Preface

Exposure to risk permeates our daily experiences. The assessment of risk and strategies to reduce the likelihood of suffering harm or loss is the concern of all scientific endeavors. However, the study of risk has never evolved into its own area with its own language and methodologies. Instead, risk analysis is a cross-cutting topic combining areas that might include such diverse subjects as engineering, medicine, finance theory, public policy, and the military. Independent of the specific areas of applications, the core ideas behind risk assessment and analysis are essentially the same. A solution depends upon the probabilities of the occurrence of a set of potential problems, the probabilities of different levels of catastrophes being realized if a particular problem occurs, and a loss function associated with the cost of each catastrophe. The challenge is the quantification of the probabilities and costs to specific problems for setting policies that minimize costs while maximizing benefits.

Different disciplines have met those challenges in a variety of ways. A few have explicitly built upon the large body of statistical work subsumed in probabilistic risk assessment, but most have not. Many have developed alternative strategies that are robust to specific kinds of uncertainty, or handle adversarial situations, or deal with dynamically changing action spaces such as decision making in an economic environment. These kinds of diverse settings have broadened risk analysis beyond the traditional mathematical formulations.

Currently, the relevant literature on risk assessment is scattered in professional journals and books, and is not readily accessible to those who would profit from it. The aim of the encyclopedia is to draw together these varied intellectual threads in the hope that risk analysts in one area can gain from the experience and expertise of those in other disciplines. Corporate risk assessment, for example, may learn from military solutions; the work on monitoring for adverse health events might help to inform the early detection of unsafe automobiles; and portfolio management is very likely to be relevant to public policy investments.

Quantitative risk assessment is an important growing component of the larger field of risk assessment that includes priority setting and the management of risk. The statistical theory within the encyclopedia is designed to unify the study of risk by presenting the underpinnings of risk management within the context of the special features of particular areas. Applications from such diverse areas as drug safety, investment theory, public policy applications, transportation safety, public perception of risk, epidemiological risk, national defense and security, critical infrastructure, and program management are included to illustrate this unification.

Further, the need to understand the risks of an activity has spawned new classes of mathematical techniques for hazard identification, dose–response assessment, exposure assessment, and risk characterization. These concepts are discussed in the encyclopedia and illustrated with applications that require a more general description of variability and uncertainty inherent in the risk identification process than were available in the classical statistical literature.

The need for a unifying authoritative reference work on risk assessment was recognized in 2005 by John Wiley and Sons and the editors-in-chief. The project began with the identification
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of 10 major areas that have contributed to the literature of developing strategies for studying risk. For each area, a section editor was recruited with known expertise in his or her field. These categories, and the section editors, are:

1. Risk management (Tony Cox)
2. Environmental risk (Walt Piegorsch)
3. Insurance/actuarial risk (Michel Denuit)
4. Financial/credit risk (Ngai Chan)
5. Toxic substances/chemical risk (Dennis Paustenbach and Jennifer Roberts)
6. Reliability (Frank Coolen and Leslie Walls)
7. Bayesian methods/decision analysis (Simon French)
8. Clinical risk (Susan Sereika)
9. Epidemiology/public health (Susan Sereika)
10. Homeland security (Edward Melnick)

Once recruited, editors-in-chief and section editors developed a list of entries within each topic, and from there the section editors solicited authors. The entries were chosen to provide a broad coverage of methods and applications of risk quantification and analysis. Some entries were chosen to cover material at a basic level, while others were at a sophisticated mathematical level. The goal was to make the encyclopedia meet the needs of a wide readership with articles that differed in technical level and mathematical content.

The section editors did an outstanding job of soliciting leading authors to write authoritative articles on selected key topics. Out of approximately 400 potential authors, they were able to recruit all but a handful. We would like to thank all of them for their very substantive and insightful contributions.

Once the first draft of manuscripts was received, the editors-in-chief read and made suggestions to the section editors. The section editors then worked with the authors as supporters and editors. Once the section editors accepted the final version of the manuscripts, the editors-in-chief set up the cross-referencing and compiled all the articles into the encyclopedia.

Any success that the encyclopedia may have will be due, in no small measure, to the efforts of the nearly 360 authors. They all worked very hard, often through multiple drafts, to produce this work. With the editors-in-chief on different sides of the Atlantic, and section editors and authors spread all over the world, this work could not have been carried out without the Internet. We want to thank all who responded promptly to messages sent in the middle of the night (their time) or just after they went home for the weekend.

This encyclopedia uses a system of cross-referencing to make the material more accessible to the reader. Firstly, other articles that the reader might be interested in are cross-referenced using the words “see” or “see also” in parentheses at the appropriate location within the text of an article. For example, ‘…of the air pollutant in ambient air (see Air Pollution Risk)’. Secondly, related articles are listed at the end of many of the articles, under the heading “Related Articles”. Finally, there are a number of “blind entries” that refer the reader to a full-length article. For example, ‘Polypatterns: See Remote Sensing,’ or ‘Epistemic Communities: See Scientific Uncertainty in Social Debates around Risk.’

Jill Hawthorne, who was our Project Editor at Wiley, did a superb job leading us along, providing encouragement where it was needed, and somehow keeping complete track of over 300 articles in various stages of completion. We could not have done this without her. We are also grateful for the assistance offered by her colleagues at Wiley, including Daniel Finch, Layla Harden, Debbie Allen and Tony Carwardine all of whom did sterling work on the project.
We also acknowledge the contribution of Sangeetha and the team at Laserwords Private Ltd., who were responsible for the copyediting and typesetting of all the articles.

John Wiley & Sons, Ltd was supportive of this work throughout. They provided funds for several meetings of the editors-in-chief, and made much of the editorial process almost completely transparent to us.

Brian S. Everitt
Edward L. Melnick

July 2008