Brownfields

Multimedia Modelling and Assessment

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Editor: G Whelan

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G. Whelan
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Preface

Multimedia modeling and assessment refers to compartmentalizing the real-world environment into its respective components or processes and describes the linkages and interactions between those components and processes to provide the decision maker with the ability to make more informed decisions. Components could include the environment (e.g., groundwater, surface water, overland, and air), resource allocation (e.g., cost estimation), project management, remediation alternatives, databases, Geographic Information Systems - in other words, anything that can be described as a real-world object. Processes refer to the mechanisms that could be employed to implement the components. These could comprise algorithms describing advection, convection, dispersion, uptake, impacts, numerical and statistical techniques, etc.

All aspects of the environment are impacted by anthropogenic and non-anthropogenic activities, including air, water, soil, vegetation, and wildlife. Environmental crimes are distributed and interact across multiple media, resulting in a "multimedia" problem. The need for environmental systems modeling is growing rapidly because of the 1) combination of increasing technical scope and complexity related to questions of risk-based cause and effect and 2) need to explicitly address cost effectiveness in both the development and implementation of environmental regulations. The nature of risk assessments are evolving with their increased complexity in assessing individual sites and collection of sites, addressing regional or national regulatory needs. These assessments require the integration of existing tools and the development of new databases and models, based on a comprehensive and holistic view of the risk assessment problem. To meet these environmental regulatory needs, multiple-media-based assessments are formulated to view and assess risks from a comprehensive environmental systems perspective, crossing the boundaries of several scientific disciplines. Given the consideration and the advanced states of computer hardware and software, it is possible to design a software system that facilitates the development and integration of assessment tools (e.g., databases and models).

Within the past 20 years, multimedia contaminant environmental exposure and risk assessment methodologies have been the focus of a considerable amount of research and development. These multimedia methodologies describe the release of contaminants into the environment, their transport and fate through various environmental media (i.e., groundwater, surface water, overland, and air), exposures

to sensitive receptors (i.e., via inhalation, ingestion, dermal contact, and external dose), and health consequences resulting from the exposures. Multimedia models can be effectively used to concurrently assess multiple waste sites with multiple constituents to include baseline (at $t = 0$), no-action (at $t > 0$), during-remediation, and residual (post-remediation) assessments, including land-use patterns (e.g., agricultural, residential, recreational, and industrial). Multimedia models can be applied to describe environmental concentrations within each medium at all locations surrounding the site. Most assessments are conducted on a single site, although at large installations multiple sites represent the norm. Large groups of sites can and have been aggregated into a group of centrally located sites; therefore, aggregation represents a cost-effective alternative for regional assessments. Using a systematic approach, the analysis becomes automated, and the approach becomes powerful and relatively easy to apply.

The first international symposium on Multimedia Modeling and Assessment was held in Cadiz, Spain in 2002. The subject area broadly dealt with intermedia and multiple-media, decision-support tools, including models, databases, and confederations of models/databases (e.g., frameworks). The purpose of these software tools is to help planners and assessors perform their job more easily, quicker, cheaper, and more scientifically defensible. Topics covered seamless linkages between disparate models; seamless linkages between databases and models; remote and local applications of software; risk assessments; risk management; cost analyses; remediation assessment; decision-support analyses; Geographic Information System linkages; life-cycle analyses; and site-specific, regional, and national assessments. The 2002 symposium focused on tools that would help decision-makers make more informed and scientifically defensible decisions.

Since then, the state-of-the-art in intermedia/multiple-media modeling has significantly advanced to the point where full and deployable frameworks are available to help in the assessment process.

Multimedia Modeling and Assessment is based on papers presented at the Second International BROWNFIELDS 2004 conference (http://www.wessex.ac.uk/conferences/2004/brownfields04/index.html). Each paper was by invitation, and each contribution was reviewed and revised to conform to suggested technical review comments. They cover some of the most mature and widely used software technology products and approaches to support brownfields and hazardous waste site decision makers. This volume describes the software tools and methods, and provides illustrative examples.

The goals of this book are to 1) raise the awareness that software tools are now available to deal with conflicting complexities associated with a multimedia environment, 2) foster closer ties, communication, and collaboration between developers and assessors from around the world, as these issues are global and, therefore, require multi-national approaches and solutions, and 3) capture a summary and application of some of the more mature multimedia software technology tools. Much effort has gone into the preparation of this publication. The legacy of this topical area in the United States has been maintained by continued support from a number of researchers, who have acted anonymously behind the scenes. They

must be recognized for their outstanding contributions. They include Mr. Gerard Laniak, Dr. David Brown (retired), Dr. Ronald Wilhelm, and Dr. Anthony Wolbarst (U.S. Environmental Protection Agency); Dr. Mark Dortch (U.S. Army Engineer Research and Development Center); Dr. Ralph Cady and Dr. Thomas Nicholson (U.S. Nuclear Regulatory Commission), and Dr. Paul Beam (U.S. Department of Energy). In addition, the efforts by Prof. Carlos Brebbia of the Wessex Institute of Technology (WIT), UK, is recognized. We sincerely appreciate his collaboration and the support that he and the staff at WIT have provided, thus making the publication of this book possible.

The Editor
Sienna, 2004

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