

Workshops - Sunday, December 5

Full Day Workshops – 8:30 am – 5:30 pm
(Lunch is on your own, 12:30-1:30, other than as noted on particular workshop description)

WK 1: New Risk Management Ideas from Nature

Organizer: Tony Cox, Cox Associates

\$190 preregistration; \$240 onsite registration

Over the past four billion years, biological organisms and populations have developed a dazzling variety of methods for coping with risk and uncertainty in unknown and changing environments. Chemotaxis, reflexes, instincts, reinforcement learning, foraging, swarming, immune surveillance, intelligence and reasoning, consciousness, social and pack teamwork, and diversification of genotypes and phenotypes are among the adaptations used in nature to manage risks and to increase the chances of survival. Human risk managers can learn much from this rich array of natural risk assessment and risk management strategies. This course surveys what biology can teach us about effective risk assessment, risk communication, and risk management for individuals, groups, organizations, and crowds. We discuss the challenges posed by complexity, unpredictability, and uncertainty in natural and man-made systems and their environments; identify algorithms and methods to identify hazards and manage risks (e.g., pattern recognition in neural networks, adaptation via reinforcement learning and genetic algorithms, problem-solving via particle swarm optimization, and emergence of evolutionarily stable strategies via distributed interactions); and illustrate biologically-inspired risk management methods via practical applications to risk management of business, engineering, financial, economic, health, and terrorism risks.

WK 2: Benchmark Dose Modeling and Its Use in Risk Assessment – EPA's BMDS Version 2.1.2

Organizer: J. Allen Davis, US Environmental Protection Agency

\$250 preregistration; \$300 onsite registration

This workshop will provide participants with interactive training on the use of the U.S. EPA's Benchmark Dose Software (BMDS), and its application to risk assessment. The course will provide an overview of the BMD process, including determination of data adequacy, model fitting and comparison, and selection of a benchmark response level. This workshop will cover all the

BMD models available in the current version of BMDS as well as the new MS-COMBO model, which calculates multi-tumor composite risk values. Instruction will also be given in regard to additional changes that have been implemented in Version 2.1.2, including model input (expanded file lengths and use of spaces in file names) and output (plot editing and improved Excel export) features. This interactive training workshop in the use of BMDS will consist of a mix of instructor presentations and individual and group class activities. Attendees will work on examples from chemical assessments and learn how to use BMDS to prepare summary reports for insertion in their assessments. Questions and critical discussions of presentation material and class activities are highly encouraged. NOTE: Participants need to bring their own laptops to the workshop with the latest version of BMDS 2.1.2 installed (with necessary administrative rights). The latest version of the software can be found at: <http://epa.gov/ncea/bmbs/>. To ensure students receive the maximum benefit from participating in the workshop, it is recommended that they examine the online training and tutorial materials prior to the workshop. Training and tutorial materials can be found at: <http://www.epa.gov/ncea/bmbs/training/index.html>.

WK 3: Probabilistic Risk Analysis with Hardly Any Information

Organizer: Scott Ferson, Applied Biomath

\$250 preregistration; \$300 onsite registration

This full-day tutorial introduces and compares methods for developing a probabilistic risk analysis when little or no empirical data are available to inform the risk model. The talks are organized around the basic problems that risk analysts face: not knowing the input distributions, not knowing their correlations, not being sure about the model itself, or even which variables should be considered. Possible strategies include traditional approximative methods and recent robust and bounding methods. Numerical examples are given that illustrate the use of various methods including traditional moment propagation, PERT, maximum entropy, uniformity principle, probability bounds analysis, Bayesian model averaging and the old work horse, sensitivity analysis. All of the approaches can be used to develop a fully probabilistic estimate useful for screening decisions and other planning. The advantages and drawbacks of the various approaches are examined. The discussion addresses how defensible decisions can be made even when little information is available, and when one should break down and collect more empirical data and, in that case, what data to collect. When properly formulated, a probabilistic risk analysis reveals

what can be inferred from available information and characterizes the reliability of those inferences. In cases where the available information is insufficient to reach dispositive conclusions, bounding probabilistic risk analysis provides a compelling argument for further empirical research and data collection. The presentation style of the tutorial will be casual and interactive. Participants will receive a booklet of the illustrations and numerical examples used during the tutorial. (NOTE: This workshop is also being offered on Thursday 9 December, see below.)

WK 4: Get More from Your Models – Use Sensitivity Analysis

Organizer: Amir Mokhtari, RTI International

\$245 preregistration; \$295 onsite registration

This workshop will answer key questions faced by those who conduct, manage, or review probabilistic and sensitivity analysis of risk models. When should you perform sensitivity analysis? What are the typical simulation techniques and software packages? What are the roles of uncertainty and sensitivity analyses as value added techniques in risk assessment? How do you prepare a model to facilitate sensitivity analysis? What are key considerations in the development of scenarios that are the basis for sensitivity analysis? What are some typical sensitivity analysis methods and how can you select among them? How should particular sensitivity analysis methods be applied? How should the results of sensitivity analysis be presented and interpreted? This workshop will answer these questions. The methods and case studies presented are based upon several years of research at NC State University (Dr. Frey) and RTI regarding developing quantitative risk assessment models for environmental and microbial systems and research regarding transferring, applying, and adapting sensitivity analysis methods developed in other disciplines to quantitative exposure and risk assessment models. This workshop helps practitioners select specific sensitivity analysis methods relevant to the particular case study and model characteristics. The workshop will also aid in interpreting results from a sensitivity analysis in response to a particular modeling objective. The basic concepts of probabilistic risk assessment will be illustrated using practical case studies. This workshop is aimed at practitioners, managers, or reviewers who wish to refine their knowledge regarding approaches in risk assessment and sensitivity analysis methods.

WK 5: Decision Analysis for Risk Analysts

Organizer: Gregory Parnell, USMA

\$200 preregistration; \$250 onsite registration

Decision analysis is the appropriate operations research technique to help decision makers facing difficult decisions with multiple stakeholders, conflicting objectives, significant uncertainties, and complex alternatives. This workshop presents the fundamentals of decision analysis to help risk analysts understand a related discipline that offers important concepts and techniques that can be used by risk analysts to better meet the needs of their clients and key stakeholders. We present the methodology and art of single objective (usually net present value) and multiobjective decision analysis and introduce the philosophy of Value-Focused Thinking for creating value for customers that focuses on identifying stakeholder values, using values to generate new alternatives, and using values to evaluate the alternatives. Several decision analysis applications are presented including examples of the use of decision analysis and risk analysis concepts incorporated in an integrated analysis framework. In addition to the analytical concepts, the workshop compares three decision analysis approaches (analytic approach, decision conferences, and dialog decision process) to engaging decision makers and stakeholders.

WK 6: Improving Risk Governance: Stakeholder Involvement and Participation

Organizers: Ortwin Renn, Stuttgart University; Marie-Valentin Floring

\$225 preregistration; \$275 onsite registration

The success with which risks are managed in society, in the world, depends on a complex system of risk governance. Not only does risk governance include what we traditionally define as ‘risk analysis’ and ‘risk management’ but it also includes of a range of decision makers, stakeholders, scientists and other experts, or members of the public and the roles they have on decisions throughout the process. Failures of risk governance can often be traced to failures to understand and respond to this ‘bigger picture.’ This workshop focuses on how best to involve stakeholders throughout the process. The basic core of this workshop is formed by a broad conceptual framework for risk governance developed by the International Risk Governance Council (IRGC), a private, non-profit foundation. Their framework was designed to provide a more comprehensive characterization of risk governance — one that builds on foundations of risk analysis and management as embodied in many existing frameworks — and thereby to guide risk analysts and policy makers

around common pitfalls that have been encountered before. The workshop will be a combination of lecture and interactive case studies, development of mock press conferences and other role-playing exercises, and feedback discussions. The cases studies will be draw from recent experiences of the presenters with respect to food and technology. It is designed to help workshop participants think through the issues involved in dealing with inclusive governance both in the design of programs for the governance of new risks and when faced with a crisis.

WK 7: Ecological Risk Assessment Methods for Arid Environments

Organizer: Randall Ryti, Neptune & Co

\$195 preregistration; \$245 onsite registration

This course will cover the assessment of ecological effects over multiple scales of biological organization for terrestrial and aquatic species in arid and semiarid environments. Arid and semiarid environments are important, comprising almost one third of the earth's land surface and most of the western and southwestern United States. The evaluation of ecological effects in such environments needs to be technically defensible; a challenging proposal if risk assessment approaches developed for moist habitats are used. For example, standard terrestrial toxicity bioassays are more applicable to mesic sites than arid sites. This full day offering provides an overview of the tools and challenges for performing ecological assessments in arid and semiarid ecosystems and illustrates the overview with examples. To provide attendees with a more complete understanding of ecological effects characterization in arid environments, this course will demonstrate the special considerations of these environments under Superfund's ecological risk assessment (ERA) framework; illustrate conceptual site model and problem formulation development through biotic transport in the desert and bioaccumulation in arid-adapted species; describe how contamination effects in semi-arid soils can be interpreted using standard toxicity tests and using more site-specific biota; consider special needs and management of aquatic resources in arid environments; and, document the strengths and limitations of using arid ecosystem ERAs to support informed environmental decision making in southwestern and western states. This course is specifically designed to enhance the understanding of ERAs that have been or will be conducted in arid environments.

WK 8: Cumulative Risk Assessment Concepts, Methods and Resources

Organizer: Linda Teuschler, US Environmental Protection Agency

\$375 preregistration; \$425 onsite registration

Public interest has been growing regarding the health effects of environmental exposures and cumulative impacts from multiple chemical and non-chemical (e.g., microbes, noise) stressors on communities. Initiating factors for a cumulative risk assessment (CRA) could include: contaminants in environmental media from multiple pollutant sources; environmental quality metrics, e.g., pollution levels; exposure metrics, including biomonitoring; public health effect metrics; and ecosystem impacts. CRA can be defined as an analysis, characterization, and possible quantification of the combined risks to human health or the environment from multiple agents or stressors. In addition, population and individual vulnerability factors are being recognized as important to consider in a CRA, such as diet/nutritional status, behaviors, genetic traits, socio-economic status, sensitivities, and psychosocial stress. Research efforts focus on multiple chemical and nonchemical stressors, environmental fate across exposure settings, and impacts on vulnerable communities. CRA integrates information across space and time, to produce a population-based risk picture and inform health protection. This workshop highlights concepts, methods, and resources for scoping and conducting a population-based CRA. A central theme is integrating exposure information and population characteristics during CRA planning and scoping based on initiating factors. Then, chemicals or non-chemical stressors are grouped by exposure and toxicity factors for risk evaluation and linked with population vulnerability factors to develop risk characterization information. Methods for estimating human health risks are discussed, including epidemiologic approaches and methods based on existing chemical mixtures risk assessment guidance and toxicological data. Teaching methods include lectures and hands-on exercises. NOTE: Participants are asked to bring a calculator.

WK 9: OFF-SITE FIELD TRIP: Living with the White Death – Managing Risk in Avalanche Country

Organizer: Jon Nepstad

\$130 preregistration; \$180 onsite registration

The Wasatch Mountains on the outskirts of Salt Lake City are home to some of the most spectacular and treacherous avalanche terrain in North America. Past avalanches in these mountains have produced widespread destruction and loss of life on the highways and towns below. But today, this

natural hazard is tamed through a complex risk management network that includes real-time monitoring, forecasting, risk modeling, traffic management and explosive control. This workshop travels by bus to the town of Alta (elevation 8,200 feet), the birthplace of modern avalanche risk management and the battleground between emerging science and this natural hazard. Learn about the risk models, communication networks and forecasting systems aimed at protecting the town and highways. And learn about the methods, ranging from artillery, helicopter bombing and road closures used to keep the public safe. After our morning session indoors, enjoy lunch (on your own) at one of the many eateries at Snowbird Center and then join us for an enclosed aerial tram ride to the summit of Hidden Peak (11,000 feet) for spectacular views (weather permitting) of avalanche start zones and a first-hand look at how ski resorts control avalanche hazard within their boundaries, and the tools they use when the worst happens. NOTE: Portions of this field trip will take place outdoors in a mountain environment, and participants should come prepared with clothing and footwear suitable for walking on packed snow in cold and windy conditions. A release form is required to participate.

Half Day Morning Workshops – 8:00 am – Noon

WK 10: Use of Expert Elicitation to Inform Decision Making

Organizers: Aylin Sertkaya, ERG; Cristina McLaughlin, FDA/CFSAN/OSAS/DMS

\$250 preregistration; \$300 onsite registration

If combined with any afternoon workshop: \$200/\$250

Decision makers must frequently rely on data or information that is incomplete or inadequate. Judgment, often from experts, then plays a critical role in the interpretation and characterization of those data. But how experts are selected and their judgments elicited matters – they can also strongly influence the opinions obtained and the analysis on which they rely. Several approaches to eliciting expert judgments have evolved. The workshop will cover topics ranging from expert recruitment, elicitation protocol design, different elicitation techniques (e.g., individual elicitations, Delphi method, nominal group technique, etc.) to aggregation methods for combining opinions of multiple experts. The role of expert elicitation and its limitations, problems, and risks in policy analysis will also be addressed. The workshop will include presentation of three case studies: 1) from EPA on using expert elicitation to determine the relationship between mortality and exposure to fine particulates; 2) a recent FDA study that evaluated the food safety hazards and preventive controls as-

sociated with transportation and holding of food commodities; 3) EPA's use of the Nominal Group Technique to rank research priorities for nano-TiO₂ and nanomaterials more broadly. All three presentations will include a discussion of the expert selection process; elicitation protocol development, elicitation technique utilized, and the various issues that arose before, during, and after the elicitation process and the manner in which they were resolved. More detailed information on the workshop, as well as related reading, will be posted on the SRA Economics and Benefits Analysis Specialty Group website: www.sra.org/ebasg and on <http://sites.google.com/site/2010sraeeworkshop/>.

WK 11: Multi-Pathway Risk Assessment

Organizer: Stephen Zemba, Cambridge Env. Inc.

\$200 preregistration; \$250 onsite registration

An introduction to multi-pathway risk assessment (MPRA) will be provided, covering both theory and practical implementation issues for human health and ecological risk assessment. MPRA is typically applied to air toxics emissions from combustion facilities, and is an important component of MACT residual risk determinations. A series of models is used to simulate pollutant transport and disposition in the environment, beginning with air dispersion and deposition (e.g., via AERMOD), followed by soil layer mixing, uptake by plants/vegetables, watershed loading analysis (including soil erosion), and food chain accumulation. MPRA is particularly relevant to assessing impacts of bioaccumulative pollutants such as mercury and polychlorinated dibenzo(p)dioxins and furans (PCDD/Fs). MPRA's are frequently based on very scant and uncertain data, e.g., emissions data from a single stack test, and transport factors derived from unrepresentative scenarios. The compounding and linking of models introduces large and complex uncertainties. Because little validation of MPRA methods has taken place, the careful consideration of these uncertainties is essential. The workshop will focus on the basics of MPRA theory, available regulatory guidance, and key factors involved in implementation, with special emphasis on issues relevant to mercury and PCDD/F. Discussion of pitfalls (e.g., models that violate mass conservation) will be included, as well as a case study involving mercury bioaccumulation in fish, in which departure from regulatory default assumptions to realistic parameterizations resulted in risk estimates differing by several orders of magnitude. The workshop will consist mostly of lectures and illustrative examples, but some time will be allocated to open-ended discussion.

WK 12: Managing Enterprise and Project Risks from a Systems Perspective

Organizer: C. Ariel Pinto, Old Dominion University

\$275 preregistration; \$325 onsite registration

This workshop has the objective to develop understanding and skills on the basic framework for the modeling, assessment, analysis, and management of risks in the context of project and engineering enterprises. Topics to be discussed include, but are not limited to introductions to risk and project management, engineering enterprise systems, a systems perspective on project goals and anti-goals, identifying and estimating project risks, and using expert evidence in risk estimation. Also discussed will be generalized processes for project risk management and engineering enterprise risk management, including the characterization of enterprise problem space and capability approach. There will be several short case studies for workshop participants to develop fundamental skills and generate insights.

WK 13: Practice and Approaches in Occupational Risk Assessment

Organizer: Andrew Maier, TERA

\$200 preregistration; \$250 onsite registration

This workshop focuses on special issues for application of the basic steps in the NAS risk assessment paradigm to the unique needs of occupational settings. The workshop will include targeted lecture materials addressing unique and evolving aspects of occupational risk assessment, a case study exercise, and in-class discussions to reinforce key points. Resource links will provide attendees information on a variety of tools and approaches for addressing key topics in worker-health risk assessment. Highlighted technical topics will address: (1) current issues in developing a sampling strategy and interpreting the validity of exposure monitoring data; (2) traditional and advanced methods for developing occupational exposure limits, including the latest developments in assigning hazard notations and hazard bands for chemicals with limited data; and (3) hot topics in occupational risk characterization – including refinements to the traditional hazard index approach to address mixtures, biological monitoring approaches, and methods for addressing non-traditional exposure scenarios.

Half Day Afternoon Workshops – 1:00 - 5:00 pm

WK 14: Risk Analysis: Fundamental Concepts, Applications and Controversies

Organizer: Darrell Donabue, University of Maine

\$230 preregistration; \$280 onsite registration

Meetings and publications of the Society for Risk Analysis can be daunting to newcomers. More generally, risk analysis incorporates and spans many disciplines. It is often difficult for people, even those who work on some topic within risk analysis—be it toxicology, terrorist threat assessment or human behavior—to understand how their work fits into the risk analysis “big picture.” Likewise, disciplinary training does not prepare people to understand, much less converse with, fellow practitioners. This workshop, taught by two experts with extensive histories in practice, government and academia, is designed to fill that gap. We introduce fundamental risk analysis concepts, terminology, applications and calculations. The workshop is suitable for first-time Society for Risk Analysis Annual Meeting attendees, as well as all individuals new to risk analysis and those who have been involved in only a limited aspect of risk analysis. Participants should have an undergraduate degree in an area relevant to risk analysis, and/or relevant work experience. Upon completion of this course, students will understand the origins of risk analysis as well as a number of applications and controversies surrounding risk analysis. They will be prepared to evaluate risk analysis reports and presentations. Most importantly, they will be prepared to engage comfortably in the range of conversations that distinguish Society for Risk Analysis Annual Conferences.

WK 15: Introduction to Behavioral Economics

Organizer: Lisa Robinson

\$250 preregistration; \$300 onsite registration

If combined with any morning workshop: \$200/\$250

Behavioral economics is a large and rapidly growing field, with numerous implications for risk policy design and analysis. Within the Federal government, behaviorally-informed approaches to regulation are receiving significantly increased attention and emphasis. This workshop provides an introduction to behavioral economics for those who are particularly interested in its application to risk management, combining presentations from leading experts with opportunities for questions and discussion. We will begin by introducing the distinction between traditional and behavioral economics, discussing how the latter challenges the assumption that individuals act rationally and make deci-

sions that maximize their welfare. Dr. Paul Slovic, who has conducted extensive research on these issues, will then describe the psychological foundations of behavioral economics in more detail. We will next introduce staff from key Federal agencies who will describe behaviorally-informed design and implementation of risk management strategies in different policy areas. The following session will consider the implications of behavioral research for assessing the benefits and costs of risk-reducing policies. We will conclude by summarizing the effects of behavioral economics on risk management decisions. More detailed information on the workshop, as well as related reading, will be posted on the SRA Economics and Benefits Analysis Specialty Group website: www.sra.org/ebasg.

WK 16: Introduction to Environmental and Health Aspects of Nanotechnology

Organizer: Jo Anne Shatkin, CLF Ventures, Inc.

\$350 preregistration; \$400 onsite registration

This course will provide participants with an overview of the emerging concerns regarding nanotechnology and nanomaterials and impacts for occupational and public health and the environment. The course introduces the topics of nanotechnology, nanotoxicology, environmental aspects of nanotechnology, and addresses ethical, legal, societal and regulatory perspectives. Through lectures and interactive sessions, participants will obtain a knowledge base for understanding the exposure, human health, and safety issues for nanomaterials and nanotechnologies and the potential impacts for workers, consumers, stakeholders, and the environment. Nanotechnology is the understanding and control of matter at dimensions of roughly 1 to 100 nanometers, where unique phenomena enable novel applications. Nanotechnology is emerging in all economic sectors, including: energy, medicine, food technology, imaging, manufacturing, electronics and air and water purification. Some of the current and potential future materials and technologies have the potential for significant impacts on health and the environment. This course introduces participants to the technological basis of nanoscale phenomena, the current and potential future uses of nanotechnology, explores the breadth of issues raised for health and the environment, and implications of current research and gaps on regulatory policy and societal impacts. At the conclusion of this course, the participants will have gained insights into (1) key concerns regarding nanotechnology risks for employees, the public, and the environment; (2) characteristics and properties of nanomaterials and nanotechnologies; (3) nanotoxicology: state-

of-the-science regarding the toxicity of nanomaterials and nanotechnologies; (4) environmental aspects of nanotechnology; and (5) risk assessment and risk management issues for nanomaterials and nanotechnologies.

WK 17: The Evolution of Risk Communication

Organizer: Louie Rivers, Michigan State University

\$225 preregistration; \$275 onsite registration

The field of risk communication is at a crossroad. In traditional technocratic risk governance models, which are becoming increasingly anachronistic, risk communication was a tool for scientists and policy makers to communicate their decisions with the public. As risk governance grows to include greater transparency and stakeholder participation the function and purpose of risk communication is in flux. There is a recognized role for risk communication in the processes of risk assessment, risk evaluation and risk management. However, there is a danger that as risk communication is subsumed into each of these processes it may lose its distinct identity as a separate and equal process. This is an opportunity for researchers to refine what risk communication means in a transparent risk governance framework. Unfortunately, the changing nature of risk communication also presents practical challenges for risk communication practitioners. This workshop explores the changing character of risk communication with a focus on the practical ramifications. The workshop will be divided into three sections. The first part will focus on the current state of risk communication and the historical processes that have led to this current state. The second part examines several theoretical/methodological risk communication concepts from a practical standpoint (mental models, social amplification of risk framework and framing). The final part of the workshop will reference the themes explored in the first two sections via two case studies (Hurricane Katrina and America and climate change). The workshop will be a mix of presentations, small group working sessions and large group discussions.

Thursday, December 9 Workshop – 8:30 am – 5:30 pm

WK 18: Probabilistic Risk Analysis with Hardly Any Information

Organizer: Scott Ferson, Applied Biomath

\$250 preregistration; \$300 onsite registration

See description for Workshop #3; this workshop is also offered Sunday – please identify your day choice when registering.