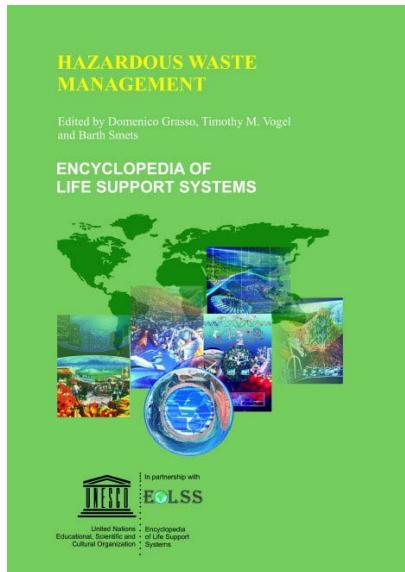


CONTENTS

HAZARDOUS WASTE MANAGEMENT



Hazardous Waste Management - Volume 1

No. of Pages: 454

ISBN: 978-1-84826-055-9 (eBook)

ISBN: 978-1-84826-505-9 (Print Volume)

For more information of e-book and Print Volume(s) order, please [click here](#)

Or contact : eolssunesco@gmail.com

CONTENTS

Hazardous Waste

1

Grasso, D, *Picker Engineering Program, Smith College, Northampton, MA 10163, USA*

Kahn, D, *Picker Engineering Program, Smith College, Northampton, MA 10163, USA*

Kaseva, M. E, *Department of Environmental Engineering, University College of Lands and Architectural Studies (UCLAS), Dar es Salaam, Tanzania*

Mbuligwe, S. E, *Department of Environmental Engineering, University College of Lands and Architectural Studies (UCLAS), Dar es Salaam, Tanzania*

1. Definition of Hazardous Wastes
2. Sources of Hazardous Wastes
3. Classification of Hazardous Waste
4. Public Health and Environmental Effects of Hazardous Wastes
5. Hazardous Waste Management
6. Industrial Hazardous Waste Management
7. Final Disposal of Industrial Hazardous Wastes
8. Site Remediation and Groundwater Decontamination Activities
9. Industrial Ecology
10. Toxicology and Risk Assessment
11. Environmental Risk Assessment
12. Nuclear Industry
13. Radiation Effects
14. Determining Risk Management Procedures and Acceptable Risk Levels
15. Stages of Waste Management Program Evolution
16. Global Status of Hazardous Waste Management
17. International Issues in Hazardous Waste Management
18. Hazardous Wastes in Developing Countries
19. Conclusion

Hazardous Waste Management: A United States Perspective

56

Lawrence K. Wang, *United Nations Industrial Development Organization, Vienna, Austria*

1. Hazardous Waste Characteristics
2. Industrial Site Management
3. Manifest System, Storage and Transportation
 - 3.1. Government Regulations
 - 3.2. Manifest System
 - 3.3. Transportation of Hazardous Wastes
 - 3.4. Standards for an Accumulation Area for Hazardous Waste Storage
 - 3.5. Standards for Waste Containers and Tanks
4. Hazardous Wastes Handling and Disposal
 - 4.1. Disposal of Large Quantities of Hazardous Solid Wastes
 - 4.2. Disposal of Small Quantities of Hazardous Solid Wastes
 - 4.3. Disposal of Infectious and Hazardous Medical Wastes
 - 4.4. Disposal of Hazardous Petroleum Contaminated Soil
 - 4.5. Disposal of Dioxin, PCB and Other Toxic Substances
 - 4.6. Disposal of Asbestos

International Issues In Hazardous Waste Management

77

Felix B. Dayo, *Triple 'E' Systems Associates Ltd., Lagos, Nigeria*

Babajide I. Alo, *University of Lagos, Akoka, Lagos, Nigeria*

Adeolu Ojo, *Triple 'E' Systems Associates Ltd., Lagos, Nigeria*

1. Transboundary Issues
 - 1.1. Legality of the export
 - 1.2. Existence of Hazardous Waste Management Technical Knowledge and Infrastructure in the Importing State
 - 1.3. Health and Safety Implications of Transboundary Movement of Hazardous Wastes
 - 1.4. Equity Issues
 - 1.5. Liability and Compensation Issues
2. Specific Agreements and Accords
 - 2.1. The London Dumping Convention
 - 2.2. Code of Practice for the International Transboundary Movement of Radioactive Wastes
 - 2.3. The Cairo Guidelines
 - 2.4. Dakar Declaration
 - 2.5. Lome IV Convention, Article 39
 - 2.6. Bamako Convention
 - 2.7. Barcelona Convention
 - 2.8. Waigani Convention
 - 2.9. Basel Convention
3. Market Instruments
 - 3.1. Introduction
 - 3.2. Potential Application of Market Instruments
4. Institutional Capacities
 - 4.1. Implementing the Basel Convention
 - 4.2. National Capacities
 - 4.3. Regional Centers
5. A Global Review of the Adequacy of Existing Institutional Capacities

Hazardous Wastes Issues in Developing Countries**112**Kahn Danielle J, *Picker Engineering Program, Smith College, Massachusetts, USA;*Kaseva, M. E, *Department of Environmental Engineering, University College of Lands and Architectural Studies (UCLAS), Dar es salaam, Tanzania*Mbuligwe, S. E,*Department of Environmental Engineering, University College of Lands and Architectural Studies (UCLAS), Dar es salaam, Tanzania*

1. Introduction
2. Hazardous Waste Management Problems
3. Hazardous Waste Sources
4. Informal Sector and Micro-Enterprises
5. Socio-Economic Needs
6. Management and technology needs
7. Solid Waste Disposal Sites
8. Industrial Management
9. Case Studies

Case Study 1: Hazardous Waste Management in Tanzania - Retrospection and Future**124**M. E. Kaseva, *Department of Environmental Engineering, University College of Lands and Architectural Studies (UCLAS), Dar es Salaam, Tanzania.*S. E. Mbuligwe, *Department of Environmental Engineering, University College of Lands and Architectural Studies (UCLAS), Dar es Salaam, Tanzania.*

1. Introduction
2. Hazardous Waste Management General Concepts and Principles
 - 2.1. Significance of Hazardous Waste Management
 - 2.2. Hazardous Waste Problems
3. Technical Issues, Facts and Figures on Hazardous Waste Management in Tanzania
 - 3.1. Identification and Characterization of Sources of Hazardous Wastes

- 3.2. Composition and Characteristics of Hazardous Wastes
- 3.3. Quantification of Hazardous Waste
- 4. Current Hazardous Waste Management Practices in Tanzania
 - 4.1. Management Practices
 - 4.2. Industrial Hazardous Waste Management Practices
 - 4.3. Existing Medical Waste Management in Tanzania
 - 4.4. Policy and Legislation Issues
- 5. Future Outlook on Hazardous Waste Management in Tanzania
 - 5.1. Needs for Proper Hazardous Waste Management
 - 5.2. Opportunities for Improvement of Hazardous Waste Management

Case Study 2: The Management of Hazardous Waste in South Africa**139**G.E. Blight,*University of the Witwatersrand, Johannesburg, South Africa*

- 1. Introduction: Origins of the Hazardous Waste Problem in South Africa
- 2. The Hazard Rating System
- 3. Records of Hazardous Waste Production
- 4. Landfills for Receiving Treated Hazardous Waste
- 5. The Effect of Co-disposal on Emissions of Hazardous Substances from a Landfill
- 6. Faults of the Minimum Requirements for Hazardous Waste Disposal
- 7. The Future

Case Study 3: Hazardous Waste Issues in India**151**P. Khanna,*SIES-Indian Institute of Environment Management, Navi Mumbai, India*Rakesh Kumar,*National Environmental Engineering Research Institute, Mumbai, India*Vijay Kulkarni, *SIES-Indian Institute of Environment Management, Navi Mumbai, India*

- 1. Introduction
- 2. Legislation
 - 2.1. Legislative Framework
 - 2.2. Hazardous Waste (Management and Handling) Rules (1989 and 2000)
 - 2.3. Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989
 - 2.4. Rules for the Manufacture, Use, Import, Export and Storage of Hazardous Chemicals and Genetically Engineered Organisms or Cells, 1989
- 3. Status of Hazardous Waste Management in India
 - 3.1. Hazardous Waste Classification
 - 3.2. Collection and Transportation of Wastes
 - 3.3. Hazardous Waste Treatment
- 4. Towards Hazardous Waste Management in the Twenty-first Century

Case Study 4: Hazardous Waste Management In Malaysia**163**Zaini Ujang,*Institute of Environmental & Water Resource Management, Universiti Teknologi, Malaysia*

- 1. Introduction
- 2. Hazardous Waste Classifications
- 3. Legislative Instruments
- 4. Centralized and Integrated Waste Facilities
- 5. Economic Instruments
- 6. Management of Toxic Chemicals
- 7. Research & Development
- 8. Clinical Waste Management in Malaysia
- 9. Future Challenges

Nuclear Industry**172**J.A. Butkus,*Department of Treasury, USA*M.A. Butkus, *Department of Geography and Environmental Engineering, U.S. Military Academy, USA*Malinowski J.C., *Department of Geography and Environmental Engineering, U.S. Military Academy, USA*

1. Introduction
2. Mining/Milling
3. Policies
4. Use of Radionuclides
 - 4.1. Industrial
 - 4.2. Academic/Medical
 - 4.3. Science
 - 4.4. Agriculture/Food
 - 4.5. Closure
5. Military Uses
6. Nuclear Physics
7. Nuclear Reactor Theory
8. Nuclear Fuels and Moderators
9. Reactor Cooling
10. Reactor Plant Design
 - 10.1. PWR
 - 10.2. BWR
11. Shielding
12. Reactor Plant Operation
 - 12.1. Control Rods
 - 12.2. Moderator Temperature
 - 12.3. Steam Formation
13. Reactor Safety
14. Case Studies: Three Mile Island and Chernobyl
 - 14.1. Three Mile Island
 - 14.2. Chernobyl
15. Nuclear Waste Disposal
 - 15.1. LLW
 - 15.2. RMW
 - 15.3. HLW
 - 15.4. TRU
16. Decommissioning
17. Impacts on Human Health
18. Perception of Nuclear Hazards
 - 18.1. Introduction
 - 18.2. Risk Perception
 - 18.3. Technological Hazards versus Natural Hazards
 - 18.4. Nuclear Accident Evacuation and Reaction
 - 18.5. Nuclear Waste Site Selection
19. The Future of Nuclear Power

Nuclear Waste Management**206**L. de Saint-Georges (1), *Department of Radioprotection (1)*P. De Boever (2), *Radioactive Waste & Cleanup Division (2)*G. Collard (2), *The Belgian Nuclear Research Center (CEN/SCK), Boeretang 200, 2400 Mol, Belgium*

1. Introduction
2. The regulatory system: exclusion versus exemption
3. The origin of radioactive waste
4. Transport of Radioactive Materials
5. Waste management
 - 5.1. The confinement strategy

- 5.2. Limitation, sorting and identification
- 5.3. Waste processing
- 5.4. Waste conditioning & packaging
- 5.5. Waste storage and disposal
 - 5.5.1. Surface or near-surface disposal
 - 5.5.2. Deep geological disposal
- 6. The costs of radioactive waste management
- 7. Alternative waste treatment techniques
 - 7.1. Reprocessing of nuclear waste
 - 7.2. Transmutation

Human Health and Environmental Risk Assessment of Chemicals**222**

Arielle GARD-FLOC'H, *Limonest, France.*
 François E. FLOC'H, *Limonest, France.*

- 1. Introduction
- 2. Hazard Assessment
 - 2.1. Development of Toxicology
 - 2.2. Acute Toxicity Endpoints
 - 2.3. Sub-Acute Toxicity Endpoints
 - 2.4. Chronic and Bioassay Endpoints
 - 2.5. Carcinogens
- 3. Ecotoxicology
 - 3.1. Aquatic Acute Tests
 - 3.2. Aquatic Chronic Tests
 - 3.3. Ecosystem Observations in Outdoors Man-made or Natural Aquatic Ecosystems (ponds, mesocosms)
- 4. Risk Assessment
 - 4.1. Human Health Risk Assessment
 - 4.2. Exposure Considerations
 - 4.3. NOEL (No Observed Effect Level)
 - 4.4. Interspecies Safety Factors
 - 4.5. Determining Correct Safety Factors
 - 4.6. Human Demographic Evolution
 - 4.7. Human Exposure from Production Processes
 - 4.8. Human Epidemiology
 - 4.9. Exposure Models and Scenarios
- 5. Environmental Risk Assessment
- 6. Uncertainties in Risk Assessments
 - 6.1. Uncertainties in Toxicological Experimental Models
 - 6.2. Uncertainties in Environmental Risk Assessment
 - 6.3. Uncertainties in Exposure and Background Levels Assessment
- 7. Safety Factors and Societal Choices

Environmental Ionizing Radiation**237**

L. de Saint-Georges, *Department of Radioprotection, CEN/SCK, Mol, Belgium.*

- 1. Introduction
- 2. Radiation
 - 2.1. Definition
 - 2.2. Ionizing Radiation
 - 2.3. Units
- 3. Sources of Ionizing Radiation
 - 3.1. Natural Radiation Sources
 - 3.2. Cosmic Rays
 - 3.3. Atmospheric Exposure

- 3.4. Food and Drinks
- 3.5. Ground and Building Materials
- 3.6. Man-Made Sources of Radiation
- 3.7. Medical Sources
- 3.8. Occupational Exposure
- 3.9. Miscellaneous Sources
- 4. Radiation Effects on Life
 - 4.1. Radiation Interactions with Matter
 - 4.2. Damage to DNA
 - 4.3. Damage Repair
 - 4.4. Apoptosis: An Emergency Exit?
 - 4.5. Radiosensitivity
 - 4.6. Early and Delayed Radiation Effects
 - 4.7. Low Dose Effects
 - 4.8. Radiation Induced Cancer
 - 4.9. Radiation Induced Hereditary Effects
 - 4.10. Linear No threshold Hypothesis, Radiation Hormesis and Adaptive Response
 - 4.11. Genomic Instability
- 5. Radiation Protection
 - 5.1. International Organizations
 - 5.2. European Organization
 - 5.3. Risk Assessment

Ecological Risk Assessment of Environmental Stress **259**

A.M. Breure, *Laboratory for Ecotoxicology, National Institute of Public Health and the Environment, Bilthoven, The Netherlands*

D.T. Jager, *Laboratory for Ecotoxicology, National Institute of Public Health and the Environment, Bilthoven, The Netherlands*

D. van de Meent, *Laboratory for Ecotoxicology, National Institute of Public Health and the Environment, Bilthoven, The Netherlands*

Ch. Mulder, *Laboratory for Ecotoxicology, National Institute of Public Health and the Environment, Bilthoven, The Netherlands*

W.J.G.M. Peijnenburg, *Laboratory for Ecotoxicology, National Institute of Public Health and the Environment, Bilthoven, The Netherlands*

L. Posthuma, *Laboratory for Ecotoxicology, National Institute of Public Health and the Environment, Bilthoven, The Netherlands*

M. Rutgers, *Laboratory for Ecotoxicology, National Institute of Public Health and the Environment, Bilthoven, The Netherlands*

A.J. Schouten, *Laboratory for Ecotoxicology, National Institute of Public Health and the Environment, Bilthoven, The Netherlands*

A. Sterkenburg, *Laboratory for Ecotoxicology, National Institute of Public Health and the Environment, Bilthoven, The Netherlands*

J. Struijs, *Laboratory for Ecotoxicology, National Institute of Public Health and the Environment, Bilthoven, The Netherlands*

P. van Beelen, *Laboratory for Ecotoxicology, National Institute of Public Health and the Environment, Bilthoven, The Netherlands*

M. Vonk, *Laboratory for Ecotoxicology, National Institute of Public Health and the Environment, Bilthoven, The Netherlands*

D. de Zwart, *Laboratory for Ecotoxicology, National Institute of Public Health and the Environment, Bilthoven, The Netherlands*

1. Methodologies for Ecological Assessments
2. Assessment of the Concentration and Fate of Toxicants in the Environment
 - 2.1. Simplebox
 - 2.2. The SimpleTreat Model
 - 2.3. Bioavailability of Chemicals
 - 2.4. Chemical Availability of Metals for Uptake by Soil Dwelling Organisms

- 2.5. Environmental Bioavailability
- 2.6. Toxicological Bioavailability
- 2.7. Bioavailability and Biodegradation
3. Assessment of Effects of Toxic Stress
 - 3.1. Species Sensitivity Distributions
 - 3.2. Derivation of Environmental Quality Criteria from SSDs
 - 3.3. Derivation of Potentially Affected Fraction of Species (PAF) from SSDs for the Evaluation of Ecotoxic Risk
 - 3.4. Ecotoxic Stress Caused by Exposure to a Cocktail of Toxicants
 - 3.5. The IQ-Tox Computer Program for Ecotoxic Risk Evaluation
 - 3.6. Measurement of the Effect of Toxic Stress in the Environment
 - 3.7. A Microbial Indicator to Assess Field Effects of Toxic Stress
 - 3.8. Assessment of Toxic Stress in Relation to Other Stresses: Multi-Stress Analysis
4. Measurement of Multi-Stress Effects
 - 4.1. Biological Indicator for Soil Quality (BISQ)
 - 4.2. A Microbial Indicator for Ecological Quality
5. Decision Support Systems
 - 5.1. The European Union System for the Evaluation of Substances (EUSES)
 - 5.2. DSS for Site Specific Risk Assessment of Toxic Contamination
 - 5.3. An Indicator Tool for Integral Analysis of Stresses
6. Concluding Remarks

Site Remediation and Groundwater Decontamination in USA**290**Lawrence K. Wang, *United Nations Industrial Development Organization, Vienna, Austria*

1. Introduction and Terminologies
2. Excavation
3. In-Situ Stabilization and Solidification of Contaminated Soils
4. In-Situ Soil Vapor Stripping or Soil Vacuum Extraction
5. Ex-Situ and In-Situ Low Temperature Thermal Desorption
6. Incineration, Thermal Destruction, Starved Air Combustion and High Temperature Pyrolysis
7. In-Situ Hot Air/Steam Enhanced Stripping and In-Situ Thermal Extraction
8. In-Situ Subsurface Volatilization and Ventilation (combined saturated zone sparging and in-situ vadose zone vapor stripping)
9. Ex-Situ Vitrification and In-Situ Vitrification
10. In-Situ Soil Surfactant Flushing and Ex-Situ Soil Washing
11. Bioremediation for Soil and/or Groundwater Decontamination
12. Slurry Bioreactor System for Soil Decontamination
13. Anaerobic-aerobic Fixed Film Biological System for Groundwater Decontamination
14. Chemical Treatment (pH adjustment, KPEG treatment)
15. Ultraviolet Radiation and Oxidation for Groundwater Decontamination
16. Air Stripping for Groundwater Decontamination
17. Granular Activated Carbon Adsorption for Groundwater Decontamination
18. Sewer Discharge for Groundwater Treatment
19. Liquid/Liquid Separation and Free Product Recovery for Groundwater Decontamination
20. Natural Attenuation, Natural Flushing, Trench, Containerizing
21. Dissolved Air Flotation for Groundwater Decontamination

Industrial Ecology**319**Lawrence K. Wang, *United Nations Industrial Development Organization, Vienna, Austria*

1. Introduction and Definitions of Industrial Ecology
2. Goal, Role and Objectives
3. Approach and Applications
4. Tasks, Steps and Framework for Implementation
5. Qualifications of Industrial Ecologists

6. Ways and Means for Analysis and Design
7. Sustainable Agriculture, Industry and Environment
8. Zero Emission and Related Terms
9. Case Studies of Successful Hazardous Waste Management through Industrial Ecology Implementation
 - 9.1. New Galvanizing Steel Technology Used at Delot Process SA Steel Factory, Paris, France
 - 9.2. Reduction of Hazardous Sulfide in Effluent from Sulfur Black Dyeing at Century Textiles, Bombay, India
 - 9.3. Replacing Toxic Solvent-based Adhesives with Non-toxic Water-based Adhesives at Blueminsters Packaging Plant., Kent, UK
 - 9.4. Recovery and Recycling of Toxic Chrome at Germanakos SA Tannery near Athens, Greece
 - 9.5. Recovery of Toxic Copper from Printed Circuit Board Etchant for Reuse at Praegitzer Industries, Inc., Dallas, Oregon, USA
 - 9.6. Recycling of Hazardous Wastes as Waste-derived Fuels at Southdown, Inc., Houston, Texas, USA
10. Conclusions

Environmentally Sound Management of Hazardous Wastes**333**

A. K. Saxena, *Environment Division, National Productivity Council, New Delhi, India*
 Yogesh Gupta, *Environment Division, National Productivity Council, New Delhi, India*

1. Introduction
2. Hazardous Waste – Definition
3. Identification, Classification and Characterisation of Hazardous Waste
 - 3.1. Hazardous Waste Characterisation
 - 3.1.1. Waste Characterisation through Process Knowledge
 - 3.1.2. Waste Characterisation through Leachate Testing
 - 3.1.2.1. Water Leach Test
 - 3.1.2.2. TCLP Test
 - 3.1.2.3. SPLP Test
 - 3.1.2.4. MEP Test
 - 3.2. Hazardous Waste Sampling and Analysis
 - 3.2.1. Random sampling
 - 3.2.2. Stratified random sampling
 - 3.2.3. Systemic random sampling
4. Status of Hazardous Waste Management
 - 4.1. Problems Associated With Hazardous Waste Management
 - 4.2. General Hazardous Waste Management Practices
5. Effects of Hazardous Waste on Health & Environment
6. International Treaties & Protocols on Hazardous Waste
 - 6.1. International Treaties & Protocols on Hazardous Wastes before Basel Convention
 - 6.2. 1989 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal
 - 6.3. International Treaties & Protocols on Hazardous Wastes after Basel Convention
7. Approach Towards Environmentally Sound Management of Hazardous Wastes
 - 7.1. Hazardous Waste Avoidance or Minimization Strategy
 - 7.1.1. Waste Exchange
 - 7.1.2. Segregation of Wastes
 - 7.1.3. Alternative process and process materials
 - 7.1.4. Product Design Modification
 - 7.2. Hazardous Waste Management Strategy
 - 7.2.1. Handling, Collection and Storage
 - 7.2.2. Recycling, Reuse and Recovery
 - 7.2.3. Treatment
 - 7.2.4. On Site / Off site Emergency Plan
 - 7.2.5. Transportation of Hazardous Waste
 - 7.2.6. Disposal of Hazardous Waste

- 7.2.6.1. Landfill Disposal
 - 7.2.6.2. Incineration
 - 7.2.6.3. Disposal at Sea
 - 7.2.6.4. Underground Disposal
 - 7.2.6.5. Deep Well Injection
8. Conclusion

Index **383**

About EOLSS **393**