

Contents

<i>Contributor contact details</i>	<i>xi</i>
<i>Woodhead Publishing Series in Food Science, Technology and Nutrition.....</i>	<i>xv</i>
<i>Foreword</i>	<i>xxiii</i>
<i>Preface.....</i>	<i>xxv</i>
Part I Regulatory control and environmental pathways	1
1 Persistent organic pollutants in foods: science, policy and regulation	3
<i>D. N. Mortimer, Food Standards Agency, UK</i>	
1.1 Introduction.....	3
1.2 Dietary exposure and total diet studies (TDSs)	4
1.3 Risk assessment, policy making and regulatory limits.....	6
1.4 Enforcement and implications for food businesses	12
1.5 Analytical methods and their influence on policy.....	14
1.6 Future trends and conclusions	15
1.7 References	17
2 Regulatory control and monitoring of heavy metals and trace elements in foods	20
<i>K. D. Hargin and G. J. Shears, Food Standards Agency, UK</i>	
2.1 Introduction.....	20
2.2 Risk assessment and policy making	21
2.3 Monitoring of foodstuffs	34
2.4 Impact of legislation on industry and enforcement	37
2.5 Suitability of analytical methods.....	40
2.6 Future trends	41
2.7 Sources of further information.....	43
2.8 References	44

3 Screening and confirmatory methods for the detection of dioxins and polychlorinated biphenyls (PCBs) in foods	47
<i>J.-F. Focant and G. Eppe, University of Liège, Belgium</i>	
3.1 Introduction	47
3.2 Biological versus physico-chemical screening for dioxins and PCBs in food and feed.....	51
3.3 Specific analytical requirements for biological and physico-chemical tools	63
3.4 Quantitative versus semi-quantitative approach	66
3.5 Validation QA/QC	67
3.6 Confirmatory methods for dioxins and PCBs in food and feed	67
3.7 Future trends	75
3.8 Sources of further information and advice	76
3.9 References	76
4 Screening and confirmatory methods for the detection of heavy metals in foods.....	81
<i>F. Arduini and G. Palleschi, Università di Roma Tor Vergata, Italy</i>	
4.1 Introduction	81
4.2 Screening methods for heavy metal detection in foods	84
4.3 Confirmatory methods for heavy metal detection in foods	95
4.4 Quality assurance and method validation	99
4.5 Future trends	102
4.6 References	102
5 Responding to food contamination incidents: principles and examples from cases involving dioxins	110
<i>C. Tlustos, W. Anderson and R. Evans, Food Safety Authority of Ireland, Ireland</i>	
5.1 Introduction	110
5.2 The risk analysis paradigm.....	112
5.3 Food traceability	115
5.4 Food recall and withdrawal	117
5.5 Risk communication strategies.....	120
5.6 Future trends	125
5.7 Sources of further information.....	126
5.8 References	127
6 Uptake of organic pollutants and potentially toxic elements (PTEs) by crops.....	129
<i>C. Collins, University of Reading, UK</i>	
6.1 Introduction	129
6.2 Uptake of organic pollutants by plants	131

6.3	Uptake of PTEs by plants.....	135
6.4	<i>In situ</i> monitoring of plant available pollutants.....	138
6.5	Conclusions	139
6.6	References	139
7	Transfer and uptake of dioxins and polychlorinated biphenyls (PCBs) into sheep: a case study	145
	<i>S. W. Panton, F. Smith and A. Fernandes, Food and Environment Research Agency (FERA), UK and C. Foxall, University of East Anglia, UK</i>	
7.1	Introduction.....	145
7.2	Uptake pathways and sources	147
7.3	Transfer of PCBs and polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/Fs) into animal tissues	151
7.4	Experimental rearing, sampling and analysis	152
7.5	Results and discussion for PCDD/Fs, dioxin-like PCBs (DL-PCBs) and ICES6 PCBs.....	157
7.6	Conclusions and future trends.....	169
7.7	Acknowledgements	169
7.8	References	170
8	Risk assessment of chemical contaminants and residues in foods	173
	<i>D. J. Benford, Food Standards Agency, UK</i>	
8.1	Introduction.....	173
8.2	Risk assessment	176
8.3	Role of risk assessment in risk management.....	184
8.4	Sources of further information.....	185
8.5	References	185
Part II	Particular persistent organic pollutants, toxic metals and metalloids	189
9	Dioxins and polychlorinated biphenyls (PCBs) in foods	191
	<i>D. Schrenk and M. Chopra, University of Kaiserslautern, Germany</i>	
9.1	Introduction.....	191
9.2	Properties and occurrence of polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/Fs)	192
9.3	Toxicity of PCDD/Fs.....	195
9.4	Toxic effects of PCDD/Fs in humans and experimental animals.....	198
9.5	Properties and occurrence of PCBs.....	205
9.6	Toxicity of PCBs	209
9.7	References	213

10 Non dioxin-like polychlorinated biphenyls (NDL-PCBs) in foods: exposure and health hazards	215
<i>L. E. Elabbas, E. Westerholm, R. Roos and K. Halldin, Karolinska Institutet, Sweden, M. Korkalainen, National Institute for Health and Welfare, Finland, M. Vihuksela, National Institute for Health and Welfare, Finland and University of Eastern Finland, Finland and H. Håkansson, Karolinska Institutet, Sweden</i>	
10.1 Introduction.....	215
10.2 Sources, occurrence in foods, limit values and monitoring methods	217
10.3 Human exposure and tissue levels	220
10.4 Toxicokinetics and metabolism	223
10.5 Classification of PCB congeners	226
10.6 NDL-PCB regulatory status.....	228
10.7 ATHON R&D project dedicated to generating NDL-PCB toxicity data for regulatory use.....	229
10.8 Cell regulation and metabolism.....	240
10.9 Classification of NDL-PCB congeners.....	247
10.10 Conclusions and future trends.....	247
10.11 Acknowledgements	249
10.12 References	250
11 Brominated flame retardants in foods	261
<i>R. J. Law, The Centre for Environment, Fisheries and Aquaculture Science, UK</i>	
11.1 Introduction.....	261
11.2 Sources, occurrence in foods and human exposure.....	262
11.3 Methods of analysis and monitoring of brominated flame retardants in foods	267
11.4 Toxicity of brominated flame retardants	268
11.5 Major incidences of brominated flame retardant contamination of foods.....	269
11.6 Implications for the food industry and policy makers for prevention and control of contamination.....	270
11.7 Future trends	270
11.8 Sources of further information and advice.....	271
11.9 References	272
12 Human dietary exposure to per- and poly-fluoroalkyl substances (PFASs)	279
<i>R. Vestergren and I. T. Cousins, Stockholm University, Sweden</i>	
12.1 Introduction.....	280
12.2 Analytical methods for PFASs in foods.....	281
12.3 Levels of PFASs in foods	284

12.4 Pathways of food contamination.....	290
12.5 Estimated exposure from food and other exposure media	293
12.6 Conclusions and future trends.....	298
12.7 Acknowledgements	299
12.8 References	299
13 Polycyclic aromatic hydrocarbons (PAHs) in foods.....	308
<i>L. Duedahl-Olesen, National Food Institute – Technical University of Denmark, Denmark</i>	
13.1 Introduction.....	308
13.2 Sources and formation of PAHs in foods	309
13.3 Methods of analysis of PAHs in foods.....	314
13.4 Human dietary exposure to PAHs from foods.....	319
13.5 Risk assessment of PAHs.....	322
13.6 Food scandals	324
13.7 Legislation of PAHs in foods within the EU	324
13.8 References	326
14 Phthalates in foods	334
<i>T. Cirillo and R. Amodio Cocchieri, University of Naples Federico II, Italy</i>	
14.1 Introduction.....	334
14.2 Human exposure to phthalates.....	335
14.3 Sources and occurrence in foods	339
14.4 Studies of the effects of phthalates on humans	344
14.5 Methods of phthalate analysis and monitoring in foods	349
14.6 Implications for the food industry and policy making for prevention and control of contamination.....	352
14.7 Future trends	353
14.8 Sources of further information and advice.....	355
14.9 References	356
15 Polychlorinated naphthalenes (PCNs) in foods: sources, analytical methodology, occurrence and human exposure.....	367
<i>A. Fernandes, The Food and Environment Research Agency (FERA), UK</i>	
15.1 Introduction.....	367
15.2 Sources of PCNs.....	368
15.3 Toxicology.....	370
15.4 Methods of analysis of PCNs in foods.....	372
15.5 Occurrence in foods	375
15.6 PCN occurrence in humans.....	383
15.7 Conclusions and future trends.....	386
15.8 References	387

16 Mercury in foods	392
<i>E. M. Sunderland and M. Tumpney, Harvard University School of Public Health, USA</i>	
16.1 Introduction.....	392
16.2 Concentrations of mercury in foods.....	396
16.3 Mercury exposures and risks from major food categories	403
16.4 References	407
17 Arsenic in foods: current issues related to analysis, toxicity and metabolism	414
<i>K. A. Francesconi and G. Raber, University of Graz, Austria</i>	
17.1 Introduction.....	414
17.2 Sources and occurrence in foods	415
17.3 Methods for determining arsenic in foods	418
17.4 Toxicity of arsenic.....	421
17.5 Implications for the food industry and policy makers	425
17.6 References	426
18 Organotin compounds in foods.....	430
<i>E. Rosenberg, Vienna University of Technology, Austria</i>	
18.1 Introduction.....	431
18.2 Technical, agricultural and industrial uses of organotin compounds	432
18.3 Physical and chemical properties of organotin compounds	444
18.4 Analysis of organotin compounds in foods.....	445
18.5 Human dietary exposure to organotin compounds from foods.....	451
18.6 Human exposure to organotin compounds from food packaging material.....	457
18.7 Health risks and toxicity of organotin compounds	461
18.8 Conclusions and future trends.....	466
18.9 References	468
18.10 Appendix: abbreviations.....	474
<i>Index.....</i>	476