

Contents

Acknowledgement	<i>X</i>
Preface	<i>XI</i>
List of Contributors	<i>XIII</i>

Introduction	<i>1</i>
<i>Manfred Weidmann</i>	
References	<i>3</i>

1	Laboratory Biosafety in Containment Laboratories	5
	<i>Annette A. Kraus and Ali Mirazimi</i>	
1.1	Routes of Infection	<i>5</i>
1.2	Classification of Microorganisms	<i>6</i>
1.3	General Containment Principles	<i>7</i>
1.4	Specific Containment Principles	<i>7</i>
1.4.1	Biosafety Level 1 Laboratory	<i>8</i>
1.4.2	Biosafety Level 2 Laboratory	<i>8</i>
1.4.3	Biosafety Level 3 Laboratory	<i>8</i>
1.4.4	Biosafety Level 4 Laboratory	<i>9</i>
1.5	Design of a Suit-Based-BSL-4 Laboratory with Negative Pressure	<i>9</i>
1.6	Safety Routines	<i>11</i>
	Summary	<i>11</i>
	References	<i>12</i>
2	Hazard Criteria and Categorization of Microbes Classification Systems	13
	<i>Nigel Silman</i>	
2.1	Facility Requirements	<i>16</i>
2.2	Exceptions to the Rules	<i>18</i>
	Summary	<i>19</i>
3	Technical and Practical Aspects of BSL-3 Laboratories	21
	<i>Frank T. Hufert and Manfred Weidmann</i>	
3.1	Technical Aspects—Facilities, Secondary Barriers	<i>21</i>

3.1.1	Air Filtration Systems	23
3.1.2	Water	23
3.1.3	Fire Protection	24
3.2	Practical Aspects—Safety Equipment, Primary Barriers	25
3.2.1	Staff	25
3.3	Personal Protective Equipment (PPE)	25
3.3.1	Primary Barriers and Working Procedures	26
	Summary	29
	References	29
4	Animal Biosafety Level 3 Facility – Enhancements When Dealing with Large Animals	31
	<i>Francisc Xavier Abad, David Solanes, and Mariano Domingo</i>	
4.1	Enhancements to Upgrade a Standard Animal ABSL-3 Facility to a LABSL-3 Facility Housing Large Animals	33
4.2	Additional Recommendations	36
	Summary	38
	References	38
5	Personal Protective Equipment	41
	<i>Nigel Silman</i>	
5.1	Definitions	41
5.2	Regulatory Background	41
5.3	Routes of Entry and Types of PPE	42
5.4	Use of PPE	45
	Summary	45
6	Shipping of Infectious Substances According IATA-DGR Regulations	47
	<i>Mandy Elschner and Martin Heller</i>	
6.1	Introduction	47
6.2	Classifications and UN Code	47
6.3	Limitations	49
6.4	Packaging	49
6.5	Packing Instruction 650 for Biological Substance, Category B	51
6.6	Packing Instruction 620 for Infectious Substance, Category A; UN 2814 and UN 2900	53
6.7	Packing Instruction 904 (UN 1845) for Dry Ice	55
6.8	Documentation	56
	Summary	58
	References	58
7	Disinfection and Decontamination	59
	<i>Patrick Butaye</i>	
7.1	Introduction	59

7.2	Ways of Decontamination/Disinfection	60
7.3	Physical Disinfection/Decontamination	61
7.4	Irradiation	61
7.5	Factors Influencing Chemical Disinfection/Decontamination	62
7.5.1	Temperature	62
7.5.2	Time of Contact	62
7.5.3	Microorganism	63
7.5.4	Surface Type (Absorbant vs Nonabsorbant)	63
7.5.5	Liquid	63
7.5.6	pH	64
7.5.7	Presence and Type of Dirt	64
7.5.8	Concentration of the Product	64
7.5.9	High-Pressure Water Cleaning	64
7.5.10	Water Used	65
7.5.11	Mechanism/Methods of Decontamination	65
7.5.12	Inoculum Concentration	65
7.6	Testing the Activity of a Certain Product	65
7.6.1	Physical Disinfection	65
7.6.2	Chemical Disinfection	66
7.6.2.1	Introduction	66
7.6.2.2	Phase 1 Studies	66
7.6.2.3	Phase 2 Studies	67
7.6.2.4	Phase 3 Studies	68
7.7	Chemical Compounds Used as Disinfectants	69
7.7.1	Introduction	69
7.7.2	Phenols	69
7.7.3	Chlorine Derivatives	69
7.7.4	Iodophores	70
7.7.5	Quaternary Ammonium Compounds	70
7.7.6	Amphoteres	70
7.7.7	Aldehydes	71
7.7.8	Calcium Oxide, Lime	71
7.7.9	Alcohols	71
7.7.10	Chlorhexidine	72
7.7.11	Peroxides	72
7.7.12	Peracetic Acid	72
7.7.13	Sodium Hydroxide	72
7.8	Conclusion	73
	Summary	73
	References	73
8	Fumigation of Spaces	75
	<i>Nigel Silman</i>	
8.1	Definitions	75
8.2	Practicalities	76

8.3	Fumigation Process	76
8.4	Validation of Fumigation	79
8.5	Post-Fumigation	80
8.6	Fumigation of Cabinets	81
8.7	Emergency Plans	82
8.8	Conclusions	82
	Summary	82
9	Learning from a History of Laboratory Accidents	83
	<i>Manfred Weidmann</i>	
9.1	Introduction	83
9.2	Strains	83
9.3	Eye Protection	84
9.4	Necropsies, Animal Experiments, and Sharps	85
9.5	Skin Protection	86
9.6	The Omnipresence of Aerosol	87
9.7	Centrifugation	89
9.8	Spills	89
9.9	Laboratory Accident Statistics	90
	Summary	91
	References	91
10	Bridging the Gap between Requirements of Biocontainment and Diagnostics	95
	<i>Manfred Weidmann, Frank T. Hufert, and Nigel Silman</i>	
	Summary	97
	References	97
11	Risk Assessment Procedures	99
	<i>Åsa S. Björndal</i>	
11.1	Introduction	99
11.2	Risk Identification	100
11.2.1	Timing of Assessment	100
11.2.2	A Qualitative Risk Assessment	100
11.2.3	Systematic Documentation	101
11.3	Additional Points for General Risk	102
	Summary	105
	Further Readings	105
12	Biosecurity	107
	<i>Jürgen Mertsching</i>	
12.1	Introduction	107
12.2	Biosecurity as Part of a Biorisk Management Program	108
12.3	Risk (Threat) Assessment Process	108
12.3.1	Identify and Prioritize Biological Materials	109

12.3.2	Identify and Prioritize the Threat to Security of Biological Materials	109
12.3.3	Analyze the Risk of Specific Security Scenarios	109
12.3.4	Integrate the Biosecurity Risk Assessment Process into a Biorisk Management Program	109
12.4	Physical Security and Access Control	110
12.4.1	Physical Security–Biosecurity Meets Biosafety	111
12.5	Material Management	112
12.5.1	Material Management–Biosecurity Meets Biosafety	113
12.6	Personnel Security Management	114
12.6.1	Personnel Security Management–Biosecurity Meets Biosafety	115
12.7	Transport of Biological Materials	115
12.7.1	Transfer within an Institution	115
12.7.2	Transport Outside of the Facility	116
12.7.3	Transport–Biosecurity Meets Biosafety	116
12.8	Information Security	116
12.9	Incident and Emergency Response Planning	117
12.9.1	Emergency Response Planning – Biosecurity Meets Biosafety	118
	Summary	118
	References	118
	Appendix	121
	Practical Course	121
	Day 1	121
	Day 2	123
	Day 3	126
	Index	129