

Rachna Bhateria
Mona Sharma
Rimmy Singh
Sumit Kumar

Environmental Impact Assessment

A Journey to Sustainable Development

 Springer

Environmental Impact Assessment

Rachna Bhateria · Mona Sharma · Rimmy Singh ·
Sumit Kumar

Environmental Impact Assessment

A Journey to Sustainable Development

 Springer

Rachna Bhateria
Department of Environmental Sciences
Maharshi Dayanand University
Rohtak, Haryana, India

Mona Sharma
Department of Environmental Studies
Central University of Haryana
Mahendragarh, Haryana, India

Rimmy Singh
Department of Applied Science
DPG Institute of Technology
and Management
Gurugram, Haryana, India

Sumit Kumar
Department of Environmental Science
and Technology
Guru Jambheshwar University of Science
and Technology
Hisar, Haryana, India

ISBN 978-3-031-66796-1 ISBN 978-3-031-66797-8 (eBook)
<https://doi.org/10.1007/978-3-031-66797-8>

© The Editor(s) (if applicable) and The Author(s), under exclusive license to Springer Nature Switzerland AG 2024

This work is subject to copyright. All rights are solely and exclusively licensed by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

If disposing of this product, please recycle the paper.

Foreword

As Vice Chancellor of Central University of Haryana, it is my steadfast commitment to nurture a generation of environmentally aware and responsible individuals. I am pleased to introduce the textbook titled *Environmental Impact Assessment: A Journey to Sustainable Development*, authored by Rachna Bhateria, Mona Sharma, Rimmy Singh, and Sumit Kumar. This book endeavors to equip the next generation with essential expertise in Environmental Impact Assessment (EIA).

This book is a timely contribution to the environmental discourse, providing a clear and practical guide for navigating the EIA process. The authors' expertise is evident throughout, offering structured insights and a comprehensive understanding of EIA, empowering readers to actively participate in shaping a sustainable future.

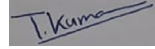
The book simplifies the complexities of EIA into digestible chapters, guiding readers through each stage of the process with clarity and precision. It goes beyond theory, providing practical tools, methodologies, and real-world examples to conduct EIA studies effectively and contribute to environmental decision-making. By covering topics like Strategic Environmental Assessment (SEA) and Environmental Risk Assessment (ERA) alongside traditional EIA, the book offers a holistic perspective on environmental impact analysis.

The book explores nuances of EIA regulations and relevant notifications, making it invaluable for Indian professionals, students, and policymakers.

This book is particularly valuable for:

Students: Building a strong foundation in EIA principles and practices for successful careers in environmental fields. **Professionals:** Enhancing their EIA expertise and staying abreast of the latest regulations and best practices. **Policymakers:** Making informed decisions that balance development needs with environmental sustainability. **Concerned Citizens:** Actively participating in the EIA process and advocating for environmentally responsible projects.

In conclusion, *Environmental Impact Assessment: A Journey to Sustainable Development* is an essential resource for understanding and influencing the EIA process. I wholeheartedly recommend this book to all stakeholders involved in environmental management and sustainable development. By equipping ourselves with knowledge and practical skills, we can collectively work towards a brighter future for our planet.



Prof. Tankeshwar Kumar
Vice Chancellor
Central University of Haryana
Mahendergarh, India

Preface

Environmental Impact Assessment (EIA) has been recognized as an important tool in the path of sustainable development. EIA has gained importance in the last few decades due to global environmental concerns. EIAs have been performed for new developments and expansion of already existing establishments for almost half a century now. There has been a phenomenal growth in EIA studies and EIA reports in terms of the number and depth. The growing awareness of the environmental impact of developing activities on the ecosystem has been highlighted in various reports issued by international agencies which has further prompted governments of various countries to continuously update their environmental laws.

In India, EIA has been mandatory for development projects since 1994, re-engineered in 2006, and again revised in 2020. Good-quality EIA reports are required for development projects to facilitate decision-making with sustainability considerations. It is felt that many professionals engaged in the preparation and reviewing of EIA reports in developing countries are not aware of the basic aspects of EIAs. Moreover, students at universities are unaware of the roots of EIA report. Therefore, an effort is made to include a thorough explanation of EIA, an assessment of the environmental components, EIA procedures, and helpful advice on how to prepare EIA reports. The procedure of EIA varies from project to project and country to country. The book will facilitate the EIA consultancies dealing with development projects.

The book covers the basic principles and salient features of EIA. The authors attempt to cover the shortcomings observed in EIA reports, the manner of conducting EIA for the proposed project, and also to facilitate the preparation of good quality EIA reports. The book is written in the form of proper numbering. Long descriptive texts have been avoided to make it easily readable. It should be mentioned that although the book is written focusing on the Indian context in its discussion of environmental regulations and the EIA framework, however, the concepts and techniques of EIA described in this book are applicable universally. Hence, it will be very useful to a wide range of stakeholders, viz. Academicians, EIA professionals and consultants, project proponents, EIA review/appraisal authorities, and competent authorities, particularly in emerging economies where major developmental work is

being undertaken and which is expected to continue in decades to come. An environmental management plan (EMP) is also included which is an essential aspect of EIA in countries where priority is on economic development by way of development projects and the EIA process has inherent weaknesses. For continual improvement of EIA reports, EIA consultants may be assigned the task of implementing and operationalizing the suggested EMP for a certain number of years in addition to conducting an EIA study and in preparation of an EIA report. The system of peer review of EIA reports is also expected to improve EIA quality.

Environmental Impact Assessment: A Journey to Sustainable Development is an attempt to cover EIA according to new knowledge acquired through research and experiences which will make this tool more versatile and dynamic. It is recognized that since EIA is continuously expanding in the context of contents, hence there will always be scope for improving the contents and expanding the coverage of the book to make it more useful to the users as per their requirement.

Rohtak, India
Mahendragarh, India
Gurugram, India
Hisar, India

Rachna Bhateria
Mona Sharma
Rimmy Singh
Sumit Kumar

Contents

| | | |
|----------|--|-----------|
| 1 | Introduction to Environment Impact Assessment | 1 |
| 1.1 | EIA: Definition | 1 |
| 1.2 | Objective of EIA | 2 |
| 1.3 | Principles of EIA | 2 |
| 1.4 | Background History of EIA | 4 |
| | 1.4.1 Origin of EIA in the World | 5 |
| | 1.4.2 Origin of EIA in India | 6 |
| 1.5 | Types of EIA | 9 |
| 1.6 | The EIA Process | 10 |
| 1.7 | Importance of EIA | 12 |
| | References | 13 |
| 2 | EIA Procedure—Screening and Scoping | 15 |
| 2.1 | Screening | 15 |
| | 2.1.1 Who Carries Out and When? | 16 |
| | 2.1.2 Screening Methods | 16 |
| | 2.1.3 Role of Screening in EIA | 17 |
| 2.2 | Scoping | 18 |
| | 2.2.1 What is Scoping? | 18 |
| | 2.2.2 Objectives of Scoping | 20 |
| | 2.2.3 Scoping Methods | 21 |
| | 2.2.4 Role of Stakeholders in Scoping | 22 |
| | 2.2.5 Importance of Scoping | 23 |
| | References | 24 |
| 3 | EIA Procedure—Baseline Study | 25 |
| 3.1 | Concept of Baseline Study in EIA | 25 |
| 3.2 | Environmental Baseline | 25 |
| 3.3 | Terms of Reference | 26 |

| | | |
|----------|---|-----------|
| 3.4 | Baseline Data Collection Process | 27 |
| 3.5 | Importance of Baseline Data | 29 |
| 3.6 | How to Write a Baseline Report? | 30 |
| | References | 32 |
| 4 | EIA Procedure—Impact Identification | 33 |
| 4.1 | Introduction | 33 |
| 4.2 | Criteria for the Selection of EIA Methodology | 34 |
| 4.3 | EIA Methods of Impact Identification | 35 |
| 4.4 | Impact Identification Methods | 36 |
| | 4.4.1 Ad Hoc Method | 36 |
| | 4.4.2 Checklist Method | 38 |
| | 4.4.3 Network Method | 42 |
| | 4.4.4 Overlay Method | 43 |
| | References | 46 |
| 5 | EIA Procedure—Mitigation and Impact Management | 47 |
| 5.1 | Objectives of Mitigation Measures | 48 |
| 5.2 | Types of Mitigation in EIA | 49 |
| 5.3 | Phases of Mitigation in EIA | 50 |
| | 5.3.1 Pre-construction Phase | 51 |
| | 5.3.2 Construction Phase | 52 |
| | 5.3.3 Operational Phase | 53 |
| 5.4 | Environment Management Program | 55 |
| | 5.4.1 Objectives of an EMP | 56 |
| | 5.4.2 The Structure of an EMP | 57 |
| | 5.4.3 The Need of EMP | 58 |
| | References | 59 |
| 6 | EIA Procedure—EIS and Public Hearing | 61 |
| 6.1 | Environment Impact Statement (EIS) | 61 |
| | 6.1.1 Importance of EIS | 62 |
| | 6.1.2 Salient Content of a Good Quality EIS Report | 63 |
| 6.2 | Public Hearing | 64 |
| | 6.2.1 Need of Public Hearing | 65 |
| | 6.2.2 Role of Local Residents in Public Hearing | 66 |
| | 6.2.3 Role of Local Associations in Public Hearing | 67 |
| | 6.2.4 Role of NGOs and Other Environmental Groups | 68 |
| | References | 69 |
| 7 | EIA Procedure—Decision Making | 71 |
| 7.1 | Importance of Decision Making in EIA | 71 |
| 7.2 | Role of Environment Appraisal Committee in Decision Making | 73 |
| 7.3 | What is NOC? | 77 |
| | 7.3.1 Steps to Be Followed for the EIA NOC | 77 |
| | 7.3.2 Validity of the EIA NOC | 78 |

- 7.3.3 Requirements for Obtaining EIA NOC 78
- 7.4 Environmental Clearance (EC) Process 79
- 7.5 Implementation and Follow up in EIA Process 80
- References 84
- 8 EIA Procedure—Post Monitoring and Environmental Audit 85**
 - 8.1 Monitoring in EIA 85
 - 8.2 Environmental Audit 86
 - 8.2.1 Steps in Environmental Auditing 87
 - 8.2.2 Importance of Environmental Audit 87
 - 8.3 Features of Environmental Audit 88
 - 8.4 Objectives of Environmental Audit 88
 - 8.5 Benefits of Environmental Audit 89
 - 8.6 Types of Environmental Audit 90
 - 8.6.1 Environmental Compliance Audit 90
 - 8.6.2 Environmental Performance Audit 91
 - 8.6.3 Functional Environmental Audits 92
 - 8.7 Environmental Audit Process 94
 - 8.7.1 Audit Initiation 95
 - 8.7.2 Audit Planning 95
 - 8.7.3 Conducting the Audit 95
 - 8.8 Stages of Environmental Audit Process 96
 - 8.8.1 Stage-1: Pre-audit 96
 - 8.8.2 Stage-2: On-Site Audit (The Audit) 97
 - 8.8.3 Stage-3: Post Audit 98
 - 8.9 Documents Required for Environmental Audit 99
 - References 100
- 9 Environmental Management System (EMS) 101**
 - 9.1 Environmental Management System 101
 - 9.2 Purpose of an EMS 102
 - 9.3 Benefits of an EMS 103
 - 9.4 A Basic EMS Framework—PDCA Cycle 105
 - 9.5 EMS Standards: ISO 14000 Series 106
 - 9.5.1 Principle and Structure 109
 - 9.5.2 Why ISO 14000? 110
 - 9.5.3 History of ISO 14000 Series 112
 - 9.5.4 Organization Standards 112
 - 9.5.5 Product-Oriented Standards 118
 - References 124
- 10 Environment Risk Assessment (ERA) 125**
 - 10.1 Introduction 125
 - 10.2 ERA and EIA 127
 - 10.2.1 Similarities Between ERA and EIA 127
 - 10.3 Environment Risk Assessment 129

- 10.3.1 Hazard Identification 129
- 10.3.2 Hazard Assessment 132
- 10.3.3 Dose Response Assessment 133
- 10.3.4 Risk Characterization 136
- 10.3.5 Risk Management 138
- 10.4 Advantages of ERA 140
- References 142
- 11 Introduction to Strategic Environmental Assessment (SEA) 145**
 - 11.1 Introduction 145
 - 11.2 The Evolution of Strategic Environmental Assessment (SEA) 147
 - 11.3 The Role and Benefits of Strategic Environmental Assessment (SEA) 148
 - 11.4 Optimizing the Usefulness of Connections Between SEA and EIA 151
 - 11.5 Steps in SEA 151
 - 11.6 Models and Methods of Strategic Environmental Assessment (SEA) 154
 - 11.6.1 Policy-Based Approach 155
 - 11.6.2 Project-Based Approach 155
 - 11.7 Methods and Techniques Used in SEA 156
 - 11.8 SEA Procedural Methodologies 157
 - 11.9 Methods 157
 - 11.9.1 Future Studies 157
 - 11.9.2 Life Cycle Assessment (LCA) 158
 - 11.10 Advantages of Strategic Environmental Assessment (SEA) 158
 - 11.11 The Principles of Applying the SEA Process Effectively 160
 - References 162

Abbreviations

| | |
|-------|---|
| BPEO | Block Primary Education Officer |
| BS | British Standards |
| BSI | British Standard Institute |
| CM | Compliance Management |
| CPCB | Central Pollution Control Board |
| CTO | Consent to Operate |
| DPR | Detailed Project Report |
| EA&RI | Environmental Auditing and Related Investigations |
| EAC | Expert Appraisal Committee |
| EC | Environmental Clearance |
| ECI | Environmental Condition Indicators |
| EHS | Environment Health and Safety |
| EIA | Environmental Impact Assessment |
| EIMS | Environmental Process Management System |
| EIS | Environmental Impact Statements |
| EL | Environmental Labelling |
| EMAS | European Environmental Management System |
| EMP | Environmental Management Plan |
| EMS | Environmental Management System |
| EN | European Standards |
| EPA | Environmental Protection Agency |
| EPD | Environmental Product Data |
| EPE | Environmental Performance Evaluation |
| EPI | Environmental Performance Indicators |
| EU | European Union |
| GEN | Global Ecolabelling Indicators |
| GIS | Geographic Information Systems |
| HLS | High Level Structure |
| IAIA | International Association for Impact Assessment |
| IEO | International Energy Outlook |
| IFC | International Finance Corporation |

| | |
|---------|---|
| ISO | International Organization for Standardization |
| LCA | Lifecycle Assessment |
| MoEF | Ministry of Environment and Forest |
| MoEFCC | Ministry of Environment, Forest and Climate Change |
| NABL | National Accreditation Board for Testing and Calibration Laboratories |
| NEPA | National Environmental Policy Act |
| NGOs | Non-Governmental Organization |
| NOC | No Objection Certificate |
| PDCA | Plan Do Check Act |
| PR | Public Relations |
| SAI | Supreme Audit Institution |
| SEA | Strategic Environmental Assessment |
| SEAC | State Expert Appraisal Committee |
| SEIAA | State Environmental Impact Assessment Authority |
| SOPs | Statement of Purpose |
| SPCB | State Pollution Control Board |
| TD | Terms and Definitions |
| ToR | Terms of Reference |
| U.S.EPA | United States Environmental Protection Agency |
| UNEP | United Nations Environment Program |
| USNEPA | US National Environment Policy Act |

List of Figures

| | | |
|-----------|---|-----|
| Fig. 1.1 | Process of environmental impact assessment | 10 |
| Fig. 7.1 | Decision making process in EIA | 72 |
| Fig. 7.2 | Environmental clearance process in India | 81 |
| Fig. 8.1 | Representing the basic steps of environmental auditing | 97 |
| Fig. 9.1 | The continuous improvement cycle | 103 |
| Fig. 9.2 | Depicting development in environmental management system through evolutionary model | 104 |
| Fig. 9.3 | Representing relationship between ISO 14000 series standards and their application (<i>Source</i> ISO 2000) | 108 |
| Fig. 9.4 | Timeline showing history of ISO 14000 | 113 |
| Fig. 9.5 | Theory to practice product-oriented EMS in Europe | 119 |
| Fig. 9.6 | Depicting lifecycle perspective | 121 |
| Fig. 10.1 | Stages involved in environment risk assessment | 129 |
| Fig. 10.2 | Fate of toxins inside the human body | 132 |
| Fig. 10.3 | Potential routes of pathogen exposure | 135 |
| Fig. 10.4 | Three different phases of risk management | 139 |
| Fig. 10.5 | Stages of developing a policy for risk management | 140 |
| Fig. 11.1 | Relation between SEA and EIA | 150 |
| Fig. 11.2 | Five general stages of strategic environmental assessment | 154 |
| Fig. 11.3 | Two primary approaches for the development and reinforcement of SEA | 155 |
| Fig. 11.4 | Integration of environment, economy, and society for effective Strategic Environment Assessment | 160 |
| Fig. 11.5 | Applicability of SEA in various sectors | 161 |

List of Tables

| | | |
|------------|--|-----|
| Table 4.1 | Adhoc method for impact identification | 37 |
| Table 4.2 | Check list method for impact identification | 41 |
| Table 4.3 | Illustration of network method of impact identification | 44 |
| Table 7.1 | Showing stages of decision making and related information | 83 |
| Table 10.1 | Framework for ERA AND EIA | 128 |
| Table 11.1 | Distinctions between EIA and SEA | 150 |

Chapter 1

Introduction to Environment Impact Assessment



The EIA process is a crucial instrument for advancing sustainable development and incorporating environmental factors into decision-making processes. It is utilized throughout several sectors such as infrastructure, energy, mining, agriculture, and tourism. EIA is mandatory in numerous nations, and global entities including the United Nations, the World Bank, and the European Union have established protocols and benchmarks for carrying out EIA. Nevertheless, while EIA offers advantages, there are also critiques of the procedure. These concerns encompass the impartiality of the process, the quality of the data utilized, and the efficacy of mitigating actions. There are worries that the Environmental Impact Assessment (EIA) procedure can be lengthy and costly, and that it might be employed to postpone or obstruct development initiatives.

The Environmental Impact Assessment (EIA) is crucial for evaluating the possible environmental effects of planned development projects and encouraging sustainable development. Despite complaints, the benefits of Environmental Impact Assessment (EIA) are widely acknowledged, and initiatives are underway to enhance its efficacy and efficiency.

1.1 EIA: Definition

Environmental Impact Assessment (EIA) is a decision-making technique that identifies and evaluates the significant environmental effects of a project to see if they can be reduced or controlled. Simply said, EIA is the assessment of the possible environmental effects of a planned project and deciding on ways to reduce or prevent those effects. This definition emphasizes the main aspects of the EIA process, which involve identifying and evaluating environmental impacts with the aim of fostering sustainable development through the reduction or prevention of adverse environmental