



# Bioaugmentation for Groundwater Remediation

Hans F. Stroo  
Andrea Leeson  
C. Herb Ward  
*Editors*



# Bioaugmentation For Groundwater Remediation Serdp Estcp Environmental Remediation Technology

**Yue Rong**



## **Bioaugmentation For Groundwater Remediation Serdp Estcp Environmental Remediation Technology:**

**Bioaugmentation for Groundwater Remediation** Hans F. Stroo, Andrea Leeson, C. Herb Ward, 2012-10-04 This volume provides a review of the past 10 to 15 years of intensive research development and demonstrations that have been on the forefront of developing bioaugmentation into a viable remedial technology This volume provides both a primer on the basic microbial processes involved in bioaugmentation as well as a thorough summary of the methodology for implementing the technology This reference volume will serve as a valuable resource for environmental remediation professionals who seek to understand evaluate and implement bioaugmentation Groundwater Engineering Rajandrea Sethi, Antonio Di

Molfetta, 2019-07-03 This textbook employs a technical and quantitative approach to explain subsurface hydrology and hydrogeology and to offer a comprehensive overview of groundwater related topics such as flow in porous media aquifer characterization contaminant description and transport risk assessment and groundwater remediation It describes the characterization of subsurface flow of pristine and polluted water and provides readers with easily applicable tools for the design of water supply systems drinking water source protection and remediation interventions Specific applications range from groundwater exploitation as a drinking water supply to the remediation of contaminated aquifers from the definition and safeguarding of drinking water sources to the assessment of human health risks in connection with groundwater contamination events The book represents an ideal learning resource for upper undergraduate and graduate students of civil engineering environmental engineering and geology as well as practitioners in the fields of water resource management and environmental protection who are interested in groundwater engineering and technical hydrogeology *In Situ*

*Bioremediation of Perchlorate in Groundwater* Hans F. Stroo, C. Herb Ward, 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      Agrochemicals in Soil and Environment M. Naeem, Juan Francisco Jimenez Bremont, Abid Ali Ansari, Sarvajeet Singh Gill, 2022-06-28 This volume Agrochemicals in Soil and Environment Impacts and Remediation is a comprehensive collection of important literature on agrochemical contamination The main focus of this book is to point out undesirable changes in biological physical and chemical characteristics of agricultural soils and its impacts on global agricultural crop productivity Soil is one of the important resources of basic needs for our sustenance but due to various anthropogenic activities like urbanization and industrialization the soil is losing its basic quality characteristics Soil microorganisms water holding capacity minerals salts and nutrients are under the direct threat due to agrochemicals therefore agricultural sector is facing a serious challenge Lack of proper knowledge and luxurious applications of agrochemicals resulting into degradation and deterioration of soil quality loss of soil and crop productivity and threatening the food security Therefore it is imperative to develop indices indicators and soil parameters for the monitoring and impact assessment of agricultural contaminants Further biotic and abiotic stresses and their tolerance mechanisms in plants in relation to the soil contaminants such as toxic pollutants heavy metals inorganic and organic matters variety of pesticides insecticides herbicides agricultural runoffs and solid wastes and chemical fertilizers are also highlighted in this volume This book also discusses causes of reduced agriculture productivity and suggests sustainable measures such as plant based technologies bioremediation and nanotechnology that can be used to overcome the crop losses The book is interest to research students teachers agricultural scientists agronomists environmentalists as well as policy makers

Organohalide-Respiring Bacteria Lorenz Adrian, Frank E. Löffler, 2016-08-03 This book summarizes the current state of knowledge concerning bacteria that use halogenated organic compounds as respiratory electron acceptors The discovery of organohalide respiring bacteria has expanded the range of electron acceptors used for energy conservation and serves as a prime example of how scientific discoveries are enabling innovative engineering solutions that have transformed remediation practice Individual chapters provide in depth background information on the discovery isolation phylogeny biochemistry genomic features and ecology of individual organohalide respiring genera including Dehalococcoides Dehalogenimonas Dehalobacter Desulfitobacterium and Sulfurospirillum as well as organohalide respiring members of the Deltaproteobacteria The book introduces readers to the fascinating biology of organohalide respiring bacteria offering a valuable resource for students engineers and practitioners alike      Sustainable eco-technologies for water and wastewater treatment Eldon Rene , Li Shu , Veeriah Jegatheesan , 2020-03-15 One of the major challenges in the world is to provide clean water and sanitation for all With 3% fresh water reserves in the earth there are more than 1 billion people who still lack access to clean drinking water The declining water quality has not only reduced the life expectancy of humans but it has also contributed to the deleterious negative impacts on aquatic marine life flora fauna and the ecosystem However with rapid technological advancements and the availability of advanced scientific instruments there has been substantial improvement in the design

and operation of water and wastewater treatment systems Recently these sustainable eco technologies have been designed and operated to offer the following advantages i a smaller footprint ii less maintenance iii 99% removal of contaminants iv provides the option for resource recovery v less energy consumption vi minimal use of chemicals and vii less investment and operational costs This book highlights the technologies used for the removal of pollutants such as dyes uranium cyanotoxins faecal contamination and P N compounds from water environments and shows that ecotechnologies are becoming more and more important and playing critical role in removing a wide variety of organic and inorganic pollutants from water In Focus a book series that showcases the latest accomplishments in water research Each book focuses on a specialist area with papers from top experts in the field It aims to be a vehicle for in depth understanding and inspire further conversations in the sector

**The Handbook of Groundwater Engineering** John H. Cushman, Daniel M. Tartakovsky, 2016-11-25 This new edition adds several new chapters and is thoroughly updated to include data on new topics such as hydraulic fracturing CO<sub>2</sub> sequestration sustainable groundwater management and more Providing a complete treatment of the theory and practice of groundwater engineering this new handbook also presents a current and detailed review of how to model the flow of water and the transport of contaminants both in the unsaturated and saturated zones covers the protection of groundwater and the remediation of contaminated groundwater

*Co-treatment of Septage and Faecal Sludge in Sewage Treatment Facilities* Dorai Narayana, 2020-04-15 Over the past few years on site sanitation has been widely promoted as a solution which can be quickly implemented to address sanitation issues and it is gaining traction As such treatment of the contents emptied from on site containments has become a pressing issue While dedicated treatment facilities for this purpose have been advocated co treating these wastes in sewage treatment facilities is a promising option which many countries have implemented or are exploring This option maximises the utilisation of city infrastructure In cases where the existing sewage treatment facilities are underutilised co treatment presents a ready solution for managing fecal sludge and septage In spite of co treatment being a well known practice in many countries it remains clouded in uncertainty especially regarding the technical advisability and potential risks of co treating fecal sludge or septage in sewage treatment plants Planners and decision makers are often very apprehensive in considering co treatment As a result the opportunity to better utilise available infrastructure for co treatment of sludge is often being missed Meanwhile there are also many cases where co treatment has been tried either successfully or otherwise but it has not been possible to draw conclusions from these to guide the way forward This guide book explores some of the basic principles behind sewage treatment and how it may be impacted by co treatment of wastes from on site containments to try to throw some light on how co treatment could be considered in an incremental manner recognising risks and mitigating them It is intended to facilitate a better understanding among planners engineers decision makers and technical practitioners and to help them evaluate and consider the option of co treatment

Fundamentals of Environmental Site Assessment and Remediation Yue Rong, 2018-07-03 Fundamentals of Environmental

Site Assessment and Remediation examines all aspects of environmental site assessment and remediation and outlines the interdisciplinary skills needed to work in the field. It provides a comprehensive overview for students, environmental professionals, and real estate developers and includes the latest environmental regulations, environmental site assessment and remediation practices, and industry standards. It examines pollution sources and the related impacts on drinking water supplies, the associated health risks, and how to protect water resources. The monitoring of surface water, groundwater, and soil is explained, as well as vapor intrusion. It will include several practical case studies throughout. Features include the latest and best practices for environmental site assessment and remediation procedures. Presents a multidisciplinary approach including environmental forensics, nanotechnology, microbiology, DNA technology, and isotopes, etc. Examines various pollutants and their related impacts on drinking water supplies, the associated health risks, and how to protect water resources. Presents the best practices for the monitoring of surface water, groundwater, and soil. Covers the latest environmental regulations and industry standards.

*Chlorinated Solvent Source Zone Remediation* Bernard H. Kueper, Hans F. Stroo, Catherine M. Vogel, C. Herb Ward, 2014-04-22. The purpose of this book is to help engineers and scientists better understand dense nonaqueous phase liquid (DNAPL) contamination of groundwater and the methods and technology used for characterization and remediation. Remediation of DNAPL source zones is very difficult and controversial and must be based on state-of-the-art knowledge of the behavior, transport, and fate of nonaqueous phase liquids in the subsurface and site-specific geology, chemistry, and hydrology. This volume is focused on the characterization and remediation of nonaqueous phase chlorinated solvents, and it is hoped that mid-level engineers and scientists will find this book helpful in understanding the current state of practice of DNAPL source zone management and remediation.

**In Situ Remediation of Chlorinated Solvent Plumes** Hans F. Stroo, C. Herb Ward, 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, ranging from 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

**Delivery and Mixing in the Subsurface** Peter K. Kitanidis, Perry L. McCarty, 2012-04-23 This volume is meant to provide the practitioner with information on the natural mixing processes occurring in aquifers as well as to describe basic strategies that can be implemented to enhance mixing in particular cases For example when it comes to mixing miscible liquids one can speed up mixing in the formation by manipulating the flow such as through the use of recirculation wells Furthermore much of the mixing can be achieved partially within recirculation wells themselves where contaminated water is admixed with additives volatile products may be removed through a vapor mass exchanger etc Thus adding mixing wells can significantly increase the performance of the delivery and mixing system and speed up the process of remediation

**Soil and Groundwater Remediation Technologies** Yong Sik Ok, Jörg Rinklebe, Deyi Hou, Daniel C.W. Tsang, Filip M.G. Tack, 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

**Bioaugmentation Techniques and Applications in Remediation** Inamuddin, Charles Oluwaseun Adetunji, Mohd Imran Ahamed, Tariq Altalhi, 2022-06-29 It has been observed that rapid population expansion has raised the amount of anthropogenic activity resulting in high levels of pollution in water air and solid waste as well as an increase in the pressure placed on agricultural lands Bioaugmentation Techniques and Applications in Remediation provides detailed information on bioaugmentation approaches for the remediation of sediments water and soil polluted with organic and inorganic pollutants Practical applications of bioaugmentation techniques performed in restricted systems under controlled conditions laboratory investigations and in the field are addressed Special emphasis is placed on the applications of nanomaterials in combination with bioaugmentation techniques for enhanced bioremediation efficiency FEATURES Explores abiotic and biotic factors that

enhance and facilitate environmental remediation of contaminants Provides a primer on the elementary microbial processes entailed in bioaugmentation Summarizes methods and approaches for executing bioaugmentation technology Details commercially available products and instrumentation This book is an ideal resource for researchers students and engineers working in materials science and bioremediation

*Physicochemical Groundwater Remediation* James A. Smith, Susan E. Burns, 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

**Innovative Bio-Based Technologies for Environmental Remediation** Pardeep Singh, Chaudhery Mustansar Hussain, Mika Sillanpää, 2022-01-20 Innovative Bio Based Technologies for Environmental Remediation explores the recent applications of both the latest and broad practical and theoretical aspects of environmental remediation with an aim to combine various innovation based biotechnology for waste management waste minimization and waste to economy This book summarizes the recent progress of bio based technologies for environmental remediation at both an experimental and a theoretical model level An emphasis has been made on trends and the probable future of sustainable techniques to reduce waste and harmful compounds from the environment Biological based technologies have low operating costs and involve direct degradation of



organic pollutants without the release of toxic intermediates Recent applications covered in this book include process intensification in bio based approaches green technology phytoremediation biopolymers biosurfactants for environmental applications and other bio based technologies with sustainable design and the future of remediation are also discussed This book is an important reference source for environmental scientists and engineers who are seeking to improve their understanding of how bio based technologies are playing an increasingly important role in environmental remediation It brings together recent innovations and practices of bio based technologies for environmental remediation outlines major bio based technologies and discusses biopolymers and biosurfactants for environmental management *Advanced Groundwater Remediation* Franz-Georg Simon,T. Meggyes,Chris McDonald,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

**Abiotic in Situ Technologies for Groundwater Remediation Conference** ,2000 **Biostimulation Remediation Technologies for Groundwater Contaminants** Rathoure, Ashok K.,2018-05-19 The rapid progression of technology has significantly impacted population growth urbanization and industrialization in modern society These developments while positive on the surface have created critical environmental problems in recent years Biostimulation Remediation Technologies for Groundwater Contaminants is a critical scholarly publication that examines the release of heavy metals into the environment as a result of human activities and the use of nanoparticles and other technologies to manage and treat the effects of the pollution Featuring coverage on a broad range of topics such as toxicity of heavy metals bioremediation and acclimated bacterial strains this book is geared toward environmentalists engineers academics researchers and graduate level students seeking current research on bioremediation as an alternate way to manage or degrade heavy metal waste *Groundwater Remediation* R.J Charbeneau,1992-05-06 This book reviews the sources of soil and groundwater contamination and the potential remediation technologies It focuses on remediation technologies that are commonly utilized in practice and discusses a number of innovative technologies that show promise for special problem circumstances

When somebody should go to the ebook stores, search start by shop, shelf by shelf, it is truly problematic. This is why we give the books compilations in this website. It will completely ease you to look guide **Bioaugmentation For Groundwater Remediation Serdp Estcp Environmental Remediation Technology** as you such as.

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