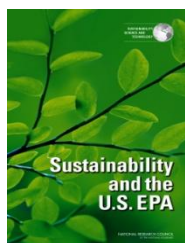


DECISION-MAKING UNDER RISK AND UNCERTAINTY

Government-University-Industry Research Roundtable
Reports on Risk and Uncertainty*
June 2012

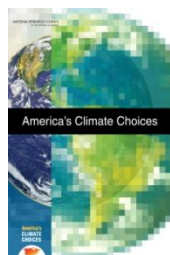
CLIMATE/ENVIRONMENT



Sustainability and the U.S. EPA (PGA 2011) The EPA asked the National Research Council (NRC) to provide a framework for incorporating sustainability into the EPA's principles and decision-making. The report recommends that EPA formally adopt as its

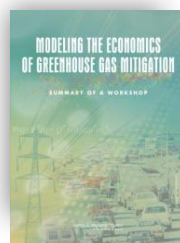
sustainability paradigm the widely used "three pillars" approach, which means considering the environmental, social, and economic impacts of an action or decision.

America's Climate Choices (DELS 2011) *America's Climate Choices* makes the case that the environmental, economic, and humanitarian risks posed by climate change indicate a pressing need for substantial action now to limit the magnitude of climate change and to prepare for adapting to its impacts.



Modeling the Economics of Greenhouse Gas Mitigation: Summary of a Workshop (DEPS 2010) Reliable estimates of the costs and potential impacts on the United States economy of various emissions reduction and other mitigation strategies are critical to

the development of the federal climate change research and development portfolio. At the request of the U.S. Department of Energy (DOE), the National Academies organized a workshop, summarized in this volume, to consider some of these types of modeling issues.



Uncertainty Management in Remote Sensing of Climate Data - Summary of a Workshop (DEPS/DELS 2009) In

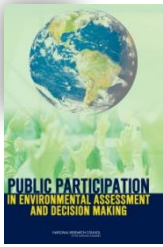
December 2008, the National Academies held a workshop, summarized in this volume, to survey how statisticians, climate scientists, and remote sensing experts might address the challenges of uncertainty management in remote sensing of climate data.

Science and Decisions: Advancing Risk Assessment (DELS 2009) *Science and Decisions* is a

complement to the widely used 1983 National Academies book, *Risk Assessment in the Federal Government* (also known as the Red Book). This book embeds these concepts within a broader framework for risk-based decision-making. Together, these are essential references for those working in the regulatory and public health fields.



*The reports listed do not include all National Academies' reports on Risk and Decision Making. To find more reports on this topic, go to www.nap.edu.



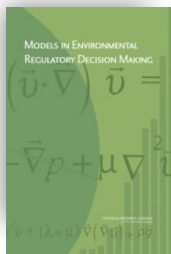
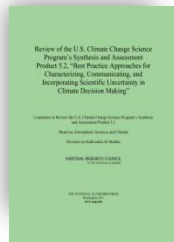
Public Participation in Environmental Assessment and Decision Making (DBASSE, 2008)

This book concludes that, when done correctly, public participation improves the quality of federal agencies' decisions about the environment. Well-managed public

involvement also increases the legitimacy of decisions in the eyes of those affected by them, which makes it more likely that the decisions will be implemented effectively. This book recommends that agencies recognize public participation as valuable to their objectives, not just as a formality required by the law. It details principles and approaches agencies can use to successfully involve the public.

Review of the U.S. Climate Change Science Program's Synthesis and Assessment Product 5.2, "Best Practice Approaches for Characterizing, Communicating, and Incorporating Scientific Uncertainty in Climate Decision Making" (DELS 2007)

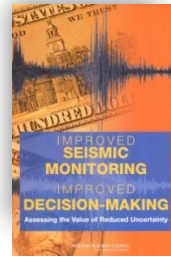
This report reviews the U.S. Climate Change Science Program's new draft assessment product on characterizing and communicating uncertainty information for climate change decision making, one of 21 climate change assessment products that the program is developing to meet the requirements of the 1990 Global Change Research Act.



Models in Environmental Regulatory Decision Making (DELS 2007)

Many regulations issued by the U.S. Environmental Protection Agency (EPA) are based on the results of computer models. Given the critical role played by models, the EPA asked the National Research Council to

assess scientific issues related to the agency's selection and use of models in its decisions. The book recommends a series of guidelines and principles for improving agency models and decision-making processes.



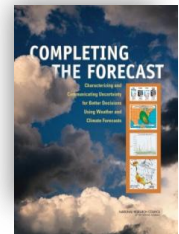
Improved Seismic Monitoring-Improved Decision-Making: Assessing the Value of Reduced Uncertainty (DELS 2006)

Improved Seismic Monitoring Improved Decision-Making, describes and assesses the varied economic benefits potentially

derived from modernizing and expanding seismic monitoring activities in the United States.

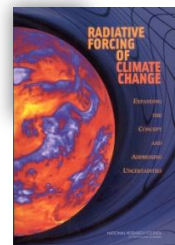
Completing the Forecast: Characterizing and Communicating Uncertainty for Better Decisions Using Weather and Climate Forecasts (DELS 2006)

Uncertainty is a fundamental characteristic of weather, seasonal climate, and hydrological prediction, and no forecast is complete without a description of its uncertainty. Fortunately, the National Weather Service and others in the prediction community have recognized the need to view uncertainty as a fundamental part of forecasts. "Completing the Forecast" makes recommendations to the National Weather Service and the broader prediction community on how to make this transition.



Radioactive Forcing of Climate Control: Expanding the Concept and Addressing Uncertainties (DELS 2005)

The report reviews current knowledge of climate forcings and recommends critical research needed to improve understanding. Whereas emphasis to date has been on how these climate forcings affect global mean temperature, the report finds that regional variation and climate impacts other than temperature deserve increased attention.



Decision Making for the Environment: Social and Behavioral Science Research Priorities (DBASSE 2005)

Decision Making for the Environment: Social and Behavioral Science Research Priorities is the result of a 2-year effort by 12 social and behavioral

scientists, scholars, and practitioners. The report sets research priorities for the social and behavioral sciences as they relate to several different kinds of environmental problems.

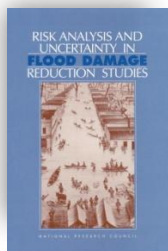


Communicating Uncertainties in Weather and Climate Information: A Workshop Summary (DELS 2003) The report explores how best to communicate weather and climate information by presenting five case studies, selected to illustrate a range of time scales and issues, from the

forecasting of weather events, to providing seasonal outlooks, to projecting climate change.

Risk Analysis and Uncertainty in Flood Damage Reduction Studies (DELS 2000)

This report reviews the Corps of Engineers' risk-based techniques in its flood damage reduction studies and makes recommendations for improving these techniques. The report also includes recommendations for improving the federal levee certification program, for broadening the scope of flood damage reduction planning, and for improving communication of risk-based concepts.

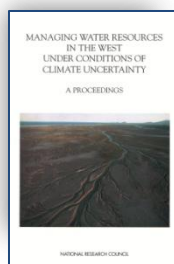
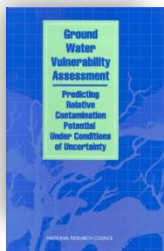


Science and Judgment in Risk Assessment (DELS 1994) The public depends on competent risk assessment from the federal government and the scientific community to grapple with the threat of pollution. When risk reports turn out to be overblown--or when risks

are overlooked--public skepticism abounds. This comprehensive and readable book explores how the U.S. Environmental Protection Agency (EPA) can improve its risk assessment practices, with a focus on implementation of the 1990 Clean Air Act Amendments.

Ground Water Vulnerability Assessment: Predicting Relative Contamination Potential Under Conditions of Uncertainty (DELS 1993)

Since the need to protect ground water from pollution was recognized, researchers have made progress in understanding the vulnerability of ground water to contamination. Yet, there are substantial uncertainties in the vulnerability assessment methods now available. With a wealth of detailed information and practical advice, this volume will help decisionmakers derive the most benefit from available assessment techniques.

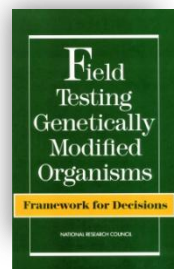


Managing Water Resources in the West Under Conditions of Climate Uncertainty: A Proceedings (DELS 1991) The question of whether the earth's climate is changing in some significant human-induced way remains a matter of much debate. But the fact that climate is variable

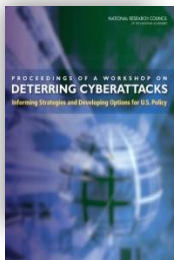
over time is well known. These two elements of climatic uncertainty affect water resources planning and management in the American West. **Managing Water Resources in the West Under Conditions of Climate Uncertainty** examines the scientific basis for predictions of climate change, the implications of climate uncertainty for water resources management, and the management options available for responding to climate variability and potential climate change.

Field Testing Genetically Modified Organisms: Framework for Decisions (DELS 1989)

Potential benefits from the use of genetically modified organisms--such as bacteria that biodegrade environmental pollutants--are enormous. To minimize the risks of releasing such organisms into the environment, regulators are working to develop rational safeguards. This volume provides a comprehensive examination of the issues surrounding testing these organisms in the laboratory or the field and a practical framework for making decisions about organism release.



GLOBAL SECURITY/TERRORISM

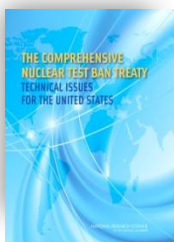
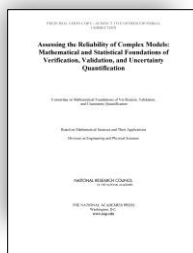


Proceedings of a Workshop on Detering Cyberattacks: Informing Strategies and Developing Options for U.S. Policy (DEPS/PGA 2012) At the request of the Office of the Director of National Intelligence, the National Research Council undertook a project aimed to foster a broad,

multidisciplinary examination of strategies for deterring cyberattacks on the United States and of the possible utility of these strategies for the U.S. government.

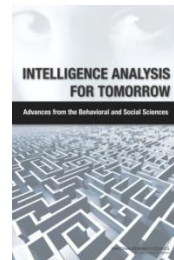
Assessing the Reliability of Complex Models: Mathematical and Statistical Foundations of Verification, Validation, and Uncertainty Quantification (DEPS 2012)

Assessing the Reliability of Complex Models discusses changes in education of professionals and dissemination of information that should enhance the ability of future verification, validation, and uncertainty of quantification (VVUQ) practitioners to improve and properly apply VVUQ methodologies to difficult problems, enhance the ability of VVUQ customers to understand VVUQ results and use them to make informed decisions, and enhance the ability of all VVUQ stakeholders to communicate with each other. This report is an essential resource for all decision and policy makers in the field, students, stakeholders, UQ experts, and VVUQ educators and practitioners.



Comprehensive Nuclear Test Ban Treaty: Technical Issues for the United States (PGA 2012) This report reviews and updates the 2002 National Research Council report, *Technical Issues Related to the Comprehensive Nuclear Test Ban Treaty (CTBT)*. It also assesses

various topics, including: the plans to maintain the safety and reliability of the U.S. nuclear stockpile without nuclear-explosion testing; the U.S. capability to detect, locate, and identify nuclear explosions; commitments necessary to sustain the stockpile and the U.S. and international monitoring systems; and potential technical advances countries could achieve through evasive testing and unconstrained testing.

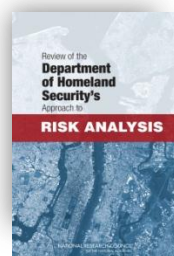
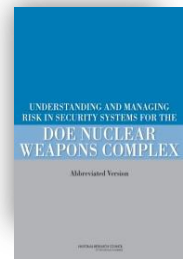


Intelligence Analysis For Tomorrow: Advances from the Behavioral and Social Sciences (DBASSE 2011) In 2008, the Office of the Director of National Intelligence (ODNI) asked the National Research Council (NRC) to establish a committee to synthesize and assess evidence

from the behavioral and social sciences relevant to analytic methods and their potential application for the U.S. intelligence community. This report offers the Director of National Intelligence (DNI) recommendations to address many of the IC's challenges.

Understanding and Managing Risk in Security Systems for the DOE Nuclear Weapons Complex (DELS 2011)

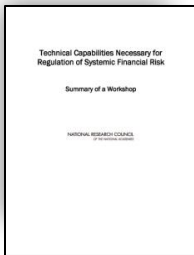
The U.S. Congress directed the National Nuclear Security Administration (NNSA)--a semi-autonomous agency in the U.S. Department of Energy (DOE) responsible for securing nuclear weapons and significant quantities of SNM--asked the National Academies for advice on augmenting its security approach, particularly on the applicability of quantitative and other risk-based approaches for securing its facilities. In carrying out its charge, the committee has focused on what actions NNSA could take to make its security approach more effective and efficient.



Review of the Department of Homeland Security's Approach to Risk Analysis (NRC 2010)

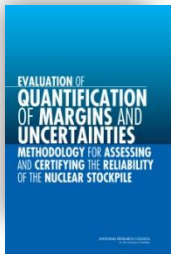
Review of the Department of Homeland Security's Approach to Risk Analysis explores how DHS is building its capabilities in risk analysis to inform decision making. The department uses risk analysis

to inform decisions ranging from high-level policy choices to fine-scale protocols that guide the minute-by-minute actions of DHS employees. In addition to assessing the capability of DHS risk analysis methods to support decision-making, the book evaluates the quality of the current approach to estimating risk and discusses how to improve current risk analysis procedures.



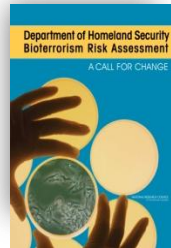
Technical Capabilities Necessary for Regulation of Systemic Financial Risk: Summary of a Workshop (DEPS 2010) The financial reform plans currently under discussion in the United States recognize the need for monitoring and

regulating systemic risk in the financial sector. To inform those discussions, the National Research Council held a workshop on November 3, 2009, to identify the major technical challenges to building such a capability. The workshop, summarized in this volume, addressed the following key issues as they relate to systemic risk: 1) What data and analytical tools are currently available to regulators to address this challenge? 2) What further data-collection and data-analysis capabilities are needed? 3) What specific resource needs are required to accomplish the task? 4) What are the major technical challenges associated with systemic risk regulation? 5) What are various options for building these capabilities?



Evaluation of Quantification of Margins and Uncertainties – Methodology for Assessing and Certifying the Reliability of the Nuclear Stockpile (DEPS 2008) In this book, the National Research Council evaluates: 1) how the national security labs were using QMU, including any significant

differences among the three labs, 2) its use in the annual assessment and 3) whether the applications of QMU to assess the proposed reliable replacement warhead (RRW) could reduce the likelihood of resuming underground nuclear testing. This book presents and assessment of each of these issues and includes findings and recommendations to help guide laboratory and NNSA implementation and development of the QMU framework.

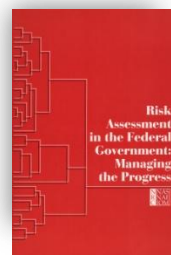
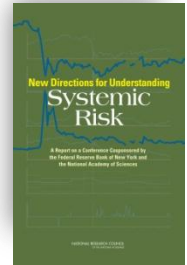


Department of Homeland Security Bioterrorism Risk Assessment: A Call for Change (DELS/DEPS 2008) The mission of *Department of Homeland Security Bioterrorism Risk Assessment: A Call for Change*, is to independently and scientifically review the

methodology that led to the 2006 Department of Homeland Security report, *Bioterrorism Risk Assessment* (BTRA) and provide a foundation for future updates. This book identifies a number of fundamental concerns with the BTRA of 2006, ranging from mathematical and statistical mistakes that have corrupted results, to unnecessarily complicated probability models and models with fidelity far exceeding existing data, to more basic questions about how terrorist behavior should be modeled.

New Directions for Understanding Systemic Risk (DEPS 2007) The stability of the financial system and the

potential for systemic events to alter its function have long been critical issues for central bankers and researchers. To help assess these concerns, the Federal Reserve Bank of New York and the NRC cosponsored a conference to promote better understanding of systemic risk in a variety of fields. The book presents an examination of tools used in ecology and engineering to study systemic collapse in those areas; a review of current trends in economic research on systemic risk, the payments system, and the market of interbank funds; and for context, descriptions of how systemic risk in the financial system affects trading activities.



Risk Assessment in the Federal Government: Managing the Process (DELS 1983) The regulation of potentially hazardous substances has become a controversial issue. This volume evaluates past efforts to develop and use risk assessment guidelines, reviews the experience of regulatory agencies with different administrative arrangements for risk assessment, and evaluates various proposals to modify procedures. The book's conclusions and recommendations can be applied across the entire field of environmental health.

HEALTH



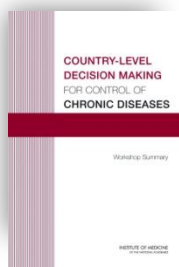
Research Strategy for Environmental, Health, and Safety Aspects of Engineered Nanomaterials (DEPS/DELS 2012)

A Research Strategy for Environmental, Health, and Safety Aspects of Engineered Nanomaterials presents a strategic

approach for developing the science and research infrastructure needed to address uncertainties regarding the potential EHS risks of ENMs. The report summarizes the current state of the science and high-priority data gaps on the potential EHS risks posed by ENMs and describes the fundamental tools and approaches needed to pursue an EHS risk research strategy.

Country-Level Decision Making for the Control of Chronic Diseases: Workshop Summary (IOM 2012)

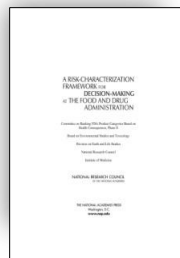
Promoting Cardiovascular Health in the Developing World, found that not only is it possible to reduce the burden of cardiovascular disease and related chronic diseases in developing countries, but also that such a reduction will be critical to achieving global health and development goals. As part a series of follow-up activities to the 2010 report, the IOM held a workshop that aimed to identify what is needed to create tools for country-led planning of effective, efficient, and equitable provision of chronic disease control programs.



Clinical Practice Guidelines We Can Trust (IOM 2011)

Advances in medical, biomedical and health services research have reduced the level of uncertainty in clinical practice. Clinical practice guidelines (CPGs) complement this progress by establishing standards of care backed by strong scientific

evidence. CPGs are statements that include recommendations intended to optimize patient care. These statements are informed by a systematic review of evidence and an assessment of the benefits and costs of alternative care options. *Clinical Practice Guidelines We Can Trust* examines the current state of clinical practice guidelines and how they can be improved to enhance healthcare quality and patient outcomes.



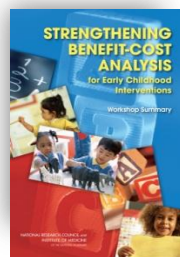
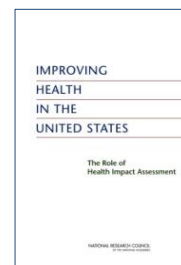
A Risk-Characterization Framework for Decision-Making at the Food and Drug Administration (DELS/IOM 2011)

A Risk-Characterization Framework for Decision-Making at the Food and Drug Administration describes the proposed risk-characterization framework that

can be used to evaluate, compare, and communicate the public-health consequences of decisions concerning a wide variety of products. The framework presented in this report is intended to complement other risk-based approaches that are in use and under development at FDA, not replace them.

Improving Health in the United States: The Role of Health Impact Assessments (DELS 2011)

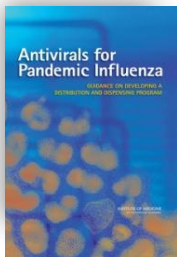
The report presents a six-step framework for conducting HIA of proposed policies, programs, plans, and projects at federal, state, tribal, and local levels, including within the private sector. In addition, the report identifies several challenges to the successful use of HIA, such as balancing the need to provide timely information with the realities of varying data quality, producing quantitative estimates of health effects, and engaging stakeholders.



Strengthening Benefit-Cost Analysis for Early Childhood Interventions: Workshop Summary (DBASSE 2009)

Benefit-Cost Analysis for Early Childhood Interventions summarizes a workshop that was held to explore ways to strengthen benefit-cost analysis so it can be

used to support effective policy decisions. This book describes the information and analysis that were presented at the workshop and the discussions that ensued.



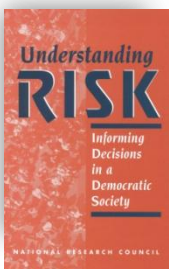
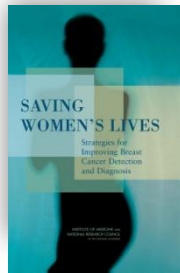
Antivirals for Pandemic Influenza: Guidance on Developing a Distribution and Dispensing Program (IOM 2008)

The Institute of Medicine (IOM) Committee on Implementation of Antiviral Medication Strategies for an Influenza Pandemic was asked by the Department of Health and

Human Services, (DHHS) to consider best practices and policies for providing antiviral treatment and prophylaxis during a pandemic event. This report calls for a national and public process of creating an ethical framework for antiviral use within the context of uncertainty and scarcity.

Saving Women's Lives: Strategies for Improving Breast Cancer Detection and Diagnosis (IOM/PGA 2005)

Building on the 2001 report *Mammography and Beyond*, this new book not only examines ways to improve implementation and use of new and current breast cancer detection technologies but also evaluates the need to develop tools that identify women who would benefit most from early detection screening. *Saving Women's Lives: Strategies for Improving Breast Cancer Detection and Diagnosis* encourages more research that integrates the development, validation, and analysis of the types of technologies in clinical practice that promote improved risk identification techniques. In this way, methods and technologies that improve detection and diagnosis can be more effectively developed and implemented.



Understanding Risk: Informing Decisions in a Democratic Society (DBASSE 1996)

Understanding Risk addresses a central dilemma of risk decisionmaking in a democracy: detailed scientific and technical information is essential for making decisions, but the people who make and live with those decisions are not

scientists. The key task of risk characterization is to provide needed and appropriate information to decisionmakers and the public. This important new volume illustrates that making risks understandable to the public involves much more than translating scientific knowledge. The volume also draws conclusions about what society should expect from risk characterization and offers clear guidelines and principles for informing the wide variety of risk decisions that face our increasingly technological society.