
Natural attenuation is a topic of great practical importance that has gained widespread acceptance by regulatory agencies and entities responsible for site remediation. Despite its increasing importance, many gaps remain in our knowledge of the underlying processes and their collective action; the use of natural attenuation might be far greater if the constituent processes and their interrelationships were more broadly understood and disseminated. Yong and Mulligan clearly had these issues motivating them as they produced a comprehensive text about natural attenuation processes occurring in soils. The treatment is ambitious, covering both metals and organic contaminants in roughly equal detail, and ranges from relatively fundamental to quite applied. The book is also coherent, unlike many in the environmental genre, reading as if it was written for the present purpose (rather than being a hodge-podge of retrofit material from other articles or books) and prepared by a single author (rather than the two who actually contributed). The authors take an expansive view of natural attenuation, covering topics from monitored natural attenuation to various engineered approaches, such as barriers intended to contain or reactively transform the target contaminants.

The book is divided into three sections of approximately equal length comprising eight chapters. The first section (Chapters 1–3) introduces the topic and provides background on water and solute transport in soils. The second section (Chapters 4–6) is concerned with more detailed exposition of the operative abiotic and biotic attenuation processes for metals and organic compounds. The final section (Chapters 7–8) attempts to integrate the foregoing process-level information to produce an overall understanding of the attenuation process and its potential pitfalls.

Chapter 1 introduces the concept of natural attenuation and sets the process within the context of available techniques for restoring land to different sustainable uses. Soil structure and composition and their impacts on water transport are the focus of Chapter 2. The chapter provides a brief overview of soil formation processes and soil size classification, including the role of microscale soil texture in establishing water flow according to the Poiseuille and Karmen–Cozeny equations. The third chapter makes the transition between the more general material of the first two chapters and the more specific material to follow. It includes a discussion of surface charge on soil particles and its role in ionic solute uptake as described (qualitatively) by surface complexation models, although the use of these models in predicting metal uptake is not specifically outlined. The remainder of the chapter examines water retention in unsaturated soils, sorption mechanisms, and chemical reactions in pore water and introduces the governing equations for unsaturated and saturated solute transport.

The second section of the book delves into the specific abiotic processes. Chapter 4 deals with the sorption of contaminants (i.e., emerging contaminants could be included), but like many of the coverage of theory in the book, it is a bit cursory. For example, the distinction between molecular diffusion and dispersion is blurred, providing no clue about the origin and nature of the parameters. The hybrid compound “partitioning model” is introduced in a chapter followed by a brief treatment of the important phase (solids, liquids, and gaseous) of natural attenuation. The chapter concludes with a brief introduction to the potential pitfalls.

Chapter 5 outlines abiotic processes governing contaminant mobility parallel to that presented in Chapter 4 for metals. The treatment is primarily oriented toward petroleum hydrocarbons and chlorinated solvents general to be relevant to a broader spectrum of contaminants (i.e., emerging contaminants could be considered). The ideas presented, but are not explicitly model dependent. The advection-dispersion model for solute transport is introduced, but like much of the coverage of theory in the book, it is a bit cursory. For example, the distinction between molecular diffusion and dispersion is blurred, providing no clue about the origin and nature of the parameters. The hybrid compound “partitioning model” is introduced in a chapter followed by a brief treatment of the important phase (solids, liquids, and gaseous) of natural attenuation. The chapter concludes with a brief introduction to the potential pitfalls.

Chapter 7 focuses on methods of assessing natural attenuation, including procedures for monitoring the components of monitoring networks, and geotechnical probing subsurface conditions. Appropriately, the importance of monitoring by process monitoring to parent compound disappearance is then reviewed and critiqued, followed by a review of established natural attenuation assessment tools from ASTM, USEPA, DOE, or others. The natural attenuation of chlorinated solvents concludes the chapter, but these are brief and provide an extensive and helpful review of sequential methods for assessing metal association in soils.

The final section of the book attempts to integrate the individual and transport processes described through 6 into a more holistic view of natural attenuation. Chapter 7 focuses on methods of assessing natural attenuation, including procedures for monitoring the components of assessment protocols described in Chapter 7 and the greater complexity in anticipating the success of this component of the process, a greater understanding of the measurement and prediction of intrinsic parameters of soils would have been warranted. There is almost nothing in the book regarding current approaches to conducting biostimulation or bioremediation.

Future directions in natural attenuation are qualitatively discussed. The chapter concludes with a series of generalizations about the biodegradation of organic contaminants, metals, nitrogen, and sulfur. Given the fundamental role of biotransformation in all natural attenuation processes and the greater complexity in anticipating the success of this component of the process, a greater understanding of the measurement and prediction of intrinsic parameters of soils would have been warranted. There is almost nothing in the book regarding current approaches to conducting biostimulation or bioremediation.

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