Decision Science and Social Risk Management: A Comparative Evaluation of Cost-Benefit Analysis, Decision Analysis, and Other Formal Decision-Aiding Approaches. Miley W. Merkhofer. D. Reidel Publishing Company (Technology, Risk, and Society Series), Dordrecht, The Netherlands. 1987. 330 pp. $49.00 hard cover.

This book contains a synthesizing discussion of three methods for societal risk analysis: decision analysis, social choice theory, and cost-benefit analysis. It is designed to be of interest to a wide audience including professional risk analyzers and managers, legislators, regulators, concerned citizens' groups, as well as students. A major strength of the book is the emphasis on detailed descriptions of the methods in lengthy appendices. After reading this book, a person could be an "educated consumer" of the methods covered, with an understanding of the advantages, limitations, and potentials of the methods. Additional study and experience would be required to actually apply the methods to a risk analysis problem.

The Chinese word for crisis, *weiji*, is written by combining the characters for danger and opportunity. Similarly, the three methods for aiding societal risk analyses described in this book use different mathematical representations to weigh danger vs. opportunity and risk vs. benefit before ultimately recommending the best among competing options.

The special nature of decisions involving substantial health, safety, and environmental risks is presented in Chapter 1. The discussion draws on research by psycologists on the perception of risks and by economists on governmental intervention to control risks. The existing risk management system in the United States is next discussed. This system includes tort and common law, insurance plans, volunteer standard-setting organizations, and mandatory government standards or regulations.

Next, the three decision-aiding approaches are presented and compared in Chapter 2. The original research citations are given, so interested readers can obtain further information on the relevant theories and previous applications. Methods for valuing the variables representing the possible outcomes associated with a decision alternative are nicely summarized. Single and multiple attribute preference functions are used in decision analysis and social welfare theory to represent the value or utility of various outcomes. Market-based procedures in which prices (for an amount of a good or a service level) or defensive expenditures (for a substitute such as an air conditioning system to avoid air pollution exposure) are used in cost-benefit analysis to determine the utility to a person of various outcome levels. A variant of this is the contingent valuation approach in which a hypothetical "contingent" market is postulated, and a person is asked to supply an amount he or she is willing to pay for an improvement in the level of the outcome variables. For example, in a UC Irvine-based project for the United States Environmental Protection Agency we have asked heart patients to state their willingness to pay to avoid additional angina episodes. Their answers can be used to value changes in angina episodes due to changes in the carbon monoxide level in the ambient air, which provides one piece of data for E.P.A. decisionmakers in setting standards to regulate allowable carbon monoxide emissions.

Models for representing the elements of a risk analysis are briefly described, including influence diagrams, signed directed graphs, fault and event trees, and decision trees.

The final two chapters contain criticisms and limitations of the formal decision-aiding approaches and a comparative evaluation of the approaches. General criteria for choosing the most appropriate method(s) for a specific type of risk problem are discussed.

Roughly one-third of the book is devoted to three appendices illustrating the application of the methods. Many readers may wish to read the appendices first, since these "case studies" give a nice overview of the methods within a decision-making context. The first appendix contains a hypothetical cost-benefit analysis of mobile-source sulfur oxide emission control. The second appendix contains a decision analysis of alternative government policies for commercial cryptography conducted by the author. The last appendix describes one of the few applications of social choice theory. Professor James Dyer of the University of Texas, Austin and Dr. Ralph Miles of Jet Propulsion Laboratory used this method to guide selection of the best pair of satellite trajectories for the Voyager project. They published this study in 1976 in the *Operations Research* journal (24:220-244). Each science team was required to evaluate alternative pairs of trajectories based upon the scientific value of the trajectories to meet that team's scientific objectives. Substantial conflict existed among science teams: some wanted to pass very close to Jupiter or Saturn, others needed to pass near the rings of Saturn, etc. Science teams responded to lottery questions and

THE ENVIRONMENTAL PROFESSIONAL, Vol. 10 pp. 176-184, 1988. Printed in the USA.
0191-5398/88 $3.00+.00

a utility function for each science team was constructed. Then the overall social "utility" for all science teams was obtained by aggregating the individual utilities. In retrospect, if the study were done now, the authors would probably have framed this as a decision under certainty, since some science team members felt that artificially introducing risk into the problem by assessing preferences with a lottery (with a p chance of the best trajectory pair and a l-p chance of the least preferred trajectory pair) decreased face validity and confounded strength of preference with risk aversion. Instead, the teams' preferences could have been assessed through direct assessment of a measurable value function in which equal increments in ratings represent equal increments in strength of preference.

In summary, this book provides a nice comparison of three methods for quantitative analysis. I predict that for most interested readers the benefits of reading the book will outweigh the costs.

L. Robin Keller
University of California
Irvine, CA

Personal Computers for Scientists: A Byte at a Time. Glenn I. Ouchi. American Chemical Society. Washington, DC. 1986. 250 pp. $34.95 hard cover, $22.50 soft cover.

This book is well written and for the most part well illustrated. The author introduces the reader to personal computing through 276 pages, comprising eleven chapters, each devoted to a special topic. He begins by reviewing hardware and defining the computer terminology that is needed throughout the remaining chapters. Next he reviews software, beginning with operating systems and continuing through word processing, spreadsheets, databases, graphics, communication, and real-time data acquisition. The author's emphasis is on the personal computer user's needs. Generalized overviews and summaries explain the utility and need for the particular application, leaving details of its implementation to the reference manuals. The reader is given the overview he needs to make his own computing decisions.

The author's experience seems to be primarily with PC-DOS and IBM PC compatible computing. Most of the examples are written around this hardware and operating system, although he uses other examples in some instances. Most applications involve chemistry problems or chemistry lab applications. The text is strongest in real-time computing and data reduction techniques, and weakest in data base and project management software. The author's emphasis is on *personal computing* and this shows; there is very little coverage of networks, mainframe communication (he does discuss connectivity and terminal emulation), and multi-tasking operating systems. He does a good job of showing the reader how to be happy with existing capabilities of currently available personal computers.

The author has succeeded in staying away from excessive detail when describing programs, and the reader will need the reference manuals and other texts to fully understand any particular application. The computer novice, especially those interested in laboratory computing, will find this an excellent first text. Intermediate users will also benefit from this text. Educators will find it useful to familiarize beginning students with computing principles.

Michael K. Stenstrom
School of Engineering and
Applied Science
University of California
Los Angeles, CA

Acid Rain: 1986, Handbook for States and Provinces: Research, Information, Policy. Proceedings of Wingspread Conference. The Acid Rain Foundation, Inc. St. Paul, MN. 609 pp. $55.00 soft cover.

I have often wondered if one can actually use a thick conference proceeding for anything other than supporting one end of a bookshelf. I am happy to report that this volume covering the second International Wingspread Conference on Acid Deposition, held during September 1986, is both informative and reader friendly.

The objective of the conference was to update knowledge in three major areas on acid deposition: research, information, and policy at levels ranging from the local, state, and provincial to the national and international. It was the first such conference held specifically to bring officials together from both the United States and Canada.

The conference findings emphasized solutions rather than the complexities of the problem. It noted that acid rain as an issue is expanding to include other airborne pollutants within a perspective of total atmospheric loading.

I enjoyed the sense of history woven into the combination of papers delivered by resource people as well as state and provincial government officials. The Tribute to Savante Oden, the acknowledged "Father of Acid Rain Research," reflects on his unique role and considers the ensuing growth of the field.