

Table of Contents

Chapter 1. Chemical Hazards	7
1.1. Hazardous chemical substances	7
1.2. Systematic description of chemical hazards	10
1.2.1. Classification and labelling	10
1.2.2. The substance's form and the hazards	12
1.3. Routes of exposure	14
1.3.1. Oral route of exposure	14
1.3.2. Dermal route of exposure	16
1.3.3. Ocular route of exposure	20
1.3.4. Route of exposure by inhalation	21
1.3.5. Exposure by subcutaneous / intramuscular injection	24
1.4. Time dependence and cumulative effect of toxic exposure	24
1.5. Odours and toxicity	26
References:	27
Chapter 2. Radiological hazards	28
2.1. Ionizing radiation	28
2.1.1. Types of ionizing radiation	28
2.1.2. Influence of ionizing radiation on living organisms	29
2.1.3. Harmfulness of various types of ionizing radiation	30
2.2. Exposure, dose and dose rate of ionizing radiation	31
2.2.1. Units of exposure and doses of ionizing radiation	31
2.2.2. Units of dose rate and intensity of exposure of ionizing radiation	35
2.3. Radiation hazards and principles of the radiation protection	37
2.3.1. Optimization of the radiological protection – ALARA principle	37
2.3.2. Radiation doses limits	38
2.3.3. Dose rate limits of ionizing radiation	40
2.3.4. The effect of the ionizing radiation exposure – radiation sickness	40
2.4. Protection against ionizing radiation	41
2.4.1. Radiation intensity	42
2.4.2. Time of the radiation exposure	42
2.4.3. Distance from a radiation source	42
2.4.4. Shielding against ionizing radiation	43
2.5. Summary	46
Chapter 3. Biological hazards	48
3.1. Overview of biological threats	48
3.2. High-profile bio-agents	51
3.2.1. Bacillus anthracis	51
3.2.2. Yersinia pestis	53
3.2.3. Francisella tularensis	55
3.2.4. Ebola virus	55
3.2.5. Multi-drug resistant (MDR) pathogens	56

TRAINING MANUAL

3.2.6. Clostridium botulinum toxin	57
3.2.7. Ricin	58
3.2.8. Abrin	59
3.2.9. T-2 Mycotoxin	60
Chapter 4. Knowledge and understanding of the detection and identification of CBR substances	64
4.1. Detection of chemical compounds	66
4.1.1. Chemical methods for contamination detection	67
4.1.2. Biochemical methods for chemical contamination detection	68
4.1.3. Physical and physicochemical methods of chemical contamination detection	69
4.1.4. Remote methods for detecting atmospheric pollution	80
4.1.5. Detection of chemicals – summary	81
4.2. Detection of ionizing radiation and radioactive substances	82
4.2.1. Detectors for ionizing radiation	82
4.2.2. Radiometers – instruments for measuring the dose rate of ionizing radiation	88
4.2.3. Dosimeters – instruments for measuring the absorbed dose of ionizing radiation	94
4.2.4. Detection of ionizing radiation – summary	98
4.3. Detection of biological threats – dangerous pathogens and biological toxins	99
4.3.1. Methods for detecting protein in a sample	100
4.3.2. Analysis of the presence of nucleic acids – DNA and RNA	103
4.3.3. Immunochromatographic tests	104
4.3.4. Real-Time PCR Method	105
4.3.5. Flow cytometry	107
4.3.6. Bioluminometry	108
4.4. Non-destructive techniques for evaluating the content of enclosed objects	109
4.4.1. X-ray radiography	110
4.4.2. Neutron Induced Prompt Photons Spectroscopy – NIPPS	117
Chapter 5. Personal protection against CBR hazards	132
5.1. Introduction	132
5.2. Three-zone concept in CBR protection	133
5.3. Rules of selection of the CBR personal protective equipment	134
5.4. CBR personal protective equipment	135
5.4.1. CBR respiratory protective equipment	136
5.4.2. CBR skin (dermal) protection	141
5.4.3. Levels of CBR personal protection	148
5.4.4. Selection of the level of CBR personal protection	150
5.5. Elements of a PPE Management Program	153

TRAINING MANUAL

5.6. Medical Management	153
5.7. Summary	154
Chapter 6. Sampling principles, equipment and procedures	156
6.1. Sampling main principles	156
6.1.1. Sampling strategies	156
6.1.2. Sample homogenization	158
6.1.3. General sampling site selection considerations	159
6.1.4. Quality Control	160
6.1.5. Use of sampling equipment in the field	161
6.1.6. Sampling tips	162
6.1.7. Field processing of the samples	163
6.2. Sampling equipment	164
6.2.1. Air/vapour sampling equipment	164
6.2.2. Liquid samples	165
6.2.3. Wet and dry wipe/swab samples	165
6.2.4. Solid samples	166
6.2.5. Sample Transport containers	167
6.3. Sampling procedures	168
6.3.1. Planning and assembly of equipment	168
6.3.2. General instructions for collection of samples	168
6.3.3. Sealing, packing and transportation on-site	171
6.3.4. Sample splitting	171
6.4. Sampling procedures under hazardous conditions: team tasks and samples management	172
6.4.1. Sampling team and supporting personnel	173
6.4.2. Safety and protective measures	174
4.3. Assembly of equipment	174
6.4.4. Sampling procedures	174
6.4.5. Decontamination, packing and on-site transport of the samples	176
6.4.6. Off-site transport of the samples	177
6.4.7. Documentation	177
Appendices to Chapter 6	178
Appendix 6.1. Sample Collection Form	179
Appendix 6.2. Chain of Custody Form	180
Chapter 7. Decontamination procedures	181
7.1. Strategy of the decontamination	181
7.1.1. Contamination avoidance	181
7.1.2. Contamination control	181
7.1.3. Decontamination control	182
7.2. Operational plan for tasks requiring following decontamination activities	182
7.2.1. Description of the tasks and CBR hazard	183
7.2.2. Selection of PPE and equipment	184

TRAINING MANUAL

7.3. Decontamination procedures	185
7.3.1. Methods of decontamination	185
7.4. Organization of the decontamination site	189
7.4.1. General outline	189
7.4.2. Layout of the decontamination site	190
7.4.3. Summary	196
7.5. Principles of decontamination of different objects	196
7.5.1. Decontamination of PPE	196
7.5.2. Decontamination of equipment	197
7.5.3. Decontamination of skin	198
7.6. Summary	198
Appendix	203