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Environmental Toxicology and Risk Assessment

SEVENTH VOLUME

Edward E. Little, Bruce M. Greenberg
and Aaron J. DeLonay, editors

STP 1333

STP 1333

Environmental Toxicology and Risk Assessment: Seventh Volume

*Edward E. Little, Bruce M. Greenberg, and
Aaron J. DeLonay, Editors*

ASTM Stock #: STP1333



ASTM
100 Barr Harbor Drive
West Conshohocken, PA 19428-2959

Printed in the U.S.A.

ISBN: 0-8031-2479-1
ISSN: 1071-720X

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To make technical information available as quickly as possible, the peer-reviewed papers in this publication were prepared "camera-ready" as submitted by the authors.

The quality of the papers in this publication reflects not only the obvious efforts of the authors and the technical editor(s), but also the work of these peer reviewers. The ASTM Committee on Publications acknowledges with appreciation their dedication and contribution of time and effort on behalf of ASTM.

Printed in Fredericksburg, VA
April 1998

Foreword

This publication, *Environmental Toxicology and Risk Assessment: Seventh Volume*, contains papers presented at the Seventh Symposium on Toxicology and Risk Assessment: Ultraviolet Radiation and the Environment, held 7–9 April, 1997 in St. Louis, MO. The symposium, the 24th in a series on environmental toxicology, was sponsored by Committee E-47. Edward E. Little, of the U.S. Geological Survey/Biological Services Division in Columbia, MO, presided as chairman of the symposium. Bruce M. Greenberg, with the Department of Biology at the University of Waterloo in Ontario, Canada, and Aaron J. DeLonay, also with the U.S. Geological Service/Biological Services Division in Columbia, MO, served as co-chairmen of the symposium. Each of these men served as editor of the resulting publication.

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Overview

The Seventh Symposium on Environmental Toxicology and Risk Assessment: Ultraviolet Radiation and the Environment was held on 7–9 April, 1997 in St. Louis, Missouri. This conference is the 24th symposium on Environmental Toxicology that has been sponsored by ASTM Committee E-47 on Biological Effects and Environmental Fate. We gratefully acknowledge the efforts of the session chairs for developing stimulating and comprehensive platform sessions and for encouraging the preparation of manuscripts provided in this volume.

This Special Technical Publication (STP) includes 28 peer-reviewed papers presented at the symposium. The reports represent the three major components of Ecotoxicology including measures of toxicity of contaminants in aqueous, sediment, soils, air, and dietary media to terrestrial and aquatic plants and animals; the monitoring, identification, and quantification of contaminants in the environment; and the assessment of ecological and human health risks of exposure. The authors also represent a cross-section of Ecotoxicology's professional community, including scientists from academia, government, and the private sector.

The symposium theme of ultraviolet radiation and the environment was introduced in the plenary session, which examined the current status of atmospheric ozone depletion, the biological impact of UV radiation, and the interaction of UV radiation with natural and anthropogenic substances. In this volume, David Lean provides an overview of ultraviolet radiation in aquatic habitats and the environmental factors that influence UV-induced injury to aquatic organisms. This topic is pursued further in a paper by Berrill and Lean concerning methods for *in-situ* exposures of amphibians to solar radiation in the field, and in a report by Hurtubise et al. on methods for laboratory studies of UV sensitivity in aquatic invertebrates.

The toxicological reports provide new procedures for evaluating toxicity, including a discussion of methods for conducting toxicity tests with nematodes by Freeman et al., and an assay for measuring the impacts of toxicants on the development of grass shrimp by Wilson. Black and Belin evaluate indices of sublethal toxicity in Asiatic clams. Villeneuve et al. describe the use of biochemical procedures to identify enzyme-inducing polyaromatic hydrocarbons in complex aqueous mixtures.

Sediments often become an environmental repository for contaminants, and can become a source of long-term contamination in the food web. Lopes and coworkers provide a synoptic assessment of the occurrence and distribution of semivolatile organic compounds in stream bed sediments of 19 major river basins in the United States. Wong and Sanders discuss ambient concentrations of metals and polycyclic aromatic hydrocarbons in surface soils from urbanized areas of New Jersey.

Measures of neurotoxicity are critical in identifying substances that pose health hazards through effects to the central nervous system. Feldhaus et al. provide data on the interactive toxicity of pesticide mixtures on neurobehavioral responses and cholinesterase concentrations in planaria. Tanaka and Bursian discuss a histopathological technique for measuring organophosphorous-induced neuropathy in mammalian and avian central nervous systems.

Studies on the toxicity of contaminants to plants provide important information on aqueous and airborne contaminants, as well as exposures to sediment and soils-bound substances. Bioavailability and uptake of lead to terrestrial plants is the topic of a report by DeShields et al. concerning the potential toxicity of lead at a small arms firing range. Powell et al. explore

the use of *Azolla*, an aquatic macrophyte, to measure the toxicity and accumulation of metals from sediments. Roshon and Stephenson report morphological and physiological effects of two reference toxicants on an aquatic plant. Sheppard and Evenden discuss a procedure for defining the qualities of a control soil for assays with terrestrial plants. Youngman and co-workers describe the use of a duckweed bioassay to evaluate the leaching of heavy metals in contaminated soils from smelter sites.

The monitoring of air- and water-borne contaminants is of major concern in ecotoxicology and a significant emerging technology. Quality control procedures required in the use of semipermeable membrane devices are described by DeVita and Crunkilton. Louch and colleagues provide a critique of the U.S. Environmental Protection Agency's proposed screening analysis for compounds that bioconcentrate. Kleinheinz and St. John discuss the quantification of complex mixtures of volatile organic compounds in a biofiltration unit.

Toxicant identification and evaluation techniques (TIE) provide diagnostic tools to identify the chemical characteristics of toxins in environmental samples. Often such samples comprise a complex mixture of substances and rapid identification techniques are necessary to isolate the toxic components of these samples through a series of filtration, extraction, and binding procedures. Amato and Wayment provide a case study of the application of TIE techniques in which surfactants are identified as the toxic component of municipal wastewater. Jirik and coworkers describe the application of TIE techniques to urban stormwater runoff. Coello and Kahn present information on the removal of metals from water by keratin from feathers and fur.

The assessment of risk has become a major emphasis in ecotoxicology. In addition to defining the potential hazard posed by a substance, it is also important to understand the probability that such exposure will occur in the real world. Risk assessments require considerations such as the amount of a substance produced, its toxicity and potential for bioaccumulation of the substance; the frequency and duration with which the substance persists when it is released in the environment; and the uncertainties associated with these parameters. Adams et al. use probabilistic procedures to verify a proposed water quality criterion for selenium. Habig and Leyes discuss a tiered approach for assessing the risk posed by pesticide products to birds. Velagaleti and Winberry summarize ecological risk assessment considerations for pharmaceutical products using a chemical fate and environmental effects approach. Tchounwou et al. provide a human health risk assessment of hexachlorobenzene and hexachlorobutadiene residues for fish collected from a hazardous waste site.

Statistical considerations are essential in defining toxicity, measuring the status of natural populations and communities, as well as in defining risk and associated uncertainties. Sebaugh evaluates several commonly used computer programs for computing LC50s (concentrations lethal to 50% of the test population). Steele and Skinner survey mathematical methods for comparing the structure of natural communities.

In conclusion, the papers in this volume provide a cross-section of the diversity of environmental toxicology issues, and reflect the current status of numerous aspects of ecotoxicology research and methodology. Undoubtedly, certain of the topics discussed in this volume will become the focus of future ASTM standards. As such, the ASTM symposium is critical in providing a public scientific forum for emerging issues and technology, which is an essential first step toward the development of consensus standards for ecotoxicology.

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ISBN 0-8031-2479-1