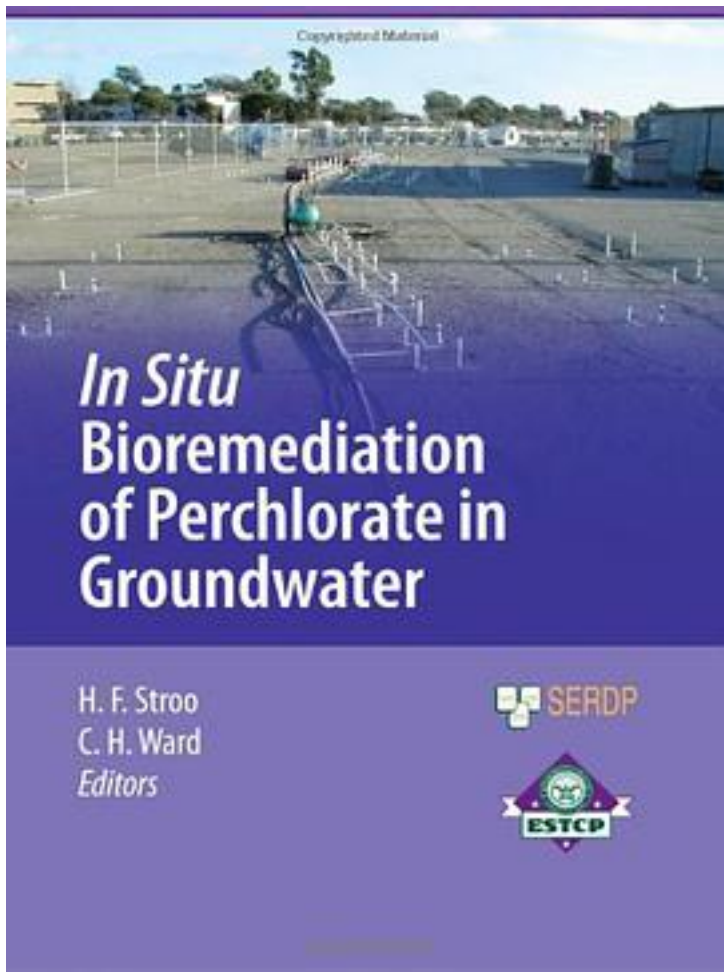


In Situ Bioremediation of Perchlorate in Groundwater



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This volume presents a critical analysis and timely synthesis of the past decade of

intensive research, development, and demonstrations on the in situ bioremediation of perchlorate in groundwater. The intended audiences include the decision makers, practicing engineers and hydrogeologists who will select, design, and operate these remedial systems, as well as researchers seeking to improve the current state-of-the-art. Our hope is that this volume will serve as a useful resource to assist remediation professionals in applying and developing the technology as effectively as possible. An overview of the current state-of-understanding of perchlorate remediation is followed by a discussion of basic principles of microbial and abiotic processes, and of the engineering and implementation issues underlying the technologies described. Characterization of both anthropogenic and natural sources of perchlorate, including isotopic analysis to distinguish between differing sources, precedes discussions of the advantages, performance, and relative costs of applying a range of remedial technologies. Active, semi-passive, and passive in situ bioremediation are fully described and compared with emphasis on field application. Cost information for each technology, using case studies and analyses of several template sites, covers capital costs, as well as costs for laboratory testing, pilot-scale demonstration, design, system operation, monitoring and maintenance during operations, and demolition and restoration after remediation. In addition, analogous cost data are presented for pump-and-treat systems for each template site to illustrate the potential cost savings associated with the use of alternative approaches. Emerging technologies such as monitored natural attenuation, phytoremediation, and vadose zone bioremediation are described, and field demonstrations are used to illustrate the current stage of maturity and the potential applicability of these approaches for specific situations. Each chapter in this volume has been thoroughly reviewed for technical content by one or more experts in each subject area covered.

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