklists, 41

Chapter 7 Analysis of Measurement Results, 48

- 7.1 Introduction, 48
- 7.2 Dealing with variability in measurement results, 48
- 7.3 Summary statistics and data presentation, 50

Chapter 8 Hygiene Reports and Records, 53

- 8.1 Measurement records, 53
- 8.2 Survey reports, 55

**Part 2 Inhalation Exposure**

Chapter 9 Dust and Fibrous Aerosols, 63

- 9.1 Introduction, 63
- 9.2 Airborne dust, 63
- 9.3 Fibres, 65
- 9.4 Measurement of airborne dust levels, 66
- 9.5 Measurement of flow rate, 73
- 9.6 Pumps, 74
- 9.7 Direct-reading aerosol monitors, 75
- 9.8 Calibration of a rotameter or electronic flow calibrator by using the soap-bubble method, 76
- 9.9 The measurement of inhalable airborne dust, 80
- 9.10 The measurement of airborne respirable dust by using a cyclone sampler, 83
- 9.11 The sampling and counting of airborne asbestos fibres, 84
- 9.12 The choice of filter and filter holder to suit a specific dust, fume or mist, 88
- 9.13 To trace the behaviour of a dust cloud by using a Tyndall beam, 89

**Chapter 10 Gases and Vapours, 92**

- 10.1 Introduction, 92
- 10.2 Collection devices, 94
- 10.3 Containers, 100
- 10.4 Direct-reading instruments, 101
- 10.5 To measure personal exposure to solvent vapours using an adsorbent tube, 102
- 10.6 Sampling for gases by using a bubbler, 104
- 10.7 To measure the short-term airborne concentration of a gas by using a colorimetric detector tube, 106
- 10.8 To measure a vapour concentration using a diffusive sampler, 108

**Chapter 11 Bioaerosols, 111**

- 11.1 Introduction, 111
- 11.2 Classification of microorganisms, 112
- 11.3 Viruses, 112
- 11.4 Bacteria, 113
- 11.5 Moulds and yeasts, 114
- 11.6 Allergens, 115
- 11.7 Principles of containment, 115
- 11.8 Handling microorganisms, 116
- 11.9 Monitoring bioaerosols, 117
- 11.10 Measurement of endotoxins and allergens, 120
- 11.11 Interpretation of sample results, 121

**Part 3 Dermal and Ingestion Exposure****Chapter 12 Dermal and Ingestion Exposure Measurement, 125**

- 12.1 Introduction, 125
- 12.2 Occupations where dermal exposure is important, 125
- 12.3 Local and systemic effects, 126
- 12.4 How do we know if dermal exposure is an issue?, 127
- 12.5 What do we measure?, 128
- 12.6 Methods for dermal exposure measurement, 129
- 12.7 Sampling strategy, 132
- 12.8 Liquids and solids, 132
- 12.9 Biomonitoring and modelling of dermal exposure, 134
- 12.10 From exposure to uptake, 135
- 12.11 Controlling dermal exposure, 136
- 12.12 Inadvertent ingestion exposure, 136

**Part 4 Physical Agents****Chapter 13 Noise, 143**

- 13.1 Introduction, 143

- 13.2 Pressure and magnitude of pressure variation, 143
- 13.3 Frequency, 144
- 13.4 Duration, 147
- 13.5 Occupational exposure limits, 147
- 13.6 Equipment available, 148
- 13.7 Sound level meters and personal noise dosimeters, 148
- 13.8 Personal noise dosimeters, 151
- 13.9 Calibration, 152
- 13.10 To measure workplace noise using a SLM, 153
- 13.11 To measure workplace noise using a PND, 155
- 13.12 To measure the spectrum of a continuous noise by octave band analysis, 157
- 13.13 To determine the degree of noise exposure and the actions to take, 159

#### Chapter 14 Vibration, 161

- 14.1 Introduction, 161
- 14.2 Vibration, 163
- 14.3 Occupational exposure limits, 165
- 14.4 Risk assessment, 165
- 14.5 Measurements and measurement equipment, 166
- 14.6 To measure hand–arm vibration, 167
- 14.7 Control of vibration, 171

#### Chapter 15 Heat and Cold, 173

- 15.1 Introduction, 173
- 15.2 Heat stress, 175
- 15.3 Measurement equipment, 176
- 15.4 Personal monitoring, 181
- 15.5 Measurement of the thermal environment, 182
- 15.6 Predicted Heat Strain Index, 185
- 15.7 Risk assessment strategy, 186
- 15.8 Cold, 188
- 15.9 To calculate the wind chill factor, 189

#### Chapter 16 Lighting, 191

- 16.1 Introduction, 191
- 16.2 Lighting Standards, 192
- 16.3 Equipment available, 193
- 16.4 Calibration, 193
- 16.5 To measure lighting, 194
- 16.6 Control, 197

#### Chapter 17 Ionising Radiation, 199

- 17.1 Introduction, 199
- 17.2 Ionising radiation, 200

- 17.3 Background radiation, 201
- 17.4 Basic concepts and quantities, 201
- 17.5 Types of radiation, 202
- 17.6 Energy, 204
- 17.7 Activity, 204
- 17.8 Radiation dose units, 205
- 17.9 Dose limits, 206
- 17.10 Derived limits, 207
- 17.11 Procedures to minimise occupational dose, 207
- 17.12 Personal dosimetry and medical surveillance, 209

## Chapter 18 Non-Ionising Radiation, 216

- 18.1 Introduction, 216
- 18.2 Ultraviolet radiation, 218
- 18.3 Infrared radiation, 220
- 18.4 Microwaves and radiowaves, 220
- 18.5 Lasers, 222

## **Part 5 Assessing the Effectiveness of Control**

## Chapter 19 Introduction to Control, 227

- 19.1 Introduction, 227
- 19.2 Specific control measures, 228
- 19.3 The effectiveness of control measures, 231

## Chapter 20 Ventilation, 233

- 20.1 Introduction, 233
- 20.2 Air pressure, 234
- 20.3 Measurement equipment, 235
- 20.4 Ventilation measurement records, 242
- 20.5 Measurement of air flow in ducts, 246
- 20.6 Measurement of pressure in ventilation systems, 252
- 20.7 To measure the face velocity on a booth or hood, 254
- 20.8 To measure the face velocity on a fume cupboard, 255
- 20.9 To measure the performance of a suction inlet, 257

## Chapter 21 Personal Protective Equipment, 260

- 21.1 Introduction, 260
- 21.2 Components of an effective PPE programme, 260
- 21.3 Face-fit testing using a particle counter, 269

## **Part 6 Risk Assessment and Risk Communication**

## Chapter 22 Risk Assessment, 275

- 22.1 Introduction, 275
- 22.2 Identify all hazardous substances or agents, 276

## Contents

- 22.3 Identify the likely levels of exposure, 276
- 22.4 Identify all persons likely to be exposed, 278
- 22.5 Assess whether the exposures are likely to cause harm, 279
- 22.6 Consider elimination or substitution, 279
- 22.7 Define additional control measures necessary to reduce the harm to acceptable levels, 280

## Chapter 23 Risk Communication, 282

- 23.1 Introduction, 282
- 23.2 Risk perception, 282
- 23.3 Trust, 283
- 23.4 Communication, 284
- 23.5 An example of quantitative risk assessment to aid risk communication, 285

Equipment Suppliers, 288

Chemical Analytical Services, 290

Index, 291