

# In Situ Soil And Groundwater Bioremediation Techniques And

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Microbial Biodegradation and Bioremediation Surajit Das 2014-07-01 Microbial Biodegradation and Bioremediation brings together experts in relevant fields to describe the successful application of microbes and their derivatives for bioremediation of potentially toxic and relatively novel compounds. This single-source reference encompasses all categories of pollutants and their applications in a convenient, comprehensive package. Our natural biodiversity and environment is in danger due to the release of continuously emerging potential pollutants by anthropogenic activities. Though many attempts have been made to eradicate and remediate these noxious elements, every day thousands of xenobiotics of relatively new entities emerge, thus worsening the situation. Primitive microorganisms are highly adaptable to toxic environments, and can reduce the load of toxic elements by their successful transformation and remediation. Describes many novel approaches of microbial bioremediation including genetic engineering, metagenomics, microbial fuel cell technology, biosurfactants and biofilm-based bioremediation Introduces relatively new hazardous elements and their bioremediation practices including oil spills, military waste water, greenhouse gases, polythene wastes, and more Provides the most advanced techniques in the field of bioremediation, including insilico approach, microbes as pollution indicators, use of bioreactors, techniques of pollution monitoring, and more

**Alternatives for Ground Water Cleanup** National Research Council 1994-02-01 There may be nearly 300,000 waste sites in the United States where ground water and soil are contaminated. Yet recent studies question whether existing technologies can restore contaminated ground water to drinking water standards, which is the goal for most sites and the result expected by the public. How can the nation balance public health, technological realities, and cost when addressing ground water cleanup? This new volume offers specific conclusions, outlines research needs, and recommends policies that are technologically sound while still protecting health and the environment. Authored by the top experts from industry and academia, this volume Examines how the physical, chemical, and biological characteristics of the subsurface environment, as well as the properties of contaminants, complicate the cleanup task. Reviews the limitations of widely used conventional pump-and-treat cleanup systems, including detailed case studies. Evaluates a range of innovative cleanup technologies and the barriers to their full implementation. Presents specific recommendations for policies and practices in evaluating contamination sites, in choosing remediation technologies, and in setting appropriate cleanup goals.

*Soil and Groundwater Remediation Technologies* Jörg Rinklebe 2020 This book offers various soil and water treatment technologies due to increasing global soil and water pollution. In many countries, the management of contaminated land has matured, and it is developing in many others. Topics covered include chemical and ecological risk assessment of contaminated sites; phytomanagement of contaminants; arsenic removal; selection and technology diffusion; technologies and socio-environmental management; post-remediation long-term management; soil and groundwater laws and regulations; and trace element regulation limits in soil. Future prospects of soil and groundwater remediation are critically discussed in this book. Hence, readers will learn to understand the future prospects of soil and groundwater contaminants

and remediation measures. Key Features: Discusses conventional and novel aspects of soil and groundwater remediation technologies Includes new monitoring/sensing technologies for soil and groundwater pollution Features a case study of remediation of contaminated sites in the old, industrial, Ruhr area in Germany Highlights soil washing, soil flushing, and stabilization/solidification Presents information on emerging contaminants that exhibit new challenges This book is designed for undergraduate and graduate courses and can be used as a handbook for researchers, policy makers, and local governmental institutes. Soil and Groundwater Remediation Technologies: A Practical Guide is written by a team of leading global experts in the field.

**Environmental Soil Remediation and Rehabilitation** Eric D. van Hullebusch 2020-04-22 This book provides a comprehensive overview of innovative remediation techniques and strategies for soils contaminated by heavy metals or organic compounds (e.g. petroleum hydrocarbons, NAPLs and chlorinated organic compounds). It discusses various novel chemical remediation approaches (in-situ and ex-situ) used alone and in combination with physical and/or thermal treatment. Further, it addresses the recovery of NAPLs, reuse of leaching solutions, and in-situ chemical reduction and oxidation, and explores the chemical enhancement of physical NAPLs recovery from both practical and theoretical perspectives. Also presenting the state-of-the-art in waste-assisted bioremediation to improve soil quality and the remediation of petroleum hydrocarbons, the book is a valuable resource for students, researchers and R&D professionals in industry engaged in the treatment of contaminated soils.

**Practical Techniques for Groundwater & Soil Remediation** Evan K. Nyer 1992-09-25 Practical Techniques for Groundwater and Soil Remediation is a compilation of articles by the author that were printed in the National Ground Water Association (NGWA) magazine Groundwater Monitoring Review. The book provides valuable data, emphasizes the practical aspects of remediation, presents results from actual remediation programs, and helps readers prepare remediation strategies. The book also includes detailed technical data on treatment equipment performance and the costs associated with their design and operation. A unique feature of the book is that it also contains data from treatment systems that did not work. Practical Techniques for Groundwater and Soil Remediation is a "must have" source of invaluable data and tips that will be useful for all groundwater and soil remediation professionals.

*Advanced Groundwater Remediation* Franz-Georg Simon 2002 This book presents a concise summary of advanced groundwater treatment methods, especially 'pump-and-treat' and 'permeable reactive barriers'. The topics include heavy metal removal, with special emphasis on uranium, and sorption, one of the basic mechanisms in groundwater remediation.

**Soil and Groundwater Remediation** Chunlong Zhang 2019-10-30 An introduction to the principles and practices of soil and groundwater remediation Soil and Groundwater Remediation offers a comprehensive and up-to-date review of the principles, practices, and concepts of sustainability of soil and groundwater remediation. The book starts with an overview of the importance of groundwater resource/quality, contaminant sources/types, and the scope of soil and groundwater remediation. It then provides the essential components of soil and groundwater remediation with easy-to-understand design equations/calculations and the practical applications. The book contains information on remediation basics such as subsurface chemical behaviors, soil and groundwater hydrology and characterization, regulations, cost analysis, and risk assessment. The author explores various conventional and innovative remediation technologies, including pump-and-treat, soil vapor extraction, bioremediation, incineration, thermally enhanced techniques, soil washing/flushing, and permeable reactive barriers. The book also examines the modeling of groundwater flow and contaminant transport in saturated and unsaturated zones. This important book: Presents the current challenges of remediation practices Includes up-to-date information about the low-cost, risk-based, sustainable remediation practices, as well as institutional control and management Offers a balanced mix of the principles, practices, and sustainable concepts in soil and groundwater remediation Contains learning objectives, discussions of key theories, and example problems Provides illustrative case studies and recent research when remediation techniques are introduced Written for undergraduate seniors and graduate students in natural resource, earth science, environmental science/engineering, and environmental management, Soil and Groundwater Remediation is an authoritative guide to the principles and components of soil and groundwater remediation that is filled with worked and practice problems.

**In Situ Bioremediation** Bruce E. Rittmann 1994-12-31 This critical review of the status of in situ bioremediation, which is used to clean up contaminated groundwater aquifers and surface soils, has been organized according to possibilities and restrictions. Possibilities are based on present knowledge and indicate that in situ bioremediation can achieve

decontamination of aquifers and soils. Restrictions encompass the scientific, engineering, legal, and other questions that stand in the way of successful development and application of in situ bioremediation. Although much has been written about bioremediation, this critical review is unique because it is comprehensive, critical, and integrated. This situation was no accident; the organization of the authorship team and the report's contents were designed to achieve each of the three attributes. Combining a good plan, outstanding individuals contributing, and an incredible amount of work, they created a critical review that defines the technical and non-technical issues that will determine how much of an impact in situ bioremediation makes on solving the world's challenges for cleanup of our legacy of improperly disposed of materials. Readers of this review will find the issues identified and connected. They will have a solid foundation for research, application, or evaluation of in situ bioremediation in the future.

**Bioelectrochemical Systems** Korneel Rabaey 2009-12-01 In the context of wastewater treatment, Bioelectrochemical Systems (BESs) have gained considerable interest in the past few years, and several BES processes are on the brink of application to this area. This book, written by a large number of world experts in the different sub-topics, describes the different aspects and processes relevant to their development. Bioelectrochemical Systems (BESs) use microorganisms to catalyze an oxidation and/or reduction reaction at an anodic and cathodic electrode respectively. Briefly, at an anode oxidation of organic and inorganic electron donors can occur. Prime examples of such electron donors are waste organics and sulfides. At the cathode, an electron acceptor such as oxygen or nitrate can be reduced. The anode and the cathode are connected through an electrical circuit. If electrical power is harvested from this circuit, the system is called a Microbial Fuel Cell; if electrical power is invested, the system is called a Microbial Electrolysis Cell. The overall framework of bio-energy and bio-fuels is discussed. A number of chapters discuss the basics - microbiology, microbial ecology, electrochemistry, technology and materials development. The book continues by highlighting the plurality of processes based on BES technology already in existence, going from wastewater based reactors to sediment based bio-batteries. The integration of BESs into existing water or process lines is discussed. Finally, an outlook is provided of how BES will fit within the emerging biorefinery area.

*Sustainable Remediation of Contaminated Soil and Groundwater* Deyi Hou 2019-11-23 Sustainable Remediation of Contaminated Soil and Groundwater: Materials, Processes, and Assessment provides the remediation tools and techniques necessary for simultaneously saving time and money and maximizing environmental, social and economic benefits. The book integrates green materials, cleaner processes, and sustainability assessment methods for planning, designing and implementing a more effective remediation process for both soil and groundwater projects. With this book in hand, engineers will find a valuable guide to greener remediation materials that render smaller environmental footprint, cleaner processes that minimize secondary environmental impact, and sustainability assessment methods that can be used to guide the development of materials and processes. Addresses materials, processes, and assessment needs for implementing a successful sustainable remediation process Provides an integrated approach for the unitization of various green technologies, such as green materials, cleaner processes and sustainability assessment Includes case studies based on full-scale commercial soil and groundwater remediation projects

*Strategies for Bioremediation of Organic and Inorganic Pollutants* Maria S. Fuentes 2018-01-29 Increased awareness surrounding environmental protection has prompted the development of more ecofriendly technologies. This book provides useful information on technologies based upon the use of biological agents for environmental clean-up, including bacteria, yeast, fungi, algae, and plants. Some chapters refer to the direct application of products derived from plants and microorganisms for designing strategies of environmental remediation. The combination of strategies helps in efficient removal of pollutants generated from anthropogenic activities with minimal environmental impact. This book is meant for professionals involved in environmental technology and waste management.

Groundwater and Soil Cleanup National Research Council 1999-11-21 This book presents a comprehensive, up-to-date review of technologies for cleaning up contaminants in groundwater and soil. It provides a special focus on three classes of contaminants that have proven very difficult to treat once released to the subsurface: metals, radionuclides, and dense nonaqueous-phase liquids such as chlorinated solvents. Groundwater and Soil Cleanup was commissioned by the Department of Energy (DOE) as part of its program to clean up contamination in the nuclear weapons production complex. In addition to a review of remediation technologies, the book describes new trends in regulation of contaminated sites

and assesses DOE's program for developing new subsurface cleanup technologies.

**Groundwater and Soil Remediation** Evan K. Nyer 1998-05-01 This bestselling author presents his latest compilation of time- and cost-saving techniques, methods, and strategies for soil and groundwater remediation. This book outlines advanced technologies, including phytoremediation, air sparging, reactive zones, vacuum-enhanced recovery, and more!

*Contaminants in the Subsurface* National Research Council 2005-04-23 At hundreds of thousands of commercial, industrial, and military sites across the country, subsurface materials including groundwater are contaminated with chemical waste. The last decade has seen growing interest in using aggressive source remediation technologies to remove contaminants from the subsurface, but there is limited understanding of (1) the effectiveness of these technologies and (2) the overall effect of mass removal on groundwater quality. This report reviews the suite of technologies available for source remediation and their ability to reach a variety of cleanup goals, from meeting regulatory standards for groundwater to reducing costs. The report proposes elements of a protocol for accomplishing source remediation that should enable project managers to decide whether and how to pursue source remediation at their sites.

**In Situ Bioremediation of Perchlorate in Groundwater** Hans F. Stroo 2008-12-02 In the late 1970s and early 1980s, our nation began to grapple with the legacy of past disposal practices for toxic chemicals. With the passage in 1980 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as Superfund, it became the law of the land to remediate these sites. The U. S. Department of Defense (DoD), the nation's largest industrial organization, also recognized that it too had a legacy of contaminated sites. Historic operations at Army, Navy, Air Force, and Marine Corps facilities, ranges, manufacturing sites, shipyards, and depots had resulted in widespread contamination of soil, groundwater, and sediment. While Superfund began in 1980 to focus on remediation of heavily contaminated sites largely abandoned or neglected by the private sector, the DoD had already initiated its Installation Restoration Program in the mid 1970s. In 1984, the DoD began the Defense Environmental Restoration Program (DERP) for contaminated site assessment and remediation. Two years later, the U. S. Congress codified the DERP and directed the Secretary of Defense to carry out a concurrent program of research, development, and demonstration of innovative remediation technologies. As chronicled in the 1994 National Research Council report, "Ranking Hazardous-Waste Sites for Remedial Action", our early estimates on the cost and suitability of existing technologies for cleaning up contaminated sites were wildly optimistic. Original estimates, in 1980, projected an average Superfund cleanup cost of a mere \$3.

**Bioremediation of Contaminated Soils** Donald L. Wise 2000-06-09 This volume focuses on innovative bioremediation techniques and applications for the cleanup of contaminated media and sites. It includes quantitative and design methods that elucidate the relationships among various operational parameters, and waste chemistry that defines the cost effectiveness of bioremediation projects. It also presents numerical models.

**In Situ Remediation of Chlorinated Solvent Plumes** Hans F. Stroo 2010-09-10 In the late 1970s and early 1980s, our nation began to grapple with the legacy of past disposal practices for toxic chemicals. With the passage in 1980 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as Superfund, it became the law of the land to remediate these sites. The U. S. Department of Defense (DoD), the nation's largest industrial organization, also recognized that it too had a legacy of contaminated sites. Historic operations at Army, Navy, Air Force, and Marine Corps facilities, ranges, manufacturing sites, shipyards, and depots had resulted in widespread contamination of soil, groundwater, and sediment. While Superfund began in 1980 to focus on remediation of heavily contaminated sites largely abandoned or neglected by the private sector, the DoD had already initiated its Installation Restoration Program in the mid-1970s. In 1984, the DoD began the Defense Environmental Restoration Program (DERP) for contaminated site assessment and remediation. Two years later, the U. S. Congress codified the DERP and directed the Secretary of Defense to carry out a concurrent program of research, development, and demonstration of innovative remediation technologies. As chronicled in the 1994 National Research Council report, "Ranking Hazardous-Waste Sites for Remedial Action," our early estimates on the cost and suitability of existing technologies for cleaning up contaminated sites were wildly optimistic. Original estimates, in 1980, projected an average Superfund cleanup cost of a mere \$3.

*Bioremediation of Hydrocarbon-contaminated Soils and Groundwater in Northern Climates* 1998 A field demonstration and research project was conducted in Fairbanks, Alaska, to demonstrate,

evaluate, and document the construction and operation of three selected bioremediation technologies—landfarming, recirculating leachbeds, and infiltration galleries. Landfarming involves adding water and nutrients to contaminated soil to stimulate microbial activity and contaminant degradation. Infiltration galleries are dynamic in-situ treatment systems designed to stimulate microbial activity and subsequent hydrocarbon degradation by circulating nutrient and oxygen-amended water through petroleum-contaminated soil. Recirculating leachbeds, in a way similar to slurry reactors, aerate and mix nutrients with contaminated soil, and can be built as on-site bioreactors. Estimated biotreatment costs in the landfarm were between \$20 to \$30 per cubic yard (\$15 to \$23 per cubic meter). Nutrient placement has been demonstrated to be a critical factor, even though the site is tilled and mixed frequently. Success of the infiltration gallery was more difficult to document. Benzene was detected at less than 2 ppb and BTEX levels were less than 5 ppb for water extracted from the pumping well during 1992, which is significantly lower than the 1991 levels. Problems were encountered during the brief operation of the recirculating leach bed, but a similar system has performed well. Relatively simple, low-cost techniques provided significant potential for improving degradation rates.

**Bioremediation of Chlorinated Solvents** Robert E. Hinchee 1995 These articles discuss aerobic and anaerobic biological degradation for dehalogenating sites contaminated with pesticides and chlorinated solvents. Bench- and field-scale studies are described, as are microcosm studies, numerical simulations, and site characteristics and their effect on the stability of methanotrophic community. Methods discussed include air venting, alternative electron donors, biofilm reactors, surfactants, municipal digester sludge, iron enhancement, and sulfate reduction to improve conditions for microbial consortia.

**Groundwater and Subsurface Remediation** Helmut Kobus 2012-12-06 The complex topic of in-situ subsurface remediation technologies has been addressed at an international symposium at the Universitat Stuttgart on September 26 and 27, 1995, on the occasion of the inauguration of the research facility VEGAS (Versuchseinrichtung zur Grundwasser- und Altlastensanierung). The results are contained in this book with 22 contributions from leading experts in the field from Europe and North America. The book illustrates the role of large-scale experiments in groundwater and subsurface remediation research. The subtopics address the various links between conventional laboratory experiments, technology-scale experiments and field-site studies, showing the contribution of large-scale experiments to bridging the gap between small-scale investigations and large-scale field investigations (upscaling). The interdisciplinary nature of the problems requires a multidisciplinary approach. Therefore, the idea has been followed to bring together the various disciplines involved in the different aspects and facets of subsurface flow, transport and transport as hydraulics and hydrology, physics, formation, involving such diverse disciplines chemistry, microbiology, geology, industrial, chemical and hydraulic engineering, mathematics and hydroinformatics. The individual contributions from these diversified fields address the subject from different angles in an attempt to form a coherent picture of the various aspects of the complex problems of subsurface remediation. The focus is on research approaches and strategies with respect to the development of new and improved technologies and to the role of large-scale experiments in research and application.

**In Situ Bioremediation** National Research Council 1993-02-01 In situ bioremediation—the use of microorganisms for on-site removal of contaminants—is potentially cheaper, faster, and safer than conventional cleanup methods. But in situ bioremediation is also clouded in uncertainty, controversy, and mistrust. This volume from the National Research Council provides direction for decisionmakers and offers detailed and readable explanations of the processes involved in in situ bioremediation, circumstances in which it is best used, and methods of measurement, field testing, and modeling to evaluate the results of bioremediation projects. Bioremediation experts representing academic research, field practice, regulation, and industry provide accessible information and case examples; they explore how in situ bioremediation works, how it has developed since its first commercial use in 1972, and what research and education efforts are recommended for the future. The volume includes a series of perspective papers. The book will be immediately useful to policymakers, regulators, bioremediation practitioners and purchasers, environmental groups, concerned citizens, faculty, and students.

**New and Emerging in Situ Soil and Groundwater Remediation Technologies** Sikina Jinnah 2002

**In Situ Soil Remediation** A.M. Otten 2012-12-06 In situ remediation techniques have experienced a boom over the last few years, thereby producing a wide range of valuable experiences. Their results have demonstrated that in situ techniques are a mature alternative

to conventional remediation techniques. Irrespective of future policy developments, it is impossible to imagine future remediation practice without the use of in situ techniques. The book presents an overview of recent developments in the field of in situ soil remediation. The book is unique in that it is not a compilation of unrelated case studies. A conceptual approach has been chosen; remediation models described in this book are illustrated from a practical point of view. The authors present the Dutch way of treating contaminated land; The Netherlands is renowned for being at the forefront of remediation techniques as a result of the country's progressiveness and experience in this area.

*Management of Contaminated Sites in Western Europe* Gundula Prokop 2000 Recoge: 1.Management of contaminated sites in western Europe - 2.Review of terminology.

**Practical Techniques for Groundwater & Soil Remediation** Evan K. Nyer 2019-08-13 Practical Techniques for Groundwater and Soil Remediation is a compilation of articles by the author that were printed in the National Ground Water Association (NGWA) magazine Groundwater Monitoring Review. The book provides valuable data, emphasizes the practical aspects of remediation, presents results from actual remediation programs, and helps readers prepare remediation strategies. The book also includes detailed technical data on treatment equipment performance and the costs associated with their design and operation. A unique feature of the book is that it also contains data from treatment systems that did not work. Practical Techniques for Groundwater and Soil Remediation is a "must have" source of invaluable data and tips that will be useful for all groundwater and soil remediation professionals.

Remediation of Petroleum-contaminated Soils David J. Friend 1996 This synthesis will be of interest to state transportation personnel involved with project planning and location (administrative and regulatory personnel), design staff (general civil, geotechnical, and environmental engineers), and project managers (construction and maintenance engineers and staff). It will also be of interest to federal and state environmental agencies and to environmental consultants and contractors as well as to trainers in the field of petroleum-contaminated soil remediation. This synthesis describes the remedial technologies that may be available to transportation agencies faced with the regulatory responsibility to clean or remediate petroleum-contaminated soils in the vadose zone (unsaturated soils above the groundwater table) at a particular site as well as the state of the practice within the agencies. This report of the Transportation Research Board describes the applicability and cost-effectiveness of alternate technologies to remediate petroleum-contaminated soil. Practices currently being used by state transportation agencies to remediate petroleum-contaminated soils, both on site and off site are also described. This summary of transportation agency practice complements the limited telephone survey of soil remediation techniques that was performed in preparing NCHRP Report 351, Hazardous Wastes in Highway Rights-of-Way.

*In Situ Treatment Technology, Second Edition* Evan K. Nyer 2000-12-28 Completely revised and updated, the second edition of the bestselling In Situ Treatment Technology adds three new chapters to provide the reader with an even more comprehensive reference source on remediation. This authoritative book goes beyond discussion of individual in situ technologies by providing an understanding of the geologic foundation, the strengths and limitations of each of the technologies, and the details necessary to implement them. It also integrates all chapters to show how these technologies fit together to make a particular remediation method simultaneously the best technical and the most cost-effective design. The latest updates from the EPA and DOD, as well the inclusion of new material, affords you the detailed knowledge necessary to design a full-scale treatment system. New in this edition are sections in three of the chapters that provide the specific calculations necessary to design an actual treatment system. In Situ Treatment Technology, Second Edition is a comprehensive reference source.

**Groundwater and Subsurface Remediation** Helmut Kobus 1996 The complex topic of in-situ subsurface remediation technologies has been addressed at an international symposium at the Universitat Stuttgart on September 26 and 27, 1995, on the occasion of the inauguration of the research facility VEGAS (Versuchseinrichtung zur Grundwasser- und Altlastensanierung). The results are contained in this book with 22 contributions from leading experts in the field from Europe and North America. The book illustrates the role of large-scale experiments in groundwater and subsurface remediation research. The subtopics address the various links between conventional laboratory experiments, technology-scale experiments and field-site studies, showing the contribution of large-scale experiments to bridging the gap between small-scale investigations and large-scale field investigations (upscaling). The interdisciplinary nature of the problems requires a multidisciplinary approach. Therefore,

the idea has been followed to bring together the various disciplines involved in the different aspects and facets of subsurface flow, transport and trans as hydraulics and hydrology, physics, formation, involving such diverse disciplines chemistry, microbiology, geology, industrial, chemical and hydraulic engineering, mathematics and hydroinformatics. The individual contributions from these diversified fields address the subject from different angles in an attempt to form a coherent picture of the various aspects of the complex problems of subsurface remediation. The focus is on research approaches and strategies with respect to the development of new and improved technologies and to the role of large-scale experiments in research and application.

Innovations in Ground Water and Soil Cleanup National Research Council 1997-10-21 Most books on ground water and soil cleanup address only the technologies themselves--not why new technologies are or are not developed. *Innovations in Ground Water and Soil Cleanup* takes a holistic approach to the entire field, addressing both the sluggish commercial development of ground water and soil cleanup technologies and the attributes of specific technologies. It warns that, despite cleanup expenditures of nearly \$10 billion a year, the technologies remain rudimentary. This engaging book focuses on the failure of regulatory policy to link cleanup with the financial interests of the company responsible for the contamination. The committee explores why the market for remediation technology is uniquely lacking in economic drivers and why demand for innovation has been so much weaker than predicted. The volume explores how to evaluate the performance of cleanup technologies from the points of view of the public, regulators, cleanup entrepreneurs, and other stakeholders. The committee discusses approaches to standardizing performance testing, so that choosing a technology for a given site can be more timely and less contentious. Following up on *Alternatives for Ground Water Cleanup* (NRC, 1994), this sequel presents the state of the art in the cleanup of various types of ground water and soil contaminants. Strategies for making valid cost comparisons also are reviewed.

Environmental Microbiology Ian L. Pepper 2011-10-13 For microbiology and environmental microbiology courses, this leading textbook builds on the academic success of the previous edition by including a comprehensive and up-to-date discussion of environmental microbiology as a discipline that has grown in scope and interest in recent years. From environmental science and microbial ecology to topics in molecular genetics, this edition relates environmental microbiology to the work of a variety of life science, ecology, and environmental science investigators. The authors and editors have taken the care to highlight links between environmental microbiology and topics important to our changing world such as bioterrorism and national security with sections on practical issues such as bioremediation, waterborne pathogens, microbial risk assessment, and environmental biotechnology. WHY ADOPT THIS EDITION? New chapters on: Urban Environmental Microbiology Bacterial Communities in Natural Ecosystems Global Change and Microbial Infectious Disease Microorganisms and Bioterrorism Extreme Environments (emphasizing the ecology of these environments) Aquatic Environments (now devoted to its own chapter- was combined with Extreme Environments) Updates to Methodologies: Nucleic Acid -Based Methods: microarrays, phyloarrays, real-time PCR, metagenomics, and comparative genomics Physiological Methods: stable isotope fingerprinting and functional genomics and proteomics-based approaches Microscopic Techniques: FISH (fluorescent in situ hybridization) and atomic force microscopy Cultural Methods: new approaches to enhanced cultivation of environmental bacteria Environmental Sample Collection and Processing: added section on air sampling

Soil and Groundwater Remediation Technologies Yong Sik Ok 2020-03-23 This book offers various soil and water treatment technologies due to increasing global soil and water pollution. In many countries, the management of contaminated land has matured, and it is developing in many others. Topics covered include chemical and ecological risk assessment of contaminated sites; phytomanagement of contaminants; arsenic removal; selection and technology diffusion; technologies and socio-environmental management; post-remediation long-term management; soil and groundwater laws and regulations; and trace element regulation limits in soil. Future prospects of soil and groundwater remediation are critically discussed in this book. Hence, readers will learn to understand the future prospects of soil and groundwater contaminants and remediation measures. Key Features: Discusses conventional and novel aspects of soil and groundwater remediation technologies Includes new monitoring/sensing technologies for soil and groundwater pollution Features a case study of remediation of contaminated sites in the old, industrial, Ruhr area in Germany Highlights soil washing, soil flushing, and stabilization/solidification Presents information on emerging contaminants that exhibit new challenges This book is designed for undergraduate and

graduate courses and can be used as a handbook for researchers, policy makers, and local governmental institutes. *Soil and Groundwater Remediation Technologies: A Practical Guide* is written by a team of leading global experts in the field.

**Advances in Remediation Techniques for Polluted Soils and Groundwater** Pankaj Kumar Gupta 2021-12-13 *Advances in Remediation Techniques for Polluted Soils and Groundwater* focuses on the thematic areas for assessment, mitigation, and management of polluted sites. This book covers advances in modelling approaches, including Machine Learning (ML)/ Artificial Intelligence (AI) applications; GIS and remote sensing; sensors; impacts of climate change on geogenic contaminants; and socio-economic impacts in the poor rural and urban areas, which are lacking in a more comprehensive manner in the previous titles. This book encompasses updated information as well as future directions for researchers working in the field of management and remediation of polluted sites. Introduces fate and transport of multi-pollutants under varying subsurface conditions Details underlying mechanisms of biodegradation and biotransformation of geogenic, industrial and emerging pollutants Presents recent advances and challenges in assessment, water quality modeling, uncertainty, and water supply management Provides authoritative contributions on the diverse aspects of management and remediation from leading experts around the world

Trace Metals in the Environment Mario Alfonso Murillo-Tovar 2021-01-07

**Groundwater and Soil Remediation** Marve Hyman 2001 Hyman and Dupont describe conventional treatment technologies to remediate contaminated soil and groundwater and explain how these treatments are designed and what they cost.

**Physicochemical Groundwater Remediation** James A. Smith 2007-05-08 As we transition into the 21st century, it is apparent that this is an exciting time for environmental engineers and scientists studying remediation technologies. There has been a rapid development of new ways to clean-up polluted groundwater. Research activities of the past and next 10 years will have a dramatic impact on the quality of the subsurface environment for the next century. In 20, or even 10 years from now, our approach to subsurface remediation will probably be vastly different than it is today. Many of the emerging technologies presented in this book will form the basis of standard remediation practices of the future. *Physicochemical Groundwater Remediation* presents detailed information on multiple emerging technologies for the remediation of the contaminated subsurface environment. All of these technologies apply our knowledge of physical and chemical processes to clean up ground water and the unsaturated zone, and many (if not all) of these emerging technologies will help define standard practices in the future. These technologies include in situ sorptive and reactive treatment walls, surfactant-enhanced aquifer remediation, optimization analyses for remediation system design, chemical, electrochemical, and biochemical remediation processes, and monitored natural attenuation. You will learn how palladium catalyzes the dehalogenation of chlorinated solvents. You will find out how barometric pumping can naturally remove significant quantities of volatile organic pollutants from shallow ground water and the unsaturated zone. You can learn about mobilizing non-aqueous phase liquids (NAPLs) without risking significant downward migration of the NAPL. You can find out how processes such as electroosmosis and electromigration can be exploited for groundwater remediation purposes and how zero-valent iron and zeolite treatment walls can be used in situ to treat and control contaminant plume migration. Contributors to this book are experts in groundwater remediation processes, and they represent industry, consulting, academia, and government. If your work involves the clean up of contaminated soil and groundwater, this book is an essential reference to keep you up to date on the most promising new developments in remediation research.

**Advances in Bioremediation of Wastewater and Polluted Soil** Naofumi Shiomi 2015-09-09 The pollution of soil and groundwater by heavy metals and other chemicals is becoming a serious issue in many countries. However, the current bioremediation processes do not often achieve sufficient remediation, and more effective processes are desired. This book deals with advances in the bioremediation of polluted soil and groundwater. In the former chapters of this book, respected researchers in this field describe how the optimization of microorganisms, enzymes, absorbents, additives and injection procedures can help to realize excellent bioremediation. In the latter chapters, other researchers introduce bioremediation processes that have been performed in the field and novel bioremediation processes. Thus, the readers will be able to obtain new ideas about effective bioremediation as well as important information about recent advances in bioremediation.

**In-Situ Bioremediation of Ground Water and Geological Material** Robert D. Norris 1995-08 Provides a detailed background of the technologies available for the bioremediation of contaminated soil & ground water. Prepared for scientists, consultants, regulatory personnel,

& others who are associated in some way with the restoration of soil & ground water at hazardous waste sites. Also provides insights to emerging technologies which are at the research level of formation, ranging from theoretical concepts, through bench scale inquiries, to limited field-scale investigations. 95 tables & figures.

*In Situ Chemical Oxidation for Groundwater Remediation* Robert L. Siegrist 2011-02-26 This volume provides comprehensive up-to-date descriptions of the principles and practices of in situ chemical oxidation (ISCO) for groundwater remediation based on a decade of intensive research, development, and demonstrations, and lessons learned from commercial field applications.

**Soil and Groundwater Remediation** Chunlong Zhang 2019-10-30 An introduction to the principles and practices of soil and groundwater remediation Soil and Groundwater Remediation offers a comprehensive and up-to-date review of the principles, practices, and concepts of sustainability of soil and groundwater remediation. The book starts with an overview of the importance of groundwater resource/quality, contaminant sources/types, and the scope of soil and groundwater remediation. It then provides the essential components of soil and groundwater remediation with easy-to-understand design equations/calculations and the practical applications. The book contains information on remediation basics such as subsurface chemical behaviors, soil and groundwater hydrology and characterization, regulations, cost analysis, and risk assessment. The author explores various conventional and innovative remediation technologies, including pump-and-treat, soil vapor extraction, bioremediation, incineration, thermally enhanced techniques, soil washing/flushing, and permeable reactive barriers. The book also examines the modeling of groundwater flow and contaminant transport in saturated and unsaturated zones. This important book: Presents the current challenges of remediation practices Includes up-to-date information about the low-cost, risk-based, sustainable remediation practices, as well as institutional control and management Offers a balanced mix of the principles, practices, and sustainable concepts in soil and groundwater remediation Contains learning objectives, discussions of key theories, and example problems Provides illustrative case studies and recent research when remediation techniques are introduced Written for undergraduate seniors and graduate students in natural resource, earth science, environmental science/engineering, and environmental management, Soil and Groundwater Remediation is an authoritative guide to the principles and components of soil and groundwater remediation that is filled with worked and practice problems.

Remediation Technologies for Soils and Groundwater Alok Bhandari 2007 This report provides a comprehensive and thorough overview of conventional engineered processes and technologies used for the remediation of contaminated sites.