

### **Morning Workshops: 8 AM-Noon**

#### **WK1: Risk Analysis: Fundamental Concepts, Applications and Controversies.**

*Organizer: David Hassenzahl, University of Nevada Las Vegas*

Preregistration: \$225/Onsite Registration: \$250

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 three 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, 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.

*Further information about this workshop can be found at:*

*<http://www.unlv.edu/faculty/dmh/SRAWorkshop2007/>*

#### **WK2: Evaluating the Human Relevance of Modes of Action in Animals.**

*Organizer: Stephen Olin, ILSI Research Foundation*

Preregistration: \$225/Onsite Registration: \$250 (**\$50 discount per workshop applies if also taking WK9**)

This half-day workshop presents a systematic approach to characterizing the mode(s) of action (MOA) of toxicants and will give participants “hands-on” experience in the application of a framework for evaluating the relevance of an animal mode of action in assessing human risk. Frameworks for characterizing MOA data for carcinogens and analyzing its human relevance have been developed over the past decade and, more recently, these concepts have been extended to non-cancer endpoints. The evaluation of mode of action is becoming a routine component of regulatory risk assessments, and an important consideration is always whether the MOA determined in animals can be assumed to be directly applicable for humans. This workshop will demonstrate the use of an MOA human relevance framework, through a combination of lecture and interactive case studies with group participation. Opening tutorial presentations will introduce workshop participants to basic concepts and walk them through a model case study. This leads into a series of facilitated case studies in which participants, working in small groups, analyze “real world” examples of varying complexity. The course will show clearly how the framework analysis is done, illustrate the importance of a systematic evaluation of the available data, and provide course participants with the tools and confidence to begin applying the MOA/human relevance framework in their own work. The speaker/facilitators for this workshop – Dr. Vicki Dellarco, Dr. Penny Fenner-Crisp, and Ms. Bette Meek – have been leaders in the development of MOA human relevance analysis and have extensive experience in its practical use.

*Further information about this workshop can be found at:*

*<http://rsi.ilsil.org/Projects/RFSRA.htm>*

#### **WK3: Introduction to Environmental and Health Aspects of Nanotechnology.**

*Organizer: Jo Anne Shatkin, CLF Ventures*

Preregistration: \$300/Onsite Registration: \$325 (**\$50 discount per workshop applies if also taking WK10**)

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.

*(Registrants should note that content on this topic will also be provided by the workshop organizer in Session T.3-B offered on Tuesday at 2:00-3:30 during the SRA Annual Meeting.)*

#### **WK4: Incorporating "Omic" Information into Risk Assessment and Policy.**

*Organizer: Elaine Faustman, University of Washington*

Preregistration: \$275/Onsite Registration: \$300

This half-day course is designed for risk practitioners who have an interest in the emerging technologies of genomics, proteomics, and metabolomics – increasingly referred to as “Omics”. We will provide both a general overview of the science and describe how they are used in risk assessment and policy. The course will proceed in three discrete modules:

*The Omic Revolution:* The overview will provide background information to understand the central paradigm of the connection between DNA, RNA, and proteins in the functioning of cells and organisms. This session will include a brief introduction to transcription and translation and the flow of information from genes to functional protein. We will provide a definition of “omics and new “omic” technologies will be discussed including genomics, proteomics, metabolomics, metabonomics, nutrigenomics.

*The Omic Revolution’s Impact on Risk Assessment:* The use of “omic” tools in science is providing new ways to understand the impact of environmental exposures of toxicants on living organisms. We will review examples of how these tools are used to understand toxicological response at the molecular, cellular, organ and organism levels. We will also look at their use in defining mechanisms of toxicity and susceptibility. Examples of how information from new “omic” tools can be incorporated into human health risk assessment. The importance of understanding the sources of variability in applying “omic” tools will be emphasized. Approaches and issues related to data analysis, experimental design, and bioinformatics will be discussed.

*Current Incorporation into Policy:* We will look at current policies and practices for incorporating information from “omic” tools into Risk Assessment at two Federal agencies, USEPA and USFDA and discuss future directions within genomics.

*Further information about this workshop can be found at:*

*[http://depts.washington.edu/irarc/SRA\\_genomics\\_seminar.html](http://depts.washington.edu/irarc/SRA_genomics_seminar.html)*

#### **WK5: Geochemical Evaluations of Metals in Environmental Media: How to Distinguish Naturally Elevated Metals Concentrations from Site-Related Contamination.**

*Organizers: Jonathan Myers, Karen Thorbjornsen, Shaw Environmental, Inc.*

Preregistration: \$250/Onsite Registration: \$275

Do you really have metals contamination at your site? Metals concentrations in soil, sediment, groundwater, and surface water are problematic in site investigations because they often exceed screening criteria. It is not always clear whether these represent site-related contamination or simply naturally high concentrations. However, it is well known that trace elements naturally associate with a limited number of minerals in the soil and sediment matrix (or with specific suspended particulates in groundwater and surface water) under a given set of environmental conditions. These well-understood processes result in strong correlations between trace elements and major elements. Positive correlations and consistent elemental ratios are observed in scatter plots of specific trace versus major element pairs in uncontaminated samples. Contaminated samples are identified by their positions off the natural trend, indicating

anomalously high elemental ratios. For groundwater and surface water, additional factors are considered such as pH effects, redox effects, aqueous complexation, and salinity gradients.

This approach for evaluating metals has several advantages: it greatly reduces the probability of falsely identifying contamination where none exists; does not require a large, statistically valid set of background samples; precisely identifies contaminated locations, thereby focusing remediation efforts; and, unlike a purely statistical approach, provides mechanistic explanations for naturally elevated trace element concentrations. The geochemical evaluation techniques that are presented allow investigators to distinguish between natural concentrations and potential contamination, without performing geochemical modeling, acquiring nonstandard analytical data, or adding significantly to overall project cost. The instructors have successfully applied these techniques at many facilities, providing insightful case studies for the workshop.

#### **WK 6: Extensions to Probabilistic Risk Analysis Using Possibilistic Mathematics.**

*Organizer: Arlin Cooper, Sandia National Laboratory*

Preregistration: \$175/Onsite Registration: \$200

This half-day workshop introduces a family of mathematical structures, many built around possibility theory (including fuzzy mathematics), for estimating risk and propagating uncertainty in quantitative analyses where objective data are limited. These analyses, while less powerful than conventional analyses where data are abundant, can be effective tools for situations involving sparse data. As one example for utilizing uncertain parameters, we show that interval analysis (when used with care) has features that serve as a basis for more sophisticated mathematical structures. Some of the details can be subtle, and inattention to these details can lead to overly large bounds or erroneous conclusions. Consequently, some of the topics will be: (1) how the math you are tempted to use can hurt you, (2) how to mathematically specify inputs when data are sparse, (3) comparison with other (e.g., conventional) methods of uncertainty analysis, and (4) combining possibility and probability theories in a hybrid analysis. The methods will be applied to several examples and case studies, including fault tree and event tree assessment, as well as “latent effects analysis.” Participants will be expected to share their individual backgrounds and experiences as applicable to the approaches addressed. Handout “notebooks” will provide copies of the slides used and supporting material, with room for note-taking.

*Further information about this workshop can be found at:*

*<http://www.ramas.com/intervalfuzzy.htm>*

#### **WK7: Brownfield Redevelopment Using EPA’s Free Decision Analysis Support System: SMARTe.**

*Organizers: Kelly and Paul Black, Neptune and Company, Inc.*

Preregistration: \$150/Onsite Registration: \$175

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*Further information about this workshop can be found at:*

*<http://www.smarte.org>*

## **Afternoon Workshops: 1-5 PM**

### **WK8: Current Topics in Risk Analysis.**

*Organizer: David Hassenzahl, University of Nevada Las Vegas*

Preregistration: \$225/Onsite Registration: \$250

The Society for Risk Analysis now comprised of a range of specialty groups. These include Biological Stressors, Decision Analysis and Risk, Dose-Response, Ecological Risk Assessment, Economics and Benefits Analysis, Emerging Nanoscale Materials, Engineering and Infrastructure, Exposure Assessment, Risk Communication, and Risk Policy and Law. Expert representatives from these specialty groups will give presentations summarizing major topics in their fields.

*Further information about this workshop can be found at:*

*<http://www.unlv.edu/faculty/dmh/SRAWorkshop2007/>*

### **WK9: Replacing Default Values for Uncertainty Factors with Chemical-Specific Adjustment Factors: Reducing Uncertainty in Noncancer Risk Assessment.**

*Organizers: Lynne Haber, Andrew Maier, TERA*

Preregistration: \$225/Onsite Registration: \$250 (**\$50 discount per workshop applies if also taking WK2**)

The World Health Organization, through the International Programme on Chemical Safety (IPCS), has established guidance on the use of mechanistic data to replace default uncertainty factors for interspecies extrapolation and intraspecies variability in deriving risk values such as Reference Doses (RfDs) and Tolerable Concentrations (TCs). This guidance informs the choice and application of data that can be used to replace defaults with chemical specific adjustment factors (CSAFs), resulting in values that better reflect the data for the chemical of interest. Under the CSAF framework, the uncertainty factors for interspecies differences (UFA) and human variability (UFH) are first subdivided into toxicokinetic (TK) and toxicodynamic (TD) components. The data relevant for each subcomponent is then evaluated to determine whether chemical-specific data can be used in place of the default. Use of the CSAF framework allows the improved use of available data in deriving risk values, and can assist in targeting new studies to address uncertainties and lead to more accurate risk values. CSAFs have been used by the U.S. EPA in deriving an RfD for boron and by Health Canada in deriving a TC for 2-butoxyethanol. This half-day workshop will provide a brief review of the use of uncertainty factors and historical perspective on the reliance on quantitative data to develop values for inter- and intraspecies extrapolation. The course will focus on the IPCS methodology for CSAF development, including the thinking process and steps used for evaluating data. Examples and classroom activities will be used as instructional aids.

*Further information about this workshop can be found at:*

*[http://www.tera.org/education/SRA\\_CSAF2007.htm](http://www.tera.org/education/SRA_CSAF2007.htm)*

### **WK10: Nanomaterials Risk Management: Current Developments and Trends.**

*Organizer: Igor Linkov, Intertox*

Preregistration: \$300/Onsite Registration: \$325 (**\$50 discount per workshop applies if also taking WK3**)

With 300 products in use today, what information is available to demonstrate that nanomaterials do not pose unnecessary risks to human and environmental health? What areas are in need of EHS science? How could risks and environmental impacts of nanomaterials throughout the product life-cycle be minimized with engineering practices to improve product safety and to avoid potential future litigation? Our training course is designed to help you navigate the ever-changing world of nanotechnology.

The half-day-long training course will cover a diverse range of topics essential for professionals in nanotechnology and biotechnology. Topics will include a discussion of the current understanding of nanomaterial risks, EHS state-of-the-practice in companies involved with nanomaterials, a discussion of current and anticipated regulatory developments in the field, a primer on the toxicology of nanomaterials (including ecotoxicological issues), and an assessment of appropriate occupational safety and health practices associated with these technologies.

Participants should expect to gain an awareness of the critical issues in this evolving field and a set of conceptual tools needed to make decisions and prioritize challenges in their own organizations.

Nanotechnology is a broad and complex field of research and manufacturing with many discrete decision-points. For example, some decisions might be based upon an ability to predict which nanomaterials will have favorable chemical characteristics and lower toxicities, to identify important knowledge and

technology gaps, and to develop effective communication with stakeholders and the general public. This course is intended to facilitate those who must make these decisions in an uncertain environment. (Registrants should note that content on this topic will also be provided by the workshop organizer and joint instructors in Session W.1-B offered on Wednesday at 8:30-10 during the SRA Annual Meeting.)

**WK11: Use of Internal Doses in Health Risk Assessment of Chemical Mixtures.**

*Organizers: Linda Teuschler, Glenn Rice, US Environmental Protection Agency*

Preregistration: \$249/Onsite Registration: \$274

This half-day workshop presents methodologies for using internal doses to assess cumulative health risk from exposure to chemical mixtures, emphasizing issues such as internal dose metrics, physiologically-based pharmacokinetic modeling, toxicological interactions and multiple route exposures. A brief overview will be given on basic concepts and terminology, including a simple one compartment PBPK model; the bulk of the course will discuss uses of internal dose information in chemical mixture health risk assessment and present hands on exercises for several important classes of chemical mixtures (e.g., pesticides, metals, drinking water disinfection by-products). Workshop topics include the development of Relative Potency Factors based on internal dose metrics, mechanistic information on and interpretation of toxicological interactions, PBPK modeling of changes in kinetics for a binary mixture, and chemical mixtures exposure and risk assessment using multiple route internal doses. Discussions include real world examples, exercise results, and general questions and comments. This course provides information on the latest methods for using internal doses to assess exposure and risk of chemical mixtures. It targets people familiar with chemical mixtures risk assessment who are interested in stretching beyond simple concepts. For example, interested individuals might include those who have conducted Superfund/RCRA site assessments, worked on Food Quality Protection Act (1996) issues regarding cumulative risk, conducted pharmacokinetics modeling, been involved with human or toxicological studies on chemical mixtures or taken an introductory course in Chemical Mixtures Health Risk Assessment. Emphasis will be on the presentation of new approaches and hands-on exercises representing the latest thinking in this area.

*Further information about this workshop can be found at:*

*<http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=155775>*

**WK12: Introduction to Regional Scale Ecological Risk Assessment.**

*Organizer: Wayne Landis, Western Washington University*

Preregistration: \$300/Onsite Registration: \$325

Risk assessment is a decision making tool based upon the quantification of the probabilities of effects (risks) upon ecological receptors. In this course we will outline the basics of landscape ecology and apply them using the relative risk model (RRM). Regional risk assessment requires the use of the tools of population dynamics and landscape ecology in an environment with multiple stressors and multiple receptors. The multiple stressors can be contaminants, changes in land use and habitat, dams, elevated temperature, the introduction of non-native species and the change in the patchiness of the environment. Regional risk assessment has been used to estimate risks due to contaminants in a watershed, the loss of productivity of a fishery, natural resource management, and the management of invasive species. First the course summarizes the basics of landscape thinking, especially the hierarchical patch dynamics paradigm. Next the course will cover the construction of conceptual models, the assignment of ranks, calculation of risk and estimating uncertainty. Examples of studies from North America, Australia, and Australia will be reviewed. Finally, communicating risks at the landscape or regional scale will be introduced. The last third of the class will involve teams evaluating examples of regional risk assessments applying the fundamentals of the relative risk model.

*Further information about this workshop can be found at:*

*<http://www.ac.wvu.edu/~ietc/riskassessmentoutline.html>*

**WK13: Statistical Analysis with the R Programming Language.**

*Organizer: Patrick Gurian, Drexel University*

Preregistration: \$65/Onsite Registration: \$90

This workshop is designed for a risk analyst who is beginning to find the spreadsheet environment constraining and wishes to gain familiarity with a freely available and powerful tool for risk assessment, the R statistical programming language. Participants will learn the theory of maximum likelihood estimation as

a means of estimating both dose-response functions and exposure distributions for risk assessment. Participants will then complete a hands-on exercise using R to estimate an exposure model. The second half of the class will cover the conceptual basis of bootstrapping as a means to assess parameter uncertainty and will involve a second hands-on programming exercise on this topic. The combination of maximum likelihood estimation and bootstrapping will allow participants to fit a wide variety of statistical models and to assess the uncertainty in these models. As R is freely available, participants will be able to use this tool at their home institutions. Participants must provide their own laptop computers and should download and install R by visiting [www.r-project.org](http://www.r-project.org) before attending the workshop.

*Further information about this workshop can be found at:  
<http://www.pages.drexel.edu/~plg28/SRA.doc>*

### **Full-Day Workshops: 8 AM-Noon, 1-5 PM**

#### **WK14: Improving Risk Governance: Defining a Better Process for Risk Communication and Stakeholder Participation.**

*Organizers: Ortwin Renn, State University in Stuttgart, Germany; Ragnar L. f̄stedt, King's College, UK*  
Preregistration: \$300/Onsite Registration: \$350

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.' In this workshop, we focus on a major challenge to successful risk governance – risk communication 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 in Geneva, Switzerland. Their risk governance framework was designed to provide a more comprehensive characterization of risk governance – one that builds on foundations of risk analysis and risk management as embodied in many in 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, including development of mock press conferences and other role-playing exercises, and feedback discussions. The cases studies will be draw from recent experiences of the two presenters on the governance of food safety. It is designed to help workshop participants think through the issues involved in dealing with risk communication both in the design of programs for the governance of new risks and when faced with a crisis.

#### **WK15: Methods for Probabilistic and Sensitivity Analysis of Risk Models.**

*Organizers: Amir Mokhtari, Research Triangle Institute; Chris Frey, North Carolina State University*  
Preregistration: \$295/Onsite Registration: \$345

Those who conduct, manage, or review probabilistic and sensitivity analysis of risk models face key questions – such as: When should you perform sensitivity analysis? What are 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 be presented and interpreted? This workshop will answer these questions.

Methods and case studies are presented based upon several years of research developing quantitative risk assessment models for environmental and microbial systems, including NC State research regarding transferring, applying, and adapting sensitivity analysis methods developed in other disciplines (e.g. complex engineering systems) to quantitative exposure and risk assessment models. That research resulted in guidance regarding selection, application, and interpretation of sensitivity analysis methods applied to quantitative risk assessment models. This workshop will help practitioners select specific sensitivity analysis methods relevant to a particular case study and to the characteristics of the model, and to help interpret results from a sensitivity analysis in response to a particular modeling objective. Participants will be provided with course notes, a copy of the guidance document, and a tutorial with

examples for how to perform sensitivity analysis using common methods. The basic concepts of probabilistic risk assessment will be illustrated using software packages such as @Risk and Crystal Ball. Uncertainty and sensitivity analysis methods will also be illustrated with practical case studies.

*Further information about this workshop can be found at:  
<http://www4.ncsu.edu/~frey/SRA/Workshop07/>*

#### **WK16: Probabilistic Risk Analysis with Hardly Any Data.**

*Organizers: Scott Ferson, W. Troy Tucker, Applied Biomathematics*

Preregistration: \$240/Onsite Registration: \$290

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 highlighted and compared. 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 and a CD with these files for their personal use.

*Further information about this workshop can be found at:  
<http://www.ramas.com/nodata.htm>*

#### **WK17: Benchmark Dose Modeling and Its Use in Risk Assessment.**

*Organizers: Jeff Gift, Angela Howard, Jay Zhao, US Environmental Protection Agency*

Preregistration: \$225/Onsite Registration: \$275

This training course is designed to provide participants with an overview of benchmark dose modeling for cancer and noncancer dose-response assessment, and to provide a hands-on experience in using the EPA's BMDS software. Through this training course, participants will learn the basic concept of the BMD approach, when BMD modeling is appropriate, how to select an appropriate model and appropriate data to model, how to conduct benchmark modeling, and how to select an appropriate BMD as the point of departure for use in a human health risk assessment. This workshop will cover all the BMD models available in the current version of the EPA's BMDS software in enough depth to allow attendees to perform basic analyses of dichotomous, continuous and nested dichotomous data on their own. Pitfalls of modeling, helpful hints and future planned improvements to the BMDS software will also be addressed. It is expected that all participants bring their own computers with the BMDS software installed prior to the workshop. The latest BMDS software (1.4.1) can be downloaded from [www.epa.gov/ncea/bmds.htm](http://www.epa.gov/ncea/bmds.htm).

#### **WK18: Using EPA's CatReg Software in Risk Assessment for the Evaluation of Concentration (Dose)-Time-Response Relationships.**

*Organizer: Kenneth Brown, consultant*

Preregistration: \$225/Onsite Registration: \$275

Attendees of this course will receive an introduction to the use of the CatReg Software program in the analysis of toxicological data for chemical risk assessment. CatReg uses a categorical regression approach to data analysis. There are often categories of severity of an adverse response (e.g., no effect, mild effect, irreversible effect, life-threatening effect) that can provide additional information to supplement traditional dose-response assessment methods. It is particularly well suited to the assessment of risk where exposure duration may be an important factor in the occurrence of adverse effects. CatReg allows users to estimate, for example, the doses across exposure durations (time) that would have a 10%

probability (ERC<sub>10</sub>) of causing a particular effect severity or higher, taking into account the exposure concentrations and durations that cause effects in all user defined severity categories.

This workshop will discuss options available within CatReg, including modeling options (e.g., probit/log-probit or logit/log-logit), and other options for addressing the relationship between response curves of different severity levels. Other features that will be highlighted through case examples include: (1) the calculation of the value of the parameter “n” in C<sup>n</sup>T (as proposed by ten Berge et al., 1986) which can be estimated for concentration-time relationships; (2) how to use stratification (i.e., segregation of data to compare results) and (3) testing to determine how covariates that differ between studies, such as species, affect the concentration-response relationship.

*Further information about this workshop can be found at:*

*<http://www.CatRegWorkshop.com>*

### **WK19: From Quantitative Risk Assessment to Cost-Benefit Analysis to Risk Management: How to Use Different Tools, Methods, and Techniques for Better Decision Making.**

*Organizer: Cristina McLaughlin, US Food and Drug Administration*

Preregistration: \$200/Onsite Registration: \$250

This workshop will provide risk managers and other risk professionals with tools to help interpret health outcomes estimated in risk assessments, see how those outcomes are used in a cost benefit analysis, and use that information to make risk-based decisions. The focus is on techniques currently being used to integrate risk assessment into cost-benefit analysis, and how they can be used to arrive at a decision. Decision making can be complicated when analyzing multiple options and hazards because it is hard to balance the interests of different stakeholders. Economics provides methods to characterize trade-offs and – if not necessarily pointing to a single optimal decision – provide decision makers with better information when making difficult choices among options. That information may show when it is better to use self-interest or mixed incentives in serving the public interest, and when more prescriptive measures are needed. Risk assessment provides methods to show how to use probability distributions instead of deterministic calculations when deciding among options.

The morning session will illustrate advantages of different models for estimating impacts of public or private actions that affect the environment, food, and water, and how these models can be used to predict unforeseen market or consumer behaviors that may lead to offsetting risks. Different quantitative risk assessment models and techniques will be presented, with examples of how they are incorporated in a cost-benefit analysis, and relative usefulness of different types of data in risk assessments and cost-benefit analyses will be discussed. In the afternoon, a panel will discuss hypothetical or real problems in risk assessment and cost-benefit analysis for a case study, and then for problems submitted by participants in advance or at the workshop.

### **WK20: Managing Multi-Criteria Environmental Contamination Problems: Software Tools.**

*Organizer: Terry Sullivan, Brookhaven National Laboratory*

Preregistration: \$300/Onsite Registration: \$350

The workshop will provide an overview of types of software tools and functionality commonly needed to address complex environmental contamination problems. These problems are often complex due to the need to incorporate many differing measures and views into the decision process. Environmental decision-making strategies have evolved with the development of computer capabilities and analytical tools. Strategies often involve subjective judgment to incorporate public and stakeholder values, cost-benefit analysis, toxicological risk assessment, ecological risk assessment, and methods to combine all these measures. This evolution has led to an improved array of decision-making aides, including multi-criteria decision analysis (MCDA) tools for a scientifically sound decision analytical framework. MCDA methods and MCDA and geographic information systems (GIS) tools both contribute to the possibility of practical implementation of these approaches/methods for environmental problems.

The workshop is geared towards providing a fundamental level of understanding on the application and use of multi-criteria decision analysis tools for environmental problems. Following an overview of existing environmental decision support tools and the many criteria (cost, ecological risk, environmental risk, societal values, etc.) that are part of the decision process, the concept of multi-criteria decision analysis tools will be introduced and basic MCDA methods covered. The DECERNS (Decision Evaluation for Complex Risk Network Systems) decision support software tool will serve as a teaching aid. DECERNS integrates GIS, MCDA, cost/benefit, and risk tools into a common web-based platform for

integrated analysis. Discussion of each component will begin with an overview of the general capabilities and functionality of the models and progress to practical applications. The course will culminate with a case study that integrates different components into the analysis within a consistent framework.

*(Registrants should note that content on this topic will also be provided by the workshop organizer and joint instructors in Session T.3-H offered on Tuesday at 2:00-3:30. during the SRA Annual Meeting.)*