

Environmental health in emergencies and disasters

A PRACTICAL GUIDE

Edited by

B. Wisner

J. Adams

Para tener acceso completo a este libro usted debe solicitarlo de manera formal a la Coordinación del Programa de Doctorado Interinstitucional en Ciencias Ambientales mediante el **Formato de Préstamo Bibliográfico** ([descargar formato](#)) y remitirlo al siguiente correo: dicambientales@unicauca.edu.co



DOCTORADO INTERINSTITUCIONAL EN
CIENCIAS AMBIENTALES



WHO Library Cataloguing-in-Publication Data

Environmental health in emergencies and disasters: a practical guide.

Edited by B. Wisner, J. Adams.

1.Environmental health. 2.Disasters. 3.Disaster planning. 4.Risk management. 5.Safety management. 6.Manuals. I.Wisner, Ben. II.Adams, John.

ISBN 92 4 154541 0

(NLM/LC classification: WX 185).

© World Health Organization 2002

All rights reserved. Publications of the World Health Organization can be obtained from Marketing and Dissemination, World Health Organization, 20 Avenue Appia, 1211 Geneva 27, Switzerland (tel: +41 22 791 2476; fax: +41 22 791 4857; email: bookorders@who.int). Requests for permission to reproduce or translate WHO publications—whether for sale or for noncommercial distribution—should be addressed to Publications, at the above address (fax: +41 22 791 4806; email: permissions@who.int).

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.

The mention of specific companies or of certain manufacturers' products does not imply that they are endorsed or recommended by the World Health Organization in preference to others of a similar nature that are not mentioned. Errors and omissions excepted, the names of proprietary products are distinguished by initial capital letters.

The World Health Organization does not warrant that the information contained in this publication is complete and correct and shall not be liable for any damages incurred as a result of its use.

Cover photos: Pan-American Health Organization

The named editors alone are responsible for the views expressed in this publication.

Typeset in Hong Kong

Printed in Malta.

Contents

List of illustrations	xii
Preface	xvi
Acknowledgments	xix
1. About this book	1
1.1 Objectives	1
1.2 Target audiences	1
1.3 Organization of the chapters	2
1.4 Scope	2
1.5 Approach	3
1.6 Glossary of terms	4
Part I. General aspects	
2. The nature of emergencies and disasters	9
2.1 Environmental health and disasters	9
2.2 Disasters and emergencies	9
2.2.1 <i>Hazards and extreme events</i>	9
2.2.2 <i>Disasters</i>	10
2.2.3 <i>Conflict</i>	10
2.2.4 <i>The effects of disasters on environmental health facilities and services</i>	11
2.2.5 <i>Emergencies</i>	12
2.3 Vulnerability to disasters and emergencies	13
2.3.1 <i>The concept of vulnerability</i>	13
2.3.2 <i>High susceptibility</i>	13
2.3.3 <i>Low resilience</i>	14
2.3.4 <i>The impact of disasters at national level</i>	14
2.4 Human actions that increase vulnerability to disasters	15
2.4.1 <i>Improper resource management</i>	15
2.4.2 <i>Urbanization and vulnerability to disasters</i>	15
2.4.3 <i>Rural/urban connections</i>	16
2.4.4 <i>Global environmental change</i>	17
2.5 The disaster-management cycle	17

2.5.1	<i>Disaster management—a developmental approach</i>	17
2.5.2	<i>Sustainable livelihoods and disaster management</i>	18
2.5.3	<i>Limitations in complex emergencies</i>	18
2.6	<i>Steps in disaster management</i>	20
2.6.1	<i>Vulnerability assessment</i>	20
2.6.2	<i>Prevention and mitigation</i>	20
2.6.3	<i>Emergency preparedness</i>	20
2.6.4	<i>Planning, policy and capacity building</i>	21
2.6.5	<i>Emergency response</i>	21
2.6.6	<i>Rehabilitation, reconstruction and recovery</i>	22
2.7	<i>Further information</i>	22
3.	Predisaster activities	24
3.1	<i>Introduction</i>	24
3.2	<i>Institutional arrangements</i>	24
3.2.1	<i>Policy development</i>	24
3.2.2	<i>National and subnational disaster organizations</i>	24
3.3	<i>Vulnerability and capacity assessment</i>	25
3.3.1	<i>The purpose and process of vulnerability and capacity assessment</i>	25
3.3.2	<i>Hazard mapping</i>	27
3.3.3	<i>Vulnerability analysis of water-supply systems</i>	28
3.3.4	<i>Assessment of environmental health vulnerability</i>	28
3.3.5	<i>Describing communities, their environment and the effects of hazards</i>	28
3.3.6	<i>Ongoing monitoring of vulnerability</i>	30
3.3.7	<i>Environmental health review of development policies and projects</i>	30
3.4	<i>Prevention and mitigation</i>	30
3.4.1	<i>Reducing community vulnerability through long-term environmental health improvements</i>	30
3.4.2	<i>Environmental safety regulations</i>	31
3.4.3	<i>Reducing the vulnerability of environmental health infrastructure</i>	31
3.4.4	<i>Protecting other facilities</i>	32
3.5	<i>Preparedness and planning</i>	32
3.5.1	<i>The national emergency planning process</i>	32
3.5.2	<i>A general model for disaster-preparedness planning</i>	33
3.5.3	<i>Strategic plans and operational plans</i>	36
3.5.4	<i>Participatory methods in planning</i>	36
3.6	<i>Institutional learning and memory</i>	37
3.6.1	<i>Evaluation of emergencies and disasters</i>	37
3.6.2	<i>Vulnerability analysis of major projects</i>	37
3.6.3	<i>Using rules and regulations concerning environmental health and hazards</i>	38
3.7	<i>Warning indicators</i>	38
3.7.1	<i>Early warnings</i>	38
3.7.2	<i>Slow-onset hazards</i>	38

3.7.3	<i>Hazards with moderate warning time</i>	39
3.7.4	<i>Warning of industrial accidents</i>	40
3.7.5	<i>Warning of refugee movements</i>	40
3.8	<i>Further information</i>	40
4.	Emergency response	42
4.1	<i>Assessments</i>	42
4.1.1	<i>Purpose of emergency assessments</i>	42
4.1.2	<i>Process of assessments</i>	43
4.1.3	<i>Field assessment techniques</i>	43
4.1.4	<i>Organizing an emergency assessment</i>	44
4.2	<i>Evacuation</i>	44
4.2.1	<i>Disaster warnings and emergency instructions</i>	45
4.2.2	<i>Organized evacuation</i>	45
4.2.3	<i>Spontaneous evacuation</i>	45
4.2.4	<i>Environmental health services on evacuation routes</i>	45
4.2.5	<i>Environmental health problems associated with evacuations</i>	46
4.2.6	<i>Influencing settlement in evacuations</i>	46
4.2.7	<i>Strengthening services in host communities</i>	47
4.2.8	<i>Problems with temporary emergency settlements</i>	47
4.3	<i>Environmental health measures in the emergency phase</i>	48
4.3.1	<i>General objective and activities</i>	48
4.3.2	<i>Priorities for emergency response</i>	49
4.3.3	<i>Hospitals and relief centres</i>	49
4.3.4	<i>Environmental health in search and rescue operations</i>	50
4.4	<i>Organization of environmental health activities during emergencies</i>	51
4.4.1	<i>The place of environmental health in the organization of emergency activities</i>	51
4.4.2	<i>Emergency field teams for assessment and initial response</i>	53
4.4.3	<i>Other specialized emergency environmental health functions</i>	53
4.4.4	<i>Coordination of emergency response activities</i>	53
4.5	<i>Personnel management in emergencies</i>	54
4.5.1	<i>Professional functions</i>	54
4.5.2	<i>Flexibility in the use of human resources</i>	55
4.5.3	<i>Cooperation with the private sector</i>	55
4.5.4	<i>Working with volunteers</i>	55
4.5.5	<i>Facilities for emergency personnel</i>	55
4.5.6	<i>Support for specialist activities</i>	56
4.5.7	<i>Subsistence needs of personnel</i>	56
4.5.8	<i>Security and safety needs of personnel</i>	56
4.5.9	<i>Psychological needs of personnel</i>	57
4.5.10	<i>Administrative support for personnel</i>	57
4.6	<i>Equipment and supplies</i>	58
4.6.1	<i>Types of equipment needed</i>	58

4.6.2	<i>Procurement</i>	58
4.6.3	<i>Specifications</i>	59
4.6.4	<i>Storage and distribution</i>	59
4.7	<i>Transportation and logistics</i>	59
4.7.1	<i>Types of vehicle required</i>	60
4.7.2	<i>Sources and numbers of vehicles required</i>	60
4.7.3	<i>Repairs and maintenance</i>	61
4.7.4	<i>Road operations: transportation logistics in field operations</i>	61
4.7.5	<i>Air operations</i>	61
4.7.6	<i>Other modes of transportation</i>	62
4.7.7	<i>Pooling of transportation services</i>	62
4.7.8	<i>Vehicle priorities</i>	62
4.7.9	<i>Field logistics systems</i>	62
4.8	<i>Telecommunications</i>	63
4.8.1	<i>Types of telecommunications equipment</i>	63
4.8.2	<i>Sources of radio communications</i>	64
4.8.3	<i>Developments in telecommunications</i>	64
4.9	<i>Financial procedures</i>	65
4.10	<i>Rules, standards and guidelines in disaster response</i>	65
4.10.1	<i>Importance of rules and guidelines in emergencies</i>	66
4.10.2	<i>Basic principles for creating rules for emergencies</i>	66
4.10.3	<i>Special rules in areas of high potential public-health risk</i>	67
4.10.4	<i>Rules concerning foreign relief workers</i>	67
4.10.5	<i>International standards and codes of conduct for humanitarian response</i>	67
4.11	<i>International assistance</i>	68
4.11.1	<i>In-country coordination</i>	68
4.11.2	<i>Forms and functions of international assistance</i>	69
4.11.3	<i>Integrating international staff and local specialists</i>	69
4.11.4	<i>Guidelines on employment of international assistance teams</i>	69
4.12	<i>Further information</i>	70
5.	Recovery and sustainable development	71
5.1	<i>From disasters to development</i>	71
5.1.1	<i>The transition from relief to recovery</i>	71
5.1.2	<i>Sustainable development</i>	71
5.1.3	<i>Increasing individual and institutional capacity</i>	72
5.2	<i>Assessment for recovery</i>	72
5.2.1	<i>Reconstruction of housing</i>	73
5.2.2	<i>Reconstruction of water-supply and sanitation systems</i>	75
5.2.3	<i>Secondary damage assessment</i>	75
5.2.4	<i>Secondary vulnerability assessment</i>	76
5.3	<i>Recovery planning</i>	77
5.4	<i>Recovery in different contexts</i>	78
5.4.1	<i>Self-sheltering or short-term evacuees</i>	78
5.4.2	<i>Resettlement</i>	78

5.4.3	<i>Rehabilitation and reconstruction for long-term camp residents</i>	80
5.4.4	<i>Chronic conflict situations</i>	80
5.5	Post-disaster environmental health activities and sustainable development	81
5.5.1	<i>Vulnerability reduction</i>	81
5.5.2	<i>Specific implications of sustainable development in environmental health planning</i>	81
5.6	Further information	82

Part II. Technical aspects

6.	Shelter and emergency settlements	85
6.1	Introduction	85
6.2	Assistance to self-sheltering populations	85
6.3	Short-term shelter in existing buildings	86
6.4	Site selection and arrangement of emergency settlements	87
6.5	Longer-term issues for emergency settlements	89
6.6	Community participation in environmental health management	90
6.7	Further information	91
7.	Water supply	92
7.1	Water-supply preparedness and protection	92
7.1.1	<i>Establishing and protecting small-scale decentralized supplies</i>	92
7.1.2	<i>Establishing and protecting large-scale, centralized supplies</i>	93
7.1.3	<i>Preparation for displacement emergencies</i>	94
7.2	Emergency water-supply strategy	94
7.2.1	<i>Situations demanding an emergency water-supply response</i>	94
7.2.2	<i>Emergency response strategy</i>	95
7.2.3	<i>Rural emergencies</i>	96
7.2.4	<i>Emergency water-supply measures in urban areas</i>	97
7.2.5	<i>Supplies for affected periurban areas</i>	98
7.2.6	<i>Short-term displacement and temporary shelters</i>	99
7.2.7	<i>Long-term emergency settlements</i>	99
7.3	Assessment	99
7.3.1	<i>Assessment of damage and available water resources</i>	100
7.3.2	<i>Needs assessment</i>	100
7.3.3	<i>Needs and standards</i>	101
7.4	Emergency water-supply techniques	103
7.4.1	<i>Water sources</i>	103
7.4.2	<i>Water quality and water testing in emergencies</i>	113
7.4.3	<i>Treatment of emergency water supplies</i>	117
7.4.4	<i>Water movement, storage and distribution</i>	121
7.4.5	<i>Prepackaged water kits</i>	124

7.4.6	<i>Facilities for personal hygiene</i>	124
7.5	Operation and maintenance	126
7.6	Further information	126
8.	Sanitation	127
8.1	Human waste and health	127
8.1.1	<i>Faeces</i>	127
8.1.2	<i>Urine</i>	127
8.1.3	<i>Sullage</i>	127
8.1.4	<i>Solid waste</i>	128
8.1.5	<i>The importance of hygiene behaviour</i>	128
8.2	Strategy for excreta disposal in emergencies	128
8.2.1	<i>Situations demanding an emergency excreta-disposal response</i>	128
8.2.2	<i>Gradual improvement</i>	130
8.2.3	<i>Technology choice</i>	130
8.2.4	<i>Assessment</i>	132
8.2.5	<i>Standards</i>	132
8.3	Techniques for excreta disposal in emergencies	132
8.3.1	<i>Defecation fields</i>	133
8.3.2	<i>Shallow trench latrines</i>	134
8.3.3	<i>Deep trench latrines</i>	134
8.3.4	<i>Simple pit latrines</i>	136
8.3.5	<i>Other types of latrine</i>	136
8.3.6	<i>Site selection for latrines</i>	138
8.3.7	<i>Management of excreta disposal facilities</i>	138
8.4	Disposal of wastewater (sullage)	139
8.4.1	<i>Assessment of the problem and design of the response</i>	139
8.4.2	<i>Wastewater disposal techniques</i>	139
8.5	Management of refuse	142
8.5.1	<i>Assessment of the problem and design of the response</i>	142
8.5.2	<i>Refuse storage</i>	142
8.5.3	<i>Refuse collection and transport</i>	143
8.5.4	<i>Treatment and disposal</i>	143
8.5.5	<i>Disposal of rubble</i>	144
8.5.6	<i>Medical wastes</i>	145
8.6	Further information	147
9.	Food safety	148
9.1	The importance of safe food	148
9.2	Food control	149
9.2.1	<i>Food control measures</i>	149
9.2.2	<i>Salvageable and unsalvageable foods</i>	149
9.2.3	<i>Inspection of food businesses</i>	151
9.2.4	<i>Control of donated or imported food</i>	151
9.3	Food safety and nutrition	151
9.3.1	<i>General considerations</i>	151
9.3.2	<i>Providing dry rations for household cooking</i>	151

9.3.3	<i>Mass-feeding centres</i>	153
9.3.4	<i>Therapeutic-feeding centres</i>	154
9.3.5	Breastfeeding and breast-milk substitutes	154
9.4	Public education and information	156
9.5	Safe and hygienic warehouse management	157
9.6	Further information	157
10.	Vector and pest control	158
10.1	The importance of vector and pest control in disasters and emergencies	158
10.1.1	<i>Assessment</i>	159
10.2	Disease control and nuisance control	159
10.2.1	<i>Disease control</i>	159
10.2.2	<i>Nuisance control</i>	159
10.3	Available control measures	160
10.3.1	<i>Density reduction</i>	160
10.3.2	<i>Longevity reduction with pesticides</i>	160
10.4	Environmental management for vector and pest control	163
10.4.1	<i>The benefits of environmental management</i>	163
10.4.2	<i>Environmental management measures for vector and pest control</i>	163
10.5	Hygiene and personal protection	164
10.5.1	<i>The importance of hygiene and personal protection</i>	164
10.5.2	<i>Repellents</i>	164
10.5.3	<i>Impregnated materials for malaria control</i>	166
10.5.4	<i>Disinfection and disinfestation</i>	166
10.6	Further information	166
11.	Control of communicable diseases and prevention of epidemics	168
11.1	The importance of communicable diseases in emergencies and disasters	168
11.2	Measures for controlling communicable diseases and epidemics	169
11.2.1	<i>Preparedness and prevention</i>	169
11.2.2	<i>Public-health surveillance</i>	171
11.2.3	<i>Outbreak control</i>	172
11.3	The control of cholera: an example	173
11.4	Further information	174
12.	Chemical incidents	175
12.1	Types of chemical incident	175
12.2	The health effects of chemical incidents	175
12.2.1	<i>Toxic effects of chemicals</i>	175
12.2.2	<i>Public-health effects of chemicals</i>	175
12.3	Operational planning and preparedness	176
12.3.1	<i>Multidisciplinary public-health working arrangements</i>	177
12.3.2	<i>Vulnerability assessment</i>	177
12.3.3	<i>Local incident surveillance and environmental monitoring</i>	178

12.3.4	<i>Baseline health assessment</i>	178
12.3.5	<i>Health impact assessment</i>	179
12.3.6	<i>Baseline environmental assessment</i>	179
12.3.7	<i>Liaison with the local community</i>	179
12.3.8	<i>Public-health plans for chemical incidents</i>	180
12.3.9	<i>Databases</i>	180
12.3.10	<i>Reducing the probability of incidents</i>	181
12.3.11	<i>Reducing the health risks of incidents</i>	181
12.3.12	<i>Establishing routine procedures</i>	181
12.3.13	<i>Conducting exercises and training</i>	183
12.3.14	<i>Conducting national chemical incident surveillance and contributing to international chemical incident surveillance</i>	185
12.4	<i>Dealing with chemical incidents</i>	185
12.4.1	<i>Alerting the health-care services</i>	185
12.4.2	<i>Best outcome assessment/estimation</i>	185
12.4.3	<i>Information and public warnings—communication skills</i>	186
12.4.4	<i>Advice on protection</i>	186
12.4.5	<i>Sheltering or evacuation/removal</i>	186
12.4.6	<i>Other restrictions to protect health</i>	186
12.4.7	<i>Organizing registers and samples</i>	187
12.4.8	<i>Collection of samples—biomarkers of chemicals and their effects</i>	187
12.4.9	<i>Environmental monitoring</i>	188
12.5	<i>Assessing the impact on public health</i>	188
12.5.1	<i>Health impact assessment</i>	189
12.6	<i>Further information</i>	190
13.	Radiation emergencies	191
13.1	<i>Health consequences of radiation</i>	191
13.2	<i>Radiation from nuclear incidents</i>	191
13.3	<i>International and local response to a major nuclear accident in compliance with the Convention on Early Notification and Assistance Convention</i>	191
13.4	<i>The role of WHO in a radiation emergency</i>	193
13.5	<i>Mitigation of effects</i>	193
13.6	<i>Inadvertent exposure to radioactive material</i>	196
13.7	<i>Further information</i>	197
14.	Mortuary service and handling of the dead	198
14.1	<i>Recovery of the dead</i>	198
14.2	<i>Organization of the mortuary</i>	198
14.3	<i>Identification of the dead</i>	199
14.4	<i>Handling the dead</i>	199
14.5	<i>Ceremonial aspects</i>	200
14.6	<i>Further information</i>	201

15. Health promotion and community participation	202
15.1 Definitions	202
15.2 Hygiene promotion and community participation in the disaster-management cycle	203
15.3 Community participation	204
15.3.1 <i>Principles of community participation</i>	206
15.3.2 <i>Obstacles to community participation</i>	207
15.3.3 <i>Overcoming obstacles and reaching the community</i>	207
15.3.4 <i>Community organization in urban and rural areas</i>	209
15.4 Hygiene promotion and hygiene education	210
15.4.1 <i>Perception of risk and predisaster awareness raising</i>	210
15.4.2 <i>The need for hygiene promotion in emergencies</i>	211
15.4.3 <i>Setting up a hygiene promotion programme in an emergency</i>	211
15.4.4 <i>Participatory approach to hygiene promotion</i>	212
15.4.5 <i>Environmental health messages in emergencies</i>	213
15.4.6 <i>Communication methods</i>	213
15.4.7 <i>Choosing an approach</i>	214
15.5 Further information	214
16. Human resources	216
16.1 Professional staff	216
16.2 Volunteer staff and employed labour	217
16.3 Training	217
16.3.1 <i>Training professionals</i>	217
16.3.2 <i>Training volunteers</i>	218
16.3.3 <i>Integrated training exercises</i>	218
16.4 Further information	220
References	221
Websites	235
Annex 1 WHO model of country-level emergency planning	237
Annex 2 Equipment and supplies for environmental health activities in disasters and emergencies	240
Annex 3 Accidental pesticide poisoning	243
Annex 4 International and national actions in response to a radiation emergency	245
Annex 5 Selected information from the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources	248
Annex 6 Checklist of hygiene practices that protect health in emergencies and disasters	250