

Aquatic Toxicology and Environmental Fate Ninth Volume

Poston/Purdy, *editors*



AQUATIC TOXICOLOGY AND ENVIRONMENTAL FATE: NINTH VOLUME

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Foreword

The Ninth Symposium on Aquatic Toxicology was presented at Philadelphia, Pennsylvania, 14–16 October 1985. The symposium was sponsored by ASTM Committee E-47 on Biological Effects and Environmental Fate. Ted M. Poston, Battelle Pacific Northwest, and Rich Purdy, 3M Company, served as chairmen of the symposium and as editors of this publication.

Related ASTM Publications

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A Note of Appreciation to Reviewers

The quality of the papers that appear in this publication reflects not only the obvious efforts of the authors but also the unheralded, though essential, work of the reviewers. On behalf of ASTM we acknowledge with appreciation their dedication to high professional standards and their sacrifice of time and effort.

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Overview

In the past nine years, ASTM has sponsored nine symposia addressing the disciplines of aquatic toxicology, environmental chemistry, and hazard evaluation. These symposia have served as a forum for industry, government, and academia to present and debate the merits of development, interpretation, and application of research in this field. The underlying theme of these symposia has been methods development and validation; however, related areas of aquatic biology, ecology, and chemistry also have been addressed. The proceedings from the past eight symposia have chronicled technical advances as well as political and industrial perspectives in this branch of environmental science.

This volume of the Ninth Symposium on Aquatic Toxicology and Environmental Fate continues in that endeavor with emphasis on research and application of research to regulatory needs. It may be used as a key reference by professionals and students in the environmental arena. Organization of the proceedings differs from the format of the symposium to provide better integration of platform and poster presentations. In addition to the introductory section, there are seven sections dealing with topics of specific relevance to the discipline of aquatic toxicology and environmental fate.

The introductory section focuses on defining a goal for aquatic toxicology, a question that leads directly into Neuhold's keynote discussion on the interactions between aquatic toxicology and ecological principles. The theme is continued in the following section dealing with the relevance of ecological perspectives to aquatic toxicology. A key question put forth by the many papers in this section is what are acceptable and unacceptable ecological perturbations? How are they defined, and how are they measured? These questions are difficult to answer because of the high variability and uncertainty involved in ecosystem analysis. New approaches are presented to deal with the interpretation of ecological perturbation, including application of information theory, self organization, and resource competition modeling.

The impact of genetically engineered microorganisms in aquatic environments was addressed in four presentations. Genetically manipulated organisms are being developed to protect plants from frost, biological pest control, and detoxification agents for hazardous materials. Methods for the assessment of adverse impacts resulting from implementation of this technology are still being developed. The potential for engineered microbes to exist and compete in terrestrial and aquatic habitats is a fundamental aspect of the assess-

ment of adverse impacts. New research initiatives and the role that the Environmental Protection Agency assumes in the regulation of genetically engineered organisms are reviewed.

A major emphasis of the Ninth Symposium was bioaccumulation and biotransformation of xenobiotics. The ability of aquatic organisms to metabolize toxic chemicals may help establish acceptable levels of exposure for aquatic organisms. Metabolism of several organic compounds were investigated in trout, blue crabs, and bivalve mollusks. In some cases, metabolized compounds may become mutagenic or carcinogenic. Two studies report on the use of the rainbow trout embryo for (1) metabolism studies and (2) studies on toxicity, teratogenicity, and carcinogenicity. The data generated from these types of studies not only help understand potential environmental impacts, but also indicate potential hazards to humans. The use of lower organisms and other alternative test systems for assessing the hazards of chemicals to humans was reviewed.

Past symposia have traditionally focused on many varied aspects of methods development in aquatic toxicology. The importance of quality assurance and quality control have come to the forefront as one of the major issues confronting aquatic toxicologists. Concern has been raised regarding the nutrition and health of test organisms as well as the need to be able to consistently reproduce test results. The effects of light intensity, photoperiod, temperature, and nutrition on reproduction and survival of *Daphnia magna* was evaluated with respect to toxicity testing. Consideration and standardization of these factors can contribute to the success or failure of round-robin testing. A successful testing program requires more than technical and scientific competence. Quality assurance has emerged as a necessary component of toxicity testing. The quality assurance programs for the hydra reaggregation test and the hydrogen oxidation soil bioassay are covered in this volume.

Additional sections of this volume deal with biomonitoring, new test methods, and the relationship between sediment and toxicity and bioavailability of chemicals. Criteria for selection of organisms for biomonitoring requires a sensitivity to toxic chemicals and amenability to laboratory culture and handling. Use of *Heliophrya*, a sessile suctorian protozoon, was evaluated as a biomonitor or urban runoff. A timely review of the use of biomonitoring systems indicates that they are best suited for the detection of acutely toxic materials and best utilized with other physico-chemical water quality monitors.

As an evolving science, new and innovative methods are constantly being developed to evaluate the toxicity of new chemicals. Specific concerns, such as the influence of environmental factors on toxicity, require the development of specialized test procedures. The toxic effects of substituted chlorophenols was evaluated by measuring the suppression of bioluminescence in relation to ambient levels of dissolved organic carbon. Studies such as this point to the complexity of evaluating the toxicity of chemicals in relation to environmental factors. In another study, behavioral and morphological responses of fathead

minnows were grouped into ten categories to develop a model for screening and differentiating chemicals according to toxic action. Faced with the unrealistic prospect of evaluating the toxicity of literally thousands of chemicals, approaches that assign chemicals of prescribed toxic action into selected groups affords a feasible and efficient method of grouping and evaluating toxic chemicals.

Binding of toxicants to sediments is the predominant environmental vector for removal of most toxicants from the water column. This process results in accumulations of toxic compounds in sediments, a condition that has caused considerable research activity in the environmental arena. The approaches to deal with this problem involve modeling efforts to predict toxicity based on thermodynamic equilibria of metals to laboratory and field studies focusing on the toxicity of organic compounds sorbed to organically enriched sediments.

As a scientific discipline, aquatic toxicology and environmental fate is young and evolving. The presentations of the Ninth Symposium, held in Philadelphia, in April 1985, focused on many of the more relevant issues facing industry and government today. While our understanding of environmental processes regarding the fate and effects of anthropogenic agents has increased greatly over the last 20 years, our present knowledge is greatly overshadowed by what remains to be learned and applied.

The symposium chairmen are indebted to Dr. Richard Emery, Dr. Wayne Landis, Mr. Steven Schimmel, Dr. Ronald Breteler, Dr. Ralph Stahl, Dr. Joseph Ferris, Mr. Rod Parrish, Dr. Lew Williams, and Dr. James Carlilse for convening sessions during the symposium. The assistance of the ASTM Staff is recognized for their efforts to organize the symposium and publication of this volume.

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