

## Preface

### INTRODUCTION

In September 1994, scientists and policy makers from 24 countries met in Rome at The International Symposium on Assessing and Managing Health Risks from Drinking Water Contamination: Approaches and Applications. The symposium, jointly organized by the International Commission on Groundwater (ICGW) of the International Association of Hydrological Sciences (IAHS) and the Istituto Superiore di Sanita, Rome, was a follow-up to the work of an ICGW working group on groundwater contamination risk assessment. The working group concluded that further efforts were needed to address the practical issues of applying risk assessment methodologies to actual case studies and to more fully consider the range of health risks in developing as well as developed countries (Reichard *et al.*, 1990). This symposium was organized as a step towards addressing these needs.

The objectives of the symposium were to explore drinking water contamination health risks from a multidisciplinary perspective and to exchange experiences in risk assessment and management from developed and developing countries. The symposium attempted to meet these objectives in several ways. First, specialists from a wide range of disciplines (including epidemiology, toxicology, microbiology, chemistry, hydrology, geology, engineering, statistics, economics, philosophy, and regulatory analysis) were brought together. Second, people working to assess health risks from drinking water were brought together with those responsible for managing these risks. Third, people working on theoretical and methodological formulations were brought together with those applying these theories and methods to actual problems. Finally, the symposium brought together participants from many different countries facing different sets of drinking water challenges.

### OVERVIEW OF PROCEEDINGS

This proceedings volume was organized so as to provide an accurate representation of all the technical presentations at the symposium, while at the same time presenting more detail on selected topics. It includes extended papers from four sessions (Emerging issues in drinking water risk assessment in developed and developing countries; Health effects from drinking water contamination: epidemiology and toxicology; Multipathway exposure assessment; and Remediation of contamination) and abstracts from all the other sessions. This volume aims to accurately document the symposium and also serve as a useful interdisciplinary, international reference on assessing and managing drinking water health risks.

The papers in Section 1 provide an introduction to selected emerging issues in drinking water risk assessment, while emphasizing contrasts and commonalities between developed and developing countries. Smith describes the relationship between development and environmental hazards. Fawell *et al.*, Reiff, and Hoque *et al.* analyze some key issues relating to disinfection methods and by-products in both

developed and developing countries. Ojo and Yaziz & Pillay present surveys of drinking water health issues in Nigeria and Malaysia, respectively. Hauchman provides an overview of the drinking water research being pursued by the U.S. Environmental Protection Agency. Finally, Raucher details some economic aspects of drinking-water regulation.

The papers in Section 2 present results from epidemiological and toxicological studies of health effects from drinking water contamination. Morris & Levin, Eisenberg *et al.*, and Araujo describe epidemiological analyses of microbial contamination. Nuckols *et al.*, Susheela, Fabiani *et al.*, and Sancha *et al.* describe epidemiologic analyses of chemical contamination. Angjeli and Csanady & Straub present results from two national epidemiologic surveys of drinking water health risks (both chemical and microbial). Höring & Dieter, Zapponi *et al.*, and Mantovani *et al.* present frameworks for toxicological evaluation of contaminants found in drinking water. Cranor introduces some pragmatic approaches for expediting carcinogenic potency assessment.

Section 3 includes three papers on multipathway exposure assessment for drinking water contamination. Reichard *et al.* present examples of uncertainties which arise in exposure assessment for groundwater contamination. Maslia *et al.* demonstrate how the linkage of environmental transport models and geographic information systems (GIS) can facilitate exposure assessment. Keating *et al.* present a new technique for estimating dermal absorption of drinking water contaminants.

Section 4 includes four papers on remediation of drinking water contamination, focusing on groundwater. Cerutti *et al.* present a wellhead protection strategy. Magyar *et al.* describe two groundwater remediation projects conducted at abandoned military bases. Belousova & Shmakov present an analytic framework for studying groundwater contamination from oil-field brines. Finally, Misirli *et al.* demonstrate the use of optimization techniques to design a groundwater management strategy which incorporates the fixed costs of wells.

In addition to the extended papers, the final section of this volume also includes abstracts from six sessions: Causes and processes of contamination – surface water; Regulatory issues; Causes and processes of contamination – groundwater; Pesticides and other non-point sources of contamination; Treatment processes and distribution systems; and Use of computer models for risk assessment.

## ISSUES RAISED AT THE SYMPOSIUM

Throughout the symposium, in formal presentations, in questions and comments following each talk, and in the round-table session, participants raised several general ideas. These ideas, while not necessarily new, were considered by the participants to be extremely important in assessing and managing drinking water health risks. First, different countries at different stages of development face different sets of drinking water problems and feasible solutions. Because of this, international interaction is needed to enable drinking water specialists to better understand these differences, to determine appropriate approaches for technological transfer, to develop optimal control pathways, and to identify common drinking water concerns. As a step towards facilitating such interaction, it may be worthwhile to establish a permanent network

for information exchange and scientific cooperation. Second, in order to effectively communicate risks and develop sustainable risk control strategies, relevant agencies must consider the implications of cultural differences among societies and take steps to ensure local participation. Third, when setting priorities for risk management actions, decision makers should consider total exposure levels (including ingestion, inhalation, and dermal absorption), explicitly account for uncertainties, and evaluate the relative importance of traditional versus modern risks. Fourth, several factors should be kept in mind when setting drinking water quality standards and regulations:

- There are costs to doing nothing.
- It is preferable to explicitly characterize all uncertainties, rather than using all "worst-case" assumptions (note, in some cases, what are assumed to be worst-case assumptions may not be so).
- Standard setting should be a dynamic process with routine reevaluations of standards and reduced barriers to changing them.

Finally, drinking water contamination is an interdisciplinary problem. Increased emphasis on interdisciplinary training of individuals is important. In addition, bringing together specialists from different disciplines either in teams to address specific problems (developing WHO guidelines for risk assessment, for example) or in symposia such as this is essential. Because of the benefits of such interdisciplinary interaction, it is hoped that a 2nd International Symposium on Assessing and Managing Health Risks from Drinking Water Contamination will be held to continue and build on the interchange of ideas that took place in Rome.

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## REFERENCE

- Reichard, E., Cranor, C., Raucher, R. & Zapponi, G. (1990) *Groundwater Contamination Risk Assessment: A Guide to Understanding and Managing Uncertainties*. IAHS Publ. no. 196, IAHS Press, Wallingford, Oxfordshire, UK.