Table of Contents

Foreword ........................................................................................................................................... V
Preface ................................................................................................................................................ VI
List of Contributors ........................................................................................................................ XIX

Part I – Environmental Policies and Key Drivers for Setting Standards and Thresholds .................................................. 1

1 Principles and Purposes of Standards and Thresholds in the EIA Process...3
   John Glasson
   1.1 Introduction ......................................................................................................................... 3
   1.2 Thresholds and Standards – Definitions and Dimensions .............................................. 4
   1.3 Environmental Impact Assessment .................................................................................... 6
   1.4 Standards and Thresholds in the EIA Process .................................................................. 7
   1.5 Thresholds and Standards in the Screening Stage –
   a More in Depth Review ........................................................................................................ 10
   1.6 Conclusions and Recommendations ................................................................................ 16

2 Standards and Thresholds in German Environmental Law.............19
   Eike Albrecht
   2.1 Introduction ......................................................................................................................... 19
   2.2 Functions of Thresholds and Standards in German Environmental Law ....................... 20
   2.3 Main Limitations of Standards and Thresholds in German Environmental Law .............. 21
   2.4 Sources of Standards and Thresholds .............................................................................. 23
   2.5 Standards and Thresholds in Federal Emission Control Law ....................................... 26
   2.6 Standards and Thresholds in Federal Soil Protection Law ............................................ 27
   2.7 Conclusions and Recommendations ................................................................................ 30

3 Standards and Thresholds for EA in Highly Polluted Areas –
   The Approach of Ukraine ......................................................................................... 33
   Dmytro Palekhov, Michael Schmidt and Gennady Pivnyak
   3.1 Introduction ........................................................................................................................ 33
   3.2 Basic Directions in Development of Ukrainian Environmental Policies .......................... 34
   3.3 Standards and Thresholds in Ukrainian Practice ............................................................ 35
   3.4 Norms for Quality of the Atmospheric Air ........................................................................ 39
   3.5 Conclusions and Recommendations ................................................................................. 44
4 Poverty and Disease Remediation in the Millennium Development Goals: Time for Kenya to Set Standards and Thresholds? 

Vincent Onyango and Michael Schmidt

4.1 Introduction ................................................. 49
4.2 The Millennium Development Goals ...................... 50
4.3 Implementation of MDGs in Kenya: Target Setting .......... 51
4.4 Need and Justification for Standards and Thresholds .......... 54
4.5 Discussion ............................................................ 58
4.6 Conclusions and Recommendations ...................... 59

5 Widening the Scope – Sustainability Indicators, Legal Thresholds and Standards in Portugal

Anastássios Perdicoúlis

5.1 Introduction ......................................................... 63
5.2 Standards and Thresholds ......................................... 64
5.3 Indicator and Information Systems .......................... 66
5.4 Analysis ................................................................. 70
5.5 Discussion ............................................................. 72
5.6 Conclusions and Recommendations ...................... 73

6 Problems in Setting Thresholds

Reinhart Bartsch

6.1 Introduction .......................................................... 75
6.2 Assessing Target Functions, Benefits and Costs of Ecological Measures Incorrectly .......... 76
6.3 Conclusions and Recommendations ...................... 84

Part II – Thresholds and Standards for Different Types of Projects

Part IIa – Thresholds and Standards for Site-Specific Projects

7 Requirements on EIA Quality Management

Joachim Hartlik

7.1 Introduction .......................................................... 89
7.2 Quality Requirements on EIA-Procedure .......................... 90
7.3 Quality Requirements on EIS .................................. 93
7.4 The Role of Standards and Thresholds within Quality Management .. 101
7.5 Conclusions and Recommendations ...................... 102
8 Environmental Impact Assessment Standards and Thresholds for Sanitary Landfills .............................................................. 103  
*Cem B. Avci and Erol Güler*  
8.1 Introduction ...................................................................................................................... 103  
8.2 Regulatory Overview ..................................................................................................... 103  
8.3 EIA Standards and Thresholds .................................................................................... 104  
8.4 Conclusions and Recommendations .............................................................................. 110  

9 Standards and Thresholds for Waste Water Discharges in Mexico ............ 113  
*Constantino Gutiérrez*  
9.1 Introduction ...................................................................................................................... 113  
9.2 Standards Antecedents ................................................................................................... 114  
9.3 Standards for Discharges into Surface and Groundwater ........................................ 117  
9.4 Standards for Discharges into Municipal Sewerage ................................................ 119  
9.5 Standards for Reuse Treated Wastewater ..................................................................... 121  
9.6 Standards for Sludge Disposal ..................................................................................... 122  
9.7 Experiences in Ten Years of Application ..................................................................... 123  
9.8 Conclusions and Recommendations .............................................................................. 124  

10 Standards for Wastewater Treatment in Brazil ........................................... 125  
*Marcos von Sperling*  
10.1 Introduction ...................................................................................................................... 125  
10.2 Quality Standards for Water Bodies in Brazil ........................................................... 127  
10.3 Discharge Standards in Brazil ..................................................................................... 130  
10.4 Progressive Implementation of the Standards ........................................................... 131  
10.5 Conclusions and Recommendations .............................................................................. 132  

11 Standards for and Evaluation of Small-Scale Dam Projects in Yemen ... 133  
*Michael Schmidt, Fadhl Al-Nozaily and Amer Al-Ghorbany*  
11.1 Introduction ...................................................................................................................... 133  
11.2 Need for Dams in Yemen .............................................................................................. 133  
11.3 Dams' Water Uses and Guidelines .......................................................................... 134  
11.4 Dams and Water Quality Deterioration ....................................................................... 137  
11.5 EIA Practice at PWP in Yemen ................................................................................... 140  
11.6 Conclusions and Recommendations .............................................................................. 143  

12 The Need for Developing Thresholds for the Recycling Rate of Products in Thailand ......................................................................................................................... 145  
*Angkarn Wongdeethai and Jürgen Ertel*  
12.1 Introduction ...................................................................................................................... 145  
12.2 Challenges and Opportunities ..................................................................................... 147  
12.3 Which Products Should be Concerned? ...................................................................... 150  
12.4 Who will be Affected from the Implementation? ....................................................... 151
Table of Contents

12.5 Methods to Fulfil the Requirements for Developing Thresholds for Recycling Rate of Products .......................................................... 152
12.6 Conclusions and Recommendations .............................................. 155

13 Guidelines for SEA in Marine Spatial Planning for the German Exclusive Economic Zone (EEZ) – with Special Consideration of Tiering Procedure for SEA and EIA ........................................... 157
   Juliane Albrecht
   13.1 Introduction ................................................................................. 157
   13.2 Legal Peculiarities of Marine Spatial Planning in the German EEZ . 158
   13.3 The Importance of Offshore Wind Use for Marine Spatial Planning in the EEZ ................................................................. 159
   13.4 The Requirements of SEA of Spatial Structure Planning in the EEZ .................................................................................. 160
   13.5 Methodology and Standards for Application of the SEA in the EEZ .................................................................................. 161
   13.6 Criteria for Avoiding Duplication of SEA and EIA: the Example of Offshore Wind Energy Use (Tiering) ........................................ 165
   13.7 Conclusions and Recommendations .............................................. 168

14 Standards of Implementing Renewable Energy Technologies in Cameroon .......................................................................................... 171
   Ernestine A. Tangang Yntenwi, Victor Ngu Cheo and Jürgen Ertel
   14.1 Introduction .................................................................................. 171
   14.2 Institutional Framework of the Ministry of Energy and Water and EIA Procedures in Cameroon ......................................................... 174
   14.3 Global Efforts to Mitigate Problems Caused By RET  ..................... 178
   14.4 Standards and Thresholds for Mitigating Indoor Air Pollution from Biomass Use ................................................................. 179
   14.5 Conclusions and Recommendations .............................................. 182

15 Standards for Mining and Quarrying .................................................... 185
   Stanislaw Gruszczynski
   15.1 Introduction .................................................................................. 185
   15.2 Factors of Impact .......................................................................... 186
   15.3 Symptoms of Significant Environmental Threat ............................. 190
   15.4 Mining and EIA ........................................................................... 196
   15.5 Conclusions and Recommendations .............................................. 199
<table>
<thead>
<tr>
<th>Part IIb – Thresholds and Standards for Spatially Dispersed Projects</th>
<th>203</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>16 Thresholds and Standards for Tourism Environmental Impact</strong></td>
<td>205</td>
</tr>
<tr>
<td>Assessment</td>
<td>Ralf Buckley</td>
</tr>
<tr>
<td>16.1 Introduction</td>
<td>205</td>
</tr>
<tr>
<td>16.2 EIA for Different Types of Tourism</td>
<td>206</td>
</tr>
<tr>
<td>16.3 Holiday Housing Clusters</td>
<td>209</td>
</tr>
<tr>
<td>16.4 Tourism and Protected Areas</td>
<td>210</td>
</tr>
<tr>
<td>16.5 Conclusions and Recommendations</td>
<td>213</td>
</tr>
<tr>
<td><strong>17 Spatial Planning: Indicators to Assess the Efficiency of Land Consumption and Land-Use</strong></td>
<td>217</td>
</tr>
<tr>
<td>Harry Storch and Michael Schmidt</td>
<td></td>
</tr>
<tr>
<td>17.1 Introduction</td>
<td>217</td>
</tr>
<tr>
<td>17.2 Land Consumption: Actual Trends in Germany</td>
<td>217</td>
</tr>
<tr>
<td>17.3 Efficiency Indicators for Land Use and their Impacts</td>
<td>220</td>
</tr>
<tr>
<td>17.4 Linking Indicators to Urban Development Models</td>
<td>224</td>
</tr>
<tr>
<td>17.5 Conclusions and Recommendations</td>
<td>225</td>
</tr>
<tr>
<td><strong>18 EIA Performance Standards and Thresholds for Sustainable Forest Management in Ghana</strong></td>
<td>229</td>
</tr>
<tr>
<td>Edward K. Nunoo</td>
<td></td>
</tr>
<tr>
<td>18.1 Introduction</td>
<td>229</td>
</tr>
<tr>
<td>18.2 Country Background</td>
<td>230</td>
</tr>
<tr>
<td>18.3 EIA and Institutional Framework in Ghana</td>
<td>231</td>
</tr>
<tr>
<td>18.4 Standards and Thresholds of Significance</td>
<td>232</td>
</tr>
<tr>
<td>18.5 Conclusions and Recommendations</td>
<td>237</td>
</tr>
<tr>
<td><strong>Part III – Thresholds and Standards for Environmental Media</strong></td>
<td>241</td>
</tr>
<tr>
<td><strong>19 Critical Loads and Levels Concept for Ecosystems</strong></td>
<td>243</td>
</tr>
<tr>
<td>Robert Mayer</td>
<td></td>
</tr>
<tr>
<td>19.1 Introduction</td>
<td>243</td>
</tr>
<tr>
<td>19.2 Research in Dynamic Environmental Systems</td>
<td>245</td>
</tr>
<tr>
<td>19.3 New Instruments in Environmental Policy</td>
<td>246</td>
</tr>
<tr>
<td>19.4 The Concept of Critical Loads and Levels</td>
<td>247</td>
</tr>
<tr>
<td>19.5 Advantages of Using the Critical Loads and Level Concept</td>
<td>248</td>
</tr>
<tr>
<td>19.6 The Deduction of Critical Loads and Legislation in Germany</td>
<td>250</td>
</tr>
<tr>
<td>19.7 Conclusions and Recommendations</td>
<td>251</td>
</tr>
</tbody>
</table>
20 Soil Standards and Thresholds.......................................................... 253
Robert Mayer

20.1 Introduction .................................................................................. 253
20.2 Standards for Soil Protection ........................................................ 253
20.3 Standards for the Protection from Soil-Mediated Hazards .......... 255
20.4 Soil Standards and Threshold Values under Various Acts in Germany ................................................................. 256
20.5 Conclusions and Recommendations ............................................. 260

21 Soil Background and Reference Values for PAH and PCB.............. 263
Jürgen Ritschel

21.1 Introduction .................................................................................. 263
21.2 Determination of Terms and Fundamentals of Assessment ....... 264
21.3 Taking Samples and Status Report on Soil Site Parameters ....... 265
21.4 Implementation of Pot Trials and Taking Samples in the Field ...... 266
21.5 Results .......................................................................................... 267
21.6 Conclusions and Recommendations ............................................. 275

22 Standards and Indicators for Monitoring Impact of Disturbance on Biodiversity in a Post-Mining Area Using GIS ........................................ 277
Effah Kwabena Antwi and Gerhard Wiegleb

22.1 Introduction .................................................................................. 277
22.2 Materials and Methods ................................................................. 280
22.3 Data Acquisition and Spatial Database ...................................... 280
22.4 Results .......................................................................................... 284
22.5 Diversity and Interspersion Metrics ............................................. 286
22.6 Discussions .................................................................................. 286
22.7 Conclusions and Recommendations ............................................. 288

23 Air Pollution and Climate: Standards for Particulate Matter ........... 291
Matti Johansson

23.1 Introduction .................................................................................. 291
23.2 Integrated Assessment ................................................................. 292
23.3 Air Quality Guidelines ................................................................. 296
23.4 Conclusions and Recommendations ............................................. 298

24 Standards and Thresholds of the EU Water Framework Directive (WFD) – Phytoplankton and Lakes ...................................................... 301
Brigitte Nixdorf, Atis Rektins and Ute Mischke

24.1 Introduction .................................................................................. 301
24.2 WFD — Aim and Present State of the Implementation ............... 302
24.3 Main Objectives of WFD and Intercalibration ......................... 303
24.4 Biological Quality Elements and Ecological Status ................. 305
24.5 Phytoplankton Assessment System ................................................... 307
24.6 European Standards (CEN) for Alpine and Lowland Regions for Lake Assessment and Sampling Procedure ........................................... 311
24.7 Conclusions and Recommendations ................................................. 312

25 Landscape and Protected Areas – Polish Experiences ...................... 315
Tadeusz J. Chmielewski
25.1 Introduction ..................................................................................... 315
25.2 Landscape Quality Objectives: Problems of Identification and Conservation in Europe ................................................................. 316
25.3 Natural Landscapes of Poland and System of their Protection ......... 317
25.4 Polish Standards for Environment Impact Assessment in Protected Areas ....................................................................................... 322
25.5 Conclusions and Recommendations .................................................. 324

26 The Use and Misuse of Noise Standards .............................................. 327
Riki Therivel and Chris Bennett
26.1 Introduction ..................................................................................... 327
26.2 Components of Noise Standards ...................................................... 327
26.3 Examples of Noise Standards ............................................................ 330
26.4 Use of Noise Standards in Practice: Stansted ‘Generation 1’ Environmental Impact Statement ......................................................... 333
26.5 Conclusions and Recommendations .................................................. 339

27 Assessing Environmental Impacts on Human Health –
Drinking-Water as an Example ............................................................... 341
Ingrid Chorus
27.1 Introduction ..................................................................................... 341
27.2 Societal Perception and Scientific Understanding ......................... 341
27.3 Deriving Guideline Values and Setting Standards for Hazardous Agents in Drinking-Water ............................................................ 343
27.4 Assessing Human Health Risks: Can We Quantify or at Least Prioritise them? ........................................................... 347
27.5 How do we Effectively Protect Human Health from Environmental Hazards – Process Control ......................................................... 351
27.6 Water Quality Targets for Human Health and for Aquatic Ecosystems ....................................................................................... 352
27.7 Conclusions and Recommendations .................................................. 353
### 28 Management of Dams in Trans-National River Basins – a Preliminary Sustainability Impact Assessment for the Upper Elbe River Basin

*Martin Socher, Stefan Dornack and Hans Ulrich Sieber*

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>28.1 Introduction</td>
<td>355</td>
</tr>
<tr>
<td>28.2 The Method of SIA</td>
<td>356</td>
</tr>
<tr>
<td>28.3 Dam Systems of the Upper Elbe River Basin, the Moldau Cascade</td>
<td>358</td>
</tr>
<tr>
<td>and Saxon Dams in Tributaries from the Ore Mountains</td>
<td></td>
</tr>
<tr>
<td>28.4 Screening and Scoping</td>
<td>364</td>
</tr>
<tr>
<td>28.5 Preliminary Assessment</td>
<td>365</td>
</tr>
<tr>
<td>28.6 Conclusions and Recommendations</td>
<td>367</td>
</tr>
</tbody>
</table>

### Part IV – Examples of Emerging Issues

#### 29 Environmental Impact of Nano Technology on Human Health

*Amoah Benedicta and Jürgen Ertel*

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>29.1 Introduction</td>
<td>371</td>
</tr>
<tr>
<td>29.2 Research Approach</td>
<td>372</td>
</tr>
<tr>
<td>29.3 Application of Nanotechnology</td>
<td>372</td>
</tr>
<tr>
<td>29.4 Impact of Nanotechnology on Human Health</td>
<td>373</td>
</tr>
<tr>
<td>29.5 Technical Suitability of Nanotechnology</td>
<td>375</td>
</tr>
<tr>
<td>29.6 The Need for Environmental Impact Assessment</td>
<td>376</td>
</tr>
<tr>
<td>29.7 Conclusions and Recommendations</td>
<td>377</td>
</tr>
</tbody>
</table>

#### 30 Ecotoxicological Risk of Human Pharmaceuticals in Brandenburg Surface Waters?

*Werner Kratz*

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>30.1 Introduction</td>
<td>379</td>
</tr>
<tr>
<td>30.2 For Which Pharmaceutical Active Substances Can a Risk Assessment be Accomplished?</td>
<td>380</td>
</tr>
<tr>
<td>30.3 Which Concentrations are to be Expected from these Active Substances in Brandenburg’s Surface Waters and Which are Already Proven?</td>
<td>380</td>
</tr>
<tr>
<td>30.4 Which Active Agent Concentrations Adversely Affect the Aquatic Ecosystem?</td>
<td>382</td>
</tr>
<tr>
<td>30.5 For Which Pharmaceutical Active Substance Does an Ecotoxicological Risk Exist?</td>
<td>385</td>
</tr>
<tr>
<td>30.6 Conclusions and Recommendations</td>
<td>388</td>
</tr>
</tbody>
</table>

#### 31 Environmental Oxygenology and Related Thresholds and Standards

*Witold Stepnievski and Agnieszka Rozej*

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>31.1 Introduction</td>
<td>391</td>
</tr>
<tr>
<td>31.2 Thresholds and Standards Related to Dioxygen (O₂)</td>
<td>392</td>
</tr>
<tr>
<td>31.3 Thresholds and Standards Related to Thrioxygen (O₃)</td>
<td>396</td>
</tr>
</tbody>
</table>
31.4 Water ................................................................. 398
31.5 Soil ................................................................. 399
31.6 Conclusions and Recommendations ......................... 401

32 Quantitative Threshold Values for Strategic Environmental Assessment
Hendrike Helbron and Michael Schmidt

32.1 Introduction ...................................................... 405
32.2 Assessment Methodology .................................... 406
32.3 Environmental Quality Objectives (EQO) and Environmental Quality Standards (EQS) ......................... 410
32.4 Quantitative Threshold Values and Conflict Intensity Classes .... 413
32.5 Conclusions and Recommendations ......................... 417

Part V – Implementation ............................................. 419

33 A Method to Monitor the Implementation of Mitigation Measures in Infrastructure Projects – Exemplified with a Project in the Republic of Yemen
Reinhart Bartsch and Dirk Hein Westerveld

33.1 Introduction ...................................................... 423
33.2 The Infrastructure Project .................................... 424
33.3 The Monitoring Method ..................................... 425
33.4 Result: The Mitigation Measure Monitoring Plan ............ 429
33.5 Conclusions and Recommendations ......................... 430

34 The Role of Environmental Management Systems in Enforcing Standards and Thresholds in the Context of EIA Follow-Up
Aleh Cherp

34.1 Introduction ...................................................... 433
34.2 EMPs and EMSs ............................................... 437
34.3 SEA Follow-Up: Similarities and Differences with the Project-Level .................................................. 439
34.4 The Role of Standards and Thresholds ....................... 443
34.5 Conclusions and Recommendations ......................... 444

35 Consequences of EIA Prediction Uncertainty on Mitigation, Follow-Up and Post-Auditing
Aud Tennøy

35.1 Introduction ...................................................... 447
35.2 Uncertainty and Handling of Uncertainty in EIA Predictions ...... 448
35.3 Mitigation, Follow-Up and Post-Auditing ....................... 452
### 35.4 Consequences of EIA Uncertainty on Mitigation, Follow-Up and Post-Auditing

35.5 Conclusions and Recommendations

---

### 36 Environmental Quality Standards as a Tool in Environmental Governance – the Case of Sweden

_Lars Emmelin and Peggy Lerman_

36.1 Introduction

36.2 Types of Environmental Quality Standards

36.3 The Swedish Implementation System

36.4 Some Theoretical Considerations

36.5 Discussion: Factors Influencing the Effectiveness of Standards and Thresholds in Environmentally Rational Governance

---

**Subject Index**
Standards and Thresholds for Impact Assessment
Schmidt, M.; Glasson, J.; Emmelin, L.; Helbron, H. (Eds.)
2008, XXX, 493 p. 52 illus., Hardcover
ISBN: 978-3-540-31140-9