

PERCHLORATE

**Environmental Occurrence,
Interactions and Treatment**

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edited by

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PREFACE

Perchlorate (ClO_4^-) has been detected recently in groundwater, surface water, and soils and, more ominously, in plants, food products and human breast milk in many areas of the United States and the world. Because of its potential health affect on thyroid function by interfering with iodide uptake, the widespread occurrence of perchlorate in the environment has generated considerable interest in its contamination source, environmental interactions, toxicology, risk assessment, and remediation technologies. Most perchlorate is manufactured for use as a primary ingredient of solid rocket propellant and explosives. However, perchlorate is also used in pyrotechnic devices, such as fireworks, highway flares, gun powder, and air bags, and in a wide variety of industrial applications such as tanning and leather finishing, rubber manufacturing, and paint and enamel production. Naturally-occurring perchlorate is also known to exist, particularly in the hyperarid Atacama Desert in Chile. The widespread use and the presence of both natural and anthropogenic perchlorate thus have resulted in intense public debate and far-reaching ramifications, ranging from public health issues to liabilities that could be imposed by environmental cleanup needs.

The goal of this book is to provide the current state of science and technology with respect to the occurrences and potential sources of perchlorate contamination, its behavior, exposure pathways, and detection in the environment, toxicology and risk assessment, and recent advances in treatment technologies for removing perchlorate from contaminated soil and water. To this end, internationally recognized experts in each respective field of perchlorate research have contributed to this text to render a complete inter-disciplinary overview of the state of the science. The book is intended to serve as a comprehensive reference for environmental professionals, regulators, policy makers, scientists, engineers, and others interested in issues associated with perchlorate in the environment. The book consists of 17 chapters covering diverse subjects. The first six chapters describe the challenges and various sources of perchlorate contamination, its chemistry and detection in the environment, its natural occurrence and unique isotopic signatures that may be used for environmental forensics. Chapters 7 to 9 summarize our current understanding of perchlorate toxicology, risk assessment, and exposure pathways. The remaining chapters address recent advances in innovative treatment technologies for remediating perchlorate contaminated soil and water. In particular, significant advances in selective ion exchange and its regeneration technologies enable the treatment of large volumes of contaminated water with reduced costs. Furthermore, rapid advances in our understanding of the microbiology, biochemistry and genetics of perchlorate-reducing microorganisms offer great hope for

eliminating perchlorate from contaminated environments in the future. Presented in this book several chapters are also devoted to field demonstration and case studies involving the use of highly-selective, regenerable ion exchange processes, in situ bioremediation strategies, and modified activated carbon technologies for perchlorate removal. Further attention is given to other treatment technologies, such as titanium-catalyzed reduction and membrane filtration, and to the pros and cons of various remedial options.

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