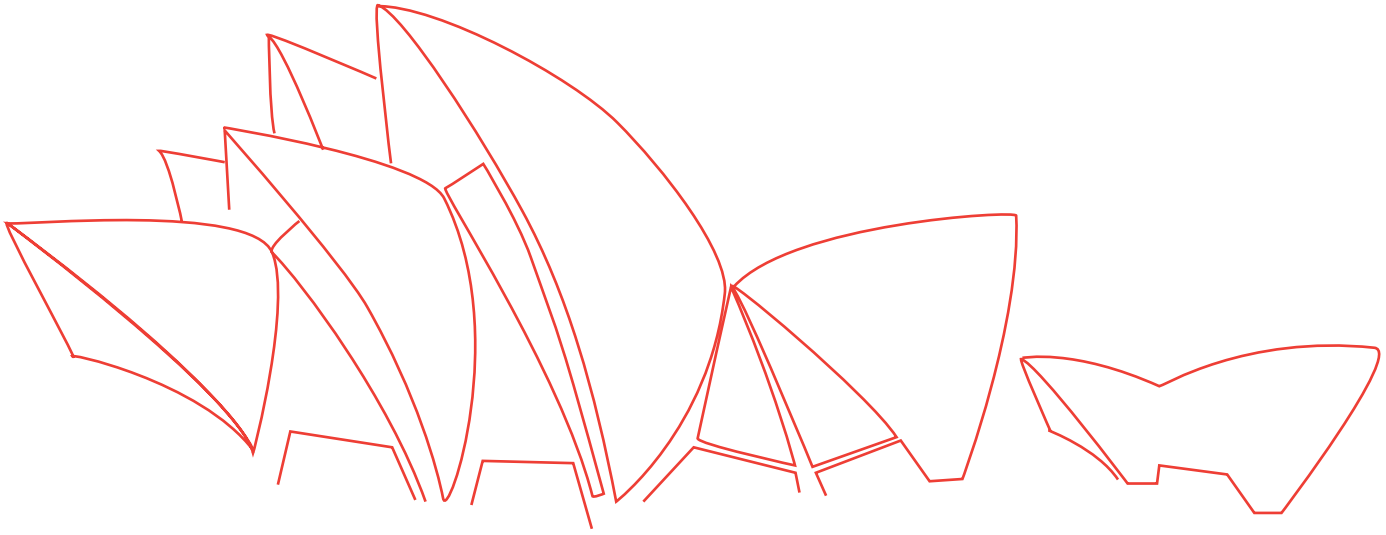
Society for Risk Analysis

World Congress on Risk 2012

"Risk and Development in a Changing World"



FINAL PROGRAM

Sydney Convention and Exhibition Centre
Darling Harbour, Sydney, Australia
17-20 July 2012

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Registration Hours

Novotel Darling Harbour Hotel

Tuesday, 17 July ..... 5:00-7:00 pm

Sydney Convention and Exhibition Centre

Wednesday, 18 July ..... 8:00 am-4:00 pm

Thursday, 19 July ..... 8:00 am-4:00 pm

Friday, 20 July ..... 8:00 am-3:00 pm

World Congress on Risk 2012:
Risk and Development in a Changing World

Background

The World Congress on Risk 2012, being held on 17-20 July in Sydney, Australia, focuses on the theme "Risk and Development in a Changing World." This is the third in the series of World Congresses on Risk, organized by the Society for Risk Analysis (SRA) to further develop the field of risk analysis and its applications worldwide. In partnership with other professional societies and organizations, the SRA launched the first of this series in 2003 in Europe, and held the second in 2008 in Mexico. The theme for 2012, "Risk and Development in a Changing World," invokes the global trend toward better use of risk-based concepts, tools, and processes (derived from both research and practice) in science, decision-making and risk management. The SRA deeply appreciates core support from two additional major sponsors in 2012, the US National Science Foundation (NSF) and the Alfred P. Sloan Foundation, along with many contributing sponsors, partners, and scientific and professional organizations.

Conference Coordinator:
Society for Risk Analysis,
1313 Dolley Madison Blvd., Suite 402; McLean, VA 22101
web: www.SRA.org; email: SRA@BurkInc.com

World Congress 2012 Co-Chairs:
Alison Cullen, University of Washington
Daniela Leonte, Australian Department of Health/NICNAS
Jonathan Wiener, Duke University

Recognition

We recognize and express thanks for the generous support of our participating organizations and financial sponsors, including:

World Congress Sponsors - Core Leadership Level:
US National Science Foundation
Alfred P. Sloan Foundation
Society for Risk Analysis

World Congress Supporters:
Australian Centre of Excellence for Risk Analysis
American Chemistry Council
Minerals Industry Safety and Health Centre, Sustainable Minerals Institute, The University of Queensland

Friends of the Society for Risk Analysis:
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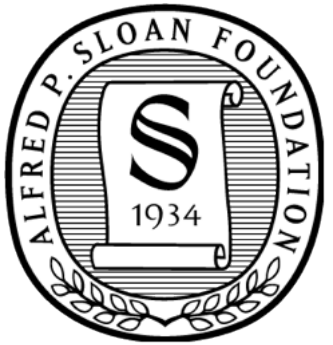
And we thank the many organizations that sponsored individual sessions (see list on page 6).

Special thanks to our Core Leadership Sponsors



	Bayside 204 A	Bayside 204 B	Bayside 203	Bayside 202	Bayside 201
Wednesday 18 July 2012	08:30 - 10:00 W1-A Framing the Risks of Climate Change	08:30 - 10:00 W1-B Symposium: Trust and Risk Perception	08:30 - 10:00 W1-C Symposium: New Approaches to Old Chemicals: Assessing the Risks of Existing Chemicals...		
	10:30 - 12:00 W2-A Symposium: Risk Assessment, Sustainable Development and Multi-Criteria Decision Analysis	10:30 - 12:00 W2-B Risk Perception and Communication	10:30 - 12:00 W2-C Symposium: Risk Emergence and Emerging Risk: The IRGC Project	10:30 - 12:00 W2-D Symposium: Advances in Risk Assessment Methodologies	10:30 - 12:00 W2-E Symposium: Product Liability in a Global Marketplace
	Wednesday Plenary Luncheon - Extreme Risks: Shocks & Disasters; 12:00-13:30, Parkside Ballroom B *Speakers: Pierre-Alain Schieb and David Zhang*				
	14:00 - 15:30 W3-A Disasters, Socioeconomic Development and Modeling Methods	14:00 - 15:30 W3-B Perception and Communication in Nuclear, Mercury, Metals and Medicine	14:00 - 15:30 W3-C Symposium: iNTeg-Risk Project: Part 1	14:00 - 15:30 W3-D Symposium: Tools for Quantitative Microbial Risk Assessment	14:00 - 15:30 W3-E Symposium: Public Decision Making and Risk Management
	Poster Session 1 - 15:30 - 16:00; Bayside Terrace				
	16:00 - 17:30 W4-A Energy Risks and Governance	16:00 - 17:30 W4-B Perception and Communication	16:00 - 17:30 W4-C Symposium: iNTeg-Risk Project, Part 2	16:00 - 17:30 W4-D Symposium: Quantitative Microbial Risk Assessment and Water Supply Management	16:00 - 17:30 W4-E Symposium: Biosecurity and Intelligence Analysis
Thursday 19 July 2012	**Thursday Plenary Session, Synthetic Genomics, Risk and Governance - Sponsored by the Alfred P. Sloan Foundation**; 08:30 - 10:00, Bayside 204 AB *Speakers: Michele Garfinkel and Robert Friedman*				
	Poster Session 1 - 10:00 - 10:30; Bayside Terrace				
	10:30 - 12:00 T2-AB Symposium: Emerging Risks and Synthetic Biology: Part 1		10:30 - 12:00 T2-C Risk and Disease	10:30 - 12:00 T2-D Symposium: Extreme Event Risks: Low-Probability, High-Consequence	
	A Roundtable on Risk Challenges, World Development, and *Risk Analysis: An International Journal*; 12:00-12:40, Bayside 203 **Roundtable on Regional Affairs and SRA Integration**; 12:45-13:25, Bayside 202				
	13:30 - 15:00 T3-A Toxic Exposures	13:30 - 15:00 T3-B Emerging Risks and Synthetic Biology: Part 2	13:30 - 15:00 T3-C Global Financial Risks/Assessing Emerging Risks	13:30 - 15:00 T3-D Symposium: Issues Emerging after the 3.11 Earthquake in Japan...	13:30 - 15:00 T3-E Symposium: Food Safety
	Poster Session 2 - 15:00 - 15:30; Bayside Terrace				
	15:30 - 17:00 T4-A Symposium: Vaccines and Risk Perception	15:30 - 17:00 T4-B Risks and Opportunities in the Field of Genomics	15:30 - 17:30 T4-C SETAC Symposium: Human and Ecological Implications of Climate Change	15:30 - 17:00 T4-D Symposium: Risk Communication Strategies	15:30 - 17:00 T4-E Food Health Risks
Friday 20 July 2012	08:30 - 10:00 F1-A Symposium: Transdisciplinary Risk Analysis	08:30 - 10:00 F1-B Natural Disasters	08:30 - 10:00 F1-C Symposium: Assessing Emerging Chemical and Biological Risks	08:30 - 10:00 F1-D Reducing Accident Risks	08:30 - 10:00 F1-E Changing Risks in Land Use and Air Quality
	Poster Session 2 - 10:00 - 10:30; Bayside Terrace				
	10:30 - 12:00 F2-A Symposium: Global Catastrophic Risks (GCRs)	10:30 - 12:00 F2-B Warnings, Perceptions, and Consequences	10:30 - 12:00 F2-C Symposium: Risk Analysis Tools for Biosecurity	10:30 - 12:00 F2-D Safety, Accident, Response	10:30 - 12:00 F2-E Symposium: Air Pollution and Health Risks
	Friday Plenary Lunch - Global Public Health; 12:00 - 13:30, Parkside Ballroom B *Speakers: Antoine Flahault and Raina MacIntyre*				
	14:00 - 15:30 F3-A Risk and Nanotechnologies	14:00 - 15:30 F3-B Risk of Climate Change	14:00 - 15:30 F3-C Symposium: Health Impact Assessment	14:00 - 15:30 F3-D Risk Assessment in Industrial Settings	14:00 - 16:00 F3-E Symposium: Risks in New SRA Regions: Latin America and North Africa
	16:00 - 17:30 F4-A Symposium: Regulation of GMOs in South East Asia	16:00 - 17:30 F4-B Qualitative Uncertainty Methods	16:00 - 17:30 F4-C Benefit Cost and Risks in Developing Countries	16:00 - 17:30 F4-D Symposium: Risk Communications and H1N1	16:00 - 17:30 F4-E Symposium: Energy, Security and Emergency Management

Plenary Keynote Speaker Biographies

Plenary Luncheon Session - Extreme Risks: Shocks and Disasters

Wednesday 18 July, Parkside Ballroom; 12:00 - 13:30

Pierre-Alain Schieb; *OECD*

Dr. Pierre-Alain Schieb (a French national) is Counsellor in the Directorate of Science, Technology and Industry of the OECD, and Head of Futures Projects as part of the International Futures Programme, the OECD's strategic foresight unit.

Before joining the OECD in 1994, Dr. Schieb was Executive Vice-President of International Business of one France's major corporations (1991-1994); Dean of a graduate school of business (1985-1991); and held an Associate-Professorship at the University of Paris, Dauphine and other Universities in France and Canada (1970-1985)

Plenary Luncheon Session - Extreme Risks: Shocks and Disasters

Wednesday 18 July, Parkside Ballroom; 12:00 - 13:30

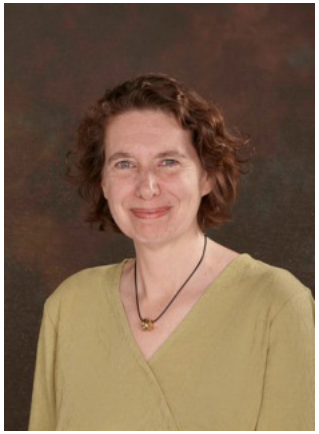
David Dian Zhang; *University of Hong Kong*

Dr. David Zhang is Professor in the Department of Geography of the University of Hong Kong, where he has been a member of the faculty since 1995. He previously taught at the Department of Geography of the University of the West Indies, and was a postdoctoral fellow at the School of Geography of the University of Manchester. He received his M.SC from SW China Normal University, and his Ph.D from the University of Manchester. He is the recipient of the Hong Kong University Outstanding Researcher and Research Output Prize. He has published more than 150 academic journal papers, books and book chapters in diverse disciplines including geomorphology, environmental hydro-chemistry, archaeology, and climate change. In the last seven years, his research has concentrated on the study of climate change and social responses, including two papers published in the Proceedings of National Academy of Sciences of the USA (PNAS) in 2007 and 2011 on the historical associations between global climate change, wars, social crises, and population declines.

Plenary Session - Synthetic Genomics, Risk and Governance

Thursday 19 July, 204 AB; 08:30 - 10:00

Michele Garfinkel; *European Molecular Biology Organization, Germany*



Michele Garfinkel is the Manager of the Science Policy Programme at the European Molecular Biology Organization in Heidelberg, Germany. Her work focuses on societal concerns for the introduction of new life-science based technologies, scientific publishing, and the responsible conduct of research.

Previously she was a policy analyst at the J. Craig Venter Institute, where she worked on societal issues related to the emerging technologies of genomics, particularly synthetic biology. She has also done policy research as a staff member at the American Association for the Advancement of Science, primarily on human stem cell research policy and on the societal impacts of germline gene therapy. As a research fellow at Columbia University's Center for Science, Policy & Outcomes she worked on biomedical research policy.

Michele holds an AB in Genetics from the University of California, a PhD in Microbiology from the University of Washington, and an MA in Science, Technology, and Public Policy from the George Washington University.

Plenary Session - Synthetic Genomics, Risk and Governance

Thursday 19 July, 204 AB; 08:30 - 10:00

Robert Friedman; *J. Craig Venter Institute (JCVI)*

Robert Friedman is the Director of the California office, and leads the Policy Group, of the J. Craig Venter Institute (JCVI). JCVI is a not-for-profit research institute dedicated to the advancement of the science of genomics; the understanding of its implications for society; and the communication of those results to the scientific community, the public, and policymakers.

Prior to joining JCVI, Friedman was Vice President of The H. John Heinz Center for Science, Economics, and the Environment; for many years before that, he was with the now-defunct Office of Technology Assessment, U.S. Congress (OTA). Bob is a Fellow of the American Association for the Advancement of Science and received his Ph.D. from the University of Wisconsin, Madison, in Ecological Systems Analysis.

Plenary Luncheon Session - Global Public Health

Friday 20 July, Parkside Ballroom; 12:00 - 13:30

Antoine Flahault; *French School of Public Health,University Paris-Descartes Hôtel Dieu*

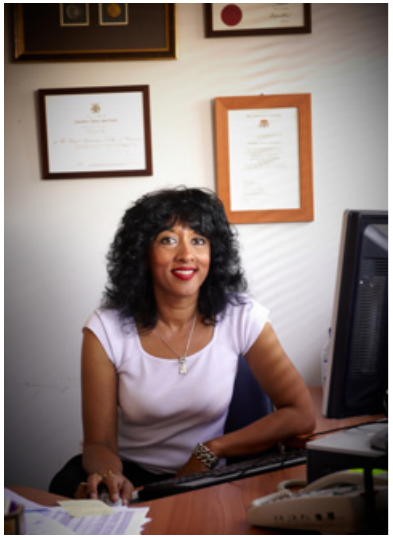
Antoine Flahault, MD, PhD, is Dean of the new EHESP French School of Public Health (Ecole des Hautes Etudes en Santé Publique, http://blog.ehesp.fr/). He is Professor in Epidemiology, at University Paris-Descartes Hôtel Dieu. He directed a public health department at hospital Tenon in Paris. He was responsible for the national system of communicable disease surveillance in general practice in France (named réseau Sentinelles http://www.sentiweb.fr), and has developed with WHO-HQ the global monitoring of influenza (FluNet). His work in research is conducted in a joint unit (UMR-S 707) at Institut National de la Santé et de la Recherche Médicale and University Paris 6 where he was the director of the WHO collaborating centre for electronic disease surveillance, coordinating a program which combines public health surveillance, mathematical modelling and epidemiology. After having coordinated a task force on multidisciplinary research against a chikungunya outbreak in the Indian Ocean, he was asked by the French government to coordinate a task force against dengue fever and dengue hemorrhagic fever in the French Caribbean islands. In 2009, he was elected president of the Association of School of Public Health in the European Region (ASPHER), Brussels, Belgium. He launched the European Academic Global Health Alliance he co-chairs with Andy Haines, from the London School of Hygiene and Tropical Medicine. In 2010, he was selected as a corresponding member at Académie Nationale de Médecine, Paris, France. He is editor-in-chief of Public Health Reviews (http://www.publichealthreviews.eu/).

By June 2012, he had 220 published references quoted in PubMed, several books (in French) among them one PLON best seller named A(H1N1), le journal de la pandémie, a dialogue written with Jean-Yves Nau, MD and journalist at Le Monde and Slate.fr. He supervised a vast and innovative exhibition named EPIDEMIK in Paris La Cité des Sciences, which has moved to Rio de Janeiro and Sao Paolo, Brasil, in 2010 and the USA in 2012.

Plenary Luncheon Session - Global Public Health

Friday 20 July, Parkside Ballroom; 12:00 - 13:30

Raina MacIntyre; *University of New South Wales, Australia*



Professor Raina MacIntyre MBBS (Hons 1), FRACP, FAFPHM, M App Epid, PhD, is Head of the School of Public Health and Community Medicine, Faculty of Medicine at the University of New South Wales and Professor of Infectious Diseases Epidemiology.

She has dual physician specialities in internal medicine and public health, and trained in epidemiology at both masters and PhD level. She was a Harkness Fellow at Johns Hopkins Bloomberg School of Public Health and studied transmission of TB in Maryland prisons during her fellowship.

She runs a strategic research program spanning epidemiology, vaccinology, mathematical modelling, public health and clinical trials in infectious diseases. She is best known for research in the detailed understanding of the transmission dynamics and prevention of infectious diseases, particularly emerging infections including influenza, tuberculosis and other vaccine-preventable infections. She is an international leader in research on face masks and respirators for protection against infectious diseases. She has an interest in adult vaccination with a focus on the elderly. She has won many career awards including the Sir Henry Wellcome Medal and Prize from the Association of Military Surgeons of the US in 2007 for work on bioterrorism risk assessment. She leads a NHMRC Centre for Research Excellence in Immunisation in under studied and special risk populations. She has won over $12 million in category 1 competitive research grants, has 175 publications in peer-reviewed medical journals.

Session & Symposium Supporters

We thank the many organizations that have supported and contributed sessions and symposia in the World Congress on Risk 2012. Each of the supporters listed below helped organize and/or fund the participation of speakers in these sessions.

Wednesday's Sponsored Sessions:

W1-B Trust and Risk Perception
Sponsor: Society for Risk Analysis - Europe

W1-C New Approaches to Old Chemicals: Assessing the Risks of Existing Chemicals Around the World
Sponsor: National Industrial Chemicals Notification and Assessment Scheme (NICNAS), Australia

W2-A Symposium: Risk Assessment, Sustainable Development and Multi-Criteria Decision Analysis
Sponsor: INERIS

W2-C Symposium: Risk Emergence and Emerging Risk: The IRGC Project
Sponsor: International Risk Governance Council (IRGC), Switzerland

W3-C Symposium: iNTeg-Risk Project: Part 1
Sponsor: EU-VRi

W3-E Public Decision Making and Risk Management

Sponsor: Cranfield University/UK

W4-C Symposium: iNTeg-Risk Project, Part 2
Sponsor: EU-VRi

W4-E Biosecurity and Intelligence Analysis
Sponsor: Australian Centre of Excellence for Risk Analysis

Thursday's Sponsored Sessions:

T1-A Synthetic Genomics, Risk and Governance
Sponsor: Alfred P. Sloan Foundation

T2-AB Emerging Risks and Synthetic Biology
Sponsor: Alfred P. Sloan Foundation and the Society for Risk Analysis - National Capitol Area Chapter

T2-D Extreme Event Risks: Low-Probability, High-Consequence
Sponsor: Society for Risk Analysis - Japan

T3-B Emerging Risks and Synthetic Biology: Part 2
Sponsor: Alfred P. Sloan Foundation

T3-C Global Financial Risks/Assessing Emerging Risks
Sponsor: Mount Kenya University

T3-D Symposium: Issues Emerging after the 3.11 Earthquake in Japan: Risk Governance Deficits in Radioactive Materials
Sponsor: Society for Risk Analysis - Japan

T3-E Food Safety
Sponsor: Society for Risk Analysis - Taiwan and Japan

T4-B Risks and Opportunities in the Field of Genomics
Sponsor: Alfred P. Sloan Foundation

T4-C SETAC Symposium: Human and Ecological Implications of Climate Change
Sponsor: Society for Environmental Toxicology & Chemistry

Friday's Sponsored Sessions:

F1-A Transdisciplinary Risk Analysis
Sponsor: Research Institute for Humanity and Nature, Kyoto, Japan

F1-C Assessing Emerging Chemical and Biological Risks
Sponsor: Australian Regulatory Science Network

F2-C Risk Analysis Tools for Biosecurity
Sponsor: Society for Risk Analysis - Australia and New Zealand

F2-D Safety, Accident, Response
Sponsor: University of Geneva

F2-E Air Pollution and Health Risks (SRA-Korea)
Sponsor: Society for Risk Analysis - Korea

F3-A Risk and Nanotechnologies
Sponsor: Cranfield/UK

F3-B Risk of Climate Change
Sponsor: Curapp/CNRS

F3-C Health Impact Assessment
Sponsor: Environ International Corporation

F3-E Symposium: Risks in New SRA Regions: Latin America and North Africa
Sponsor: Society for Risk Analysis - Latin America and Society for Risk Analysis - Egypt

F4-C Benefit Cost and Risks in Developing Countries
Sponsor: Society for Risk Analysis/Engineering Infrastructure Specialty Group; and Economics and Benefits Analysis Specialty Group

F4-D Risk Communication and H1N1
Sponsor: University of Manitoba and University of Alberta

F4-E Symposium: Energy, Security and Emergency Management
Sponsor: Society for Risk Analysis - Russia

Organizing Committee

The Co-Chairs of the SRA World Congress on Risk 2012 – Alison Cullen, Daniela Leonte, and Jonathan Wiener – also thank the many members of our Organizing Committee who contributed to planning, fundraising, and hosting this event, including: Souad Benromdhane, David Berube, Ann Bostrom, Mark Burgman, Robin Cantor, Chang-Chuan Chan, Jean Chesson, Luis Cifuentes, Rachel Davidson, Sandra Demichelis, Elaine Faustman, Sharon Friedman, Janet Gough, George Gray, Michael Greenberg, Charles Haas, Sasa Ivanovic, Allison Kelly, Atsuo Kishimoto, Gul Kizil, Margot Kuttschreuter, Jim Lambert, Valery Lesnykh, Yasunobu Maeda, Charlie Menzie, Myriam Merad, Patricia Nance, Jose Palma, Rick Reiss, Ortwin Renn, Sarah Ryker, Olivier Salvi, Martin Schultz, Kami Seo, Dong-Chun Shin, Akihiro Tokai, Claudia Vivalda, Marcelo Wolansky, and Kuen-Yuh Wu. We also thank local hosts in Sydney, notably Sandra Seno-Alday and Melissa Grah-McIntosh, SRA-Australia/New Zealand, ACERA and ACTRA; and our webmasters, Jim Butler and Ruedi Birenheide. And we thank the tireless staff of the SRA Secretariat at Burk Associates: Richard Burk, Sue Burk, Brett Burk, David Drupa, Jill Drupa, Jennifer Rosenberg, Mary Lou Scarborough, and Lori Strong.

W1 - Wednesday Morning
8:30 - 10:00 am (08:30 - 10:00)

Bayside 204 A

W1-A Framing the Risks of Climate Change

Chair: Robert O'Connor

W1-A.1 Risk Perceptions, Causal Thinking, and Policy Preferences for Climate Change: A Six Nation Survey
O'Connor RE, National Science Foundation; Bostrom A, University of Washington; Böhm G, University of Bergen; Hanss D, University of Bergen

W1-A.2 Climate Change and Market Liberalization's Impact on Hydropower: An Interdisciplinary Risk Assessment
Gaudard L, Romerio F; University of Geneva

W1-A.3 New Techniques to Take Nonlinearity into Account for Indicator Based Climate Change Vulnerability Assessment
Tonmoy FN, El-Zein A; University of Sydney

W1-A.4 Assessing Risks Associated with Climate Extremes: Effects of Heavy Tails and Range of Dependence
Alparslan UT, American University, Washington DC

Bayside 204 B

W1-B Symposium: Trust and Risk Perception

Chair: Michael Siegrist

W1-B.1 The Importance of Trust and Confidence for Acceptance of Technologies
Siegrist M, ETH Zurich

W1-B.2 Building and Losing Public Trust in Risk Management
White M, University of Exeter, UK; Eiser JR, University of Sheffield, UK

W1-B.3 Trust as a Determinant of Information Seeking: The Case of Food Related Risks
Kuttschreuter M, Hilverda F; University of Twente

W1-B.4 Do you Believe in Risk Assessments? Findings of an Experimental Study
Wiedemann P, ITAS

Bayside 203

W1-C Symposium: New Approaches to Old Chemicals: Assessing the Risks of Existing Chemicals Around the World

Co-Chairs: Marion Healy, Bette Meek

W1-C.1 Implications of Early Canadian Experience in Considering All Existing Chemicals
Meek B, University of Ottawa

W1-C.2 The EU Registration, Evaluation, Authorisation and Restriction of Chemicals Regulation (REACH): Systematic Approach for Chemical Safety
Dancet G, European Chemicals Agency

W1-C.3 Japan's New Approach to Existing Chemicals -Introduction of Stepwise Assessment Scheme under the CSCL
Fukushima T, Chemical Management Policy Division METI (presented by Nanimoto, H)

W1-C.4 The US ToxCast Program
Kavlock R, US EPA

W1-C.5 Accelerated Assessment of Existing Chemicals - The Australian Inventory Multi-Tiered Assessment Program (IMAP)
Healy M, NICNAS

SRA Regional Summit Meeting

Wednesday 18 July, 17:30 - 19:00

in Room 201

Note: Meeting is By Invitation Only for the Leaders of SRA Regional Organizations

W2 - Wednesday Morning
10:30 am - 12:00 pm (10:30 - 12:00)

Bayside 204 A

W2-A Symposium: Risk Assessment, Sustainable Development and Multi-Criteria Decision Analysis

Co-Chairs: Myriam Merad, Darrell Donahue

W2-A.1 Governing Sustainability of Public Organizations. The French Experience
Merad M, INERIS

W2-A.2 Application of MCDA to Animal Health Risk Assessment: Import Risk Assessment
Donahue DW, University of Maine; Krywulak T, Council of Canadian Academies

W2-A.3 Sustainable Sediment Management: Case Studies in Decision Analysis and Stakeholder Engagement
Bates M, Collier Z, Linkov I; US Army Corps of Engineers; Sparrevik M, Norwegian Geotechnical Institute; Keegan M, Wolf S, Habel M, Fredette T; US Army Corps of Engineers

W2-A.4 How to Engage Stakeholders in Risk Management? Values-Based vs. Situation-Based Approaches for Water Planning
Daniell KA, Australian National University

W2-A.5 Integrating the Physical and Social Sciences to Guide Sustainable Development Research
Bates ME, Linkov I; US Army Corps of Engineers

Bayside 204 B

W2-B Risk Perception and Communication

Chair: Sabine Pahl

W2-B.1 Media and Social Amplification of Risk: BSE and H1N1 Cases in South Korea
Jibum C, Korea Institute of Public Administration; Gi Woong Y, Bowling Green State University

W2-B.2 Between Fragmentation and Segmentation: a Relational Model of Consumers' Food Risk Perceptions
Merkelsen H, Gabrielsen G; Copenhagen Business School

W2-B.3 Mental Models and Risk Perceptions of Global Environmental Risks
Böhm G, University of Bergen, Norway; Pfister H-R, Leuphana University Lüneburg (Germany)

W2-B.4 Traveling to the Ozone Hole Through Polluted Air: Perception of Environmental Risks by Tourists
Pfister H-R, Leuphana University Lüneburg; Böhm G, University of Bergen

W2-B.5 Exploring the Risks and Benefits of Visits to Marine Environments: Comparing Expert and Visitor Perceptions
Pahl S, Wyles K, Thompson R; Plymouth University; sabine.pahl@plymouth.ac.uk

Bayside 203

W2-C Symposium: Risk Emergence and Emerging Risk: The IRGC Project

Chair: Marie-Valentine Florin

W2-C.1 An Orientation for Risk Managers for Dealing with Emerging Risks
Renn O, Stuttgart University

W2-C.2 Cascading Failures and Complexity: A Challenge for Regulators?
Schieb PA, OECD

W2-C.3 Emerging Risks in Emerging Market: An Exploratory Study on Risk Profile in China
Xue L, Tsinghua University

W2-C.4 Dynamic Financial Planning: Making Enterprise Risk Management Matter
Wittenberg A, Oliver Wyman

W2-C.5 Asia-Pacific Regional Risk Assessment Report 2012: Risk Governance and Sustainable Development
Mohanty S; UNISDR, United Nations International Strategy for Disaster Reduction

Bayside 202

W2-D Symposium: Advances in Risk Assessment Methodologies

Co-Chairs: Julie Fitzpatrick, Margaret Hartley

W2-D.1 Improving Risk Analysis through Globally Harmonized Risk Assessment Methodology
Hartley M, Australian Academy of Technological Sciences and Engineering; Vickers C, World Health Organisation, Switzerland

W2-D.2 Problem Formulation to Dose-Response: Advances via the ARA Beyond Science and Decisions Workshops
Dourson M, TERA

W2-D.3 International Developments in Consideration of Combined Exposures
Meek B, University of Ottawa

W2-D.4 A Case Study Illustrating the IPCS Combined Exposures Framework: Substances Potentially Detectable in Surface Water
Boobis A, Imperial College London

W2-D.5 Component vs Mixture: Approaches to Chemical Risk Assessment and Their Applicability to Cosmetic Products
Leonte D, National Industrial Chemicals Notification and Assessment Scheme

Bayside 201

W2-E Symposium: Product Liability in a Global Marketplace

Chair: Robin Cantor

W2-E.1 Product Liability: An Overview of the Emerging Issues
Cantor R, Meer S; Exponent

W2-E.2 Shortening the Long Arm of U.S. Law?
Miller DE, Colin Biggers & Paisley

W2-E.3 Measuring Risk Exposure When Using Global Suppliers
Reiss R, Exponent

W2-E.4 Pharmaceuticals and Personal Care Products in the Environment: Chemicals of Emerging Concerns
Kookana R, CSIRO

12:00-13:30
Parkside Ballroom B

Plenary Luncheon

Extreme Risks: Shocks & Disasters

Co-Chairs: Jonathan Wiener, Alison Cullen

Welcomes from:
Ann Bostrom, President, SRA; Rochelle Christian, President, SRA-Australia/New Zealand

Future Global Shocks: A New Class of Risks?
Pierre-Alain Schieb, Counsellor; Head of Futures Projects, OECD

Global Climate Change and War Outbreaks in the Pre-industrial Era
David D. Zhang, Dept of Geography, University of Hong Kong

W3 - Wednesday Afternoon
2:00 - 3:30 pm (14:00 - 15:30)

Bayside 204 A

W3-A Disasters, Socioeconomic Development and Modeling Methods

Chair: Wolfgang Kröger

W3-A.1 Development, Disaster & Causation
Lavell CM, University of Costa Rica

W3-A.2 Modeling the Effect of Sea-Level Rise on Risks to Coastal Infrastructure Using Bayesian Networks
Schultz MT, Rullan-Rodriguez JA, Case MP, Bourne SG, Burks-Copes KA; US Army Corps of Engineers

W3-A.3 Disaster Capitalism and Risk Assessment: Development Opportunism after the 2004 Tsunami
Hutanuwatr K, King Mongkut's Institute of Technology Ladkrabang, Thailand; Bolin B, Arizona State University; Pijawka D, Arizona State University

W3-A.4 Understanding Vulnerable Complex Systems
Kröger W, ETH; Zio E, Laboratoire Gènie Industriel Ecole Central Paris and Supelec

W3-A.5 Ocean Networks Canada Near-Field Tsunami Research Facility
McLean SD, Ocean Networks Canada; Taylor SM, Ocean Networks Canada; Moran K, Ocean Networks Canada; Thomson RE, Department of Fisheries and Oceans Canada; Lintern G, Natural Resources Canada

Bayside 204 B

W3-B Perception and Communication in Nuclear, Mercury, Metals and Medicine

Co-Chairs: Britt-Marie Drottz-Sjöberg

W3-B.1 European Work on Nuclear Waste Management: Public Perception, Risk Communication and Governance Issues
Drottz-Sjöberg B-M, NTNU; Andersson K, Karita AB

W3-B.2 Including Moral Emotions In Political Decision Making About Nuclear Energy Risks
Kaliarnta S, Roeser S; TU Delft

W3-B.3 Perceptions of Mercury Risk and its Management
Turaga RMR, Indian Institute of Management Ahmedabad; Borsuk M, Dartmouth College

W3-B.4 Efficacy of Threat, Incentive and Risk Appeal on Perception of Heavy Metal Risk among the Public
Zhang X, Beijing Normal University; Wang M, Academy of Disaster Reduction and Emergency Management Ministry of Civil Affairs & Ministry of Education

W3-B.5 The Study of the Perception Gaps Between Ordinary People and Medical Doctors
Yoshida Y, Nagoya University; Yoshida Y, Nagoya City University; Motoyoshi I, Kansai University; Saito M, Teikyo-Heisei University; Hayase T, Nagasaki

Bayside 203

W3-C Symposium: iNTeg-Risk Project: Part 1

Chair: Aleksandar Jovanovic

W3-C.1 The Early Warning for Emerging Risks Related to New Technologies: Principles and Implementation
Jovanovic A; European Virtual Institute for Integrated Risk Management (EU-VRi)

W3-C.2 IRGC: Improving the Management of Emerging Risks from New Technologies, System Interactions and Unforeseen or Changing Circumstances
Florin MV, IRGC

W3-C.3 Holistic Risk Management of Atypical Accident Scenarios
Paltrinieri N, Øien K, Wilday J, Wardman M, Cozzani V; Alma Mater Studiorum - University di Bologna, Italy, SINTEF, Trondheim, Norway, HSL, Buxton, UK

W3-C.4 Managing Emerging Risks: How to Outsource in a Safe Way
Dien Y, Duval C; EDF - R&D

W3-C.5 How Emerging are Emerging Risks? A Critical Analysis from Management Science Perspective
Mazri Ch; INERIS

Bayside 202

W3-D Symposium: Tools for Quantitative Microbial Risk Assessment

Chair: Charles Haas

W3-D.1 Molecular Tools for Developing a Recreational QMRA
Rose JB, Michigan State University

W3-D.2 Quantitative Microbial Risk Assessment for Airborne Pathogens
Watanabe T, Yamagata University

W3-D.3A Application and Policy Implication of Quantitative Microbial Risk Assessment in Developing Countries
Nguyen H, Pham Duc P, Hanh Tran T, Luu Quoc T; Hanoi Public Health University

W3-D.3B Infection Risks of Diarrhea Associated with Wastewater and Excreta Use in Agriculture in Vietnam
Pham DP, Nguyen-Viet H; Hanoi School of Public Health; Odermatt P, Swiss Tropical and Public Health Institute; Zürbrugg C, Eawag/Sandec; Zinsstag J, Swiss Tropical and Public Health Institute

W3-D.4 User-friendly Computational Free Tools for Quantitative Microbial Risk Assessment for Drinking Water
Schijven J, Expert Centre for Methodology and Information Services; Teunis P, Epidemiology and Surveillance; Rutjes S, Bouwknegt M, De Roda Husman A; Laboratory for Zoonoses and Environmental Microbiology

W3-D.5 Drinking Water QMRA: Necessary Considerations for Decision-Making
Schmidt P, Emelko MB, Thompson ME, University of Waterloo

Bayside 201

W3-E Symposium: Public Decision Making and Risk Management

Chair: Simon Pollard

W3-E.1 The Devolved Management of Risk: New Risks, New Risk Managers
Pollard SJT, Rock SA; Cranfield University, UK

W3-E.2 Migrating from Project Risk Management to Operational Risk Management
Mordecai Y, Dori D; Technion, Israel Institute of Technology

W3-E.3 Climate Change as a Business Risk - Insights from the Adaptation Reporting Power
Jude S, Drew G, Pollard SJT, Rocks SA; Cranfield University, UK

W3-E.4 Looking into the Future: Challenges to the Successful Integration of Risk and Foresight Models
Prpich F, Cranfield University, UK

W3-E.5 Distinguishing Evidence from Advocacy
Hrudey S, University of Alberta, Canada

P1 - Wednesday Afternoon & Thursday Morning
18 July: 3:30 - 4:00 pm (15:30 - 16:00); 19 July: 10:00 - 10:30 am (10:00 - 10:30)

Bayside Terrace

P1.1 Incorporating Sustainable Development in Risk Assessment: An Approach through Cost-Benefit Analysis
Tazid A, Dibrugarh University; Rubab N, DHSK College

P1.2 Risk Based Classification of Toxic Fluids and Gases
Vandebroek L, Daenen M, Joosten P; M-tech; Berghmans J, K.U.Leuven

P1.3 Health Risk Assessments of Salmonella spp. in Pork in Hanoi, Vietnam
Luu Quoc T, Hanoi School of Public Health; Bui Mai H, Le Danh T; National Institute of Nutrition; Nguyen-Viet H, Hanoi School of Public Health

P1.4 Assessing Health Risk Due to Exposure to Arsenic in Drinking Water in Hanam Province, Vietnam
Huy-Tung B, Hanoi Medical College; Tuyet Hanh T, Nguyen-Viet H; Hanoi School of Public Health

P1.5 Methodology for the Estimation of the Environmental Damage
Cifuentes LAC, Lapuente PLF, Pica APT, Pontificia Universidad Catûlica de Chile

P1.6 Applying Probability Bounds Analysis to Model Uncertainties in Fisheries Risk Assessments
Dixon WJ, Fisheries Victoria; Flander LB, The University of Melbourne

P1.7 Contributing Factors to Risk Emergence
Florin M-V, IRGC

P1.8 The IRGC Trilogy: IRGC Risk Governance Framework, Risk Governance Deficits and How to Deal with Emerging Risks
Florin M-V, IRGC

P1.9 On the Concept of Risk in View of ISO 31000:2009
Gaidow S, Defence Science & Technology Organisation

P1.10 A Framework for Assessment of Supply Chain Risk in the Changing World
Ganguly K, Research Scholar

P1.11 Continued Research of Facility Layout Optimization through MILP And MINLP Approaches
Cadena J, Ramos M, Gomez J, Gomez G, Munoz F; Universidad de los Andes, Columbia

P1.12 Emerging Risk from Uncertainty in Experimental Characterization of Combustible Solids
Murillo C, Vignes A, Lopez O, Gomez G, Munoz F; Universidad de los Andes, Columbia

P1.13 The Attitude Change and Its Determinants after Fukushima Nuclear Power Accidents
Ham Y, Daegu University; Cheonhee P, Ajou University; Kim S, Ajou University

P1.14 Dose-Response Assessment Tools: A Practical Methods Compendium for Risk Assessors
Haber LT, Kroner O, Dourson ML; TERA

P1.15 Risks Associated with Uncontrolled Livestock Movements in the Greater Mekong Region
Hawkins C, Department of Agriculture and Food; Sieng S, Consultant; Kerr J, Department of Agriculture and Food; Cai C, Murdoch University

P1.16 The Mental Model Interpreting the Accident Information Related with Nuclear Power Plant at Fukushima, Japan
Hong Y, Ajou University; Jong S, Korea University; Kim S, Ajou University

P1.17 Population-Group Exposure Assessment of Traffic-Related Air Pollutants Using Intake Fraction
Lim YW, Roh YM, Lee YJ, Kim JY, Hong SH, Yonsei university

P1.18 Coordinating European Stakeholders in the Area of Emerging Risks
Jovanovic A, European Virtual Institute for Integrated Risk Management, Germany; Salvi O, Mazri C; INERIS, France; Jovanovic S, Steinbeis Advanced Risk Technologies GmbH, Germany

P1.19 The Management of the Levels of Safety Integrated
Guenachi K, Universitè d'Oran; Baitiche C, Sonatrach; Belkhatir AA, Universitè d'Oran

P1.20 The Transport of Hazardous Materials by Sea Route
Guenachi K, Belkhatir AA, Hamdani O, Benkheira H, Universitè d'Oran; Benchaouchi N, Sonatrach

P1.21 Searching for Determinant and Change in Attitude toward Nanotechnology
Seoyong K, Ajou University; Hyukjun S, Hyunjung L; Korea University

P1.22 Exposure to Heavy Metals in Blood of the Population Living in the Vicinity of MWIs in Korea
Lee CS, Shin DC, Lim YW, Kim HH, Yang JY; Yonsei University

P1.23 Impact of Typhoon and Heavy Rain Disaster on Mortality and Diarrhea Hospitalization in South Korea
Kim S, Shin YS, Jongsik H, Pak H; Korea Environment Institute

P1.24 Risk Attitude vs. Personal Characteristics: Perspective from Two Representative Population Groups in China
Ye T, Wang M, Liu YB, Li M; Beijing Normal University (Presented by Zhang X)

Be sure to visit Poster Session P1 during the Coffee Breaks in Bayside Terrace

Presenters will stand beside their posters at these times

Wednesday from 15:30-16:00

and

Thursday from 10:00-10:30

W4 - Wednesday Afternoon
4:00 - 5:30 pm (16:00 - 17:30)

Bayside 204 A

W4-A Energy Risks and Governance

Chair: Renate Schubert

W4-A.1 Institutional Transformation Toward Global Risk and Energy Governance
Rosa G, Washington State University

W4-A.2 Public Preferences for Energy Sources & Waste Management Practices in the US: Pre and Post-Fukushima
Greenberg M, Rutgers University

W4-A.3 The Ethical Acceptability of Multinational Nuclear Waste Repositories
Taebi B, Delft University of Technology

W4-A.4 Transformation of Energetic Risk in the Baltic States
Genys DR, Vytautas Magnus University

W4-A.5 Energy-Using Durables: The Risks of Increasing Costs and Decreasing Benefits
Schubert R, Fehr H, Epper T; ETH Zurich

Bayside 204 B

W4-B Perception and Communication

Chair: Sally Kane

W4-B.1 A Comparative Study of Risk Perception for Waste Incineration Facility in Japan and Korea
Shirakawa H, Moon D, Nagoya University

W4-B.2 What Does Sustainable Remediation Mean to Us? Implications for Risk Communication
Norrman J, Chalmers University of Technology; Söderqvist T, Enveco Environmental Economics Consultancy; Norin M, NCC Construction; Rosèn L, Brinkhoff P; Chalmers University of Technology

W4-B.3 A Shift in Natural Hazard Perception: Implications for Risk Governance
Wachinger G, Renn O; DIALOGIK

W4-B.4 Social Science of Natural Disaster Risk
Kane SM, Independent Consultant

W4-B.5 Risk Communication Discourse: A Content Analysis of Australian Media Coverage of Queensland Cyclones, 2011
Al-Harbi A, Monash University

W4-B.6 Probability-Time & Space Trade-off in Environmental Risk Perception
Shengxiang S, Guilin University of Technology

Bayside 203

W4-C Symposium: iNTeg-Risk Project, Part 2

Chair: Aleksandar Jovanovic

W4-C.1 The iNTeg-Risk LNG Blue Book: An Integrated Approach to LNG Safety
Uguccioni G, D'Appolonia S.p.A., Italy; Paltrinieri N, Alma Mater Studiorum-Università di Bologna; Busini V, Politecnico di Milano; Tugnoli A, Alma Mater Studiorum-Università di Bologna; Rota R, Politecnico di Milano; Salzano E, CNR-IRC, Italy; Cozzani V, Alma Mater Studiorum-Università di Bologna

W4-C.2 RiskEars - The Early Warning System for Emerging Risks Related to New Technologies: Applications
Jovanovic A, European Virtual Institute for Integrated Risk Management, Germany; Schneider R, SwissRe; Renn O, ZIRN, University of Stuttgart; Balos D, Steinbeis Advanced Risk Technologies GmbH, Germany; Klimek P, European Virtual Institute for Integrated Risk Management, Germany

W4-C.3 Biogas Safety and Regulation: Overview of the European Situation and Future Needs using the iNTeg-Risk Framework
Salvi O, EU-VRi; Evanno S, INERIS; Joubert M, SEQUARIS

W4-C.4 Accident Scenarios for LNG Releases at Offshore Regasification Facilities
Bubbico R, Sapienza University of Rome; Salzano E, CNR-IRC, Italy

Bayside 202

W4-D Symposium: Quantitative Microbial Risk Assessment and Water Supply Management

Chair: Susan Petterson

W4-D.1 Application of QMRA to Select among Drinking Water Interventions in the Developing Context: Incorporating Reliability and Compliance Rates
Petterson SR, Water & Health Pty Ltd

W4-D.2 Options for Sustainable Municipal Water Services: Integrating QMRA with Ecosystem and Economic Assessments for Selecting Future Water Infrastructure
Ashbolt NJ, Schoen ME; USEPA

W4-D.3 QMRA in Planning and Decision Making Processes: Sustainable Development and Urban Water Systems
Ottoson J, Swedish University of Agricultural Sciences; Petterson S, Australia and Norwegian University of Life Sciences

W4-D.4 Uncertainties in the Application of QMRA when Prioritizing Drinking Water Infrastructure for Communities Lacking Satisfactory Water Supplies
Roser D, Ashbolt N; University of New South Wales; Petterson S, Water and Health, Australia; Jagals P, University of Queensland

W4-D.5 Modelling the Risk of Waterborne Disease in 2 and 4 Degree Warmer Worlds
Hunter P, Lake I; University of East Anglia, UK; Nichols G, Centre for Infection Health Protection Agency, UK

Bayside 201

W4-E Symposium: Biosecurity and Intelligence Analysis

Chair: Mark Burgman

W4-E.1 Integrating Open Source Information in Delphi Groups
Burgman M, Fidler F, Flander L; University of Melbourne; Lyon A, University of Maryland; McBride M, University of Melbourne; Mascaro S, Bayesian Intelligence, Melbourne; Saw G, University of Melbourne

W4-E.2 Foresight and Intelligence for Animal Biosecurity
Nunn M, Department of Agriculture, Fisheries and Forestry

W4-E.3 Intelligence for Aquatic Health
Grossel G; DAFF, Australia

W4-E.4 Adaptive Adversary Decision Modeling for Global Terrorism Risk Management
Maya I, University of Southern California; John R, University of Southern California; Rosoff H, University of Southern California; Bier V, University of Wisconsin-Madison; Barrett A

T1 - Thursday Morning Plenary
8:30 - 10:00 am (08:30 - 10:00);

Bayside 204 AB

Plenary Session

Synthetic Genomics, Risk and Governance

Sponsored by the Alfred P. Sloan Foundation

Co-Chairs: Alison Cullen and Paula Olsiewski

Overview of the Technology, Potential Benefits, and Biosecurity Concerns

Michele Garfinkel, European Molecular Biology Organization

Overview of Societal Concerns and US Governance of the Products of Synthetic Biology

Robert Friedman, J. Craig Venter Institute

T2 - Thursday Morning
10:30 am - 12:00 pm (10:30 - 12:00)

Bayside 204 AB

T2-AB Symposium: Emerging Risks and Synthetic Biology: Part 1

Chair: Genya Dana

T2-AB.1 Synthetic Biology and DIYBIO Safety and Security

Kuiken T, Woodrow Wilson International Center for Scholars

T2-AB.2 Proactive Syn Bio Security Risk Governance: Open Engagement of Law Enforcement with the Technical Community

You E, FBI Supervisory Special Agent, Biological Countermeasures Unit, WMD Directorate

T2-AB.3 Security Risks of Synthetic Biology - Assumptions, Methods and Sources of Uncertainty

McCreight RE, Institute of Crisis, Disaster and Risk Management, George Washington University

T2-AB.4 Proactive Ecological Risk Governance: Multi-stakeholder Exercises on Synthetic Biology Applications

Oye K, MIT Engineering Systems and Political Science

T2-AB.5 The Cartagena Protocol on Biosafety and Initial Discussions Related to Synthetic Biology

Dana GV, US Department of State

Bayside 203

T2-C Risk and Disease

Chair: Spring Cooper

T2-C.1 Risk of Avian Influenza from Live Bird Markets to Local Poultry and Impact on the Livelihood of Farmers

Abdu P, Assam A; Faculty of Veterinary Medicine, Ahmadu Bello University, Zaria - Nigeria

T2-C.2 Communicable Disease Risk Management System Maturity in the Papua New Guinean Mining Industry

Hancock MG, Rio T

T2-C.3 Regional Risk Assessment of Drinking Water Supplies

Lindhe A, Rosèn L, Pettersson T; Chalmers University of Technology; Bergstedt O, Göteborg Vatten & Chalmers University of Technology; Nordensten C, The National Food Agency

T2-C.4 Quantitative Risk Estimation for a Legionella Pneumophila Infection Due to Whirlpool Use

Bouwknegt M, Schijven JF, Schalk JAC, De Roda Husman AM; National Institute for Public Health and the Environment

T2-C.5 Development and Pilot Evaluation of a Parent and Adolescent Shared Decision Aid for HPV Vaccination

Cooper Robbins SC, Cree R, McCaffery K, Skinner R; USyd

Bayside 202

T2-D Symposium: Extreme Event Risks: Low-Probability, High-Consequence (Sponsored by SRA-Japan)

Chair: Kami Seo

T2-D.1 Methodological Issues of Responding to Complex and Uncertain LPHC Risk Events Beyond Conventional Scope of Risk Analysis: Lessons Learned from 2011 Earthquake-Tsunami-Fukushima Disaster

Ikeda S, Tsukuba University

T2-D.2 From Risk Management to Uncertainty Management: Trade-Off Dilemma

Han G, Stockholm Environment Institute

T2-D.3 Nuclear Risk Assessments Should be Living Documents That are Resources in Emergency Situations: Lessons from Fukushima and other Nuclear Accidents

Goble R, Clark University

T2-D.4 Comparing Disaster Perceptions in Japan and the US

Tsuchida S, Tsujikawa N, Shiotani T, Nagagawa Y; Kansai University

T2-D.5 How Does a Disaster Overwhelm Social Precautions: An Empirical Study of 3.11 Tsunami-Fukushima Case

Seo K, Aoyama Gakuin University

T3 - Thursday Afternoon
1:30 - 3:00 pm (13:30 - 15:00)

12:00-12:40
Bayside 203

TL-A Roundtable on Risk Challenges, World Development and *Risk Analysis: An International Journal*
Michael Greenberg, Editor-in-Chief

12:45-13:25
Bayside 202

TL-B Roundtable on Regional Affairs and SRA Integration

Box lunches can be picked up in the Bayside Foyer

Bayside 204 A

T3-A Toxic Exposures
Chair: Janet Gough

T3-A.1 Multi-Criteria Assessment of Environmental risk in Chinese Rural Area
Ban J, Bi J, Yu W, Huang L; School of the Environment in Nanjing University

T3-A.2 Mapping Spatial & Temporal Human Health Risk of Dioxin in Kaohsiung City Area, Taiwan
Li PC, Ma HW; National Taiwan University

T3-A.3 Risk Benefit Assessment and Regulation of Pesticides
Gough J, (Presented by Dreze V, Armstrong J); EPA New Zealand

T3-A.4 Assessing Risk for an International Occupational Safe Work Practice
Boelter F, Bullock S, Persky J; ENVIRON

Bayside 204 B

T3-B Emerging Risks and Synthetic Biology: Part 2
Chair: Alison Cullen

T3-B.1 Risk Analysis in Synthetic Biology: Global and Emerging
Schmidt M, BIOFACTION, Dep. for Technology Assessment

T3-B.2 Regulatory Decision-Making Frameworks for Consumer Products
Healy M, National Industrial Chemicals Notification and Assessment Scheme (NICNAS)

T3-B.3 Metabolic Engineering through Systems and Synthetic Biology
Vickers CE, Australian Institute for Bioengineering and Nanotechnology, The University of Queensland

T3-B.4 Risk Assessment of New Technologies: Bridging the Regulatory Divide between High and Low Income Countries
Roca M, Zamorano University, Honduras; Keese P, Office of the Gene Technology Regulator, Australia

Discussant: *Faustman E*

Bayside 203

T3-C Global Financial Risks/ Assessing Emerging Risks
Chair: Michel Maila

T3-C.1 Multisectoral Risk Model for the Global Economy
Anyika E, Weke P, Achia T; Mount Kenya University

T3-C.2 World Risk Society Revisited: Discursive Governance on New Global Risks
Klinke A, Memorial University of Newfoundland

T3-C.3 The Dynamics of Political Risk Underwriting: Risk Decision-Making in a Specialist Insurance Market
Baublyte L, Mullins M, Garvey J; University of Limerick, Ireland

T3-C.4 A Systems Engineering Approach to Communicating Measures of Global Systemic Financial Risk
Worrell C, MITRE Corporation

T3-C.5 Conducting A Back-testing Analyis on Operational Risk: A Clinical Study
Feria-Dominguez JM, Jimenez-Rodriguez E, Rivera-Perez MP; Universidad Pablo de Olavide, Spain

Bayside 202

T3-D Symposium: Issues Emerging after the 3.11 Earthquake in Japan: Risk Governance Deficits in Radioactive Materials (Sponsored by SRA-Japan)
Chair: Yasunobu Maeda

T3-D.1 Delphi Analysis of Issues after the 2011 Great East Japan Earthquake: Interim Report 2
Maeda Y, Shizuoka University; Seo K, Aoyama Gakuin University; Motoyoshi T, Kansai University

T3-D.2 Development of Risk Assessment Simulation Tool for Optimal Control of a Low Probability - High Consequence Disaster
Tsunemi K, National Institute of Advanced Industrial Science and Technology

T3-D.3 Deficits on Risk Management of Radioactive Substances In Food
Ono K, National Institute for Agro-Environmental Sciences

T3-D.4 Deficits on Risk Assessment of Radioactive Materials
Nagai T, National Institute of Advanced Industrial Science and Technology

T3-D.5 Deficits in Risk Governance and Communication
Yasutaka T, National Institute of Advanced Industrial Science and Technology

T3-D.6 Risk Governance Dilemma on the Countermeasure of Radioactive Contaminated Soil in Japan
Kashimoto A, National Institute of Advanced Industrial Science and Technology

Bayside 201

T3-E Symposium: Food Safety
Co-Chairs: Kuen-Yuh Wu and Jun Sekizawa

T3-E.1 Probabilistic Risk Assessment for Variant Creutzfeldt-Jakob Disease (vCJD) Risk from Daily Consumption of Beef by Incorporation of the Prion Conversion Mechanisms
Wu KY, National Taiwan University

T3-E.2 Risk Governance on Radionuclide Contamination in Food
Sekizawa Y, SRA Japan

T3-E.3 Tools, Approaches and Institution: Towards Integrated Food Safety Governance - Preliminary Findings
Matsuo M, University of Tokyo

T3-E.4 Chicken, Duck, Pig, Goat, and Man: Whose Health? Whose Risk?
Lin YP, National Yang-Ming University

T3-E.5 An Experimental Interactive Risk Communication on the Effects of Radioactive Substances on Health through Food
Niiyama Y, Kito Y, Kudo H; SRA Japan

P2 - Thursday Afternoon & Friday Morning
19 July: 3:00 - 3:30 pm (15:00 - 15:30); 20 July: 10:00 - 10:30 am (10:00 - 10:30)

Bayside Terrace

P2 Poster Session 2

P2.1 Urban Fire Risk Assessment Based on GIS and its Application in Disaster Mitigation Planning
Liu M, Zhou Y; Nankai University

P2.2 Characterizing the Impacts of Uncertainty and Scientific Judgment in Exposure Limit Development
Maier A, Haber LT, Patterson J; TERA

P2.3 Achieving Pervasive Risk Management: Overcoming a Key Risk Governance Challenge
Mauelshagen CW, Denyer D, Rocks S, Pollard S; University of Cranfield

P2.4 Managing Country Level Disaster Risk: The IIASA CATSIM Model
Hochrainer S, Mechler R; IIASA

P2.5 Use of Risk Assessment Tool in the Brazilian Environmental Licensing
Montiel Frioni LS, Cetesb; Portela MAF, AGR Engenharia

P2.6 Quantitative Microbial Risk Assessment: Research Status and Future Development
Nguyen-Viet H, Hanoi School of Public Health; Nguyen HN, Hanoi School of Public Health; Nguyen TBT, Hanoi School of Public Health; Haas CN, Drexel University

P2.7 The Influence of Flow Rates Calculation Methods on Individual Risk Assessment of Ethanol Pipelines
Portela MAF, AGR Engenharia; Macedo ES, IPT

P2.8 Managing Risks: Lessons from Nature and Evolution
Sanchez-Silva M, Universidad de Los Andes; Damnjanovic I, Texas A&M University

P2.9 Map of Risks for The Implementation of RFID Solution to Trace Ancillaries
Bertrand E, Hospital of Ambroise Parè; Schlatter J, Hospital of Jean Verdier

P2.10 Simplified Health Risk Assessment for Numerous Sources
Shih H-C, Ma H-W; National Taiwan University

P2.11 Services and Products for Advanced Risk Management as a Basis For Business
Bareiss J, Balos D, Jovanovic S; Steinbeis Advanced Risk Technologies GmbH, Germany

P2.12 Testing the HSM in Judging the Risk of Nuclear Power Accidents from Fukushima, Japan
Song Y-G, Wang J, Kim S; Ajou University

P2.13 Development of a Probabilistic Coastal Hazards Model: Coupling Storm-Surge and Inland Precipitation
Thompson CM, Frazier TG, University of Idaho

P2.14 Management (Governance) of Regional Risk Based on Unified Criteria
Timashev SA, Bushinskaya AV, Poluyan LV; Russian Academy of Sciences; Krimgold F, Virginia Tech; Gheorghe A, Old Dominion University

P2.15 The Removal of Shipwrecks is a Risky Business - Methods and the Framework
Ventikos NP, Koimtzoglou AN, Louzis KA; National Technical University of Athens

P2.16 The Structure and Process of Emotional Judgment in Case of the Nuclear Power Energy or Station
Wang J, Kim S; Ajou University; Choi Y, Korea University

P2.17 Tradeoff of Health Risks Caused by Legionella and Disinfection Byproducts in Public Baths
Watanabe T, Yamagata University, Japan; Oguma K, The University of Tokyo, Japan

P2.18 Uncertain Risk, Precautionary Measures, and Tailored Risk Communication
Gutscher H, University of Zurich; Boerner F, University of Alberta; Wiedemann P, Karlsruhe Institute of Technology; Croft R, University of Wollongong

P2.19 The Improvement of Strategic Environmental Assessment-The Application of Critical Load
Wu Y-Y, Ma H-W; National Taiwan University

P2.20 Collaboration and Communication of Global Risk Assessment Information
Wullenweber A, Kroner O, Dourson M, Nance P; TERA

P2.21 Efficacy of Threat, Incentive and Risk Appeal on Perception of Heavy Metal Risk among the Public
Zhang X, Beijing Normal University; Wang M, Academy of Disaster Reduction and Emergency Management Ministry of Civil Affairs & Ministry of Education

P2.22 An Exposure Assessment of Mercury from Seafood for Consumers in Dalian, China
Zhang Y, Niu X, Zhou J, Wang D; Dalian University of Technology

P2.23 Improvement of an LPG Facility, Applying an Inherent Safety Design
Gomez G, Rodriguez S, Cadena J, Munoz F; Universidad de los Andes

P2.24 Design of Delivery Routes of Hazardous Material and Optimization with Risk Minimization Criterion
Barrios I, Gomez G, Velasco N, Gutierrez E, Munoz F; Universidad de los Andes

Be sure to visit Poster Session P2 during the Coffee Breaks in Bayside Terrace

Presenters will stand beside their posters at these times

Thursday from 15:00-15:30

and

Friday from 10:00-10:30

T4 - Thursday Afternoon
3:30 - 5:00 pm (15:30 - 17:00)

Bayside 204 A

T4-A Symposium: Vaccines and Risk Perception

Chair: Rob Goble

T4-A.1 Addressing the Vaccine Confidence Gap
Larson H, London School of Hygiene and Tropical Medicine

T4-A.2 Challenges in Monitoring and Analyzing Vaccine Safety
McIntyre P, University of Sydney

T4-A.3 Vaccine Communication in Europe: Is the Internet the Best Tool Against Rumours?
Bouder F, Maastricht University; Goble R, Clark University

T4-A.4 Risk, Ethics and Vaccines
Hooker C, The University of Sydney

T4-A.5 Learning to Listen to and Engage with Public Concerns about Vaccines
Leask J, National Centre for Immunisation Research and Surveillance of Vaccine Preventable Diseases

Discussants: Ann Bostrom and Ortwin Renn

Bayside 204 B

T4-B Risks and Opportunities in the Field of Genomics

Chair: Alison Cullen

T4-B.1 Incorporating Metagenomics into Public Health Decisions: Antibiotic Resistance in Puget Sound, WA
Port J, Wallace J, Griffith W, Faustman E; University of Washington

T4-B.2 Patentability of Stem Cells and Morality Issues in the EU after Brüstle
Bonadio EB, City University London

T4-B.3 Synthetic Biology: Regulatory Attempts to Balance Risk and Innovation
Kelly A, Cullen A; Evans School of Public Affairs, University of Washington

T4-B.4 From Nanotechnology to Synthetic Biology: Comparing Unprimed Associative Data and Public Risk Perceptions
Berube DM, Cummings CL; North Carolina State University

T4-B.5 Risk Assessment of DNA Recombination Technology in Ecological Aspects
Wei W, Institute of Botany, Chinese Academy of Sciences

Bayside 203

T4-C SETAC Symposium: Human and Ecological Implications of Climate Change

Chair: Charles Menzie

T4-C.1 Environmental, Health, Toxicology, and Natural Resource Issues Related To Climate Change: An Overview of a Society of Environmental Toxicology and Chemistry
Menzie C, Exponent

T4-C.2 How Will Global Climate Change Affect Human Health Risk Assessment?
Boxall et al

T4-C.3 A Risk-Based Portfolio Decision Model for Prioritization of Conservation Management Alternatives
Convertino M, University of Florida & US Army Corps of Engineers; Keisler JM, University of Massachusetts; Dokukin D, US Army Corps of Engineers; Foran CM, University of Massachusetts; Linkov I, US Army Corps of Engineers & Carnegie Mellon University

T4-C.4 Application of the Seven Principles for Ecological Risk Assessment Under Climate Change to the Hg Contamination and Other Factors of the South River Watershed, Virginia USA
Landis W; Western Washington University

T4-C.5 Screening Ecological Risk Assessment of Rewetted Acid Sulfate Soils in the Lower Murray River, South Australia
Stauber J, Chariton A, Binet M, Simpson S; CSIRO Land and Water, Sydney

T4-C.6 Climate Change and Human Health: A Sleeping Giant?
Cantor R, Schmier; Levine J, Exponent

T4-C.7 Environmental Contaminants and Global Climate Change: Implications for Environmental Damage Assessment and Restoration/Rehabilitation
Hickey C, National Institute of Water & Atmospheric Research (NIWA), NZ; Brasfield S, US Army Engineer Research and Development Center, MS; Fritz A, NOAA/OR&R/ARD, Seattle; Helm R, US Fish and Wildlife Service, VA; Johnson P, US Fish and Wildlife Service, AK; Rohr J, University of South Florida

Bayside 202

T4-D Symposium: Risk Communication Strategies

Chair: Peter Wiedemann

T4-D.1 Empirical Evaluation of Framework for Communicating Risk Assessments
Wiedemann P, KIT

T4-D.2 Beyond Risk Communication: Limits of Individual Persuasion in the Case of Climate Risks
Gutscher H, University of Zuerich

T4-D.3 A 'Personality' Approach to Understanding the Effect of Risk Communication Strategies in Telecommunications Messaging
Croft RJ, Magee CA; University of Wollongong; Wiedemann P, Karlsruher Institut für Technologie, Germany

T4-D.4 Making Sense of the Available Evidence on Effects of Informing about Precautionary Measures
Boerner F, University of Alberta

T4-D.5 Exploring Psychometric Representations of Information Technology Risks in the Workplace: A Longitudinal Study
Coles RS, National Grid, Wokingham UK; Hodgkinson GP, University of Warwick, UK

Bayside 201

T4-E Food Health Risks

Chair: Brian Priestly

T4-E.1 Mental Models of Food Recalls
Kaptan G, Newcastle University; Fischhoff B, Carnegie Mellon University

T4-E.2 Modeling the Risk Due to Increased Imports of Fresh Produce from Emerging Supply Sources to the UK
Mwebaze P, Harper Adams University College, UK

T4-E.3 Food Health Risk Perceptions among Consumers, Farmers, and Traders of Leafy Vegetables in Nairobi
Lagerkvist CJ, Hess S; Swedish University of Agricultural Sciences; Okello JJ, Karanja N; University of Nairobi

T4-E.4 Multi-Criteria Decision Analysis to Prioritize Exotic Disease Risks to the Australian Pig Industry
Brookes VJ, Hernandez-Jover M; University of Sydney; Holyoake PK, Department of Primary Industries, Australia; Cowled BD, Ward MP; University of Sydney

T4-E.5 Use of the Precautionary Approach in Assessing Generalist Predators in the Glasshouse Industry in New Zealand
Bromfield K, EPA · BP House

F1 - Friday Morning
8:30 - 10:00 am (08:30 - 10:00)

Bayside 204 A

F1-A Symposium: Transdisciplinary Risk Analysis

Chair: Itsuki Handoh

F1-A.1 A Transdisciplinary Risk Assessment Framework to Define Planetary Boundaries for Chemical Pollution
Handoh IC, Research Institute for Humanity and Nature

F1-A.2 Bridging Gaps Between Scientific Knowledge and Societal Perception of Unexpected Disasters
Kubota J, Research Institute for Humanity and Nature

F1-A.3 Waterlogging Risk in Eastern Siberia: A Case Study in the Permafrost Region
Hiyama T, Research Institute for Humanity and Nature

F1-A.4 Transdisciplinarity and Transprofessionalism for Global Catastrophic Risk
Baum S, Pennsylvania State University

F1-A.5 An Evolutionary Approach to Understanding Emerging Risks using Phylogenetics
Allan ND, University of Bath

Bayside 204 B

F1-B Natural Disasters

Co-Chairs: Tom Beer and Ed Blakely

F1-B.1 Policy-Relevant Assessment Method for Socio-Economic Risks of Floods: An Italian Case Study
Carrera L, FEEM and Ca' Foscari University; Farinosi F, FEEM; Mysiak J, FEEM and CMCC

F1-B.2 Long-Run Effect of a Disaster: Structural Decomposition Analysis
Okuyama Y, University of Kitakyushu

F1-B.3 Population Protection Against the Natural Mass Movement
Bernatik A, Senovsky P, Senovsky M; VSB-Technical University of Ostrava, Czech Republic

F1-B.4 Mass-Evacuation Model for a Population Located in a Floodplain
Alaeddine H, Serrhini K, Maizia M, Néron E; UMR CITERES & LI, Tours France Francois-Rabelais University; houssein.alaeddine@etu.univ-tours.fr

F1-B.5 Expect and Act: Predicting Wildfire Preparedness from Perceived Risk, Responsibility, and Obstacles
McNeill I, Dunlop P; University of Western Australia; Skinner T, University of Tasmania; Morrison D, University of Western Australia

Bayside 203

F1-C Symposium: Assessing Emerging Chemical and Biological Risks

Chair: Phil Reeves

F1-C.1 APVMA Regulatory Strategy for Nanomaterials
Reeves P, Agricultural Pesticides and Veterinary Medicines Authority

F1-C.2 NICNAS Principles for New Technologies and Regulatory Strategy for Nanomaterials
Jayewardene R, National Industrial Chemicals Notification and Assessment Scheme

F1-C.3 Developing Robust Risk Assessment Methodology for Regulation of GMOs in Australia
Newton R, Office of the Gene Technology Regulator

F1-C.4 Managing Risks Associated with Medicines
Rothenfluh H, Therapeutic Goods Administration

F1-C.5 Regulatory Requirements for the Use of NanoTechnologies in Food in Australia and New Zealand
Fletcher N; FSANZ

Bayside 202

F1-D Reducing Accident Risks

Chair: Philipp Kirsch

F1-D.1 Railroad Hazardous Materials Transportation Risk Analysis and Evaluation of Train Safety Policy
Liu X, Saat MR, Barkan CPL; University of Illinois at Urbana-Champaign

F1-D.2 Consequence Modeling of Fire and Explosion in Compressed Natural Gas (CNG) Filling Station
Mollabakhshi K, Research Institute of Applied Science (ACECR), Iran

F1-D.3 Optimization of Pipe Network Design Using an Nlp and Minlp Approach
Gomez G, Gomez J, Munoz F; Universidad de los Andes

F1-D.4 Analysis of Chinese Public WTP for Risk Reduction of Chemical Industry Accidents
Huang L, Shao ZJ, Bao WL, Yu Wei, Bi J; School of Environment, Nanjing University

Bayside 201

F1-E Changing Risks in Land Use and Air Quality

Chair: Chang-Chuan Chan

F1-E.1 Environmental Stewardship for Gold Mining: A Case of Epidemiological Risk Management in Malaysia
Mazrura S, Anizan I, Salmijah S, Rozita H, Jamal HH; United Nation University-International Institute for Global Health

F1-E.2 The Patterns and Health Risks of NO2 and SO2 Pollution in Mongolia
Luvsan M-E, Shie R-H; National Taiwan University; Purevdorj T, University of Mongolia; Lkhagvasuren B, Barkhasragchaa B; National Agency for Meteorology and Environmental Monitoring

F1-E.3 Risk in Pulmonary Function Changes Associated with Exposure to Air Pollutants
Chen BY, Chan CC; National Taiwan University; Lee CT, National Central University; Cheng CC, Chen TJ; National Health Research Institutes; Guo YL, National Taiwan University*

F1-E.4 Spatiotemporal Impact Assessment of Asian Dust Storm on Children's Clinic Visits
Yu H-L, National Taiwan University; Chien L-C, Washington University School of Medicine; Yang C-H, National Taipei University of Nursing and Health Science

F1-E.5 Sub-Chronic Effects of Environmentally Relevant PM2.5 Exposure on Myocardial and Renal Tubules
Yan Y-H, National Taiwan University; Chou C CK, Academia Sinica; Wang J-S, Veterans General Hospital-Kaohsiung; Tung C-L, Veterans General Hospital-Kaohsiung; Cheng T-J, Chia-Yi Christian Hospital

F2 - Friday Morning
10:30 am - 12:00 pm (10:30 - 12:00)

Bayside 204 A

F2-A Symposium: Global Catastrophic Risks (GCRs)

Chair: Seth Baum

F2-A.1 Astrobiology and the Risk Landscape
Cirkovic M, Astronomical Observatory of Belgrade

F2-A.2 How Do We Analyze Global Catastrophic Risks Rationally? Climate Change and Expected Utility Maximization
Ng Y-K, Monash University, Australia

F2-A.3 Catastrophic Risk and Climate Change
Sherwood S, University of New South Wales

F2-A.4 The Intelligence Stairway and Global Catastrophic Risk
Tallinn J, Ambient Sound Investments

F2-A.5 Regulating Global Catastrophic Risk
Rowell A, University of Illinois College of Law

Bayside 204 B

F2-B Warnings, Perceptions, and Consequences

Chair: Ann Bostrom

F2-B.1 Social Impacts Induced by Radiation Risk in Fukushima Prefecture, Japan
Murayama T, Waseda University

F2-B.2 Judgments of Earthquake Risk Before and After the Canterbury Earthquakes for Locals and Non-Locals
McClure J, Victoria University of Wellington; Johnston DM, GNS Science

F2-B.3 Progression of Psychological Typhoon Eye in the 2008 Wenchuan Earthquake
Rao LL, Li S; Institute of Psychology, Chinese Academy of Sciences

F2-B.4 Forecasts and Warning Decisions for Hurricanes: Public Perceptions
Bostrom A, University of Washington; Lazo J, Morss R, DeMuth J, NCAR; Childers K, University of Washington

F2-B.5 Hazard Warning Decision-Making: Issues of Law, Probability and Risk
Woo G, Risk Management Solutions, UK

Bayside 203

F2-C Symposium: Risk Analysis Tools for Biosecurity

Chair: Jean Chesson

F2-C.1 Logic Trees
Walshe T, University of Melbourne

F2-C.2 Economics in Decision Making
Kompas T, Crawford School of Economics and Government, Australian National University

F2-C.3 Performance Indicators
Robinson A, ACERA; The University of Melbourne; Mudford R, Cannon R; DAFF Biosecurity

F2-C.4 Tools Developed for Resource Allocation
Walton M, Australian Government Department of Agriculture, Fisheries and Forestry

F2-C.5 Netting Likelihoods
Pheloung P, Australian Government DAFF

F2-C.6 Dealing with Consequences
Chesson J, Australian Government DAFF

F2-C.7 Rounding Up Risks
Hood G, Australian Government DAFF

Panel Discussion
Burgman M, ACERA

Bayside 202

F2-D Safety, Accident, Response

Chair: Gul Kizil

F2-D.1 Analysis and Assessment of Risk in an Industrial Chemical Plant
Sasso S, Laterza E, Valenzano B; ARPA Puglia, Servizio Tecnologie della Sicurezza e Gestione delle Emergenze

F2-D.2 A Trade-off Between Expected Costs and Benefits: The 60 Year History of Nuclear Energy
Romerio F, Gaudard L; University of Geneva

F2-D.3 Risk Communication and Risk Perception in Complex Interactive and Tightly Coupled Organisations
Marynissen HMF, Cranfield University (UK)

F2-D.4 Design and Implementation of Risk Transfer Mechanism in Developing Countries Using Catastrophe Risk Models
Zolfaghari MR, K N Toosi University of Technology, Iran

F2-D.5 Monte Carlo Simulation and Its Application in Modelling the Inclement Weather for Programming Civil Projects
Daneshmand P; UGL Limited

F2-D.6 Application of Risk - Cost - Benefit (RCB) Decision Support Tools for Mining Subsidence Risk M
Kizil GV, Bye A, Joy J; University of Queensland

Bayside 201

F2-E Symposium: Air Pollution and Health Risks

Chair: Dong Chun Shin

F2-E.1 Human Exposure and Health Risk Assessment of Child and Adolescents by using Artificial Turf in School
Yang JY, Yonsei University, Korea (Presented by Young Man R)

F2-E.2 The Costs and Benefits of Reducing VOCs in Japan
Inoue K, Kajihara H, Shinozaki H, Higashino H, Yoshida K; National Institute of Advanced Industrial Science and Technology

F2-E.3 Valuing the Health Damage Cost of Acute Cardiopulmonary Mortality of Urban PM2.5
Lee Y, Lim Y, Yang J, Shih D; Yonsei University, Korea

F2-E.4 Environmental Health Impact Assessment on Receptor Populations in a Municipality
Subramaniam K, Laila ZAS, Farah ASS, Ismail R; University Technology of Mara Puncak Alam

F2-E.5 Risk Durability Evaluation under Multiple Risk Conditions with the Illustration of Traffic and Environmental System
Tokai A, Nakazawa K, Kojima N, Ishimaru T, Sakagami M; Osaka University, Japan

F2-E.6 Ambient Particulate Matter as a Risk Factor for Mental Health
Cho J, Yonsei University School of Medicine

12:00-1:30 pm, Parkside Ballroom B

Plenary Luncheon:

Global Public Health

Co-Chairs: Jonathan Wiener, Daniela Leonte

The Future of Global Public Health

Antoine Flahault, EHESP French School of Public Health, Rennes-Sorbonne Paris Cité, France

Risk Analysis for Bioterrorism – A Public Health Framework to Inform Policy and Planning

Raina MacIntyre, School of Public Health and Community Medicine, University of New South Wales, Australia

F3 - Friday Afternoon
2:00 - 3:30 pm (14:00 - 15:30)

Bayside 204 A

F3-A Risk and Nanotechnologies

Chair: Ann Bostrom

F3-A.1 A Transferrable System for Identifying Uncertainties within Environmental Risk Assessments

Skinner DJC, Rocks SA, Pollard SJT; Cranfield University

F3-A.2 New Technologies as Social Experiments

Van de Poel IR, TU Delft

F3-A.3 Emerging Technological Risks: Expert and Public Risk Perceptions of Nanotechnology-Enabled Products

Cummings CL, North Carolina State University; Berube DM, North Carolina State University

F3-A.4 Reducing Risks of New Nanonamaterials: A European Interactive Database of MSDS's

Jovanovic S, Balos D, Dorjderem T; Steinbeis Advanced Risk Technologies GmbH, Germany

F3-A.5 Risk? What Risk? - Why Nanotechnology Risk Perceptions Remain Nano Sized

Cormick C, Ding S; Department of Innovation, Australia

Bayside 204 B

F3-B Risk of Climate Change

Chair: Patrick Dunlop

F3-B.1 Climate Change and Reorganizing of Land Use. Flood-Control Areas as Adaptation Practice

Bruzzone S, CURAPP/CNRS

F3-B.2 Impact of Climate Change for Risk Management: How Prepared are Food Industry Leaders?

Michael DT, Wondu Business, Sydney

F3-B.3 Risk to Water Supply System Due to Climate Change and Population Growth: A Study of Las Vegas Valley

Ahmad S, Dawadi S; UNLV

F3-B.4 Assessing the Risk-Mitigating Benefit of Urban Water Supply System Augmentation

Kandulu J, CSIRO

F3-B.5 Climate Change and Extreme Events

Beer T, CSIRO; Takeuchi K, ICHARM; Abbs D, CSIRO; Stott P, UK Met Office; Meehl G, NCAR

Bayside 203

F3-C Symposium: Health Impact Assessment

Co-Chairs: Rosalind Schoof, Elizabeth Miesner

F3-C.1 Synergies of HIA and Ecosystem Services in International Development Projects

Schoof R, Reub G, Greene G; ENVIRON International Corporation, Seattle and Olympia, WA and Clackamas, OR

F3-C.2 The Intersection of Health Impact Assessment and Human Health Risk Assessment

Miesner E, Hall L; ENVIRON International Corporation, San Francisco and Emeryville, CA

F3-C.3 Overview of Health Impact Assessment Practice Worldwide

Harris-Roxas B, Harris-Roxas Health

F3-C.4 Overview of Health Impact Assessment Practice in Australia

Harris P, University of New South Wales

F3-C.5 Health Impact Assessment in the Extractive Industry Sector

McCrea S, Environmental Resources Management (ERM), Perth, Australia

Bayside 202

F3-D Risk Assessment in Industrial Settings

Chair: Philipp Kirsch

F3-D.1 Qualitative Industrial Hygiene Risk Assessment - A Basic Tool for Risk Control at Workplace

Potharaju PM, Vizag Steel

F3-D.2 Risk Assessment for Petrochemical Facilities

Hsu H-T, Lin CH, Lai CH, Chen MJ, Cheng LH, Yang YH; Fooyin University

F3-D.3 Risk-Based Model for Prioritization of Environmental Inspections in Chile

Cifuentes L, Borchers N, Pica A, Romero A; PUC Chile

F3-D.4 RISKGATE - An Innovative Online Portal to Assist Risk Management in the Australian Coal Industry

Kirsch P, Harris J, Goater S, Cliff D, Sprott D; Minerals Industry Safety and Health Centre, UQ

Bayside 201

F3-E Symposium: Risks in New SRA Regions: Latin America and North Africa

Co-Chairs: Hugo Murcia, Souad Benromdhane

F3-E.1 Volcanoes: Hazard Perception to Monogenetic Volcanism

Murcia H, University of Auckland

F3-E.2 Environmental Risk in the Del Plata Basin: Water Pollution Sources, Floods and People

Demichelis S, Universidad de La Plata

F3-E.3 The Importance of Chemical Reactivity in Quantitative Risk Assessment for the Environmental Licensing in Brazil

Portela M, AGR Engenharia

F3-E.4 Libya's Future: Challenges and Opportunities

Elmontsri M, SRA-Egypt

F3-E.5 Risk Perception in Jordan

Mahmaod M

F3-E.6 Balancing Economic, Social and Environmental Aspects - Sustainability Failure and the Tunisian Revolution

Saad A, SRA-Egypt (Presented by Benromdhane S)

F4 - Friday Afternoon
4:00 - 5:30 pm (16:00 - 17:30)

Bayside 204 A

F4-A Symposium: Regulation of GMOs in South East Asia

Chair: Paul Keese

F4-A.1 Regulation of GMOs in Australia

Smith J, Gene Technology Regulator, Australia

F4-A.2 Regulation of GMOs in Malaysia

Ramatha L, Anthonysamy A; Ministry of Natural Resources and Environment, Malaysia

F4-A.3 Regulation of GMOs in Phillippines

Carino FA, University of the Philippines-Diliman; Ramirez DA, National Academy of Science and Technology, Philippines; Estacio JFL, Department of Science and Technology, Philippines

F4-A.4 Regulation of GMOs in New Zealand

Atapattu A, Environment Protection Authority of New Zealand

F4-A.5 Untangling the Concepts of Risk and Safety in the Regulation of New Technologies

Keese P, Office of the Gene Technology Regulator

Bayside 204 B

F4-B Qualitative Uncertainty Methods

Chair: James Franklin

F4-B.1 Qualitative Occupational Risk Assessment Model - A Fuzzy Approach

Pinto A, ISEC - Instituto Superior de Educação e Ciências; Nunes IL, Universidade Nova Lisboa; Ribeiro RA, Centro de Tecnologia e Sistemas, UNINOVA

F4-B.2 Uncertainty Modelling in Risk Analysis using Bayesian Networks

Chivata CI, Al-Jibouri Saad HS, Halman J; University of Twente

F4-B.3 Extreme Risks, Data-Free Statistics, and Conflict of Interest in Risk Analyses

Franklin J, University of New South Wales

Bayside 203

F4-C Benefit Cost and Risks in Developing Countries

Chair: Royce Francis

F4-C.1 The Costs and Environmental Consequences of Passenger Vehicle Growth in India

Gilmore EA, Iyer G, Patwardhan A; University of Maryland

F4-C.2 DAISY for Development: Benefits and Costs of Introducing Assistive Technology for Equitable Access to Information in Bangladesh

Hussain F, Asian University for Women

F4-C.3 Risk-Based Mathematical Models for Evaluating Sustainable Development Progress

Amekudzi AA, Georgia Institute of Technology

F4-C.4 Estimating the Risks of Reducing Emission from Deforestation and Forest Degradation (REDD) Programs

Yaoyao J, Ram R, Macquarie University

Bayside 202

F4-D Symposium: Risk Communications and H1N1

Chair: Michelle Driedger

F4-D.1 Pandemic H1N1 in Canada: Risk Communication Context and Challenges

Kain N, Jardine C; University of Alberta; Driedger S, University of Manitoba; Keelan J, University of Toronto

F4-D.2 What is 'Vulnerability' in a Pandemic? A Case Study of the Canadian pH1N1 Response

Lechelt L, Jardine C, Bubela T; University of Alberta

F4-D.3 First Nations and Metis Responses to H1N1 Risk Messages in Manitoba

Cooper E, Driedger S; University of Manitoba; Jardine C, University of Alberta; Furgal C, Trent University

F4-D.4 Moving Beyond Knowledge Deficits: Public Understanding of Vaccine Risk Messaging

Driedger S, University of Manitoba; Boerner F, Winton L, Jardine C; University of Alberta; Keelan J, University of Toronto

F4-D.5 Lessons Learned from Canada's Pandemic H1N1 Experience - Policy Considerations and Reality on the Ground

Jardine C, University of Alberta; Driedger S, University of Manitoba; Keelan J, University of Toronto; Boerner F, University of Alberta

Bayside 201

F4-E Symposium: Energy, Security and Emergency Management

Chair: Valery Lesnykh

F4-E.1 Energy Security Analysis and Energy Security Level Assessment

Bykov A, President of the Russian Scientific Society for Risk Analysis; Faleev M

F4-E.2 The Russian Scientific Society for Risk Analysis and the Creation of Risk Management Technologies in the Field of Population and Territories Complex Safety

Bykov A, Vice-President of the Russian Scientific Society for Risk Analysis, Editor-in-Chief of the Issues of Risk Analysis Scientific Journal; Faleev M, President of the Russian Scientific Society for Risk Analysis

5:30-7:00 PM (17:30-19:00)
Bayside Terrace

Closing Reception

T2-C.1 RISK OF AVIAN INFLUENZA FROM LIVE BIRD MARKETS TO LOCAL POULTRY AND IMPACT ON THE LIVELIHOOD OF FARMERS

Abdu P, Assam A; Ahmadu Bello University, Zaria - Nigeria; paabdu2004@yahoo. com

Over a billion people living in abject poverty in the developing world keeps local poultry(LP)which was identified as a tool for poverty alleviation.This paper assessed qualitatively,risk of HPAI transmission from live bird markets(LBM)to LP and impact on farmers livelihood in Nigeria.OIE risk assessment framework was used with categorical scale used in assessing probabilities. Data to assess likelihood of occurrence of each pathway steps were obtained from literature. Identified release and exposure pathways were live birds, fowl sellers, manure, scavengers, consumers and transporters. Most release pathways were associated with high risk of occurrence: live birds, fowl sellers, manure, consumers and transporters. The release risk estimates for scavengers was medium. Most risk estimates were associated with medium level of uncertainty, due to few documented evidence except for live birds and fowl sellers estimated with low uncertainty. The risk of infection of LP through exposure to HPAI from LBMs was assessed as medium via scavengers and consumers, high via live birds and transporters; very high via manure and fowl sellers. The overall risk estimate for the transmission of HPAI from LBMs to LP is medium to high with medium level of uncertainty.Pathways associated with highest risk of transmission are live birds, manure, fowl sellers and transporters (high risk), followed by scavengers and consumers (medium risk). Purchasing of breeder LP from LBMs increases chances of LP exposure to HPAI. High level of uncertainty for most pathways indicates limited or non available data. Since most poor and landless people own LP, HPAI outbreak in LP will result in income losses thereby worsening their poverty. This would adversely affect efforts to reduce poverty and food insecurity in Nigeria while posing a threat to farmers' health. Local poultry are at high risk of being infected with HPAI virus from LBMs with adverse impact on their livelihood and health.

F3-B.3 RISK TO WATER SUPPLY SYSTEM DUE TO CLIMATE CHANGE AND POPULATION GROWTHT: A STUDY OF LAS VEGAS VALLEY

Ahmad S, Dawadi S; UNLV; dawadis@unlv.nevada.edu

The effect of increasing population growth and changing climatic conditions on the water supply and demand of the Las Vegas Valley (LVV) located in southern Nevada were investigated. A system dynamics model, operating on monthly time step was developed from 1970 to 2035. The impacts of climate change on water demand in the LVV and the water supply from the Colorado River at Lake Mead were modeled using 16 global climate model outputs and 3 emission scenarios. Different scenarios of population growth and demand management policies, including water conservation and water pricing were evaluated. With the projected population growth and no further demand management policies, the LVV will not be able to meet the water demand in near future. Major finding include: • Average reduction in streamflow magnitude by about 3% was observed by 2035. • About 14% chance of supply curtailments to the Lower Basin was observed by 2035. • Results varied from 0% to 46% for the individual GCM for the probability of Lake Mead levels dropping down below 305 m i.e., when supply will be stopped. • Ensemble average water supply reliability to the LVV was 0.86 till 2035. • Maximum deficit as a percentage of demand to the Lower Basin was approximately 40% of total demand. • Combination of conservation and a 50% price rise provides sustainable supply till 2035 • Reliability of water supply system decreases with climate change.

F1-B.4 MASS-EVACUATION MODEL FOR A POPULATION LOCATED IN A FLOODPLAIN

Alaeddine H, Serrhini K, Maizia M, Néron E; UMR CITERES & LI, Tours France Francois-Rabelais University; houssein.alaeddine@etu.univ-tours.fr

The importance of managing an urban site threatened or affected by flooding requires the development of effective evacuation systems. An effective evacuation system has to take into account some constraints such as the transportation traffic which plays an important role as well as others such as the accessibility or necessary human resources and material equipment (vehicles, assembly points, etc...).

The ultimate objective of this work is to bring assistance to the technical services and brigade forces in terms of accessibility by providing itineraries with respect to rescue operations and the evacuation of people and goods.

As part in World Congress on Risk 2012 "Risk and Development in a Changing World" in Sydney Australia, this paper aims to address the use of Spatio-Temporal Optimization Model (STOM). This model, arranged with a specific set-up (urban database, flood scenario database), enables the representation of evacuation trajectories of concerned population while minimizing the total clearance time (Tc). This optimization algorithm should take into account several constraints such as the accessibility, the capacity of transport roads, the capacity of safe areas (assembly points) and the vulnerability of transport networks (for instance during a flooding event), etc.

STOM is closely connected to specific issues such as Optimal Routing Problem (OPR), Vehicle Routing Problem (VRP) and Multi Agent System (MAS). The expected objective of these issues is to find with respect to traffic flow constraints an optimal allocation of paths connecting the origins that need to be evacuated (buildings) with safe destinations (assembly points).

A method to connect assembly points to origins and calculate the optimal egress paths will be presented. To minimize the total evacuation time, a Linear Programming (LP) formulation for optimal vehicle allocation to roads avoiding traffic-jams will be shown. The methods developed and results obtained will be tested. This paper is based on a current research project (ACCELL, 2011-2013, founded by EP-Loire and FEDER) in UMR CITERES and LI laboratories, Tours, France.

W4-B.5 RISK COMMUNICATION DISCOURSE: A CONTENT ANALYSIS OF AUSTRALIAN MEDIA COVERAGE OF QUEENSLAND CYCLONES, 2011

Al-Harbi A, Monash University; ahlam.alharbi@monash.edu

As a cross-disciplinary field, the risk communication (RC) discourse is complex. Thereof, media coverage of disasters as a fundamental resource of RC should be examined to guarantee successful delivery of risk information. This study investigated the content of risk information of cyclone-related news of the Brisbane Times and The Australian newspapers. It scrutinized the different types of risk-related messages by means of a quantitative content analysis based on the Extended Parallel Processing Mode (EPPM) proposed by Witte (1980). The media coverage of the 2011 Queensland cyclones was examined with respect to the main question: what type of risk information the public was provided with? The analysis has shown that the coverage of the Brisbane Times and The Australian might be enhanced by covering main components of RC discourse equally, focusing more on the component of efficacy, specifically 'the outcomes of preventive actions'.

F1-A.5 AN EVOLUTIONARY APPROACH TO UNDERSTANDING EMERGING RISKS USING PHYLOGENETICS

Allan ND, University of Bath; n.d.allan@bath.ac.uk

Risk systems, particularly those that involve human interaction, are often classified as complex systems. One of the key characteristics of complex systems is that they evolve and adapt. Therefore, a detailed understanding of the evolution of risks should reveal the nature, path dependency and future emerging trends in that set of risks. A methodology is proposed in this paper that draws on phylogenetic approaches that have been successfully developed for biological and language evolution studies. The methodology provides an insight into the lineage, pace and impact of external conditions on the evolution of emerging risks. The approach also provides a unique and rational classification of any risk system, which can be used to optimize risk management resources. Two case studies will be presented, one using project risk characteristics from publically available data, available from the RAMP (Risk Analysis

and Management of Projects) report, the other uses data from an international insurance company with multiple locations which allows for common patterns to be determined. A full interpretation of the evolutionary trees presented will be given along with an analysis of possible emerging risks. To conclude a critic will be given of the suitability of the available software tools used for phylogenetic analysis, within the context of this emerging risk methodology.

W1-A.5 ASSESSING RISKS ASSOCIATED WITH CLIMATE EXTREMES: EFFECTS OF HEAVY TAILS AND RANGE OF DEPENDENCE

Alparslan UT, American University, Washington DC; tuncay.alparslan@american.edu

The Fourth Assessment Report by the Intergovernmental Panel on Climate Change states that human influence is contributing to changes in local and global climate variables, which are expected to increase the probability of weather related extreme events that will have direct effects on the quality of human life. It is then imperative to specify quantitative tools to identify changes across historical data on extreme weather events, and develop techniques to estimate the probability of multiple extremes occurring together in a given region to enhance the likelihood of capturing the changes in several variables. This in turn will provide more reliable information to policy makers and planners who are developing sustainable systems to improve the human experience. In this talk we investigate "ruin probability," a commonly used performance measure in actuarial science, as a risk assessment tool for climate extremes. Classical ruin problem usually assumes independent, identically distributed steps and a linear drift. However a more realistic setting in the context of climate extremes requires temporal dependence in a given variable. Moreover, empirical evidence showing increased likelihood of extremes necessitates modeling these variables using heavy tailed probability laws. The case of heavy tailed, dependent steps is also interesting from a purely mathematical point of view as it raises the possibility of relating the dependence structure of heavy tailed stochastic processes to the asymptotic behavior of the ruin probability. This becomes particularly intriguing when the variables are highly volatile so that it is not possible to use traditional covariance based measures to quantify the dependence structure of the process. We propose a probability model, which uses dependent climate variables following infinite-variance stable distributions, and allows for nonlinear drifts. We then analyze the effects of range of dependence on the ruin probability in this setting.

F4-C.3 RISK-BASED MATHEMATICAL MODELS FOR EVALUATING SUSTAINABLE DEVELOPMENT PROGRESS

Amekudzi AA, Georgia Institute of Technology; adjo.amekudzi@ce.gatech.edu

Commitments to develop sustainably typically include credible performance objectives and evaluation methods for measuring progress toward such objectives. Over the past three decades, the literature has offered a growing number of models for evaluating progress toward sustainable development. While there are commonalities from community to community, there are also contextual differences that come into play in developing sustainably. This paper assesses the appropriateness of various models for measuring sustainable development progress in different geographical contexts, and discusses the assumptions and biases that can be introduced by adopting various classes of models. Considering the socio- economic and environmental contexts of selected non-homogeneous communities, the paper assesses the results of different models applied to evaluate sustainable development progress. Using a conceptual framework based on capital transformations and the risks of failure to develop sustainably, the results are discussed to provide guidance for selecting appropriate models to evaluate sustainable development progress for non-homogeneous communities.

T3-C.1 MULTISECTORAL RISK MODEL FOR THE GLOBAL ECONOMY

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The global economy has experienced various shocks and effects of different impacts. These include war, corruption, civil unrest, politics, piracy, terrorism, flooding to name but just a few. These have had a great influence on the global economy such that with the many austerity measures that have been undertaken in the past four years the world at large has not been able to mitigate these influences amicably. This study intends to determine a multivariable risk models that takes into consideration the various sectors of the economy and weights the different global economies against each other so that the weights can be used globally for determining various risks and cost of organisation in order to mitigate these impacts effectively. It is hoped that the model will facilitate stabilization of the markets and normalization of the spillover effects.

W4-D.2 OPTIONS FOR SUSTAINABLE MUNICIPAL WATER SERVICES: INTEGRATING QMRA WITH ECOSYSTEM AND ECONOMIC ASSESSMENTS FOR SELECTING FUTURE WATER INFRASTRUCTURE

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The justification for a particular water service infrastructure is highly dependent upon the metrics used in option selection. Focusing on only some aspects (e.g. price and human health) provides for a solution set that may prove to be unsustainable, in essence, what we have today in many US cities with decayed infrastructure and ecosystem services. Of equal concern is the correction of one problem that inadvertently creates stress on a currently unmeasured aspect of the water system. Hence, within the three pillars of sustainability (society, environment and economy), the human health aspects of pathogens and chemicals is being assessed by quantitative risk assessment approaches; and matched with other tools to assess environmental and economic aspects (e.g. ecological footprint, emergy, life-cycle assessment, life-cycle costing). The focus for this presentation is on how one could use QMRA to address potential pathogen impacts over the life-time of water systems under consideration. To provide a context to develop appropriate metrics and tools, four generic system types have been identified that form the base-cases of today's systems: 1) rural, non-sewered; 2) small, environmental justice community (with some degree of centralized drinking water and sewage, but poorly maintained and operated), 3) brownfield redevelopment, such as in downtown Detroit, Cleveland or Cincinnati; and 4) greenfield development (i.e. former open land). Hypothetical cases will initially be considered for each of these four generic types of water infrastructure. The challenge therefore identified in this paper is to provide the appropriate level of precision required to address pathogen risks along with impacts from chemicals of concern, and ecosystem and economic issues. Points addressing management systems that describe novel metrics such as system robustness from 'pathogen events' will be described, along with more traditional uses of QMRA.

F4-A.4 REGULATION OF GMOS IN NEW ZEALAND

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The Hazardous Substances and New Organisms Act 1996 (HSNO Act), which regulates genetically modified organisms (GMO) in New Zealand, sets out a unique approval system where decisions are made by weighing risks against benefits. The risk benefit assessment is conducted across five impact areas: Human Health, the Environment, Society and Community, the Treaty of Waitangi and Market Economy. No GMOs have ever been released or is there a threshold for unintended presence of GMOs been established. This creates a conundrum for industry researching GM grasses. An exposure curve for GM grass pollen-mediated gene flow at a field trial site has a peak at the site which reduces with an asymptote-like trailing edge as the distance from field trial site increases. However, while the exposure curve can provide an indication of the likelihood of gene flow, for a risk assessment based on likelihood and magnitude, this is only half the story. The magnitude of the effect must be calculated based on the consequence of exposure, for example, human allergy, contamination of non-GM certified seed and adverse effects of animals feeding on the GM grass. This creates a problem for the field trialling of a wind-pollinated GM grass, as you must demonstrate that all the risks arising from pollen mediated gene flow, under an asymptotic exposure curve, are outweighed by the benefits. The conundrum faced in performing a risk assessment for a GM grass, assuming you have a single field trial site, is how far along the curve do you have to consider risk to be certain that all the relevant risks are captured? Does it mean that we have to assume the whole country is exposed and therefore consider risks as if the field test was a full/commercial release? Can the scientific benefit of a field trial outweigh risk to the whole of New Zea-

land? Alternatively, are applicants left to chase a pot of gold at the end of a rainbow? By implementing a system that requires benefits to outweigh risk, have we broken the pipeline for GM grasses development at the field trail stage?

T3-A.1 MULTI-CRITERIA ASSESSMENT OF ENVIRONMENTAL RISK IN CHINESE RURAL AREA

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The rising environmental risk threatening Lake Taihu and the adjacent rural area is garnering more and more attention world-wide. Multiple pressures are imposed on the rural environment, which calls for an integrative assessment. Our study aimed to formulate a multi-criteria frame work to assess environmental risk in rural areas, portrayed risks from both objective and subjective perspectives. Since there might be distinguish between the real risk level and that perceived by individuals, environmental awareness was innovatively introduced into the assessment in addition to the traditional social indicators. Four parameters were selected to describe environmental awareness as an indicator influencing on regional risk. This indicator as well as its parameters measured how much people cared about the environmental problems, how much risk they could feel, and whether they were willing to mitigate risks. Then we applied the indicators in a case study in three different rural areas in Changzhou, nearby Taihu Lake. The results were converted into the geographic map to show the regional distribution heterogeneity of risks. Single-index assessment suggested: (1) the farming land posed more risk than other land use; (2) areas promoting environmental education was more sensitive to environmental risk, leading to higher risk perception level. The integrative assessment indicated that although heavy application of fertilizer caused higher risk, stronger environmental awareness might lead to more voluntary risk mitigation in this area. Thus, environmental risk could be reduced or prevented by modified land use planning and control of fertilizer usage. To strengthen the environmental sensitivity was also critical in Chinese rural area to improve individual attitudes to environment and their behaviors.

P2.11 SERVICES AND PRODUCTS FOR ADVANCED RISK MANAGEMENT AS A BASIS FOR BUSINESS

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Services and products for advanced risk management as a basis for business.

P2.24 DESIGN OF DELIVERY ROUTES OF HAZARDOUS MATERIAL AND OPTIMIZATION WITH RISK MINIMIZATION CRITERION

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The use of hazardous materials (HazMat) is required for the development of the majority of the production processes.In urban areas the vulnerability increases due to the high population density and the volume of the infrastructure. The purpose of this work is to provide a multiobjective formulation integrating both the minimization of total risk and the reduction of distance cost of transport. Obtaining a delivery model that avoid the exposure to an unacceptable level in a punctual region in comparison to the rest of the transport area. The risk was assessed taking into account the events fires and explosions for consequences determination. The estimation provides the model of an accurate approximation of risk, necessary to validate the efficiency of the model in the description of operations of urban transport and optimization to a minimal risk. The frequential probabilities for each objective event are estimated by developing an event tree (CCPS, 1999). To this effect, is compiles and analyzes the characteristics of 800 different accidents approximately of the initiating event release of hazardous material. The description of these accidents was based on the historical incident database Barpi-Aria. A distribution network with an acceptable risk was implemented in GAMS (General Algebraic Modeling System) with a combination of arcs (section of roads) and nodes (intersection points). There was integrated restrictions that includes elements as: the capacity of vehicle, estimated the risk magnitude using the total amount that is send by an arc, and the return of each truck to the source node, is also offered a propose for the multi commodity distribution and the decision to assign to each type to different vehicle or send in one truck a set of various types of materials. Finally, the specific scenario of Bogota D.C (Colombia) of delivery routes optimization was performed. The results are applied to determine the possible consequences and mitigation plans if regular distribution routes are affected.

W2-A.3 SUSTAINABLE SEDIMENT MANAGEMENT: CASE STUDIES IN DECISION ANALYSIS AND STAKEHOLDER ENGAGEMENT

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Sediment management is an important component of industrialization for countries with access to rivers, oceans, and shipping lanes. In both developed and developing countries, routine dredging is necessary to establish and maintain the usability of ports, harbors, and shipping lanes and support a primary foundation of international trade. With awareness of high levels of environmental and human health risks from contaminated sediments in many industrial harbors and with increased public scrutiny for even relative clean dredging and disposal operations, it is increasingly necessary for national governments and local authorities to consider environmental and stakeholder needs in project planning. Sustainable sediment management, which we define as having a life-cycle perspective, environmental impact and benefit assessment, structured stakeholder engagement and formal decision analysis, identifies solutions that holistically evaluate alternative projects with respect to local, international, environmental, economic, social, and human health needs. This presentation highlights recent advances in sustainable sediment management through three case studies in Grenland Fjord, Norway and Long Island Sound and New York-New Jersey Harbor, USA, where complex dredging and sediment capping decisions are being or have been made with explicit consideration of these issues. In these examples we introduce budding approach to life-cycle analysis for dredging operations, structured stakeholder engagement to collaboratively define project objectives, decision analysis methods suitable for high uncertainty, decision-based tools to evaluate and guide further research and the integration of quantitative and qualitative data/preferences to compare and rank projects in terms of their holistic appeal. The software demonstration of these case studies will be covered in separate presentation in this session on the DECERNS software tool.

W2-A.5 INTEGRATING THE PHYSICAL AND SOCIAL SCIENCES TO GUIDE SUSTAINABLE DEVELOPMENT RESEARCH

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Many agencies and organizations in the US and worldwide are focusing on sustainable development. However, the political environment is increasingly skeptical of the social benefit of basic research regarding issues that involve risk to humans, notably in areas such as environmental science. Implementing and sustaining research on sustainable development requires careful prioritization of available resources and focusing efforts to optimize the environmental, economic, and societal pillars of sustainability. A common guideline in science-related policy decisions is to structure analysis so that many parties may propose alternatives; scientific and engineering experts provide judgments about the factual questions, while stakeholders and policy makers provide judgments about value tradeoffs. Techniques such as decision analysis and value of information analysis may then be used to combine factual and value-based judgments to make defensible choices among alternative courses of action. This presentation proposes a general framework for integrating physical and social sciences and illustrates its application through the US Army Engineer Research and Development Center's current research across different domains, including portfolio approaches for water infrastructure asset management, stakeholder engagement in management of sediments (with examples from USA and Norway), and coastal restoration management (with examples of Everglades National Park and Eglin Air Force Base). Broader applications of these analytic methods would provide two important benefits: 1) improving management of technical information from scientists and engineers to the risk managers that are required to handle ever increasing volumes of data, and 2) enhancing documentation of decision processes in a manner consistent with the calls for improved transparency in regulatory decision making.

T3-C.3 THE DYNAMICS OF POLITICAL RISK UNDERWRITING: RISK DECISION-MAKING IN A SPECIALIST INSURANCE MARKET

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The Political Risk Insurance (PRI) sector has been largely overlooked by regulators, and academics alike, despite the fact that the market helps to promote foreign trade and contribute to the economic development of emerging markets. With political risk on the rise, there is a greater need to examine which factors impact on political risk perception and acceptance in the insurance market.

PRI is a challenging research field for a number of reasons. Firstly, it is a highly specialised niche market with the total of 82 public and private PRI providers worldwide (Berne Union, 2010). Secondly, it is a relatively new line of business, which origins can be traced back to the foundation of the Berne Union in 1934 with the private PRI market being formed in early 1970s. Finally, the sector suffers from lack of transparency with only scarce publicly available quantitative data (Spagnoletti and O'Callaghan, 2011).

The study overcomes obstacles of shortage of data by adopting an innovative research design which has enabled to generate primary data. A scenario-based survey approach was chosen as it allowed authors to control for more context-specific variables that could impact on an underwriter's risk perception and risk acceptance. The research instrument was divided into four sections. Each section started with a hypothetical risk description with the study participant informed that he or she would need to make an underwriting decision regarding the risk (i.e., to decide if the risk is acceptable for a portfolio of risks). A total of 113 PRI market participants successfully completed the survey. The data was analysed using the ordered probit regression model with a dependent variable that measures risk acceptance level. Control variables included risk specific factors (e.g., type of coverage requested, policy period, host country, reinsurance availability, etc.) and demographic factors (e.g., gender, age, experience, and qualification). This is a pioneering study in the field of PRI underwriting.

F1-A.4 TRANSDISCIPLINARITY AND TRANSPROFESSIONALISM FOR GLOBAL CATASTROPHIC RISK

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Global catastrophic risks (GCRs) are risks of the highest magnitude, including climate change, nuclear warfare, and pandemics. Much is at stake with our ability to understand and respond to GCRs, including no less than the long-term viability of human civilization. But the complexity of GCRs requires transdisciplinary research, i.e. research that transcends academic disciplines. Likewise, responding to GCRs requires translating research ideas into risk-reducing actions via what may be termed transprofessionalism, i.e. activity that transcends specific professions. Only when transdisciplinary research and transprofessional activity are combined can we achieve an informed and effective response to GCRs. This presentation discusses transdisciplinarity and transprofessionalism for GCR. It begins by outlining the theoretical frameworks of transdisciplinarity and transprofessionalism as discussed in the academic literature. It then discusses efforts to realize transdisciplinarity and transprofessionalism for GCR, using climate change as an illustrative example. Recent literature on catastrophic climate change has focused on the unlikely possibility of large temperature increases, but catastrophic outcomes could also come from failures to adapt to lower, likelier temperature increases. Research to understand such scenarios requires fusing several disciplines in the natural and social sciences, the humanities, engineering, and public policy. Likewise responses can involve emissions reduction, humanitarian aid, and international diplomacy. Even popular media has a role to play in raising awareness and motivating the public to take action. The most effective responses will emerge from transprofessional action as informed by transdisciplinary research.

F3-B.5 CLIMATE CHANGE AND EXTREME EVENTS

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This symposium seeks to examine the Global and Emerging Risks to the Hydrometeorological cycle of the Earth as a result of possible climate change by considering climate change and extreme events. We will examine four issues: 1. Modelling - How well do the present generation of climate models predict extreme meteorological events, extreme hydrological events, and concatenated events such as floods and storm surge from tropical cyclones (hurricanes)? 2. Attribution - to what extent can present heat waves and cold spells be attributed to climate change and global warming? 3. Predicting tropical cyclones as a result of climate change. 4. Predicting floods as a result of climate change.

F1-B.3 POPULATION PROTECTION AGAINST THE NATURAL MASS MOVEMENT

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The goal of the contribution is to present a new solution for the protection of the environment and population against the consequences of natural mass transfer due to enormous rains and other natural influences. The contribution deals with the possibilities of using information technologies as supporting tools to make the process of evacuation of populations from endangered areas more effective. The major shift from the present state should be done above all in the area of integration of data from various sources. It is especially a case of map data, river flooding models and evacuation model, combined with demographic data and condition of a road network used for evacuation. A new system should be used mainly in operations centres and crisis headquarters in the course of floods. Owing to climate changes, floods have become an integral part of our lives. Just in the Czech Republic, catastrophic floods occurred in the years 1997, 2002, 2005 and 2009. As a result of a growing frequency of these events we face a difficult decision about what should be protected, where and why. This contribution was prepared as part of the grant project of the Technology Agency of the Czech Republic under number TA01021374, titled "Nove technologie ochrany zivotniho prostredi pred negativnimi nasledky pohybujicich se prirodnich hmot" (New Technologies for Environmental Protection against Negative Effects of Natural Mass Transfer).

P2.9 MAP OF RISKS FOR THE IMPLEMENTATION OF RFID SOLUTION TO TRACE ANCILLARIES

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Ancillaries are devices provided by external manufacturers which are used to help surgeons implant or extract prosthesis. Their circuit is complex since it involves the departments of Sterilization and Surgery as well as the suppliers. The hospital must be able to justify all actions related with ancillaries to the suppliers and if necessary to the patients. Each action of the ancillaries' handling must be traced from sterilization to the surgery block. Such a long circuit exposes the instruments to potential risk hazards. In order to reduce the risk of errors we will propose the implementation of radio-frequency identification (RFID) solution to trace the ancillaries during each step of the supply chain. The objective of our study is to analyze and to map the risks associated with RFID implementation. A preliminary analysis of risks (APR) is conducted to map out the hazards for the implementation of RFID. The APR is a method used to identify hazardous situations and potential scenarios of adverse effects. It is conducted in order to make a plan of risk reduction and to elaborate on the management of residual risks. Seventy six (65%) score 1 (major risk) hazardous situations were identified and 40 score 2 (minor risk). The APR identifies 162 scenarios with a maximum risk connected to environment and technology. For each scenario, the cause of the potential hazardous situation is evaluated according to the consequences it may have and using the scales described above. To reduce the risks identified, 22 courses of action are proposed, such as audits, training, and internal controls. For each action, a procedure has been designed and evaluated. This preliminary analysis of risks allows targeting the potential dangers for the RFID implementation applied to ancillaries and reduces them significantly.

T4-B.4 FROM NANOTECHNOLOGY TO SYNTHETIC BIOLOGY: COMPARING UNPRIMED ASSOCIATIVE DATA AND PUBLIC RISK PERCEPTIONS

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Few empirical studies have been undertaken to judge public attitudes about synthetic biology and associated risk perceptions or compares public perceptions of synthetic biology to other enabling

technological risks. We discuss two data sets collected from a national public survey of US households as well during multiple US public engagement events concerning public issues in emerging science and technology. The first data set compares findings from an open-ended questionnaire that produced unprimed, baseline data concerning the public understanding of synthetic biology. Findings from a qualitative constant-comparative method identified four broad categories of responses. The second data set uses hierarchical ordinary least squares regression modeling to assess the predictive power of various individual-level characteristics on risk perceptions to a synthetic biology technology. Findings suggest that emerging technological risks are more easily predicted than other risks when isolating variables including age, sex, education, and use of digital media like blogs and wikis.

T3-A.4 ASSESSING RISK FOR AN INTERNATIONAL OCCUPATIONAL SAFE WORK PRACTICE

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Servicing engines and the removal of internal engine gaskets have inherent hazards and potential risks which contemplate a need for a Safe Work Practice (SWP) and a technician training program that can meet the asbestos regulations in some 50 countries internationally. Methods: The project was undertaken as a result of questions regarding the handling of internal asbestos-containing gaskets during normal maintenance activities in thousands of facilities in various countries worldwide. Regulations were compiled, the gaskets and applications of interest were identified, and specific exposure assessment studies were conducted to gather data regarding airborne concentrations. Activity specific isolation chamber studies and/or field studies were conducted in the United States, Singapore, Brazil, India, China, Morocco, the UAE, Mexico, and Australia. Full time, professional equipment technicians were used in the studies. Multiple day personal BZ 8-hrTWA and 30-min EL were collected and analyzed for total and asbestos fibers. A wide variety of conditions were considered such as controlled v. non controlled, wet v. dry, production volume v. specialty work, aggressive v. non-aggressive techniques. Results: Much of the data were censored with airborne concentrations of asbestos (chrysotile) were less than limits of quantification. The average of all personal 8-hrTVVA samples was

T4-D.4 MAKING SENSE OF THE AVAILABLE EVIDENCE ON EFFECTS OF INFORMING ABOUT PRECAUTIONARY MEASURES

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Potential long-term risks with high impacts on the environment and human health have changed risk policies towards a more precautionary approach in the face of unknown or unclear dangers. It has been widely accepted among both national and international regulatory bodies that the public should be informed about the precautionary nature of public safety guidelines. It is been assumed that the expressed reliance on precautionary measures will reduce public risk perception, mitigate public concerns, and even strengthen trust in the regulatory bodies themselves. However, an alternative outcome might be possible as well; the emphasis in risk communication on precautionary measures for addressing the element of uncertainty in current scientific knowledge and associated health-based risk assessments may result in countervailing effects on risk perception. Although the first outcome has become the accepted regulatory position, recent experimental research suggests that precautionary information may amplify risk perceptions, elevating public concerns. Other qualitative research reveals a more ambiguous picture. The presentation summarizes and evaluates the available empirical evidence on the effects of precautionary information on perceived risk and trust in EMF and climate change research. Practical implications and recommendations for risk communication and specific policy considerations for both areas will be discussed.

W2-B.3 MENTAL MODELS AND RISK PERCEPTIONS OF GLOBAL ENVIRONMENTAL RISKS

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Global risks such as climate change are becoming increasingly urgent challenges to our society. Human behavior plays a central role in such risks. It is therefore important to understand how people perceive them. Previous research has shown that mental models are an essential part of risk perception that shapes subjective risk evaluations, policy preferences, and the reception of risk communications. We present a study in which we pursued three aims: (a) describe lay causal mental models of global environmental risks, (b) compare lay models with an expert model, and (c) relate mental models to risk judgments. Mental models were elicited by a cognitive mapping technique in which 133 German participants indicated which causal links they perceived between 25 provided causal terms (derived from pilot work). Furthermore, participants rated the same set of 25 terms on 13 psychometric risk scales. Results show that mental models are structured according to five causally connected levels: attitudes (e.g., lack of environmental concern), behaviors (e.g., industrial production), pollution (e.g., air pollution), environmental changes (e.g., climate change), and long-term negative consequences (e.g., species extinction). These levels differ systematically in perceived risk and perceived controllability: Attitudes and behaviors are perceived as low in risk but high in controllability, environmental changes are perceived as high in risk and low in controllability, and long-term negative consequences are perceived as low in both. Network analysis reveals that lay models tend to be simple and unconnected. They are significantly less complex than an expert model. Furthermore, overall risk judgments can be predicted from structural properties of mental risk models such as their density. The results generally support a model of the risk perception process that assumes risk judgments and behaviors to be based upon causal mental models about the causes and consequences of risk events.

T4-B.2 PATENTABILITY OF STEM CELLS AND MORALITY ISSUES IN THE EU AFTER BRÜSTLE

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The proposed presentation aims at highlighting the moral and ethical issues stemming from the patentability of human embryonic stem cells in the European Union. It will focus on the recent decision of the Court of Justice of the European Union (CJEU) in Brüstle v Greenpeace (Case C-34/10). This decision interpreted the provision of the EC Directive on the patentability of biotech inventions devoted to human embryos (Article 6(2)(c) EC Directive 98/44). The ruling clarifies that a process which involves removal of stem cell from a human embryo at the blastocyst strage, entailing the destruction of that embryo, should be excluded from patentability. The author will argue that, in reaching this decision, the CJEU confirms that patent registration procedures regarding biotech inventions should constitute a "social and moral filter" and the patent system should be a "servant of public policy". This ruling therefore confirms that patent offices should carefully examine the moral concerns as well as the environmental and social risks stemming from the production and exploitation of biotech products or processes which are the subject of matter of a patent application and – on the basis of such analysis – grant or reject the patent application.

W2-D.4 A CASE STUDY ILLUSTRATING THE IPCS COMBINED EXPOSURES FRAMEWORK: SUBSTANCES POTENTIALLY DETECTABLE IN SURFACE WATER

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Improvements in analytical methodology have resulted in the routine detection of a diverse range of substances representing various chemical classes, often at very low levels, in environmental media. Many of the substances present do not have established chronic health standards or health-based guidance values, such as tolerable daily intakes; indeed, for some of the components in the particular mixture, there might be little or no information on their toxicity. Investigation of these mixtures using higher-tier assessments would require considerable resources and a significant number of data. Surface water will be used as a real-world example of a complex mixture to illustrate the potential utility of applying the threshold of toxicological concern (TTC) approach in a Tier 0 assessment to prioritize the need for further evaluation of a chemical mixture. It is envisaged that such Tier 0 assessments could be readily incorporated into the WHO/IPCS framework for assessing the impact of combined exposures to multiple chemicals. Within this context, the potential impact of synergy at environmentally relevant exposures needs to be considered. A literature review undertaken for this purpose revealed that the maximum degree of any

such synergy was 3.5 fold and this occurred at doses above the NOAELs for the mixture components. Higher tier assessments will rely increasingly on the results of non-animal testing. Many such tests are being developed and evaluated. In an effort to establish a framework for intelligent, integrated evaluation strategies, in which toxicity testing is proportionate to the potential degree of concern, the Health and Environmental Sciences Institute (HESI) of ILSI has convened a tripartite umbrella project, Risk 21, to develop such a framework. A key aspect of the framework is consideration of relevant human exposure and mode of action throughout risk assessment. The framework is being applied to two case studies, one of which comprises a mixture of chemicals found in surface water.

F2-B.4 FORECASTS AND WARNING DECISIONS FOR HURRICANES: PUBLIC PERCEPTIONS

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Improving warning systems for extreme weather events is a high priority internationally. Appropriate information dissemination and sound decision making during weather emergencies are critical to avoid disasters. Most importantly, issuing warnings in ways that promote appropriate governmental decisions and self-protective action on the part of at-risk populations is critical for reducing life loss and injuries during extreme weather-related events. Learning how to improve hazard warning systems requires developing an integrated understanding of multiple stakeholders' roles in the warning communication and decision making process. To address these needs, this study contributes to the development of an integrated understanding of warning systems and processes with a focus on hurricanes in Miami, Florida. The study examines how hurricane warnings are communicated, obtained, interpreted, and used in decision making by different participants in the warning and decision process, as well as their perceptions of the factors that influence decision making and preferences for warning information. Face-to-face mental models interviews with a random public sample (n=28) from Miami-Dade County in Florida, USA, illustrate high hurricane awareness in the community, a sense of media saturation during hurricane season, and high concern about wind, flying debris, and precipitation-related flooding, but low awareness and concern about storm surges. Comparison of these interview results with mental models interviews of hurricane forecasters (n=8), public officials (n=6) and broadcasters (n=5) from Miami-Dade reveals numerous shared perceptions and some critical differences, including greater concern about storm surges among forecasters. The paper concludes with implications for improving extreme weather event forecast and warning systems.

T4-A.3 VACCINE COMMUNICATION IN EUROPE: IS THE INTERNET THE BEST TOOL AGAINST RUMOURS?

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The success of current and future vaccination programmes to combat Sexually Transmitted Diseases- including HIV- will partly depend on the ability of medical agencies to communicate the benefits and risks of new vaccines effectively. The negative impact of the internet in the reinforcement and propagation of negative perceptions of vaccines - insofar as it has the ability to act as an unreliable source of information, to spread quack science and rumours and to amplify risks - is generating perplexity among those concerned with designing and implementing effective health programmes. Recent shortcomings in this area, both in developed and developing countries, cast doubt on the aims and strategies pursued so far. This paper addresses a central research question: do regulators take into account risk perceptions and communication science when they engage in internet-based communication? Is the internet the best way to counter rumours and how could it be used as an effective tool to support meaningful risk communication? A review of recent European Medicines Agency's (EMA) vaccine communications suggests that EMA has yet to take on-board fully the lessons that cognitive science offers concerning vaccines and risk communication; current risk communication practice remains primarily top-down, one-way, persuasive and risk-biased. In the current environment these elements are likely to undermine rather than build trust in immunisation programmes. The paper stresses the importance of injecting more perception and communication science into internet communication to succeed in building trust in immunisation programmes.

T2-C.4 QUANTITATIVE RISK ESTIMATION FOR A LEGIONELLA PNEUMOPHILA INFECTION DUE TO WHIRLPOOL USE

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Legionellae are bacteria indigenous to aqueous environments that can infect humans by inhalation. Aerosol generating devices that are associated with Legionella infection are cooling towers, fountains, saunas, shower heads and whirlpools. Global change may cause behavioral and environmental changes that lead to increased infection risks for legionella. Temperature increase, for instance, may promote whirlpool use by humans as well as legionella grow in waters. The current study used quantitative microbiological risk assessment to estimate inhalation exposure to airborne Legionellae due to whirlpool use as scenario-based descision support for risk manager. Air bubbles generated in a whirlpool ascend to the surface, intercepting Legionella from the traversed water. At the surface, the bubble bursts into non-inhalable jet drops and inhalable film drops. Assuming that film drops carry half of the intercepted Legionella, a total of about 11 (95% interval: 5–18) and 1.13?10^3 (1.07?10^3-1.20?10^3) cfu min-1 were estimated to be aerosolized for Legionella cfu concentrations of 1 and 100 per L of whirlpool water, respectively. Using a dose response model for guinea pigs to represent humans, infection risks for active whirlpool use with 100 cfu per L water for 15 minutes equaled 0.57 (~0.38–0.73) for males and 0.47 (~0.26–0.66) for females (the difference being caused by inhalation volumes and frequencies). A Legionella concentration of $\geq$1000 cfu per L water was estimated to nearly always cause an infection in susceptible males and females (mean: ~1; 95% interval: 0.99–~1). Estimated infection risks were time-dependent, ranging from 0.05 (~0–0.16) for a 1-minute exposure to ~1 (0.99–~1) for a 2-hour exposure when the Legionella concentration was 100 cfu per L water. The current study shows the increased infection risks when legionella concentrations increase, for instance due to climate change. The model can subsequently be used to assess the effectiveness of intervention measures in terms of public health effects.

T4-C.2 HOW WILL GLOBAL CLIMATE CHANGE AFFECT HUMAN HEALTH RISK ASSESSMENT?

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Global climate change is predicted to alter long-term weather characteristics in different regions. These changes, including increased temperature, greater precipitation extremes, and loss of glacial and polar ice, have implications for human exposure to chemical contaminants. Climate change may also directly and indirectly affect the vulnerability of humans to chemical exposures. Changes in human exposure may arise from altered use, inputs, fate and transport of chemicals due to climatic and other drivers. Human vulnerability may be affected directly by heat and other weather-related stressors, or indirectly through altered co-exposures or disease patterns. To further explore the implications of climate change for the assessment and management of chemical risks, the authors examine four specific risk contexts: natural toxins, pesticides, air pollutants, and legacy chemicals (e.g., mercury, POPs). For the specific types of decisions to be made in each of these contexts, we examine how assessments and management decisions may be affected by climate change, and how significant the impacts of climate change may be. Climate change is likely to both increase and decrease human exposures, depending on the specific contaminant and specific region or other exposure context. There is limited evidence that climate change will increase the sensitivity of humans to chemical exposures. But small changes in exposure variability or human vulnerability can translate into significant changes in population risk profiles. To assess and manage chemical risks effectively, exposure data sources will need to be regularly updated and defaults and assumptions used in exposure assessment evaluated in a context of changing climate.

T4-E.5 USE OF THE PRECAUTIONARY APPROACH IN ASSESSING GENERALIST PREDATORS IN THE GLASSHOUSE INDUSTRY IN NEW ZEALAND

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The introduction of biological control agents (BCA's) into New Zealand is regulated under the Hazardous Substances and New Organisms (HSNO) Act through the Environmental Protection Authority (EPA). The recent invasion of the tomato potato psyllid and the potential withdrawal of registration for organophosphate and carbomate pesticides have meant that crops in the glasshouse industry may be left without effective controls for several arthropod pests and in response, the EPA is considering the implications of the Act for introductions of generalist BCAs as replacements. The HSNO Act requires the consideration of five minimum standards regarding the impact of new organisms, and risks and benefits are considered after these have been met. One key standard is impact on non-target species, which in most cases is measured through assessments of host specificity. Therefore, the challenges facing applications to introduce polyphagous natural enemies, is the assessment of non-target impact and the perception verses quantification of risk. As a consequence, biological control programs in New Zealand avoid species that are not host specific. The parasitoid Encarsia formosa is effective against greenhouse whitefly but it is now known globally to parasitise at least 15 species of whiteflies including, in the laboratory, some native species. However, it is rarely detected outside of protected cropping and never in natural systems. So, how predictable is impact and is the precautionary approach a reasonable one in terms of net benefit?

T4-E.4 MULTI-CRITERIA DECISION ANALYSIS TO PRIORITIZE EXOTIC DISEASE RISKS TO THE AUSTRALIAN PIG INDUSTRY.

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The structure of the Australian domestic pig industry has changed over the last 50 years. The number of breeding sows has remained at 240,000 but the number of producers has dropped from nearly 50,000 to just over 1000. With fewer, larger farms and less agricultural diversification in a very competitive global market, producers are concerned that an exotic disease incursion could render the domestic pig industry economically unviable. Despite Australia's geographic isolation, trade restrictions and biosecurity, concern about these risks is heightened by other recent disease incursions worldwide. Examples include foot and mouth disease into the UK, equine influenza into Australia, and the spread of the range of vector borne diseases such as Japanese encephalitis. The pig industry has initiated research to investigate exotic disease risks. Using the OIE import risk analysis framework, the objective is to enhance exotic disease preparedness, response and recovery, targeting the three "most important" diseases. Hazard identification has identified more than thirty diseases affecting pig production worldwide that are exotic to Australia. In order to ascertain the "most important" diseases to the industry and direct further risk analysis, we introduced a step after hazard identification to prioritize disease risks based on impacts and the importance of those impacts to stakeholders using multi-criteria decision analysis (MCDA) techniques. The MCDA methods used were weighted sum models, using two indirect techniques to assign weights to criteria (probabilistic inversion and point of truth calibration), and one direct method (direct ranking of criteria). The results of this step directed stakeholder decisions about which diseases to investigate with more detailed risk assessment. We present the results of this prioritization step, compare the methods used to derive weights of importance, and discuss the value of these weighted sum MCDA models for disease prioritization.

F3-B.1 CLIMATE CHANGE AND REORGANIZING OF LAND USE. FLOOD-CONTROL AREAS AS ADAPTATION PRACTICE

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Although climate change appears to be a relatively new public issue, it does not take place on a tabula rasa; it affects "traditional" policy sectors. If this is the case, the question is how this "new issue" interacts and takes shape in established organizational processes, and how climate change is "operationalized" in local practice? In the face of major events linked - to a certain extent - to climate change, such as desertification, climatic migrations, inundations, and landslides, one might make the assumption that one of the main implications of climate change is a substantial variation in land use, or at least a transformation in land organization and management. This study explores the process of implementation of a "flood control area" as an adaptation practice for climate change. What kind of theoretical and empirical tools should the analysis adopt to give account of the multiple actors, types of knowledge, artefacts, socio-technical systems and governance configurations, and sectors engaged in the development of such practices? In other words, to what extent does climate change become a re-organizing category? This contribution adopts a theoretical approach inspired by Actor-Network Theory (Latour, 2006; Law, Hassard, 1999; Callon, 1986), and suggests that adaptation practice be considered not as a standardized top-down solution, but rather as the result of specific local connections among various actors, materials, and discourses which go beyond the boundaries of formal organizations. The analysis suggests that climate change is indeed a re-organizing category, but rather in an indirect manner, depending on the specific local materializations of the adaptation measure.

W4-C.4 ACCIDENT SCENARIOS FOR LNG RELEASES AT OFFSHORE REGASIFICATION FACILITIES

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One of the main topics in the framework of the Integrisk project is the identification and assessment of new and/or emerging risks. The diversification of the energy sources is an important issue for the future of Europe, and under this respect the use of Liquified Natural Gas is gaining more and more importance and new regasification plants, often based on new technologies, are planned both in Europe and in the US. However, the risks related to these off-shore installations have not been fully explored yet, and the hazards associated to them are often misunderstood by the population. In this paper, a review of some of the possible hazards associated with this kind of industrial installations will be presented, with particular reference to the explosive phenomena.

W4-E.1 INTEGRATING OPEN SOURCE INFORMATION IN DELPHI GROUPS

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Risk analyses rely on expert judgement for estimation and prediction. Group judgements outperform individual judgements when participants make independent assessments. A range of motivational and contextual biases can be anticipated and remediated with structured protocols for asking questions and managing group deliberations. Multi-step question formats and Delphi groups provide means for implementing effective systems. This presentation outlines the results of 12 months of experimentation with Delphi groups in Australia and the United States. The Delphi groups generated remarkable consistent estimates of the outcomes of geopolitical events.

F2-C PANEL DISCUSSION

Burgman M, ACERA

The seven short presentations will be followed by a panel discusison addressing a small number of key questions under the general theme of 'where to from here?' Audience participation will be encouraged with the aim of concluding the session with recommendations for application of methodologies and for future research.

F4-E.1 ENERGY SECURITY ANALYSIS AND ENERGY SECURITY LEVEL ASSESSMENT.

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The paper presents an investigation on the development of energy security analysis and energy security level assessment technology. Energy security analysis in this work includes energy system risks

investigation, modeling of different disturbances and consequences assessment. Methodology of energy security analysis based on both deterministic ant probabilistic models. It allows assessing of various uncertainties, identifying the most dangerous scenarios and critical energy infrastructure. The system of energy security indicators, covering technical, economic and socio-political aspects, is introduced. The security indicator is a special index which gives numerical values to important issues for security of energy sector. In the paper, each indicator is described by presenting the title, comments, factual and threshold, pre-critical and critical state values. The integral characteristics of these indicators show the level of energy security and in order to identify it, a point system assessment scale is used. The methodology developed in this paper is applied for the assessment of the Lithuanian energy security level in different scenarios. The paper presents analysis of the impact of Ignalina Nuclear Power Plant (NPP) shutdown on Lithuanian energy security. The paper analyses the Lithuanian energy security level in 2007 and, to make a comparison, in 2010 after the shutdown of Ignalina NPP, in 2014 when in Lithuania will be built LNG terminal and in 2016 when the power lines to Poland and Sweden will be constructed. A separate study in this work is dedicated to the influence of the planed nuclear power plant on Lithuanian energy security level. Acknowledgements: This research was funded by a grant for project "Lithuania energy security analysis and assessment of the energy security level" (No. ATE-1/2012) from the Research Council of Lithuania.

F4-E.2 THE RUSSIAN SCIENTIFIC SOCIETY FOR RISK ANALYSIS AND THE CREATION OF RISK MANAGEMENT TECHNOLOGIES IN THE FIELD OF POPULATION AND TERRITORIES COMPLEX SAFETY

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The Russian Scientific Society of Risk Analysis was established in 2003. It has its branches in 51 regions of Russian Federation and it unites more than 2,5 thousand of scientists, specialists, industry representatives, bodies of state power, public organizations interested in the research and practical using of the achievements in the risk analysis area. The society carries out the following activity: - research; - participation in the forming of State policy in the area of safety, population and territories protection against disasters and emergencies; - participation in the legislative process, independent examination of programs, projects, legal documents; - participation in public discussions of risk management problems; - raise public awareness, State Agencies, specialists of enterprises and organizations on analysis and risk management issues. The Society is a founder of "Issues of Risk Analysis" journal. The appearance of such a journal is reasonable. It is enough to say that annually in Russia there are 230-250 emergencies connected with dangerous nature phenomena. More than 34% country territory is situated in seismic regions where about 20 million people live. Annually in Russia from 10 to 35 thousand forest fires are registered and they cover from 5 to 25 thousand square kilometers. In Russia more than 60 million people live in the areas of possible influence of affecting factors in case of accidents at the potentially dangerous industrial facilities. Thereby the using of risk analysis methods and the risk management technologies became urgent State scientific and public task, first of all it is in the field of complex safety of population and territories. It should be noted that the legislative basis on risk analysis in Russia is insufficiently developed yet. The most advanced in this direction are such branches as nuclear energy, gas and oil production and processing. The transition from "State Standards" to "Technical Regulations", which are considered like laws recent years, stimulated the creation of the legal documents based on estimates and risks valuation. The examples are Federal Laws "About fire safety" and "About mandatory liability insurance of a dangerous object owner for injury in an accident at a hazardous facility". In practice the Authorities of the Russian Federation Regions and Local Governments, the Heads of Enterprises form a number of documents containing the risk analysis results. These include: industrial safety Declarations of potentially dangerous objects and hydraulic constructions, Safety Passports of the territories of the Russian Federation subjects, municipals and dangerous objects; Lists of main risk factors of occurrence of nature and man-made emergencies in projects of settlements and cities general layouts. Based on the information from these documents the measures aimed at risk control of disasters and emergencies are being planned and realized. Among them are the monitoring of the environment and disasters and emergencies prediction; unfavorable and dangerous nature processes prevention by their cumulative potential reducing; man-made emergencies prevention by technological safety of production processes and operational reliability of equipment increase; carrying out of engineering and technical measures on disasters losses and damage reducing; surveillance on safety issues; informing of the population about potential nature and man-made threats, etc. The most important projects of the conceptions, strategies, laws, programs and plans in the area of Russian domestic and foreign policy are subject to professional and public expertise. Specific requirements are laid claim to the exposure of risk factors in the town-planning by the Russian legislation. Thereby the spectrum of issues for effort and knowledge of the risk analysis society members is quite wide: from methods and researches to creation of Regulatory Acts and expertise. Nevertheless the Russian Scientific Society of Risk Analysis deals with the issues of fundamental science. Having set a goal to create interdisciplinary, interdepartmental risk estimation, the Society members published the correspondent Glossary. Offering to the public authorities to use risk management technologies more actively the Society members developed the Declarations "About maximum permissible levels of risk" and "About economic estimation of average person life". They worked seriously in publishing of multivolume edition of "Atlases of nature and man-made danger and risk in the Russian Federation and Russian regions". The most important factor stimulating a scientific thought is scientist contacts. That is why conferences organized by the Society are held annually not only in Moscow but also where regional organizations are situated. The journal "Issues of Risk Analysis" takes pride in the well-deserved reputation among scientific community. The journal is intended not only for scientific audience but also for managers. That is why its circulation is increasing annually. At the end it can be stated that in multilateral work on creation and distribution of risk management technologies in the field of territories and population complex safety, providing in Russia, the Russian Scientific Society of Risk Analysis takes a proactive stance and suggests weighty and interesting results of its research.

P1.11 CONTINUED RESEARCH OF FACILITY LAYOUT OPTIMIZATION THROUGH MILP AND MINLP APPROACHES

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Not always the buildings of a plant to be constructed acquired their location through a detailed and precise process but usually by following and complying with globally accepted standards and requirements. This research continues with the one initiated by S. Jung et. al. [1], in which a MILP approach is taken to find the optimized facility layout for a seven building (and a central hazardous process unit) plant is develop, including a detailed optimization of several cases of the previously formulated model for a 12 buildings plant. Additionally the MINLP approach is carried out when assuming the distance between buildings and frm the buildings to the process unit as a pitagoric distance instead of the previously used approach of Euclidean distance. All these optimizations are carried out on the basis of process safety such as minimum separation distances, risk scores for each node of the grid that divides the plant's area (and where buildings are assigned) and economic elements such as the installation and construction costs of the buildings. Keywords: Facility Layout, MILP, MINLP, Risk Scores

T4-C.6 CLIMATE CHANGE AND HUMAN HEALTH: A SLEEPING GIANT?

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This presentation will address the multiple likely effects of climate change on human health and identify the potential implications for developed and developing countries. Increased climate variability may lead to record hot or cold weather. Extreme weather events may change in terms of timing, intensity, or frequency. Extended temperature and humidity changes may allow areas that had previously been free of various disease vectors to become hospitable to them. These climate changes can have various effects on human health. In addition to the impact on morbidity and mortality, excess heat affects

productivity. Even in countries with the resources to respond to climate change, adaptive guidelines for work/rest associated with increases in temperature are likely to affect productivity or require changes to commercial and government installations, equipment, and scheduling. Many types of extreme weather events have particular importance in the developing world; for example, extreme precipitation can affect the transport or survival or waterborne disease vectors while drought can affect water and food supplies. The health concerns of flooding also can have subtle effects in developed countries. In addition to compromising water supplies, is associated with anxiety and depression as well as injuries. Drought can also bring into contact host and vector species and can increase transmission of the vector-borne diseases. Vector-borne diseases are also likely to become a substantial burden for many regions of the world. In the US, the survival of West Nile virus hosts may also be susceptible to small changes in temperature and humidity. This presentation will illuminate the often overlooked but substantial potential health outcomes exacerbated by climate change and consider the implications for development and international economics.

W2-E.1 PRODUCT LIABILITY: AN OVERVIEW OF THE EMERGING ISSUES

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This paper presents a summary of business and policy perspectives regarding product liability that are emerging from current but dramatically changing legal and global market conditions. Product liability is an important area of the United States' legal and regulatory systems, but it is also an area deeply informed by sophisticated risk and economic concepts. The paper considers some of the fundamentals of product liability in the law and regulations. This is followed by a overview of product liability in the context of enterprise risk management (ERM). Modern ERM emphasizes a proactive product liability focus for enterprises in a world with many different types of risks. For that reason, there are obvious links between ERM and the incentives and penalties inherent in the legal and regulatory structures under which enterprises operate. Within the ERM context, the process of managing product liability includes steps to identify and classify risks; to quantify risks using a number of risk metrics; to monitor risks; and to implement strategies for risk reduction, integration, diversification, and transfer. The paper links these concepts to a changing product liability landscape that is increasingly being reflected in the global marketplace.

F4-A.3 REGULATION OF GMOS IN PHILLIPPINES

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Since 2002, the Philippines has approved for direct use and for food and feed uses 39 single trait and 27 combined trait GM plants of several species. For commercial scale propagation, it has approved 5 single trait events and 3 combined trait entries for maize. A favorable risk assessment outcome is crucial to the approval of a GM crop for commercial scale propagation and use for food and feed. Risk assessments for food and feed uses are largely based on the guideline published by the Codex Alimentarius on GM plants (Guideline for the Conduct of Food Safety Assessment of Foods Derived from Recombinant-DNA Plants, CAC/GL 45-2003). Environmental safety assessments are conducted by considering, among others, characteristics of the host organism, the donated gene(s) and the donor organism(s), the introduced trait(s), safety to non-target organisms, gene(s) and trait(s) stability, and likelihood of gene flow via outcrossing, introgression into related species with weediness potential. The Philippines recognizes portability of specific data generated elsewhere, and utilizes these in conjunction with environment-specific data it deems useful for its risk assessment. The Philippines is currently fine tuning its environmental risk assessment methods, and is working on articulating criteria for the portability of data generated elsewhere.

F1-B.1 POLICY-RELEVANT ASSESSMENT METHOD FOR SOCIO-ECONOMIC RISKS OF FLOODS: AN ITALIAN CASE STUDY

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European river basin authorities are in the process of implementing the European Water Framework Directive and the Flood Risk Management Directive for extreme hydro-meteorological events. The Directive requires Member States to carry out a preliminary assessment to identify by 2011 river basins at risk of flooding. Flood risk maps will be drawn by 2013 and flood risk management plans will be established by 2015. The European Commission (EC) is promoting research projects to improve risk assessment methods. This study analyses the results of an Italian case study under the EC project PREEMPT (Policy-relevant assessment of socio-economic effects of droughts and floods) and outlines the efficiency of the assessment method to fill knowledge gaps, in particular those concerning indirect and intangible losses of floods in the Po river basin, Italy's largest and in many respects Italy's most important river basin. The case study presented in this document is related to the 2000 flood in Piedmont. During this event important urban centres were flooded; buildings and key infrastructure damaged; bridges destroyed; electricity and water supply interrupted; road and railway network impaired; riverbanks eroded; water quality deteriorated. This study aims to define indirect economic impacts, environmental impacts and social impacts of the flood. Computable General Equibrium (CGE) model-based assessment is used to define economic losses. Social and environmental impacts are estimated with spatial analysis tools combined with multiple attribute value theory (MAVT). A novel comprehensive risk assessment framework is developed to define regional sensitivity and exposure. The outcome of our study provides a combination of spatial analysis, CGE, and MAVT to define widely spread impacts of extreme events. The result is an improved approach to evaluate hydro-meteorological risk and promote sustainable development within the European Flood Risk Management Directive implementation.

F1-E.3 RISK IN PULMONARY FUNCTION CHANGES ASSOCIATED WITH EXPOSURE TO AIR POLLUTANTS

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In assessing the risk of lung function changes associated with exposure to air pollutants, we conducted a longitudinal study to investigate relationship between lung function and exposure to air pollutants and fungal spores. One hundred 100 elementary and middle-school students in Taipei County, Taiwan were examined monthly by spirometry from October 2007 to June 2008. Air pollution data were obtained from the Environmental Protection Administration monitoring station and Aerosol Supersite, and included criteria air pollutants and particulate matter with aerodynamic diameter of 10 μm or less (PM10), and those of 2.5 μm or less (PM2.5). Lung-function measurements were compared with air pollutants using mixed-effects models with 1-day-lag modeling, adjusting for potential confounders. We found that a drop of 100 ml (5.1%) in forced vital capacity was associated with the interquartile range of 18.3 to 28.3 μg/m3 in PM2.5. A drop of forced expiratory flow at 25%, 50%, and 75% of forced vital capacity by 320 ml/s, 240 ml/s, and 170 ml/s was associated with the interquartile range of 23.1 to 32.6 ppb in O3. This study suggested that exposure to PM2.5 and O3 adversely affected pulmonary function in school children. Risk of reduced lung functions can be estimated for school-aged children exposed to high levels of air pollutants.

F2-C.6 DEALING WITH CONSEQUENCES

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The Resource Allocation project requires a comprehensive and comparable assessment of consequences across a wide range of pests and diseases. I will describe the mix of techniques being applied and their integration.

F4-B.2 UNCERTAINTY MODELLING IN RISK ANALYSIS USING BAYESIAN NETWORKS

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Risk-related information inherently contains epistemic uncertainties. In risk analysis, these uncertainties on decisions can have great impact and therefore, methods are required that enable these uncertainties to be captured, modelled and analysed. Modelling epistemic uncertainty is far from straightforward. A major difficulty in modelling this kind of uncertainty is concerned how to consistently aggregate and analyse divergent pieces of information or evidence caused by epistemic uncertainty. A number of approaches have attempted to provide some solutions, however, modelling epistemic uncertainties is a subject that has yet to be resolved satisfactorily. It is argued that Bayesian Networks, BNs, are a suitable and efficient tool for modelling uncertainties. In fact, BNs are powerful to use for modelling incomplete information than for modelling epistemic uncertainties. Most of the developed BNs reported can be regarded as causal models having a fixed structure with constant conditional probabilities to represent the interactions amongst variables. This 'deterministic' configuration of BNs impedes epistemic uncertainty to be modelled. Hence, some modifications to the standard usage of a BN are required. Using the unique capabilities of BN to model risks, the proposed paper will show how the above complex issues were addressed in an ongoing research investigating risks in tunnel works. The modifications to the standard ways of constructing a BN consist of representing probabilistic information by 'evidence probability distributions'. These distributions reflect the combined evidence from all available sources of information associated with a variable in a model. A further modification relates to Conditional Probability Tables, CPTs, that represent probabilistic interactions amongst variables in a BN. In this work the CPTs, are altered to enable the epistemic uncertainty of relationships amongst variables to be modelled. Specific examples using Bayesian Networks will be presented showing how they provide information on uncertainty of risks for decision making.

F2-E.6 AMBIENT PARTICULATE MATTER AS A RISK FACTOR FOR MENTAL HEALTH

Cho J, Yonsei University School of Medicine

Abstract not available at time of printing.

P1.5 METHODOLOGY FOR THE ESTIMATION OF THE ENVIRONMENTAL DAMAGE

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In Chile,the recently created Superintendence of the Environment is responsible of ensuring environmental compliance through monitoring and enforcement.A methodology that will allow the determination of environmental damage was designed,to support enforcement procedures.This methodology considers environmental risk ratings and reparability indicators.This will enable better decision-making,through the activation of precautionary measures to protect the resources,and eventually the determination of a monetary fine. Chilean legislation defines that environmental damage may happen within the following components: Biodiversity and Renewable Natural Resources,Population Health,Socio-Cultural Heritage.The methodology considers that the severity of the environmental damage depends on two criteria,significance and reparability.Significance depends on: Degree of Disturbance (level of change in the affected environmental element,either in their structural and/or functional features);Social Value (measure of the importance of an environmental resource from a human welfare perspective);Extension (amount of resources or services potentially affected or the number of exposed population);and Permanence (residence time of the pollutant in the exposed receptor).Finally,the methodology helps assess whether the damage is repairable or not,either by natural means or by remedial measures. Using traditional methods,it may take months or even years to assess the degree of environmental damage,so these results would not be usable for decision making regarding the immediate protection of the resources. The methodology proposed evaluates the environmental damage using a two-stage process: the first stage lasts one day,and is designed to be carried out in situ by the inspector,while the second stage could take up to 15 days,and considers the support of external experts. Using a risk analysis approach,this methodology helps estimate environmental damage in a comprehensive and timely manner,allowing the Superintendence to comply effectively with its mission of protecting the environment.

F3-D.3 RISK-BASED MODEL FOR PRIORITIZATION OF ENVIRONMENTAL INSPECTIONS IN CHILE

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The recently modified environmental law created an Environmental Inspectorate, which has the goal of executing, organizing and coordinating the environmental enforcement in the country. In Chile, there are close to eleven thousand environmental permits, and the Environmental Inspectorate has the objective of enforcing compliance through different mechanisms (e.g. inspections), having limited resources (time, human resources and money). To aid the Environmental Inspectorate in accomplishing its objectives relating the prioritization of inspections, a relative risk-based model was created. This model was constructed using indexes considering the following information: magnitude of emissions, toxicity of emissions, environmental quality compliance, vulnerability and sensibility of surroundings (human, natural and heritage) and risk perception. The model was designed to function with two levels of information: simple proxies considering available information in the short term and detailed data which would be collected in the long term. A relative risk score was estimated, to create a prioritized list of projects, which would allow the Environmental Inspectorate to focus its enforcement efforts. This list was finally reordered considering the project's inspection history and the Inspectorate's inspection frequency objectives. A software tool, which used geographical information as an input and was designed with SQL language, was created. This allowed for the prioritization of environmental inspections considering local, regional, and national geographical scales.

F2-A.1 ASTROBIOLOGY AND THE RISK LANDSCAPE

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We live in the epoch of explosive development of astrobiology, a novel interdisciplinary field dealing with the origin, evolution, and the future of life. While at first glance its relevance for risk analysis is small, there is an increasing number of crossover problems and thematic areas which stem from considerations of observation selection effects and the cosmic future of humanity, as well as better understanding of our astrophysical environment and the open nature of the Earth system. In considering the totality of risks facing any intelligent species in the most general cosmic context (a natural generalization of the concept of global catastrophic risks or GCRs), there is a complex dynamical hierarchy of natural and anthropogenic risks, often tightly interrelated. I shall argue that this landscape-like structure can be defined in the space of astrobiological/SETI parameters and that it is a concept capable of unifying different strands of thought and research, a working concept and not only a metaphor. Fermi's Paradox or the "Great Silence" problem represents the crucial boundary condition on generic evolutionary trajectories of individual intelligent species; I briefly consider the conditions of its applicability as far as quantification of GCRs is concerned. Overall, such a perspective would strengthen foundations upon which various numerical models of the future of humanity can be built; the lack of such quantitative models has often been cited as the chief weakness of the entire GCR enterprise.

T4-D.5 EXPLORING PSYCHOMETRIC REPRESENTATIONS OF INFORMATION TECHNOLOGY RISKS IN THE WORKPLACE: A LONGITUDINAL STUDY

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Recent high profile debacles such as the loss of highly sensitive personal data pertaining to 25 million individuals by the UK's HM Revenue and Customs have rendered salient the many IT-related risks to which organizations are increasingly exposed. Surprisingly, however, just one small scale cross-sectional study has investigated the question of how workplace IT users represent these risks (Coles & Hodgkinson, 2008, Risk Analysis, 28, 81-93). Drawing on work in the field of managerial and organizational cognition we will argue that the collective representations of IT risks elicited from multiple groups of workplace users within and between organizations drawn from distinct sectors will be highly similar in terms of their psychometric structure, due to a number of cultural processes that shape common patterns of beliefs and behavior that transcend organizational and occupational boundaries and that these rep-

resentations remain highly stable over time, despite major developments in the social and technological environment that warrant significant change. We will then report the findings of a longitudinal study, spanning multiple organizations in the UK financial services sector with a range of methodological controls for sample attrition and carryover effects. The data, gathered from N=443 participants in the run up to Y2K and several months after the critical 1 January date had passed, support our hypotheses. A series of multidimensional scaling and cluster analyses of 18 IT risk scenarios evaluated on the basis of 13 bipolar attribute rating scales reveal high levels of convergence and stability, in the form of a six-dimensional model similar in character to the one reported by Coles and Hodgkinson (2008). In conclusion, we will consider the implications of our findings for managing the growing threat of information security and IT-related risks in the workplace.

T4-C.3 A RISK-BASED PORTFOLIO DECISION MODEL FOR PRIORITIZATION OF CONSERVATION MANAGEMENT ALTERNATIVES. CONVERTINO ET AL.

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Conservation efforts worldwide face the critical trade-off between land-use for industrial and societal needs and environmental management. Land conservation and restoration efforts are further complicated by changing climate and other stressors. The traditional approaches rank species only accordingly to the risk determined by metapopulation models with limited consideration of spatial and temporal relationships with stressors; socio-economic issues are not considered. A risk-based portfolio decision model is proposed to support environmental management decision-making by explicit consideration of the risk of extirpation of each species, the utility and cost of each conservation strategy, and societal needs. The risk is defined as product of exposure, vulnerability, and hazard for species. The exposure is calculated using a habitat suitability model. The vulnerability is calculated using a stochastic metapopulation model. The hazard is considered proportional to the anthropogenic stress on the habitat. Finally, Multi-Criteria Decision Analysis models (MCDA) is used for assessing the utility of each conservation management plan for each species. The model application is illustrated for a site where military training activity affects both mammalian and avian receptors as well as plants. The challenge is to allocate appropriate areas for training and conservation in space and time. We propose the case of Santa Rosa Island managed by Eglin Air Force Base in Florida which is the largest Air Force base in the free world. We show how the portfolio approach results in an optimal selection of non-dominated alternative sets that allow decision makers to easily find the set that results in maximum benefit, for military and species, within a given budget of the installation. The case study results in spatial vulnerability maps and training windows that would limit impact on three threatened and endangered species.

F4-D.3 FIRST NATIONS AND METIS RESPONSES TO H1N1 RISK MESSAGES IN MANITOBA

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Risk communication challenges can be compounded by historical legacies of mistrust. This presentation will focus on the experiences of First Nations and Metis living in Winnipeg and elsewhere in Manitoba, Canada in terms of their concerns of safety and trust around information regarding protective behaviours and risks associated with H1N1 as well as the availability and uptake of the H1N1 vaccine. Focus groups were conducted with a First Nations remote community after the first wave of H1N1 (n=2), with urban First Nations and Metis residents in Winnipeg (n=12), and with Metis living in remote communities in Manitoba (n=10) following the second wave of H1N1. Participants also responded to a survey designed to measure different constructs of trust, informed by both the dual mode model of trust and confidence and examining how negative bias and prior attitudes influence the uptake of risk messaging. As people discussed H1N1, they placed the pandemic within the greater historical context of disease spread, current health issues and challenges faced daily as people try to improve their health and the health of their families and community. The mixed methods project underscores how public health agencies need to pay more attention to the specific socio-economic and cultural contexts of First Nations and Metis peoples when planning for, managing responses and communicating risks associated with pandemic outbreaks. It also underscores how language can place these groups in more vulnerable circumstances when providing messaging that targets ethnicity versus less stigmatizing language that outlines how individual health conditions could make someone more vulnerable to severe outcomes of a pandemic.

T2-C.5 DEVELOPMENT AND PILOT EVALUATION OF A PARENT AND ADOLESCENT SHARED DECISION AID FOR HPV VACCINATION

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The aims of this project are to: 1) understand parental perceptions of barriers to vaccinating their adolescents against HPV, 2) develop an evidence-based educational intervention (in the form of a decision aid) to facilitate informed HPV vaccination decisions and the information and decision-making sharing between parents and adolescents, and 3) pilot test the decision aid. The decision aid will incorporate information about values clarification; personalised risk information; and testimonials.

Our research is unique in terms of developing a tool for adolescents, as well as a tool to assist joint decision making between parents and adolescents. It has become increasingly recognised that adolescents need to be involved in their own healthcare: this reflects their developing cognitive and psychosocial needs and abilities.

Phase 1: Collection and collation of data in the form of interviews with parent/caregiver and adolescent dyads. Sample: Parents of and adolescents aged 11-13 have been recruited through a purposeful sample of a diverse group of community organisations in the Sydney area. Instruments: In-depth interviews – Qualitative semi-structured interviews are based on the Health Belief Model, The Theory of Planned Behavior, and Risk Perception Theory as frameworks for the interview schedule. Analysis: Analysis is a team effort, and is facilitated through qualitative analysis software.

Phase 2 : Development and refinement. Development: The aid will be a multiple screen module with a hard copy version also developed. Both versions will incorporate relevant risk information in both text and graphical formats. Its development, maintenance, and evaluation will comply with International Patient Decision Aid Standards (IPDAS) guidelines. Pilot testing: A draft version of the aid will be pilot tested for ease of use, formatting, and risk information with 15 in-depth interview parent/adolescent dyads.

F3-A.5 RISK? WHAT RISK? – WHY NANOTECHNOLOGY RISK PERCEPTIONS REMAIN NANO SIZED

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What is it about perceptions of risk towards nanotechnologies? Surveys repeatedly show that despite interest groups and researchers promoting nanotechnology risk stories, the broad public aren't generally subscribing to these risk narratives. Using five years of tracking data, media coverage and focus groups discussions, this presentation will look at data that explains why the general public do not engage well on nanotechnology risk stories, and will also examine: - Why risk concerns about genetic modification of foods and crops do not provide a good model for nanotechnology risk concerns, - Why NGO campaigns to create 'nano-scares' are generally failing to gain traction, - Why people recall negative stories about nanotechnology in the press as positive, - Why risk perception of nanotechnology in food is the odd one out, - What drives public attitudes towards new technology risks, and - Who are the people who do perceive nanotechnologies as risky. The Australian Government's National Enabling Technologies Strategy's Public Awareness and Community Engagement program has been conducting public attitude research and undertaking public engagement activities into nanotechnologies and biotechnologies for a decade, working closely with regulators and other government agencies to better understand risk perceptions towards new technologies, and developing risk communications strategies based on these understandings.

T4-D.3 A 'PERSONALITY' APPROACH TO UNDERSTANDING THE EFFECT OF RISK COMMUNICATION STRATEGIES IN TELECOMMUNICATIONS MESSAGING

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There have been highly heterogeneous outcomes from research addressing the possibility that mobile telecommunication technologies may affect health. This ambiguity has resulted in strong community concern about these technologies, making the determination of appropriate communication strategies to address community concern increasingly important. One area that has received only little attention is the role of personality in the interpretation of such communications. Building on research demonstrating that precautionary messages result in countervailing effects, which heighten perceptions of environmental threat while failing to increase trust in public health protection, the present pilot study tested whether these effects were mediated by personality. Using a between-subjects design, participants were given either a standard text describing the health risk associated with mobile telecommunication technologies (n=30), or the standard text plus a precautionary message (n=30). This enabled a replication of previous research demonstrating countervailing effects of the precautionary message. Further, participants completed the Fear of Negative Evaluation and Fear of Personal Invalidity scales, to determine whether the countervailing effects were mediated by these aspects of personality. Results are currently being analysed and will be presented. Although viewed as pilot research, the outcomes will provide an indication of whether personality-specific risk communication needs to be considered when dealing with risks associated with mobile telecommunication technologies.

F3-A.3 EMERGING TECHNOLOGICAL RISKS: EXPERT AND PUBLIC RISK PERCEPTIONS OF NANOTECHNOLOGY-ENABLED PRODUCTS

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Developments in nanotechnology-enabled consumer products range from sunscreens, to automobile tire additives, to antimicrobial applications of toys and baby products. While many nano-enabled products have yet to see wide market penetration, there has been considerable concern and emphasis placed on how experts and the public each view the potential hazards posed by these emerging risks. This paper analyzes four sets of survey data that contribute an improved understanding of expert and public perceptions of these emerging phenomena and may aid risk communicators in expert-public engagements. The first two sets report data from a sample of nanotechnology experts involved in a three-round Delphi study and include 1) expert rankings of potentially problematic nano-enabled products, and 2) expert rankings of what they feel the public perceives as the most risky nano-enabled products. The second two sets report from a national cross-sectional survey sample of US households that asked them report on 1) their risk perceptions regarding a battery of 23 nano-enabled products, and 2) their perceptions of how experts would rate the public's concerns. While there is strong cross-discipline concordance among the expert population, this comparative study notes that there is little evidence that the views of experts are similar to those of the public. While experts and the public both held somewhat similar risk perceptions to nano-enabled food technologies, they held highly dissimilar views for a plethora of other products. For instance, experts rated "cosmetics" as the most problematic nano-enabled consumer product while the public rated the same item as 22nd out of the 23 listed products. Experts also ranked public concerns to "nanobots" as fifth overall, while the public themselves rated the item as the least worrisome potential risk. This paper reveals the need for more thorough social scientific research to inform risk communicators in order to bridge the gap between the expert and public arenas as nano-enabled consumer products continue to enter the fray.

T2-AB.5 THE CARTAGENA PROTOCOL ON BIOSAFETY AND INITIAL DISCUSSIONS RELATED TO SYNTHETIC BIOLOGY

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The Cartagena Protocol on Biosafety to the Convention on Biological Diversity is an international treaty governing the international movement of living modified organisms (LMOs) resulting from modern biotechnology. The Protocol seeks to protect biological diversity from the potential risks posed by LMOs and has been put forward by civil society as an international instrument applicable to synthetic biology. The Protocol features procedures for Parties to follow when intentionally introducing LMOs into the environment, and one for LMOs intended for use directly as food or feed or for processing. The Party of import makes its decisions in accordance with scientifically sound risk assessments, taking into consideration international obligations. This presentation provides information on the Cartagena Protocol, the definition of "LMO" and "modern biotechnology", and topics of ongoing deliberations by the Parties. This presentation also provides information on the initial discussions of synthetic biology in the context of the Protocol, including in the April 2012 meeting of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) to the Convention on Biological Diversity.

W1-C.2 THE EU REGISTRATION, EVALUATION, AUTHORISATION AND RESTRICTION OF CHEMICALS REGULATION (REACH): SYSTEMATIC APPROACH FOR CHEMICAL SAFETY

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The overall purpose of the REACH Regulation that entered in operation in 2008 is to ensure a high level of protection of human health and the environment. Industry has to ensure that chemical substances are manufactured and used safely. This is achieved by using information of the properties of substances to assess their hazards both for classification and risk assessment, and hence to develop appropriate risk management measures to protect human health and the environment. A key motivation for developing REACH was to fill infromation gaps for the large number of substances already in use in the EU, and these 'phase-in' substances have to be registered in three stages. The standard information required depends on the tonnage manufactured or imported; the higher the tonnage, the more information needed. In addition for substances at 10 tonnes per annum or above, the registration dossier must include a chemical safety report (CSR) which provides standardised information on the safe use of substances that shall be summarised in exposure scenarios per type of use to be communicated to downstream users as extensions to the (material) safety data sheets. REACH was complemented by the Regulation on Classification, Labelling and Packaging (CLP), which is based on the United Nations' Globally Harmonised (GHS) system that entered into force in January 2009. The CLP Regulation also requires a notification to ECHA of the classification and labelling of all hazardous substances on the EU market.

F2-D.5 MONTE CARLO SIMULATION AND ITS APPLICATION IN MODELLING THE INCLEMENT WEATHER FOR PROGRAMMING CIVIL PROJECTS

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Delays due to inclement weather conditions within construction projects are generally planned for. Up until now, Deterministic Analysis has been the most common methodology used to determine the extent of the problem for construction projects. However it is the lack of risk consideration inherent in Deterministic Analysis that creates the opportunity for improving executive decision making by applying Probabilistic Analysis through Quantitative Risk Analysis and different techniques like Monte Carlo Simulation (MCS). This caste study review outlines the application of Monte Carlo Simulation technique to generate a distribution of the likely of inclement weather for a $500m road alliance project in north of NSW, Australia. The paper also examines the application of MCS methodology for project programming, the advantages and challenges, and provides practical guidance for a probabilistic analysis with the application of MCS for managing the high risk of rainfall and optimizing the contingency at the activity level as well as the project level.

W2-A.4 HOW TO ENGAGE STAKEHOLDERS IN RISK MANAGEMENT? VALUES-BASED VS. SITUATION-BASED APPROACHES FOR WATER PLANNING

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Risk management is a key component of water planning practice. For many decades, engineers and water planners have performed risk analyses for potential failures of water infrastructure and damages from extreme events such as floods. Yet in increasingly uncertain, complex and conflict-ridden

contexts, technically-focussed risk assessments are typically an insufficient basis for aiding water planning and risk management processes, especially when authority for decision-making and responsibility or capacity for action implementation is distributed between multiple stakeholders. Engaging such stakeholders effectively in risk management practice for water planning is thus highly important. However, research on how to develop this practice, and the relative advantages of different approaches to stakeholder engagement in decision-aiding processes for water planning, remains relatively rare. This presentation seeks to address this subject through the analysis of two participatory risk management approaches to regional water planning: a "values-based" approach to estuarine risk management in Australia; and a "situation-based" approach to flood and drought risk management in Bulgaria. The processes included a range of interactive methods for stakeholder involvement including cognitive mapping, multi-criteria analysis and spatial mapping, and were organised by groups of consultants, researchers and local stakeholders. The values-based approach appeared an efficient means of including stakeholder objectives and preferences into the planning process, and important for gaining agreement on the plan's content and support for its implementation. The situation-based approach appeared to promote increased individual and collective stakeholder learning, as well as to develop trust between many of the stakeholders. Drawing on the insights from these processes, how stakeholder engagement in future processes might be designed to achieve specific outcomes will also be discussed.

F3-E.2 ENVIRONMENTAL RISK IN THE DEL PLATA BASIN: WATER POLLUTION SOURCES, FLOODS AND PEOPLE

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Del Plata basin is the fifth largest river basin in the world, its area covers four million km2 approximately and contains a great variety of natural environments and resources; these resources are shared by Bolivia, Paraguay, Brasil, Uruguay and Argentina. The main rivers which form the Basin are: Pilcomayo, Bermejo, Paraguay, Iguazú, Paraná, Uruguay and, finally the Río de la Plata, which is a funnel-shaped, turbid, coastal-plain estuary 300 km long, 30–220 km wide and 0.5–25 m deep with a total surface area of 35,000 km2. Uruguay River is a water course 1.800 Km long and its basin with 339.000 Km2 shared a 38% between Argentina y Brasil and a 30% between Argentina y Uruguay. The urbanization process has been developed in the last decades, although not in the same pattern in all the countries. The lack of wastewater treatments from 100 million inhabitants is the main source of chemical and biological pollution that impact on all tributaries and affects negatively to the ecosystem; while several areas of the basin are highly impacted by human activities, other remains pristine. The Niño periodically produces floods which increase the contact of inhabitants with polluted water and the Niña produces droughts which concentrate certain pollutants near punctual sources of pollution affecting directly the aquatic life. Different persistent pollutants such as polychlorinated biphenyls, chlorinated pesticides, polybrominated biphenyl ethers and anthropogenic heavy metals were found in sediment, suspended particle material (SPM) and biota. On the other hand, the Rio de la Plata, is the final receptor of all basin; it is a tidal regulated water body localized at the south, which is a direct receptor body of untreated residual water from 15 million inhabitants of the coastal cities which also are periodically exposed to floods generated mainly by the Sudestada (winds from SE). A preliminary risk status of knowledge and developing projects will be presented

W3-C.4 MANAGING EMERGING RISKS: HOW TO OUTSOURCE IN A SAFE WAY

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Industries that run large and complex operations have typically been relying for decades on a large number of specialized subcontractors performing interdependent activities. Currently, outsourcing can be seen as an emergent risk (OSHA, 2010) as it widely increases with a trend to also subcontract safety related activities and also as it induces organizational changes. Hence, safety must be managed and coordinated across organizational boundaries. At the same time, the drive to outsource non-core business tasks is a trend that is visible across all industries, prompted by globalization and owners' requirements to reduce costs. Outsourcing therefore introduces new organizational barriers in processes that previously were carried out internally.; ; Many observers have raised concerns over the effects of outsourcing on safety (Ale, 2005; van Wagner, 2007), and such concerns seem confirmed by a few prominent accidents in which outsourcing have been a contributing factor. Both the Valujet plane crash (NTSB, 1997; Langewiesche, 1998; van Wagner 2007) and the Hatfield rail crash (ORR, 2006; Cullen 2001) were due to failures in outsourced maintenance operations, as well as to inadequate management by the ordering party.

The European granted Project iNTeg-Risk tackles this issue, amongst others, and proposes a model for safe subcontracting (Thommesen et al.(a), 2011) based on actual practices (Thommesen et al.(b), 2011) and a survey of literature (Thommesen & Andersen, 2011). The model proposes the issues to be taking into account in the frame of safe outsourcing: Contract Population (size of contractors; relations between Ordering Party and Subcontractor), Contract Agreements (duration of contracts, awarding of contracts, safety incentives versus performances measures, cascading contracts, contractual condition for coordination), Competences of Subcontractor Staff and eventually Planning and Communication. Our paper is aimed to describe the model, the methodology used for its assessment and validation as well as the results of the validation phase.

P1.6 APPLYING PROBABILITY BOUNDS ANALYSIS TO MODEL UNCERTAINTIES IN FISHERIES RISK ASSESSMENTS

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As anthropogenic and environmental pressures on our natural resources increase, risk managers must be able to assess, prioritise and deal with risks in an effective and timely manner. Stressors such as drought, pests, disease and changing climate provide a complex and highly variable backdrop against which legitimate and illegitimate activities must be assessed and managed. One of the critical uncertainties in the sustainable management of wild fisheries involves 'catch' (i.e. take) that is categorised as illegal, unreported and unregulated (IUU). In many cases IUU take from a fishery is difficult or impossible to quantify, and can have severe effects on stock populations and dependant species. While a number of qualitative or subjective approaches have been applied in fisheries risk assessments, such as the use of 'risk matrices', the majority of these methods fail to capture and characterise uncertainty in a meaningful and useable fashion. In this study we use expert elicitation to capture subjective intervals on uncertain parameters and apply Probability Bounds Analysis to the aggregation and propagation of these estimates within risk models. This approach has a number of advantages including the use of natural language to capture bounds on parameters, and the straight forward implementation of scenario and sensitivity analyses to compare risks under different management regimes and identify key knowledge gaps. The outputs of the analysis are also compatible with stock assessment and modelling approaches commonly applied in fisheries. The method developed enables greater insight into fisheries management and compliance issues and provides a strategic basis for management decisions, such as prioritising the allocation of resources to combat threats.

W2-A.2 APPLICATION OF MCDA TO ANIMAL HEALTH RISK ASSESSMENT: IMPORT RISK ASSESSMENT

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The techniques and methods of Multiple Criteria Decision Analysis (MCDA) make this approach useful in world-wide animal health risk assessment, particularly in the area of import risk assessment. A structure for using MCDA as a new approach to animal import risk analysis will be presented. The proposed MCDA framework aligns closely with a number of key recommendations of the recent National Research Council and Council of Canadian Academies reports for adopting an integrated, multidimensional approach that will strengthen all elements of the tripartite of risk analysis. An example implemented for import risk assessment will be given. This structure is presented in a systems science context allowing for the integrated approach and illustrating the need for a structure to manage a broader depth of consequence assessment, the complex interactions of humans, animals and environment and the key components (signals/hazards, consequences, management options and outcomes).

W2-D.2 PROBLEM FORMULATION TO DOSE-RESPONSE: ADVANCES VIA THE ARA BEYOND SCIENCE AND DECISIONS WORKSHOPS

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Important recommendations of the 2009 NRC report, Science and Decisions: Advancing Risk Assessment, were to improve both the technical analysis that supports risk assessment and its utility. The need to evaluate specific management options and to tailor the level & complexity of assessment to be consistent with the goals of decision-making was emphasized. This presentation will discuss approaches to evolve problem formulation based dose-response assessment, through "fit for purpose" consideration of mode of action, in the context of a tiered evolving framework for purpose-specific dose-response methods. This framework was developed as part of a three workshop series involving over 45 sponsoring organizations representing government, academia, industry and NGOs under the aegis of the Alliance for Risk Assessment (ARA).

F4-D.4 MOVING BEYOND KNOWLEDGE DEFICITS: PUBLIC UNDERSTANDING OF VACCINE RISK MESSAGING

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Arguably, the two most critical components in any response to a pandemic are the rapid development of a vaccine and effective risk communication. Despite the roll-out of a publicly funded H1N1 vaccine program across the country, less than half of all Canadians were vaccinated during the 2009-10 pandemic. While this vaccine uptake rate is similar to those seen in publicly-funded annual seasonal influenza vaccine campaigns, it can be contrasted with significantly higher immunization rates against other infectious diseases like measles. Using a combination of survey and focus group data, this study examined vaccinating behaviours, impact of public health messaging, and public's attitudes towards H1N1 in three Canadian provinces. Drawing on vaccine risk communication literature, we devised a framework to analyze factors related to vaccine uptake and vaccine refusal. Our research suggests that the most predictive factor for H1N1 vaccine uptake was a prior history of vaccinating against seasonal influenza. Other important factors included barriers to immunizing (access issues) and an individual's perception of serious risk from contracting H1N1. Though we did identify critical gaps in the public's understanding of influenza infections, and misinformation about vaccination effectiveness and safety, these factors were not generally driving an individual's decision to vaccinate. Participants reported that they were well-informed yet they identified several communication issues including inconsistencies in risk messaging across jurisdictions, difficulties related to communicating scientific uncertainty, issue-fatigue from constant emotive reporting on the evolution of the pandemic. We conclude with a series of recommendations to increase the effectiveness of vaccine-related risk communication.

W3-B.1 EUROPEAN WORK ON NUCLEAR WASTE MANAGEMENT: PUBLIC PERCEPTION, RISK COMMUNICATION AND GOVERNANCE ISSUES

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Results primarily from the EU project Areas for Risk Governance, ARGONA, and the Swedish Nuclear Fuel and Waste Management Co's Social Science Programme, are presented. The ARGONA project focused on identifying factors of importance for the perception of risk in relation to nuclear waste disposal and management, as well as central components in successful risk communication strategies within and across countries. A summary workshop in 2009 included participants representing different stakeholders and cultural settings (i.e. from the UK, Sweden, Slovakia, and the Czech Republic) in relation to nuclear waste management (NWM) issues. The results reflected concerns of risk and safety in civil society from the perspectives of different countries and stakeholders. Similarities and difference of importance to successful public participation processes were identified. The suggested risk communication models have bearing on the transparency framework provided by the RISCOM model that has earlier been used successfully in Sweden, and in the Czech Republic within the ARGONA project. It has been shown that if applied in practice this model has a high potential for improving transparency and trust in the NWM process. Europe has a high focus on building trust and developing public participation in this work. The results present several theoretical models of central components contributing to a continuous process of dialogue, including clear goals, voluntariness, representability, independence, knowledge, involvement or participation, interests, accountability, communication, regulations, and follow up procedures. A number of communication approaches and techniques preferably used in such work are also outlined. The unique Social Science Programme of the Swedish Nuclear Fuel and Waste Management Co has been coordinating 18 projects between 2004-11 with special relevance to the planning and building of a final repository for spent nuclear fuel in bedrock, in Sweden. Major results from the projects are highlighted.

F3-E.4 LIBYA'S FUTURE: CHALLENGES AND OPPORTUNITIES

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It is a myth to believe that Libya will suddenly become a democratic country overnight, though it's every Libyan's dream at the moment. Libya was ruled for 42 years by the Gaddafi regime, there was no civil rights, no voting and no democratic institutions. There are enormous social, political and economic challenges that Libyans will face after the war that erupted in February 2011 in the country. The economic and political institutions in the country have been weakened, this require a comprehensive restructuring program to the country's economical system. It is expected that governance challenges in the post-conflict period will prove enormous in tackling the differences and distrust between Libya's tribal groups and that is due to the absence of necessary frameworks and institutions to resolve these differences. A risk management framework is a must for this to succeed. The reconstruction of Libya must be done in systematic and integrated way which should encounter all social, political, legal and economical initiatives to avoid the country of backsliding. It is believed that the war will impact the Libyan economy reconstruction programs. The challenges to the new government are: 1. democracy building 2. the militia factor 3. safety and security 4. economic recovery The author expects that political and economy vacuums are the main important issues Libyan will face in the coming few months and probably the coming two or three years, and the following are the most important factors which the new government must take into account: • The future of Libya's economy depends on the emergence of the declaration of the new government • The past poor economy level of Libya, the physical damage resulted from the war, and also other social and political legacies • Replacement of the old government will not resolve the problem, it is the restructuring of political and economic institutions can achieve this goal.

T3-C.5 CONDUCTING A BACKTESTING ANALYIS ON OPERATIONAL RISK: A CLINICAL STUDY

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Due to the current financial crisis, the Basel Committee on Banking Supervision in order to strengthen the regulation, supervision and risk management of the banking sector has recently revised the international standards set out by Basel II (2006) given rise what is called Basel III (2010). Inherited from market risk, the application of the Value at Risk (VaR) concept to the Loss Distribution Approach (LDA) has been encouraged by the Basel Committee on Banking Supervision for measuring the operational risk. Moreover, complementary analysis such as the back testing exercise plays an important role in assessing the excedancees beyond Operational Value at Risk (OpVaR) forecasts and providing with valuable feedback on the soundness of such advanced measurement approach (AMA). In this paper, we conduct an empirical back testing analysis on the LDA by using an Internal Operational Losses Database (IOLD) provided by a medium sized Spanish Savings Bank before being merged in 2007. We apply different techniques for carrying out the back tesing exercise: the basic analysis, based on the Binary Indicator (BI) and Extremal Index (EI), to more complex statistical methods such as Kupiec and Christoffersen's Tests. Our empirical results, based on the basic analysis, reveal that the coverage property is not satisfied. On the contrary, the independence among the exceedances is not rejected. In addition, from the statistical approach, the model satisfies the unconditional coverage and the independency property

at 95% percentile, but both are rejected at higher percentile levels, 99% and 99.9%, respectively. In a nutshell, these results bring into light that the application of the LDA model for the Savings bank analysed would be rejected at the required framework by Basel.

FL-1 THE FUTURE OF GLOBAL PUBLIC HEALTH

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Global health is currently at a crossroad. People are living longer on all continents due to improved prevention and care, and especially from declines in infant and maternal mortality. Longer lives bring new kinds of prevention and care needs to maximize health all the way into old age. Accompanying this demographic transition is the epidemiologic transition of increasing rates of chronic diseases that have time to develop over longer lives. However, in most developing countries this is not a linear process, but rather one that can be characterized as a "protracted and polarized" transition (Frenk et al., 1989), which accounts for the double burden of ill health. Further, this complex process is being worsened by dramatic shifts in the risk factors that cause disease, globally and within nations (Piot and Ebrahim, 2010), leading to a global increase in chronic diseases at younger ages as well. These include a rise in smoking, plus shifts in food types, availability and affordability which, combined with decreased physical activity, are jointly causing an epidemic of obesity globally, further exacerbating the rise in chronic diseases. Exposure to many of these risk factors increases rates of cardiovascular and pulmonary diseases, hypertension, and diabetes, along with some cancers. Chronic diseases now constitute the majority of morbidity and mortality globally, and are diseases of the poor as well as the rich and the young as well as the old. We will review the key trends shaping the changing landscape of global health during next decades. We will also see how can understanding the changes ahead of us – in the context of current needs – frame a transformational process and goals by which global public health will lead towards global health in the future (Fried et al., 2010). We will try to show how can innovations in science and technology change the way we see, think, and act. Finally, we will address issues related to needs for changes in health systems and global governance (Haines et al., 2011).

F1-C.5 REGULATORY REQUIREMENTS FOR THE USE OF NANOTECHNOLOGIES IN FOOD IN AUSTRALIA AND NEW ZEALAND

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Nanotechnologies have the potential to offer many opportunities for innovation in the food sector with applications in agriculture, water treatment, food production, processing, preservation and packaging. Whilst nanotechnologies may offer benefits in food and food packaging, the use of nanoscale materials may also present regulatory challenges similar to those for other emerging technologies, with the main issues related to potential impacts on human health. As part of an integrated whole of government approach, Food Standards Australia New Zealand (FSANZ) has assessed the capacity of the food regulatory framework in Australia and New Zealand to manage any human health risks posed by nanotechnologies under the existing legislation, the Australia New Zealand Food Standards Code, and risk assessment framework. This review sets out the current regulatory requirements for the use of nanotechnologies in food in Australia and New Zealand, amendments to data requirements for risk assessment of nanoscale and microscale particulates in the FSANZ application handbook, and ongoing monitoring of the risks associated with the use of nanotechnologies in the food sector.

P1.7 CONTRIBUTING FACTORS TO RISK EMERGENCE

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IRGC's provides concepts and methods which organisations can use for improving risk governance. In a context of systemic interconnections of risks that operate in complex systems, the task of anticipating emerging risks is a challenge to many. For this purpose, IRGC has first developed its thinking on what causes risks to emerge. This thinking, known as "contributing factors to risk emergence", helps risk professionals to understand and recognise a number of factors which, if present in their environment or organisation, may cause risks to develop but also be attenuated if they can be controlled. Risk manager can thus be better able to avoid or mitigate emerging risks in future. IRGC's report on this aspect of risk emergence was published in January 2011 and is available here: http://irgc.org/IMG/pdf/irgc_ER_final_07jan_web.pdf In order to understand the concept of "contributing factors", a useful metaphor may be that of a plant emerging from fertile ground. Just as there are a key set of factors that contribute to soil fertility and thus increase the probability that a plant will emerge if a seed is sown (factors such as nutrient and mineral content), so too are there a key set of factors that contribute to making "fertile ground" from which risks can emerge. There may (or may not) be a single dominant seed that gives rise to the risk but there are often multiple contributing factors in the growth process and they can operate in two directions, either to amplify or to attenuate the likelihood and/or severity of the emerging risk and its consequences. It is these contributing factors, their attributes and their relevance for risk anticipation, assessment and management that are the focus of IRGC. Illustrations of how the factors can explain the emergence of certain risks are available here: http://irgc.org/-Project-phase-1-case-studies-and,268-.html

P1.8 THE IRGC TRILOGY: IRGC RISK GOVERNANCE FRAMEWORK, RISK GOVERNANCE DEFICITS AND HOW TO DEAL WITH EMERGING RISKS

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Since 2004, IRGC has developed concepts and methods for risk governance, which altogether or separately can provide useful advice for dealing with risks, especially those where the level of complexity, uncertainty or ambiguity is high. - Risk Governance Framework: provides a comprehensive framework for assessing, evaluating, managing and communicating risks - Risk Governance Deficits: focuses on elements of the risk governance process where failures or deficiencies often hinder effective outcome. - Emerging risks: provides a perspective on contributing factors to risk emergence, and a protocol for dealing with emerging risks. The main purpose of this poster session is to provide an overview of these concepts and methods and how they articulate with each others. It will thus make use of visual representations to both summarize the concepts and show interrelations. Another purpose will be to highlight the holistic perspective that these methods provide, calling for and allowing other more specific, sectoral methods to be used whenever necessary and linked to IRGC's methods. Finally, the poster session will also be used to invite risk managers to connect to IRGC and share their experience of working with IRGC methods, or to seek from IRGC network experts advice on how to apply IRGC methods in their organisations. The poster presentation will be a "meeting place" for IRGC network members present in Sydney.

W3-C.2 IRGC: IMPROVING THE MANAGEMENT OF EMERGING RISKS FROM NEW TECHNOLOGIES, SYSTEM INTERACTIONS AND UNFORESEEN OR CHANGING CIRCUMSTANCES.

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IRGC has recently addressed specific challenges related to emerging risk management in industry. It has identified recurring obstacles that need to be overcome and proposes recommendations based on experience in various industries. The resulting recommendations will be presented. They relate to: a) The design of an appropriate risk governance strategy, management and organisation, to: 1. Set emerging risk management strategy as a part of the overall strategy and organisational decision-making 2. Clarify roles and responsibilities b) The development of an appropriate risk culture, which results from and contributes to: 3. Set explicit surveillance incentives and rewards 4. Remove perverse incentives to not engage in surveillance 5. Encourage contrarian views c) The organisation of training and capacity building for: 6. Surveillance and foresight activities 7. Communicating about emerging issues and dialoguing with key stakeholders 8. Working with others to improve the understanding of, and response to, emerging risks d) The creation of conditions for adaptive planning and management, in order to: 9. Anticipate and prepare for adverse outcomes 10. Evaluate and prioritise options; be prepared to revise decisions 11. Develop strategies for robustness and resilience

F4-B.3 EXTREME RISKS, DATA-FREE STATISTICS, AND CONFLICT OF INTEREST IN RISK ANALYSES

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Extreme risks (those of very low probability but of high consequence) present the problem that there is no or very little directly relevant data, as "it hasn't happened yet." Since statistical methods do not work well in a data-poor environment, the little data there is needs to be somehow supplemented by expert opinion. But the absence of feedback from data and from falsified predictions gives special scope for the well-known biases to which expert judgements of risk are prone; in addition to those familiar from psychology such as overconfidence and groupthink, we emphasise especially the ubiquity of biases due to conflict of interest, such as those that resulted in the free distibution of AAA credit ratings by leading financial ratings agencies before the Global Financial Crisis. We argue that the best known way to mitigate the problem and produce credible estimates of extreme risks is the "advocacy model" defended in Franklin et al, 'Evaluating extreme risks in invasion ecology', Diversity and Distributions 2008. Based on the Basel II banking compliance regime, especially as it applies to operational risk, the advocacy model involves the calibration of the expert opinion of an internal committee by an external regulatory agency. The external agency requires that the internal evaluation be done with the best available statistical methodology (e.g. Extreme Value Theory), and evaluates the reports from it with a sceptical (but not hostile) eye. Stakeholders with other interests are entitled to submit their own risk evaluations for scrutiny.

T1-A.2 OVERVIEW OF SOCIETAL CONCERNS AND US GOVERNANCE OF THE PRODUCTS OF SYNTHETIC BIOLOGY

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Along with the promise of benefits, all new technologies raise societal concerns. For synthetic biology, these concerns fall into five broad categories: 1) biosecurity, and in particular, bioterrorism, 2) laboratory safety, 3) potential harms to natural ecosystems as more genetically engineered products are intended for use outdoor environments, 4) human health concerns, and 5) a constellation of ethical and religious views that influence how new technologies are perceived and received by society.

Many of the concerns about synthetic biology apply to new technologies in general. Most of the concerns are shared with previous generations of biotechnology. But a few are new. In my talk, I will briefly review each of these concerns and identify what may be different about synthetic biology.

Likewise, many laws, regulations, and other governance mechanisms are in place to deal with potential harms and other concerns related to new and existing technologies. The challenge is to determine how well the existing suite of laws, regulations, and other governance mechanisms that apply to biotechnology will be able to respond to its next generation, that is, synthetic biology. These laws and regulations vary by country.

In the United States, synthetic biology is governed by the laws and regulations that comprise the "Coordinated Framework for the Regulation of Biotechnology," adopted in 1986. The framework has evolved over the intervening 25 years, both as US regulatory agencies have gained experience with biotechnology products and as the technology has advanced. I will discuss preliminary results of an ongoing study to identify gaps in, and challenges to, existing US laws and regulations.

W1-C.3 JAPAN'S NEW APPROACH TO EXISTING CHEMICALS -INTRODUCTION OF STEP-WISE ASSESSMENT SCHEME UNDER THE CSCL

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In 2009, Japan has amended its law to regulate industrial chemical substance namely Chemical Substance Control Law(CSCL). The intention of the amendment is to achieve the WSSD 2020 goal and introduced a step-wise assessment scheme. The scheme incrude several phases of assessment from screening to detailed assessment. In the presentation, the background, the procedure and the outcome of screening will be presented.

P1.9 ON THE CONCEPT OF RISK IN VIEW OF ISO 31000:2009

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People are always involved in risk management while making decisions and thus need a working knowledge of the fundamentals of the risk discipline, especially if they belong to the risk profession. Preferably, they should be well aware of the complexity of risk as a concept and its importance to the conduct of risk activities. Moreover, a common understanding of the complex nature of risks may make the difference in a joint effort to manage risks in a dynamic and ever more inter-connected and dependent world. ISO 31000:2009 introduces a risk definition that is expected to be accepted globally. This marks an important step towards unifying the opinions worldwide on what is meant by risk. There is though a lot to be desired about clarifying the meaning of the terms used in the risk definition, and the additional terms explaining these terms. Also, the five notes accompanying the definition do shed light on other aspects of the risk concept, but the relationships between them are not addressed at all. Nor are discussed the links connecting these notes and the variety of risk definitions preceding the current one and which are still in use. Do the notes contain statements that reveal the meaning of the word risk, or do they help manifest specific aspects of the complexity of the risk concept? This presentation argues that the risk concept requires clear unambiguous terminology, pre-defined and agreed upon objectives, broad thinking and no false entries in the concept. Risk is time-dependent, context-dependent, multi-dimensional and complex. A risk needs not only defining but also describing, characterising and expressing, and these four perform different functions necessary for the exploration of any risk. A 'set of quadruples' model is introduced to represent the risk concept extending the 'set of triplets' by Kaplan and Garrick. This updated model reflects the new risk thinking based on ISO 31000:2009.

P1.10 A FRAMEWORK FOR ASSESSMENT OF SUPPLY CHAIN RISK IN THE CHANGING WORLD

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1. Introduction: Risk management in supply chain is gaining importance in the changing world. Global competition, technological change and continuous strive for competitive advantage are the motives behind risk management approaches. In this sense, risk management is "an integral part of supply chain management". The objective of this work is to highlight the supply related risks and present a modeling framework for identification and mitigation of supply related risk. 2. Critical appraisal of literature survey and potential area of research: On analyzing the literature, it can be said that most of the models tend to ignore behavior of people in organizational setting. Risk assessment may be better based on probability-possibility instead of pure statistical probability. It appears promising to apply fuzzy set theory in carrying out comparative risk assessment. 4. Research methodology & Model: The framework is divided in two parts A. Model development B. Measurement methodology Part A: Model development The proposed model aims to understand risk assessment from both the quantitative and qualitative aspects. As theory of fuzzy sets allow accommodating ill defined systems involving fuzziness and vagueness, an attempt will be done to deal with the problem of risk assessment in light of fuzzy logic. Part B: Measurement methodology The data used in the measurement model correspond to the output from the Part A. The end product of this research will be a Casual and Cognitive Map that could map the complex interactions between the risk factors. The model created will judge the interrelationship between the values, returning an output value for the Supply risk. 5. Conclusion Some of the key benefits visualized are: • It can be used as a diagnostic tool to understand the risk in supply chain • Supply managers can use the information as a base for developing risk assessment tool. • The sources of supply risk identified will help organizations select and retain able suppliers.

T1-A.1 SYNTHETIC GENOMICS: SCIENCE AND GOVERNANCE: OVERVIEW OF THE TECHNOLOGY, POTENTIAL BENEFITS, AND BIOSECURITY CONCERNS

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Gene and genome synthesis, that is, constructing long stretches of DNA from constituent chemicals, provides scientists with new and unparalleled capabilities both for understanding biology and for

using it for beneficial purposes. But along with new capabilities comes new risks.

Synthetic genomics combines methods for the chemical synthesis of DNA with computational techniques for its design, allowing scientists to construct genetic material that would be impossible or impractical using more conventional biotechnological approaches. The constructed DNA can then be used in a wide variety of applications that could potentially lead to improvements in human health, the environment, and basic research, among others.

The ability to quickly construct or purchase whole genes and genomes has the potential to accelerate research in a variety of areas, from high-value pharmaceuticals to biofuels to power our cars; this capability may also make it possible to respond quickly to emerging threats, such as by developing and manufacturing vaccines during a pandemic. Improvements in the speed and cost of DNA synthesis are also opening the field to new participants (e.g., engineers seeking new tools) that may transform biotechnology.

However, as in the case of many technologies, synthetic genomics may be "dual-use;" in addition to useful advances for society, it may provide those with nefarious intent new ways to harm. Although dual-use concerns exist for almost all technologies, the power and accessibility of modern biotechnology—with synthetic genomics being a prime example—makes these concerns particularly salient.

W1-A.3 CLIMATE CHANGE AND MARKET LIBERALIZATION'S IMPACT ON HYDROPOWER: AN INTERDISCIPLINARY RISK ASSESSMENT

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Our article analyzes the impact of certain environmental and economic variables on the management of hydroelectric power plants with reservoir. In this field, we are at the interface between the hydrological system and the electrical system. Climate change affects water inflows into reservoirs, as well as power and revenue generation. Moreover, since the Nineties, electricity markets have been opened to competition. To a large extend, the emptying of water reservoirs is determined by power price fluctuations. Climate change and market liberalization are bringing about new risks and greater uncertainties, but also new opportunities which public and private decision-makers should consider and integrate into their strategies. Our study focuses on the Swiss part of the Rhone Valley, which possesses important hydropower plants with reservoirs. In the first part, we assess the operational risks, in the second we estimate the risks related to new investments. We assume that power companies' primary objective is to maximise revenues within certain technical and regulatory constraints. An optimization is performed using past data and local search algorithm. The impact of climate change on water inflows is simulated on the basis of regional climate models. The effect of market liberalization is modelled by taking into consideration different price scenarios. The investment analysis is based on real option theory. Risks are assessed using the Monte Carlo methodology. The academic interest of our research lies in the adoption of an interdisciplinary approach, as well as the use of different methodologies, to assess the short and long term risks of hydroelectric power exploitation. The practical interest is in the new tools of analysis that are provided to public and private decision makers to manage economic and environmental risks. Our research is carried out in the framework of the European project ACQWA (www.acqwa.ch).

W4-A.4 TRANSFORMATION OF ENERGETIC RISK IN THE BALTIC STATES

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The paper analyzes the case of the Baltic States where new risks and threats arose after the transition from soviet planned economy system to market economy. The paper focuses on perticular aspect of energetic system which is acute problem for the Baltic States, i.e., the problem of centralized heating system of block household. The paper deepens twofold directions: firstly, the origin of risk. The centralized heating system during its creation, in the context of a collective urbanization, was interpreted as a sign of superiority of the Soviet system (Leonavičius 2008). The problem derives from such peculiarities: at that time there was no concern with energy efficiency (as energy was cheap), there was no objective calculation of the cost of heating energy resource per household(as resource were controlled, planned and financed by the government), the quality requirements was not taken into account during the working process (all services were also organized and planned by the government and not always it was done effectively) (Buzar 2007). In other words, the advantages of soviet system (i.e., centralized heating system) after transition to market economy became the sources of different risks and particular threats (for instance bigger price for heating) for most of the people in the region. Secondly, it is good example of (in the Beck's words) organized irresponsibility: irresponsibility comes from permanently growing public knowledge about productivity of risks and threats of energetic system and its systemic repudiation (Beck 1998). Citizens are not able to solve this problem individually, but government, haven't done anything in order to minimize these threats(only about 2% of block household are renewable per year in each country). Ineffective centralized heating system of block household creates the problem hostages of which became bigger part of region's population. Acknowledgements. This research was funded by a grant for project "Lithuania energy security analysis and assessment of the energy security level" (No. ATE-06-2012) from the Research Council of Lithuania.

F4-C.1 THE COSTS AND ENVIRONMENTAL CONSEQUENCES OF PASSENGER VEHICLE GROWTH IN INDIA

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We present a social benefit cost analysis of four-wheel light-duty passenger vehicles in India and develop an interactive fully parametric model to explore a range of different scenarios and assumptions about fleet growth. Rapid economic growth has led to a dramatic increase in private vehicle ownership and use. This growth is expected to continue as the middle class expands. While passenger vehicles bring comfort and convenience, they also raise certain costs and risks, such as external costs due to pollutant emissions or the increase in accidents. The individual decision-making process, based on private costs, does not internalize these effects. To provide this type of information, we calculate a net present value (NPV) as the sum of the private and social cost for individual vehicles and fleet configurations. The private cost is the difference between the capital cost of the vehicle and the discounted sum of the cumulative cost of the fuel, maintenance, and resale value, using the prevailing market rate for borrowing. The social cost is the product of the emissions and the estimated monetary value associated with the damage caused by the air quality and climate change pollutants using a social discount rate. We investigate the influence of fuel prices, driving patterns, private and social discount rates, emission factors and potential deterioration of emissions control technologies, and social damage estimates of the different pollutants. The Indian market is highly segmented by size and fuel types. Assumptions about growth rates in these different segments are critical for the projected emissions. We also discuss the use of benefit transfer for social costs estimates for India. Our model will enable the Indian public and policy-makers to make more informed decisions about vehicles and evaluate the implications for fuel efficiency standards and fuel policy choices such that individual, environmental and social well-being are enhanced.

T2-D.3 NUCLEAR RISK ASSESSMENTS SHOULD BE LIVING DOCUMENTS THAT ARE RESOURCES IN EMERGENCY SITUATIONS: LESSONS FROM FUKUSHIMA AND OTHER NUCLEAR ACCIDENTS

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Risk assessments are commonly used as decision aids: they provide justification for a particular decision and afterwards, most often, they are retired to a bookshelf. But risk assessments can serve multiple purposes: they are structured repositories of information; these repositories can be updated, and they can contribute long after the original motivating decision has been made. The ground-breaking risk assessment for nuclear power plants, the Rasmussen report (WASH-1400) was intended to justify the renewal of the Price-Anderson act. Subsequently, plant specific assessments were required for nuclear power plant licensing decisions. Plant managers learned, however, that after licenses were granted, the risk assessments provided a template that could guide the identification of opportunities for retrofits and improvements in maintenance; the result has been substantial reduction in accident risks at many plants. Two aspects of nuclear risk assessments have not, however, been as fully exploited for risk mitigation. One is the consideration of external initiators: interactions can produce the kind of low probability/high

consequence events observed in Fukushima. The second is the accident consequence modules in the assessments: the analysis of possibilities for harmful radioactive releases from a power plant. Risk assessments can inform emergency planning by identifying systemic weak points and vulnerable populations, by characterizing opportunities for improving access to resources and capabilities for response, by defining critical decision points, and by providing a structure for assessing and updating plans based on new conditions and new knowledge. More extensive and updated preparation would have had clear value at Fukushima and other nuclear accidents.

F1-D.3 OPTIMIZATION OF PIPE NETWORK DESIGN USING AN NLP AND MINLP APPROACH

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On a refinery there are many layers of protection and safety systems that help to reduce the likelihood of an undesirable event. One of the protections that is needed especially of tanks and equipment that work with pressures above atmospherically, is a pressure relief valve. To reduce the hazard of expose the material to the operators, it is connected through determined sections of pipe to a flare, where all the materials are burned, instead of being released to the atmosphere. The issue of pipeline sizing on a pipe network depends of many factors related with the quantity of pipe sections and the properties of each can sometimes lead to an oversized network or a tight network that cannot assure that all the material that came from the pressure relief valve passes through the pipe and burn on to the flare. The network studied is the one presented by Dolan et. al. which involves 34 relief valves and 79 pipe sections. Optimal design of a pressure relief header network is developed using one of two manners, the first one is the simplified one that does not take into account the integer variable (referring to the nominal diameter of the pipe), and the other one develops a more rigorous programming using a mixed-integer nonlinear programming. The decision variables are represented by the diameters of each pipe segment between nodes (valve and flare), leaving all the properties and lengths unmodified. In the early stages of the project a comparison between results from Microsoft Office Excel® and GAMS was possible, but when the network size and complexity increases, only GAMS was able to handle the degree of complexity of the optimization.

P2.23 IMPROVEMENT OF A LPG FACILITY, APPLYING A INHERENT SAFETY DESIGN

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Inherent safety is a methodology that seeks to reduce the associated hazards to a process from the start, including safety elements right in the design of equipment and processes. It focuses on minimizing the elements that generate the most risk associated to the operation and occurrence of critical events, instead of accept the hazard and try to mitigate its effect a posteriori, just like other risk management techniques propose for existing equipment or processes. To apply this methodology a previous quantitative risk analysis realized by Liévano et al. is revised and reformulated by developing an optimization based on the principles of inherent safety in order to design the same process and determine the conditions and safety measures needed to reduce the likelihood of an incident right from the design phase.

T3-A.3 RISK BENEFIT ASSESSMENT AND REGULATION OF PESTICIDES

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New Zealand regulates all hazardous substances under the Hazardous Substances and New Organisms (HSNO) Act using a risk-benefit framework. All risks and benefits to human health, the natural environment, Maori cultural and spiritual values, society and community and the market economy are assessed using a range of risk analysis tools. Risks and benefits are then weighed up and a decision to approve or decline the substance is made. This process is currently being applied to the reassessment of a number of existing chemicals, including pesticides whose use is being phased out as we get a better understanding of the significant risks posed by some products, and as other 'new chemistry' products are developed. This paper describes the process currently being applied to the reassessment of all currently used and registered organophosphates in New Zealand. It outlines the range of risk/benefit analysis tools being applied and discusses how these will be evaluated. Finally, the paper will demonstrate how this evaluation leads to recommendations for continued use, phase out and immediate ban.

TL-A.1 RISK CHALLENGES, WORLD DEVELOPMENT, AND ***RISK ANALYSIS: AN INTERNATIONAL JOURNAL***

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The editors will discuss the journal's objectives in the context of risk and development. The EIC will discuss the options for addressing the conference issue in the journal, including theme issues, research articles, perspectives, book reviews, and virtual issues. Editors will discuss size and growth of the journal, ability to accommodate timely topics, and constraints due to reviewer and page limits. Then, area editors will offer suggestions how the editors and authors can work together to feature the issue in the journal.

W4-A.2 PUBLIC PREFERENCES FOR ENERGY SOURCES & WASTE MANAGEMENT PRACTICES IN THE US: PRE AND POST-FUKUSHIMA

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We surveyed 1900 to 3200 U.S. residents in 2005, 2008, 2009, 2010 and 2011 about preferences for different electrical energy sources, nuclear waste management practices, and facility siting. The surveys included both national and site-specific land line and cell phone samples near six DOE former nuclear weapons and some nuclear power plant sites. The 2011 (post-Fukushima results) show a decline in preference for nuclear power, a substantial increase in support for natural gas, and a reduction in support for new nuclear-related activities at DOE defense sites. Yet almost 40% of respondents remained open to nuclear energy partly because of their concern about global climate change. Respondents showed a preference for placing used nuclear fuel rods in casks and moving them to DOE defense sites or to Yucca Mountain, and for transporting the used fuel by railroad. Concern about safety and health and trust were the key correlates of preferences followed by respondent demographic and personal histories. Notable for managers of nuclear facilities was a post-Fukushima loss trust in federal agencies and contractors.

W4-E.3 INTELLIGENCE FOR AQUATIC HEALTH

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AquaticHealth.net is an online intelligence system dedicated to tracking and forecasting outbreaks of aquatic animal diseases and is the first of its kind in the world. It scans the internet on a regular basis for open-source content (such as news articles, journal articles, and 'tweets' from Twitter) related to aquatic animal health. It also allows anyone to submit content themselves. The system automatically detects location information in the content so that it can be plotted on a Google Map and tags it with useful key terms. All users can browse content and generate reports and maps (by search terms, filtered date ranges, tags, locations, etc.) and receive RSS feeds, disease alerts and a daily digest e-mail update.

Environmental change, changes in human movement, trade and economic development, and the evolution and emergence of pests and diseases, present significant challenges to biosecurity organisations globally. A systematic approach is needed to underpin gathering, analysis, reporting and application of biosecurity intelligence so that the intelligence community is able to anticipate new hazards such as emerging diseases and monitor changes in a range of dynamic processes (such as environmental, social and technological change) that affect pests and diseases. The acquisition of data and information should be accompanied by appropriate systems of storage and retrieval that support sound analysis and the production of useful intelligence. The intelligence-gathering process should include strategic foresight to support strategic planning and resource allocation, and to underpin policy development.

The ultimate objective of this work is to assist users to develop improved processes and capabilities in biosecurity intelligence-gathering and analysis. Improvements in gathering and managing data and information, analysing these to generate intelligence, and using intelligence as input to strategic planning will enhance the delivery of biosecurity services.

P1.19 THE MANAGEMENT OF THE LEVELS OF SAFETY INTEGRATED

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The safety and the health of the workers, who are statutory requirements for the employers and the security systems, take an important square in equipments and organization of the work. The Instrumented systems of Security assure the Functional Safety of equipments by trying to eliminate or to reduce the dangerous phenomena identified as such during the analysis of risks of the installation. Now, these LOCATED, integrating electric systems / programmable electronics / electronics (E / E / EP), must be designed so as to prevent any dangerous failure or master them when they arise. As voluntary application, the series of the standards the CIS 61508 (left 1 - 7) uses an approach based on the incurred risk allowing to determine the necessary prescriptions concerning the integrity of safety of the systems relative to the safety(security) (mechanical, hydraulic, pneumatic, electric) and more specifically systems on base E / E / EP. These levels of integrity of the safety of such systems are more collectively conscripts SIL (Safety Integrity Level). SIL ASSESMENT can be used for the various strategic functions of a process and in a general way can be representative of the plan of management of the maintenance of safety equipments. In a close future, he can replace the states of the balance sheets of very binding tests and will allow having a real appreciation of the functioning of the neuralgic organs of the safety instrumented so as to contribute to the safety of functioning of the installations. This work is the fruit of a study made within the framework of an academic research work applied to a petrochemical site situated in the industrial park of Arzew in Algeria.

P1.20 THE TRANSPORT OF HAZARDOUS MATERIALS BY SEA ROUTE

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The sea transport, recovering from major environmental and economic stakes for States more and more forced to the protection of their marine resources and their littoral zones underwent the repercussions of the recent ecological disasters. The admission of failure of the policies of countries in safety in the transport of hazardous materials, in particular by sea route, also led to the intensification of legislations in force at the national level that international. Security of the persons, conservation of the fauna and the flora clearly mentioned in the international agreements strengthened by the device legislatives national, aspire to the reassurance of circuits inferred in a direct or / and indirect way. In the transport by sea route, besides the natural disaster (Tsunami, violent wind, Hurricane, etc.), the risk connected to the traffic in cleanly spoken is aggravated) by the dangerousness of the transported goods. This one presents risks (fire, explosion, pollution, etc.) connected to its physical properties (flammability, explosibility, gas under pressure liquefied) or chemical (ability to react, toxicity). Experience feedback (errors, incidents, accidents and disasters) is carrier, on one hand, of teachings and on the other hand, necessities to bring the correctives to the system of organization. Their analysis constitutes a factor of improvement to develop the procedures. The common sense let us propose a study based on collection of the data aboard avitailleurs ships, an analysis of the not wished events initiators and intensifiers pays(pours) to study flow(flows) of the danger between the systems of springs and the target systems in the hyperspace of the danger that the UNO boat on the open sea will represent. This study joins in frame of a report of academic master in management of technological risks. Keywords: risk - incidents - accidents - MADS-MOSAR - analysis of the main risks - system - under system –spring of Hazard - tree of event - barriers - target - limp blacks - scenarii - experience feedback - residual risks – unacceptable risk

T4-D.2 BEYOND RISK COMMUNICATION: LIMITS OF INDIVIDUAL PERSUASION IN THE CASE OF CLIMATE RISKS

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The stream of data gathered by various sciences shows clearly continuing progressive climate change, increasing destruction of biological diversity, and the endangering of fundamental resources like water, soil, and food. And the associated costly long-term damage to mental health is not even discussed. Nevertheless, too few decisive steps heading towards a transformation into a sustainable society have been taken. Are human beings incapable of responding appropriately to certain risks? Starting out from evolutionarily determined characteristics and limitations of human information processing, this contribution will explain features and peculiarities of the human response to climate risks (and set them in relation to reactions to the risks of wireless communication technologies). Some of these characteristics are, for example, difficulty detecting danger signals; dominance of direct experience; affect heuristics; the inability to recognize consequences of non-linear processes; uncertainty regarding the veridicality of warnings; being easily made uncertain by professional "merchants of doubt"; being involved in social ecological dilemma structures; the lack of perceived self-efficacy; the tendency to discount the future when investing today; the status quo bias; and unrealistic optimism, etc. Based on these findings, the plea is made to complement the risk communication approach in the area of climate risks that aims for insight on the part of individuals with an approach that is aimed at larger collectives. It should be a systematic, multidisciplinary, and behavioral engineering approach. The goal is to take into stronger account the fact that individuals' behavior is embedded in the culture and society, which can be achieved by implementing and supporting simultaneously both massive top-down interventions and bottom-up activities. The objective here is more than knowledge and understanding; the primary goal should be appropriate "new" behavior.

P2.18 UNCERTAIN RISK, PRECAUTIONARY MEASURES, AND TAILORED RISK COMMUNICATION

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Potential long-term risks with high impacts on the environment and human health has changed current risk policies towards a more precautionary approach for rational decision-making in the face of unknown or unclear dangers. In addition to the problem of measuring the effectiveness of precautionary measures, there is the more fundamental problem of how to handle potential countervailing effects on precautionary measures on trust in risk management and on the public's perception of risk. This is of special importance considering that, in the absence of clear evidence, the perception of risk often drives a debate and any subsequent requests for a precautionary approach. While in some cases, for instance with respect to climate change, increase of public concerns are welcomed, there are in other cases more reservations that those concerns will have countervailing effects on risk management decisions. In the symposium this issue will be pursued by focusing on wireless communication technologies on the one hand and climate change on the other hand. Starting with a review of the psychological literature on intended and non-intended side effects of risk communications, we will give an overview of the underlying psychological mechanisms, effects, and biases that have to be taken into account for tailoring communication on precautionary measures. The second contribution will summarize the available evidence on effects of informing on precautionary measures and on how to address these effects in risk communication. The third contribution will introduce a framework that is designed to support the interested public and decision makers in evaluating the trustworthiness of risk assessments. Besides the framework, first results of ongoing empirical studies will be presented that support the usefulness of this framework in disputes on how much precaution is needed for the prudent protection of health and environment. The final contribution provides an analysis of personality traits, beliefs and attitudes that shape reaction to precautionary measures in order to see whether there are particularly personality traits that predict how people will respond to the precautionary measures, and to see whether the level of state anxiety is 'appreciably' changed with the precautionary measures.

P1.14 DOSE-RESPONSE ASSESSMENT TOOLS: A PRACTICAL METHODS COMPENDIUM FOR RISK ASSESSORS

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A wide variety of dose-response approaches exist that apply increasingly data-informed methods and can be used to address a range of problem formulations. However, many risk assessors may not be aware of the range of tools that are available to address specific needs and questions. This is par-

ticularly an issue in the light of the rapid development and evolution of risk methods to reflect increased biological understanding and new scientific methods. It can also be a challenge for regional and local risk assessors to stay informed of methods and guidances developed at the international level. To aid in communicating the methods that can be used to address different issues, a web-based framework for organizing and linking to risk methods has been developed in the context of a multi-stakeholder workshop series. The framework builds off of the framework in the NAS (2009) Science and Decisions report, with the goal of organizing risk assessment methods and guidances in a practical methods compendium. The internet-based framework addresses qualitative and quantitative screening approaches and in-depth assessment methods, and includes active links to additional resources. An expert panel experienced in toxicology and risk assessment reviewed approximately 25 dose-response assessment methodologies for inclusion in the framework, each as part of a case study illustrated with specific examples. A standing panel is being put in place to continue to add to and update the framework in an "evergreen" process.

P1.13 THE ATTITUDE CHANGE AND ITS DETERMINANTS AFTER FUKUSHIMA NUCLEAR POWER ACCIDENTS

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The catastrophic accidents from Fukushima power plant have changed people's attitude toward nuclear power or energy. To explain the process and degree of attitude change, it need utilize the comprehensive theoretical models and test those in term of more real situation. Our study will examine the structure and mechanism of such attitude change in case of Fukushima accident by mobilizing the survey experiment method. Frist, we will analyze the individual difference in attitude changes and highlight the process of attitude change, mainly testing the ELM (the Elaboration Likelihood Model suggested by Petty & Cacioppo 1986) that consists of the central route (high-effort scrutiny of attitude-relevant information) and peripheral route (less effortful shortcuts to evaluating attitude objects) in elaboration likelihood continuum. Then we will examine proximal determinants for the attitude change, which include not only a variety of motivational and ability reasons but also credibility and attractiveness. Finally, we test the role of distal causal factors in attitude change, which include the perceived risk/benefit, stigma, trust and knowledge about nuclear power energy.

T2-D.2 FROM RISK MANAGEMENT TO UNCERTAINTY MANAGEMENT: TRADE-OFF DILEMMA

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The main focus of this presentation is twofold. First, some reflection on the relationships between risk, uncertainty, surprises in the context of improving risk management and governance so that society can cope better with the extreme events or large scale disasters that are on the rise, driven by potential impacts of climate change and increasing interdependency and connectedness of the world. The second part of the presentation will highlight the lessons learned from large scale disasters from China – flood in 1998 and Wenchuan Earthquake in 2008, focusing on the trade-off dilemma and role of learning and resilience building.

T2-C.2 COMMUNICABLE DISEASE RISK MANAGEMENT SYSTEM MATURITY IN THE PAPUA NEW GUINEAN MINING INDUSTRY

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The management of communicable diseases is a key challenge for socio-economic development in many parts of the world. This presentation reviews the results of a recent PhD study into how mining companies in Papua New Guinea apply the risk management process to meeting this challenge. The study applies maturity model theory to the development of risk management systems and analyses the communicable disease management activities of three major mining operations in Papua New Guinea from a risk management maturity perspective. The presentation will provide an overview of communicable diseases, mining and health management in Papua New Guinea, touch briefly on risk management frameworks and the risk management process as set out in ISO 31000, discuss the capability maturity model framework and its application to risk management systems and outline some of the key lessons learnt regarding development of risk management system maturity.

F1-A.1 A TRANSDISCIPLINARY RISK ASSESSMENT FRAMEWORK TO DEFINE PLANETARY BOUNDARIES FOR CHEMICAL POLLUTION

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Chemical pollution has been one of the Planetary Boundaries (PBs) within which we expect that humanity can operate safely (Rockström et al., 2009). The control variables are yet to be clearly defined, however. While there are ample scientific evidence on individual toxic substances such as persistent organic pollutants (POPs) and heavy metals and their adverse effects on specific food-webs through bioaccumulation, an aggregate global-level analysis of human health and ecosystem functioning in response to chemical pollution has been lacking. Difficulties in conducting an integrated environmental risk assessment of chemical pollution and in deriving a few control variables for the PBs stem from uncertainties in physicochemical and biological properties of, and infinite combinations of, conventional and emerging toxic substances that exhibit their synergetic and antagonistic effects on ecosystems. Nevertheless, there are a finite number of toxic substances that have been prioritized, and their emissions to the global environment have been directly or indirectly mitigated through international regulations such as the Stockholm Convention on POPs.

We propose to combine 1) Finely-Advanced Transboundary Environmental model (FATE) which is capable of predicting the environmental fate of persistent toxic substances (Kawai et al., 2011) and 2) Bayesian uncertainty and sensitivity analysis which effectively synthesizes the FATE predictions, food-web analysis, and outcomes of laboratory-based chemical exposure experiments (Handoh and Kawai, 2011), in order to develop a transdisciplinary risk assessment framework to PBs for chemical pollution. A series of case studies on POPs are currently being conducted so as to confirm the performance of this framework, which will provide new insights into quantification of the PB control variables for chemical pollution.

F3-C.4 OVERVIEW OF HEALTH IMPACT ASSESSMENT PRACTICE IN AUSTRALIA

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Australia has a longer history of engagement in Health Impact Assessments (HIA) than most countries. HIA in Australia has been developed as an important mechanism for considering both risks and more indirect impacts of health for development projects and, increasingly, policies and plans. However adoption of HIA has yet to be fully supported, particularly in legislation, across the varying levels of government in Australia. This session presents an overview of the development and practice of HIA in Australia, and offers some directions for future progress with a particular focus on the intersection between HIA and health risk assessment. The lessons are drawn from a recent article overviewing HIA practice in Australia that incorporated insights provided by public health professionals across the country.

F3-C.3 OVERVIEW OF HEALTH IMPACT ASSESSMENT PRACTICE WORLDWIDE

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Health impact assessment (HIA) has matured as a form of impact assessment, and is being used in an increasing number of fields internationally. This session presents an overview of current practice, its evolution, strengths, weaknesses and contemporary debates, drawing from the experience and insights of International Association for Impact Assessment Health Section members who have practiced across six continents and been involved in more than 200 HIAs. A number of priorities for research and practice are identified.

W2-D.1 IMPROVING RISK ANALYSIS THROUH GLOBALLY HARMONIZED RISK ASSESSMENT METHODOLOGY

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This presentation provides an overview of the World health Organisation' (WHO)/IPCS Project on the Harmonization of Approaches to the Assessment of Risk from Exposure to Chemicals (the Project). TheProject aims to improve and harmonize global approaches to risk assessment by: increasing understanding and agreement on basic risk assessment principles and developing international guidance documents on specific issues, in order to facilitate sharing of assessments and avoid duplication of effort. The Project translates advances in scientific knowledge into new harmonized methods, promotes transparency in risk assessment, and reduces unnecessary testing of chemicals. These activities have potential benefit for all those involved in chemical hazard/risk assessment (chemical assessment authorities and other risk assessment bodies, professionals, and researchers). The presentation will describe major outcomes of the Project in a number of areas, ranging from foundations (such as risk and exposure terminology and the mode of action/human relevance framework for chemical risk assessment), to current issues and needs for the risk assessment community (such as the framework for assessment of combined exposure to multiple chemicals and guidance for immunotoxicity risk assessment for chemicals). Finally, plans for the establishment of a WHO chemical risk assessment network will be outlined.

P1.15 RISKS ASSOCIATED WITH UNCONTROLLED LIVESTOCK MOVEMENTS IN THE GREATER MEKONG REGION

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Increasing demand for livestock and livestock products, particularly cattle and beef by Vietnam and China stimulate movement of livestock from adjacent Mekong countries. Official movement channels may be too costly or otherwise unaccessable to small traders, who make informal arrangements to move livestock across extensive international borders. The nature of this informal trade is outlined, and an evaluation of the risks presented, with a focus on foot and mouth disease. Non-regulatory interventions are explored to manage these risks.

T3-B.2 REGULATORY DECISION-MAKING FRAMEWORKS FOR CONSUMER PRODUCTS

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Regulation of consumer products for hazardous chemicals or genetic modifications is crucial for environmental health risk assessment and analysis. These hazards include industrial pollutants and other environmental contaminants along with emerging technologies such as nanotechnology that can ultimately impact food supplies, water and cosmetic products, among others. Different classes of products require specific regulatory frameworks for assessing human health risk. Within the framework for a product class, there is a need for harmonization of the risk assessment and chemical safety process. We provide an overview of regulatory decision-making frameworks for selected consumer products in Australia. One of the products addressed will be genetically modified organisms (GMOs). People have been manipulating the genetic make-up of plants and animals for countless generations. This involves selecting plants and animals with the most desirable characteristics (e.g. disease resistance, high yield, good meat quality) for breeding the next generation. Today's techniques of genetic modification provide new ways of identifying particular characteristics and transferring them between living organisms. GMO labeling policy for foods is under intense development, and in the absence of any international consensus, countries are either choosing mandatory labeling or adherence to voluntary labeling. In Australia, it is mandatory for GMO foods to be identified on food labels. Most dealings with GMO organisms must be licensed, and licenses are not to be issued unless any risks they pose can be managed in such a way as to protect the health and safety of people and the environment. There is thus a need to develop and harmonize regulatory frameworks for consumer products (including GMOs, chemicals and other hazards), and to incorporate these frameworks into risk analysis and public health decision-making.

W1-C.5 ACCELERATED ASSESSMENT OF EXISTING CHEMICALS – THE AUSTRALIAN INVENTORY MULTI-TIERED ASSESSMENT PROGRAM (IMAP)

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In Australia, the National Industrial Chemicals Notification and Assessment Scheme (NICNAS) has developed in consultation with stakeholders and technical experts a scientific risk based framework for the assessment and prioritisation of chemicals on the Australian Inventory of Chemical Substances (AICS). In developing the IMAP framework NICNAS has explored availability and utility of tools, criteria and assessment approaches developed internationally, including Canada, the USA, Europe and international agencies such as OECD and the WHO.

The IMAP framework uses simple and transparent criteria for human health hazard, environmental hazard and potential exposure to chemicals to determine risk, and also allows for expert judgement to be applied where appropriate.

A number of countries and international agencies are generating or gathering information about the human health and environmental effects of a broad range of chemicals. To ensure efficiency and reduce duplication of effort, NICNAS will utilise this information, where appropriate for the Australian context. Internationally recognised assessment tools will be used to fill gaps in available data on a number of human health and environmental hazard indicators. For exposure indicators, such as import or manufacture volume and use of the chemical, the framework utilises surrogate information, such as from overseas sources, or conservative default values, where actual or surrogate information is not available.

The IMAP framework will be implemented in a staged manner, commencing with a focus on a subset of chemicals on the national inventory meeting characteristics supported by stakeholders. It is envisaged that this first stage will comprise the first two tiers of the framework, address approximately 3,000 chemicals and take four years to complete, with commencement anticipated in 2012-2013. An external review of the new framework will also be conducted. The presentation will describe the IMAP framework.

T4-C.7 ENVIRONMENTAL CONTAMINANTS AND GLOBAL CLIMATE CHANGE: IMPLICATIONS FOR ENVIRONMENTAL DAMAGE ASSESSMENT AND RESTORATION/REHABILITATION. HICKEY ET AL.

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The process of assessing the extent and magnitude of the environmental harm caused by a release of a hazardous material, or oil, is known as natural resource damage assessment (NRDA) in the U.S. and environmental liability directive (ELD) in the EU. The NRDA requires both injury assessment and implementation of a restoration of ecosystem services to the baseline condition. Establishing the historic baseline condition and the factors affecting the stability of the baseline are a major component of the NRDA process and area of potential global climate change (GCC) effect. GCC will impact the processes of assessing injury and rehabilitating/restoring and conserving resources by affecting the magnitude of impact of contaminants on natural resources and altering potential restoration/rehabilitation efforts. Baseline/reference conditions for estimating resource injury and restoration/rehabilitation also may shift significantly and exhibit greater variability due to GCC, representing a significant challenge to practitioners. This presentation will discuss how such future environmental damage assessments and restorations might be influenced by GCC and provide recommendations of research needs in the field.

F1-A.3 WATERLOGGING RISK IN EASTERN SIBERIA: A CASE STUDY IN THE PERMAFROST REGION

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Global warming will likely transform Siberian environments. Gradual increases of surface air temperature have been recorded in this region, and as a result, marked changes in the cryospheric terrestrial ecosystem such as damage to the forests and more frequent floods have been already reported. Global warming, as one of the anthropogenic climate changes, results not only in higher surface air temperatures but also in larger precipitation and thus in thawing-depth increases in the permafrost region. Since this thawing process has the greatest impact on the upper permafrost layers, it has the potential to lead to serious land surface degradation. Because such land surface degradation can affect both the social and the economic structure in a region, a framework of transdisciplinary risk analysis is necessary for the local authorities to deal with this problem. As a first step of such an analysis, we performed fieldwork focusing on adaptation strategies to the natural and social impacts of regional climate change in Eastern Siberia. This presentation will introduce the results with suggestions for a prototype of risk analysis suited for permafrost regions.

P2.4 MANAGING COUNTRY LEVEL DISASTER RISK: THE IIASA CATSIM MODEL

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The rising costs of natural disasters have instigated country governments, particularly in developing countries, to better plan and manage disaster risk. We discuss the IIASA approach based on the CATSIM (CATastrophe SIMulation Model) model, which can be used to assist in such planning exercises. CATSIM represents a simple risk-based economic framework for accounting for the fiscal and macro-economic disaster impacts and allows to study the costs and benefits of measures for reducing those impacts. CATSIM uses Monte Carlo simulation of disaster risks in a specified region and examines the ability of the government and private sector to finance relief and recovery. It is interactive in the sense that the user can change the parameters and test different assumptions about the hazards, exposure, vulnerability, general economic conditions and the government's ability to respond. As a capacity building tool, it can illustrate the tradeoffs and choices the authorities confront in increasing their resilience to the risks of catastrophic disasters. For example, the model can be used for supporting the planning for contingent disaster risks and the allocation of resources between ex-ante spending on disaster risk management (such as prevention, reserve funds, insurance) and ex-post spending for relief and reconstruction. Our paper discusses key model fea-tures and mechanics and discusses these via model applications to Nepal and Hungary.

P1.16 THE MENTAL MODEL INTERPRETING THE ACCIDENT INFORMATION RELATED WITH NUCLEAR POWER PLANT AT FUKUSHIMA, JAPAN

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After accident of nuclear power plant at Fukushima, Japan, people faced the lot of information related to it. When people received the accident or risk information, they decoded it by mobilizing the mental model, which consists of diverse perceptual and cognitive factors. Our study aims to specifying the role of mental components in interpreting the accident information. This study will adopt the experiment or survey experiment to find out such interpretation mechanism. The analysis will be answering three key questions; first, what's role of information? Since accident information is not the same one, different types or contents of information would be have different impacts on interpretation process. After providing the respondents with the diverse information related with accidents, we will check their interpretation and response. Second, what's response to the information? When information provides to respondents, they will reveal different response such as 'acceptance, reflection versus rejection', 'attenuation versus amplification', and 'holding versus transmitting'. Third, what's role of perceptual or cognitive determinants in interpreting the accident information. We will test the function of not only the variables which have usually been used in risk perception paradigm, e.g., the perceived risk/benefit, knowledge, trust and stigma, but also the new variables which concern with risk communication, e.g., credibility, content, quantity of information (source).

F2-C.7 ROUNDING UP RISKS

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Making the components of the Resource Allocation project work together poses significant challenges. I will describe the approaches we are employing to meet the challenge.

T4-A.4 RISK, ETHICS AND VACCINES

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In this presentation I will explore several frameworks that we could use to understand the ethics and politics of vaccination. I will explore the rationales and limitations of standard approaches to ethics (utilitarianism, deontology, human rights) as they can be applied to decisions and communication about vaccine safety. I will focus on the criteria that might be applied for shifting from one framework to another (as will always be necessary in different contexts). Of course, the ethics of vaccine-related decisions and communication will emerge from the hurly-burly of particular circumstances and events, and the risks we address are both incommensurable and vary widely, from mortality and morbidity through to cost, social discrimination, losses of trust and capacities for future decision making. I draw these into a framework for addressing risk communication and ethics in relation to vaccines by focusing on public trust and deliberative practices as investments in long-term success for vaccination strategies.

W3-E.5 DISTINGUISHING EVIDENCE FROM ADVOCACY

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Environmental risk assessment is intended to provide a basis for risk management decision-making. This process is intended to review, analyze and summarize the relevant scientific evidence in a format that will be useful to decision-makers. While the process seems clear enough in scope and mandate, it can fall victim to confusion over what is evidence, what is judgment and what is advocacy. Although suggesting that scientists should seek any advice from lawyers may seem counter-intuitive, the concepts of evidence, opinion and advocacy are at least clearly articulated in the legal justice system. Witnesses are restricted to providing evidence on what they have observed directly; hearsay, what witnesses have heard from others is excluded. Likewise, witnesses are barred from offering opinions or engaging in advocacy. Legal counsel will develop opinions on what the evidence means and advocate those opinions to the decision-maker(s) with the intent of influencing the decision on the question under review. Expert witnesses are accorded special status in the legal system to offer opinions that depends upon knowledge that a decision-maker may lack. The essence of the distinction between advocacy and evidence is centered on the degree to which a risk assessment is directed towards determining versus informing the decision under review. Clearly, evidence should inform a decision, but advocacy seeks to determine what the decision should be. This is a distinction that is easily blurred in the absence of clear guidance to both risk assessors and decision-makers. How we deal with evidence, opinion, advocacy and uncertainty in environmental risk assessment can be substantially improved by developing a much clearer understanding of these concepts. An environmental risk assessment that attempts to steer a decision-maker towards one course of action over alternatives has crossed the line from evidence into advocacy. Examples of how this can and does occur in environmental risk assessment can illustrate what should be avoided.

F3-D.2 RISK ASSESSMENT FOR PETROCHEMICAL FACILITIES

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Since 2006, the assessment of potential health impacts of the proposed development project has been taken into consideration as an important part of an environmental impact assessment (EIA) in Taiwan. This is to ensure that the development projects using a scientific sound and well documented process to define and quantify potential human health risks from exposure to chemical released from the proposed project. Environmental Protection Agency (EPA) of Taiwan in 2011 set the technical guidelines for conducting human health risk assessment as part of an EIA. Therefore, it is expected that human health risk assessment would play a crucial role in EIA. The EIA of the third Naphtha Cracker Plant located in Lin-Yuan Petrochemical Industrial Complex is one of a good example in Taiwan to demonstrate

the application of human health risk assessment in EIA. The project is to expand the ethylene production capacity from current 0.23 million tons/yr to 0.80 million tons/yr. However, environmental contaminations as well as human health issues due to the expansion raise many concerns. Therefore, we, including researchers from environmental engineering, environmental management, epidemiology, and human health risk assessment, form a research team to work on this study. The main task for this study consists of development of the emission inventory for the 21 processing plants in Lin Yuan Petrochemical Industrial Complex, monitoring air quality in nearby environment, implementing hazard identification based on the list of emission inventory, performing the exposure assessment by applying air dispersion model and multimedia transport model, conducting probabilistic risk analysis by using Monte-Carlo simulation technique. Furthermore, incidence of cancers and mortality rates in the study area are studied. And, we would like to use this opportunity to share the experiences as well as the results of this valuable study in the World Congress on Risk 2012. Based upon the study, we proposed five oral presentations in the Symposium entitled "Risk Assessment for Petrochemical Facilities". Topic 1: Development of a site-specific hazardous air pollutants emission inventory-A case study of Lin-Yuan Petrochemical Industrial Complex. Topic 2: Comparison of measurement and model simulation of hazardous air pollutants in ambient air-A case study of Lin-Yuan Petrochemical Industrial Complex. Topic 3: The Health Risk Assessment of Multi-chemicals emitted from a Petrochemical Industrial Complex Topic 4: Development of risk-based environmental management strategy- A case study of Lin-Yuan Petrochemical Industrial Complex. Topic 5: Study of health status for the residents living in the vicinity of a petrochemical industrial complex.

F1-D.4 ANALYSIS OF CHINESE PUBLIC WTP FOR RISK REDUCTION OF CHEMICAL INDUSTRY ACCIDENTS

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In order to explore the influencing factors on respondents' Willingness to pay (WTP) for risk reduction of chemical industry accidents, a questionnaire survey combined with contingent valuation method and psychometric paradigm method was conducted in the city of Yancheng, Jiangsu Province, China. Both traditional socioeconomic variables and perceived characteristics of the hazards were considered in this study. With maximum likelihood factor analysis, nine perception variables were categorized into three perception factors (effect, knowledge and trust). Under three scenarios of risk reduction, TOBIT model was used in this study for further analysis of influencing factors on WTP for risk reduction. The results showed that three demographic characteristics—age (α=-9.3, p=0.000), gender (α=81.0, p=0.041) and income (α=21.7, p=0.047) had statistically significant effects on WTP for chemical risk reduction, however, education was not a significant predictor of WTP but had a positive relationship with it; meanwhile, three extracted public risk perception factors—effect (α=43, p=0.023), knowledge (α=42, p=0.022) and trust (α=60.2, p=0.001) indicated statistically significant effects on WTP for chemical risk reduction. The mean value of WTP increased with the larger magnitude of risk reduction; while the numbers of determining factors on WTP decreased as the reduction level improved, and only the factor of effect had significant effect on the WTP of 80% risk reduction, which indicated that respondents only concerned about the effect of risk to determine their payment in the scenario of high level of risk reduction. The chemical safety management cost of Yancheng city was calculated to be US$7.56?107 (20% risk reduction), US$1.37?108 (50% risk reduction), and US$1.76?108 (80% risk reduction) million per month. These findings can assist governments and policy makers to reach target groups of people, and develop effective communication strategies for local risk management.

W4-D.5 MODELLING THE RISK OF WATERBORNE DISEASE IN 2 AND 4 DEGREE WARMER WORLDS

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The IPCC have identified that climate change will pose a threat to the safety and security of drinking water supplies. We undertook a risk assessment of the impact of climate change on drinking water from small supplies, the main vulnerable group. Climate data was obtained from the UK CIP09 climate projections using the Weather Generator. For each site the weather generator was run for the years 2040 and 2080 under the SRES B1 low and the SRES A1F1 high carbon emission storylines. Data from 100 runs of 100 years duration were obtained for each site in the UK. One thousand consecutive years of data were chosen for each model. The relationship between E. coli count and precipitation variables were determined by regression analysis of the PHLS dataset which has previously been described. Because this dataset is highly zero-inflated we used a variation of hurdle regression to model the impact of climate on E. coli counts. A binary logistic regression model was used to determine whether or not any E. coli were present and a subsequent GLM with gamma log link was used to model the distribution of E. coli in positive samples. The daily risk of Cryptosporidium infection was then modelled from the E. coli counts as we have described previously. The model predicting whether or not a sample was positive or negative for E. coli and count included region, month, log rainfall on the three day prior to collection. Although mean daily precipitation over the course of the year was not that different between the baseline and 2080 High emission scenario, the model predicted more dry days in summer and more frequent heavier rainfall events during the winter in 2080. The impact on probability of failing E coli counts was not that different between the baseline and high emission two scenario. Though there were differences in the actual counts observed depending on which location was being modelled. In some areas, the main risk would appear to be from seasonal aridification.

F4-C.2 DAISY FOR DEVELOPMENT: BENEFITS AND COSTS OF INTRODUCING ASSISTIVE TECHNOLOGY FOR EQUITABLE ACCESS TO INFORMATION IN BANGLADESH

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This paper explores the benefits, costs, and risks of using Information and Communication Technology (ICT) based assistive systems to ensure equitable access to information for people with disabilities (PWDs) and low-literacy population in Bangladesh. As a part of the national vision to develop a knowledge based society, the government of Bangladesh is rolling out ICT infrastructure all over the country. Information access points with high speed Internet connections, laptops/personal computers, and mobile phones are being established in both urban and rural areas. In a country with a functional literacy of 48%, such initiatives are still out of reach for a significant portion of the uneducated and impoverished population. The situation is even worse for PWDs (predominantly with visual impairments), as majority of them cannot use the traditional information outlets due to accessibility issues. The absence of a suitable information access platform further more excluded them from availing better education as well as job opportunities.

Digital Accessible Information System (DAISY) is a "text-to-speech" interface, predominantly used in the developed world for assisting visually impaired population. This paper will discuss the key opportunities of DAISY as a technological tool to eliminate information access related problems and discrimination for both, the PWDs (visually impaired) and print-disabled populace. Using expert elicitation, in-field data analysis, and survey administration among the key stakeholders, we will analyze the benefits and related costs of implementing DAISY options in Bangladesh. Moreover our research will identify and evaluate the socio-economic risks for not developing accessible information systems. The paper will also include comparative situation analysis of DAISY applications in similar global south countries.

W3-A.3 DISASTER CAPITALISM AND RISK ASSESSMENT: DEVELOPMENT OPPORTUNISM AFTER THE 2004 TSUNAMI

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Vulnerability is a key component in understanding recovery processes in post-disaster environments for the purposes of risk assessment. As recent research has demonstrated, in post-disaster processes, vulnerability can be dynamic and directly influenced by the implementation of redevelopment schemes by governments. Thus, analyzing vulnerability and the effects of recovery policy on it can provide important insights to post-disaster hazard adaptations and risk reduction. It has been argued in the literature that disaster recovery is an opportunity to pursue more resilient and sustainable communi-

ties, by reducing risk. However, the literature on 'disaster capitalism' argues that such opportunity can be misused and produce undesired and unanticipated consequences. The term disaster capitalism here is broadly defined as political economic and social processes that use disasters as an opportunity to promote particular development policies and practices that can generate greater social divisions, inequities, and amplify rather than reduce vulnerabilities. In this sense, the social and political crisis engendered by disaster produces opportunities to impose new development schemes and economic policy without encountering local opposition.

This presentation provides a case study demonstrating how the recent Thai tourism policy and its implementation in disaster redevelopment planning influenced recovery from the 2004 Tsunami in Thailand. This study applies an integrated framework combining vulnerability analysis and planning to examine redevelopment process of a tourism-based island in Thailand through multi-stakeholders interviews, field observations, and analyses of related documents. By showing the effects of redevelopment programs on people's capacity to recover, this study provides new insights into how redevelopment programs can work to disadvantage local populations while promoting new commercial ventures. The costs and benefits of such recovery programs are discussed in terms of its effects on future vulnerabilities and risk exposure.

P1.4 ASSESSING HEALTH RISK DUE TO EXPOSURE TO ARSENIC IN DRINKING WATER IN HANAM PROVINCE, VIETNAM

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Estimating health risk caused by As exposure in drinking water is important to understand the impact of As contaminated drinking water and to prioritize the interventions. We characterized the As contamination and assessed health risk related to As contaminated water in Duy Tien district, Hanam province using the Australian Environmental Health Risk Assessment Framework.; ; Exposure assessment was conducted by measuring As concentrations in 300 tube-well water samples before and after filtration, estimating water volume consumed for drinking purpose in 150 interviewed households, which gave the daily consumption dose from oral route. Health risk was characterized by comparing the As levels in water with the National technical regulations on drinking water quality, and by comparing the daily consumption dose with the Tolerable Daily Intake (TDI) value set by WHO. Finally, cancer risk of people using As contaminated water source for eating and drinking was estimated using Cancer Slope Factor index and lifetime average daily dose.; ; Results showed that water was heavily contaminated with As. The concentrations in drinking water before filtration were from 8 – 579 ppb (mean 301 ppb). The majority of households designed their sand filters themselves, but filters did not meet the standard for As removal. As daily consumptions of 60% adults were lower than the level of the TDI (1 µg/kg/day). The average cancer risk in adults due to consuming filtered tube-well water for drinking purpose was 23.5 x 10-5. This cancer risk would be 1.2 and 1.5 times higher after five and 10 years drinking filtered water, respectively. Our study showed the high contamination levels of As in tube-well water in Hanam. Improved filtration measures or the replacement of the current drinking water source (i.e. by rain water, clean pipe water...) to prevent health risk for local population are recommended.

T2-D.1 METHODOLOGICAL ISSUES OF RESPONDING TO COMPLEX AND UNCERTAIN LPHC RISK EVENTS BEYOND CONVENTIONAL SCOPE OF RISK ANALYSIS: LESSONS LEARNED FROM 2011 EARTHQUAKE-TSUNAMI-FUKUSHIMA DISASTER

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Since the beginning of 21 century, a multitude of structural changes have occurred in most of the Asian countries. Rapid urbanization, aging populations with low-birth-rate, mobilized employment, diversified life-styles, and enlarged income disparity, have created far more complex and uncertain technological/environmental risk transitions in addition to traditional risks and modern risks than ever before. In Japan, the 2011 East Japan Earthquake of magnitude 9.0 along with the triggered giant tsunami, devastated not only most of the northeastern coastal regions in the main island, but also brought a massive scale of radioactive fallout from the induced nuclear accident of Fukushima Nuclear Power Plant. This chain of catastrophic events have provoked a number of important questions associated with the methodological issues of "risk analysis" how to deal with the emergent uncertainties of extremely surprise LPHC type of disasters beyond the conventional scope of the risk analysis. This presentation will focus the necessary challenges of "interdisciplinary risk analysis" to respond to those questions in terms of risk scenarios, risk assessment and risk management/communication in the present days of risk transitions overlapped simultaneously in temporal and spatial dimensions from households, communities, regions and global systems that might be characterized by tremendous uncertainty and unpredictability.

F2-E.2 THE COSTS AND BENEFITS OF REDUCING VOCS IN JAPAN

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VOC emissions have been decreased in Japan to mainly mitigate the photochemical smog. In the present study, the health and agricultural benefits of reducing VOCs for several emission sectors were estimated considering adverse effects by VOCs themselves and secondary forming substances (such as ozone). The change of concentrations of each chemical substance in case of reducing VOCs was calculated using the chemical transport model ADMER-PRO which was developed by us. The monetary values of health and agricultural benefits were then estimated using the calculated concentration changes, the dose-response data, the geographical data such as population and land-use classification data, and the monetary valuation data such as the data of value of a statistical life and the selling price data for crops. The results suggest that the total benefits of reducing VOCs were much lower than the total costs of that in Japan while the benefits of reducing VOCs among the emission sectors were considerably variable.

F4-D.5 LESSONS LEARNED FROM CANADA'S PANDEMIC H1N1 EXPERIENCE - POLICY CONSIDERATIONS AND REALITY ON THE GROUND

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This final presentation examines further the policy implications related to managing communications issues across jurisdictions. While grounded in a Canadian context, this presentation will highlight aspects that related to good risk communication practices that transcend national jurisdictions to be relevant on a global scale. In our three case studies, novel communication channels exposed the public to a variety of messaging from across the country as well as internationally. Relative delays in providing access to vaccines, differing priority groups for treatment, and discordant messaging with respect to naming the infectious agent and actions related to social isolation recommendations and other harm reduction interventions (such as hand washing) undermined the consistency of messaging. We examine the strategies utilized to address coordination of communications including knowledge-translation activities (moving information back and forth from public health experts to communication experts and the pubic) intra and inter-governmental briefings, boiler-plate content and the range of attitudes towards local innovations or interpretations of national recommendations. We also examine perceived problems arising from systems that structured communications to push out technical information or advice from scientific experts to communication experts and then to the public and evaluate alternative approaches, such as including health communicators in the scientific and policy process more directly. While we suggest ways that communications coordination can be improved to achieve more consistent messaging, we also explore how issues of inherent technical and scientific uncertainty and pluralism in interpreting and applying scientific evidence in a local context need to be accounted for in planning pandemic communications.

F1-C.2 NICNAS PRINCIPLES FOR NEW TECHNOLOGIES AND REGULATORY STRATEGY FOR NANOMATERIALS

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In May 2008, the Commonwealth Government's Review of the Possible Impacts of Nanotechnology on Australia's Regulatory Framework found that while there is no immediate need for major changes

to existing regulatory regimes, six areas were recommended to be addressed by Government to ensure that our regulatory frameworks can better manage the risks posed by nanotechnology in the future. In response to these findings, the Federal Government's regulator of industrial chemicals, the National Industrial Chemicals Notification and Assessment Scheme (NICNAS), conducted a review of its regulatory framework in relation to nanomaterials and developed a set of principles to manage the risks posed by new technologies to health and safety of people and the environment. These principles were then used to underpin a NICNAS Regulatory Strategy for Nanomaterials. The strategy aims to strengthen existing approaches to public health, worker safety and environmental protection in relation to industrial nanomaterials, while facilitating the ability of the community to gain from the potentially beneficial aspects of this technology, and the ability of industry to innovate using the technology. This strategy is comprehensive and involves continuing work in regulatory and technical areas with additional support from compliance and outreach activities. This work has involved using current regulatory tools in a tiered approach for the notification and assessment of nanomaterials that are not already on the Australian Inventory of Chemical Substances (AICS) and the exploration of modified or new regulatory tools to facilitate the possible notification, and subsequent assessment, of nanoforms of chemicals that are already on the AICS. In this presentation significant achievements to date will be outlined and insight provided into NICNAS's current approach to managing uncertainty in relation to nanotechnology, to ensure adequate regulatory oversight.

W2-B.1 MEDIA AND SOCIAL AMPLIFICATION OF RISK: BSE AND H1N1 CASES IN SOUTH KOREA

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The researchers of this study aimed at exploring the topology of two risk communication cases, Bovine Spongiform Encephalopathy (BSE) in 2008 and H1N1 in 2009, in South Korea and investigating the progression of risk events related to media's role in risk amplification. First, the basic nature of media coverage of the events such as frequency of stories was surveyed. Second, framings adopted in media to cover two cases were analyzed. The result indicated that unfolding events related to BSE and H1N1 risk showed a similar timeline with the frequency of media coverage of the given risks. Also, media adopted political framings for BSE and health/medial framings for H1N1. The authors cautiously suggested that the framings in media influenced the politicization of BSE risk issue among the public, but, at the same time, the media framings on H1N1 attenuated potential politicization of H1N1's risk.

P1.18 COORDINATING EUROPEAN STAKEHOLDERS IN THE AREA OF EMERGING RISKS

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Coordinating European stakeholders in the area of emerging risks.

W4-C.2 RISKEARS - THE EARLY WARNING SYSTEM FOR EMERGING RISKS RELATED TO NEW TECHNOLOGIES: APPLICATIONS

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The paper describes the system for early warning system (for emerging risks related to new technologies and for emerging risks in general) developed and applied in iNTeg-Risk project. Basic elements of the system (the information entry channels, the monitoring process and the modules of the system) are presented and their applications, primarily in insurance industry shown.

W3-C.1 THE EARLY WARNING FOR EMERGING RISKS RELATED TO NEW TECHNOLOGIES: PRINCIPLES AND IMPLEMENTATION

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iNTeg-Risk project has developed a set of new principles for identification, quantification and monitoring of emerging risks, primarily based on identifying possible "critical distances/relationships" possible between hazards and possible vulnerabilities. For emerging risks related to new technologies, treated in iNTeg-Risk project, this is a complex task because the (a) distinction between the possible hazards and possible vulnerabilities are blurry, (b) the interconnectedness among are complex, (c) data are generally missing incomplete and (d) behavior models yet to be developed. The project has, therefore, largely built its solutions on advanced and alternative methods and techniques, embedding them into the respective tools/modules. Semantic networks, text mining, data mining, conceptual & relational mapping, multi-criteria decision making are used in an integrated way in order to analyze the "early warnings" coming from experts, interest groups, public, infospace, web in particular. Single most characteristic and innovative solutions are explained and the advantages they (can) yield and limitations to be respected, shown on several examples of emerging risks, such as space weather, terahertz technology, NaTech events.

F3-A.4 REDUCING RISKS OF NEW NANONAMATERIALS: A EUROPEAN INTERACTIVE DATABASE OF MSDS'S

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In EU projects MUST, iNTeg-Risk, NanoDevice, PARTICOAT, MATRANS, M-RECT, Fire-Resist, HELM and ExoMet a series of new high performance engineering nanomaterials have been or will be developed. Their use and circulation needs urgently the respective MSDS's (Material Safety Data Sheets), possibly covering all the aspects of REACH and GHS, too. Under a coordination of Steinbeis Advanced Risk Technologies, the interactive and flexible, but unified format for the MSDS's has been proposed and is already or will be applied in the above projects, by means of an interactive, web-based database, firstly operational at the level of the MUST project.

W3-E.3 CLIMATE CHANGE AS A BUSINESS RISK – INSIGHTS FROM THE ADAPTATION REPORTING POWER

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The Climate Change Act introduced the Adaptation Reporting Power (ARP), allowing Government to direct public sector organisations and statutory undertakers - organisations with functions of a public nature, such as water companies - to report on their climate change risks and adaptation responses. The first round of the ARP involved 91 organisations from across key infrastructure sectors, public bodies and regulators.

This paper describes a unique research project involving the Centre for Environmental Risks and Futures who supported the Department of Environment Food and Rural Affairs during the first round of the ARP. We present results from the analysis of ~7000 pages of Adaptation Report, detailing key findings from across ten reporting sectors. The analysis provides evidence that the ARP has not only provided the driver for many organisations to consider climate change risks and adaptation for the first time, but resulted in the development of adaptation responses and embedding of climate change risk management within existing corporate risk management processes. However, the analysis highlights the significant challenges associated with assessing and managing long-term and highly uncertain climate change risks, and provides valuable insights into current levels of risk literacy. We also outline examples of the adaptation responses being implemented by Reporting Authorities, from climate-proofing assets to flexible regulatory frameworks, and discuss the challenges that these pose for Reporting Authorities, regulators and Government. The paper also draws on our experiences of engaging with Government departments, Reporting Authorities and key industry associations. This provides evidence that the ARP

process has stimulated sector-level engagement on climate change risk research and adaptation planning, and triggered cross-sector engagement on key risk management challenges including emerging risks, adaptation barriers and interdependencies.

F4-D.1 PANDEMIC H1N1 IN CANADA: RISK COMMUNICATION CONTEXT AND CHALLENGES

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This presentation will present the overall context for pandemic H1N1 in Canada as well as situate some of the similar and unique aspects of the three individual research projects that comprise this larger program of research. Canada experienced a moderate level H1N1 illnesses, resulting in fewer than 8700 hospitalizations and 428 deaths attributed to H1N1 (compared to over 18,000 deaths reported globally). However, due to a series of factors, the Canadian response to pandemic H1N1 differed from that of other countries. The introduction of an adjuvanted pandemic vaccine (which is not part of the Canadian traditional seasonal flu vaccine program); a perception that this vaccine was 'rushed' to market and did not follow traditional steps to establish safety; conflicting responses to the management of priority groups to receive the vaccine when it became available; conflicting information regarding the safety of the vaccine for different groups (e.g. pregnant women); and a perception of vaccine scarcity following the roll out of the vaccination campaign resulted in the Canadian public responding to H1N1 very differently. Furthermore, there were continued tensions between the various levels of government responsible for communicating information on H1N1. Each of these elements contributed to a series of risk communication challenges. To evaluate these different risk communication challenges, a larger program of research has been undertaken in Canada to examine H1N1 risk communication from multiple perspectives. This involved three complementary studies involving different interdisciplinary researchers and different institutional foci. Each study will be briefly presented as an overview to this symposium.

W3-B.2 INCLUDING MORAL EMOTIONS IN POLITICAL DECISION MAKING ABOUT NUCLEAR ENERGY RISKS

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Nuclear energy was developed for its potential benefits, but it can also create great risks for humans and the environment, as the meltdown in the Fukushima power plant has shown. As a consequence of such side effects, technologies can trigger emotions, including fear and indignation, which give rise to heated and emotional debates (Slovic 2000, 2010) and lead to conflicts between experts and laypeople. Emotions are generally excluded from communication and political decision making about nuclear energy, since they are seen as irrational states (Sunstein 2005) that should at most be taken into account for instrumental reasons in order to create support for a position (Loewenstein et al. 2001). Such an approach is based on a deficient conception of emotions. Emotions can have cognitive aspects (Lazarus 1991, Solomon 1993, Nussbaum 2001) and they enable us to be practically rational (Damasio 1994, Roberts 2003). Moral emotions such as sympathy and indignation are necessary in order to judge ethical aspects of technological risks, such as justice, fairness and autonomy (Roeser 2006). Risk policy should include the moral emotions of stakeholders.

Although moral emotions are not explicitly taken into account in current approaches for risk politics, they might already play an implicit role. These approaches can be adjusted in order to give moral emotions an explicit role. Moral emotions can be legitimate sources of insight concerning the moral acceptability of risks. Main proposal is to take an emotional deliberation approach to technological risk stemming from the use of nuclear energy, by taking emotions as starting point of discussion regarding the acceptability of technological risks (Roeser 2011). By allowing for the emotional concerns of the public and stakeholders to be included and evaluated, this approach will contribute to morally better political decisions about further development of nuclear energy and a better understanding between laypeople and experts.

F3-B.4 ASSESSING THE RISK-MITIGATING BENEFIT OF URBAN WATER SUPPLY SYSTEM AUGMENTATION

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Extreme unanticipated shortfalls in municipal and industrial water supply (M & I) can be highly costly for urban water planners, service providers and users. Projected increases in future demand, supply variability, and the likelihood of extreme water shortfalls due to climate change make this a pressing reality for many cities that rely on rain-fed sources of water supply around the world. Water supply service providers must invest in additional rainfall independent sources (RIS) or cope with less water by implementing water restrictions and water demand management principles. Typically, the decision to invest in RIS would be necessary if water utilities were unable to meet minimum service-level reliability requirements due to less water. This decision will have to be made under uncertainty over the magnitude of future shortfalls. We present an analytical framework for measuring the risk-mitigation benefit value of investing in (RIS) for M & I uses. The risk-mitigation benefit of RIS alternatives is estimated as the difference between the probability-weighted (hereafter expected) cost of imposing water restrictions in the absence of RIS and the expected cost of running RIS to meet shortfalls in 5% of the driest years. We found that investments in RIS can yield risk-mitigating benefit value of up to A$56.6m per year.

W4-B.4 SOCIAL SCIENCE OF NATURAL DISASTER RISK

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Natural disasters do not occur in a vacuum. They occur through bio-geo-physical mechanisms that intersect directly with human society, often dramatically. Risk analysis combined with social science provides a highly effective framing for studying and improving the management of disaster risk and sustained economic and social well-being.

In each case, what we think of as a "natural disaster" has a strong social and human component. Preparation, response, and recovery efforts are strongly tied to decision making, governance, human behavior, cultural learning, and perception. By way of example, in areas where disaster risks are high and are well understood, communities and cultures generally do not expect, or are not psychologically willing to accept, severe disruption, especially if significant changes in lifestyles or out-migration is necessitated to lower expected losses and improve quality of life. This makes disaster planning and management highly challenging for political and other community leaders.

This presentation draws on the author's recent paper "Natural Disaster Management" (in William S. Bainbridge, ed., 2011, LEADERSHIP IN SCIENCE AND TECHNOLOGY, 2 volumes, Sage Reference Series). A short history is provided, indicating why experts are noting an increasing scale of losses experienced worldwide in the past few decades (Michel-Kerjam, Erwann O., 2008, "Toward a New Risk Architecture: The Questions of Catastrophic Risk Calculus, SOCIAL RESEARCH 75: 819-853). Topics such as social trust; cultural narrative; biases in perception and behavior by individuals and decision-makers; and social cascading of disaster effects are examined in the context of disasters experienced around the world. Lastly, a list of challenging and unresolved issues is presented to encourage a lively dialogue with the audience and other presenters.

T4-E.1 MENTAL MODELS OF FOOD RECALLS

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An estimated 47.8 million Americans get foodborne illnesses each year. The risks posed by foodborne contaminants would be reduced, if consumers routinely practiced the handling practices recommended by food safety educators. However, despite many educational efforts, they typically do not follow these practices. As a result, regulatory agencies' episodic instructions, regarding individual outbreaks, have a vital role in consumer protections. They alert consumers about situations where immediate action is needed, instruct them in what to do, and reassure them when their food is not suspect. To improve the effectiveness of foodborne outbreak communications, we applied a mental models approach seeking to identify the correct beliefs, knowledge gaps, and misconceptions that guide consumers' responses

to food recalls. It began by creating an expert model, summarizing the major factors known to affect risk levels. It proceeded to in-depth open-ended mental models interviews, structured about the expert model. The interviews were conducted with thirty consumers, recruited from Pittsburgh area. It was a diverse group, varying along dimensions that might affect food safety beliefs. We found that food recalls increase the trust of the respondents in the U.S. food safety system because the necessary steps are taken to make sure that people are safe. Although most recalls never officially end, the interviewees incorrectly believed that they will be informed, when a recall is over. Exaggerating their ability to control risks, they believed that consuming recalled products would depend on issues like whether they could eliminate the risk by themselves (e.g., washing and cooking). Their self-diagnoses of foodborne illnesses demonstrated shorter incubation and recovery periods suggesting significant misperceptions. The results provide the foundation for structured surveys, suited to evaluating the population prevalence of the most important beliefs and for designing communications to improve these mental models and evaluating their effectiveness.

T3-D.6 RISK GOVERNANCE DILEMMA ON THE COUNTERMEASURE OF RADIOACTIVE CONTAMINATED SOIL IN JAPAN

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On March 11, 2011, a massive earthquake of magnitude 9.0 occurred off the Pacific coast of northeast Japan. Tsunami generated by this earthquake caused great damage to widespread coastal areas in the Tohoku region including Fukushima prefecture where the Fukushima 1 Nuclear Power Plant was located. As a result of an accident at the Fukushima 1, large amounts of radioactive materials including 131I, 134Cs, and 137Cs were released into the atmosphere and were deposited by rain on the land surface and soil in part of the Kanto and the Tohoku district. Approximately 26,000 ha of agricultural land have been estimated as having concentrations of radioactive materials in soils exceeding 5,000 Bq/kg-15cm. Also, the Ministry of Environment has estimated the volume of contaminated soil in areas where the air dose rate of radioactive rays exceeds 5 mSv per year to be over 20,000,000 m3. Decontamination and other countermeasures to deal with soil contaminated with radioactivity are a national urgent need because of concerns about human health, effect on crops and local regeneration. However, as of January 2012, neither decontamination nor return of displaced people is progressing at the evacuation zone and its surrounding area. This delay was caused by several reasons such as not only the difficulty of the constructing framework of whole decontamination road map against this widespread contamination but also development of the decontamination and volume reduction technologies of contaminated soil. Also, there is a dilemma that agreed countermeasures not always make the situation better. It seemed impossible to satisfy various stakeholders, such as local people, municipal, prefectural and governmental authorities even if the agreed countermeasures were executed. One of this reason is that their required safety level varies among stakeholders. This research focuses on such kind of risk governance dilemma on the countermeasure of radioactive contaminated soil.

W1-C.4 THE US TOXCAST PROGRAM

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Evaluating the safety of chemicals is challenged by the expense of the traditional approach of using animal based experimental models and the resulting low throughput acquisition of knowledge. As a result, we simply do not know the potential hazards of many chemicals in commerce. EPAs National Center for Computational Toxicology was established in 2005 to help address this issue. Since that time it has developed a comprehensive high throughput screening program (ToxCast) that has profiled 1000 chemicals of environmental interest across more than 600 biological endpoints. The ToxCast approach employs protein and cell based in vitro assays as well as some model organisms such as zebrafish. We have built a number of databases and statistical approaches to understand the resulting screening information as we build models for prioritizing chemicals for targeted study based on predictions of altering various biological pathways and disease outcomes. All the databases, screening results, and models are made available in a transparent manner so that others can analyze independently. The ToxCast effort is helping to transform the conduct of toxicology. A brief description of the ToxCast program will be given.

F4-A.5 UNTANGLING THE CONCEPTS OF RISK AND SAFETY IN THE REGULATION OF NEW TECHNOLOGIES

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Risk/safety assessments form the cornerstone of regulatory decision making. This importance is now embedded in a raft of international standards and conventions such as the International Plant Protection Convention, World Organisation for Animal Health, Codex, and the Cartagena protocol on Biosafety. A simplistic perspective assumes that safety is the reciprocal of risk, implying equivalence between risk and safety assessments. This masks intractable dichotomies in the common usage of risk and safety, providing an important source of mis-communication between regulatory authorities and stakeholders, mis-directing research and impacting on development opportunities. Regulation of GMOs is used as an exemplar to explore the conceptual entanglements of risk and safety that permeate regulatory decision making. Safety is deterministic whereas Risk is probabilistic. Safety is concerned with the avoidance of harm or danger, whereas Risk looks at the balance of harmful and beneficial outcomes and looks for potential opportunities. Safety is not directly observable and is applied where undesired outcomes may not be known. Typically the burden of proof in safety considerations is on proving innocence. In contrast, Risk is perceived as objective and measurable with the focus on proving harm, ie “innocent until proven guilty”. Proponents of a safety paradigm embrace precautionary approaches and are more prone to refer to some ‘Golden Past’, whereas those who favour the trial and error approach of a risk paradigm are more likely to espouse promises of a ‘Golden Future’. Typically, regulatory legislation attempts some form of chimera between risk and safety assessments, obscuring potentially significant impacts on regulatory oversight for sustainable development.

T4-B.3 SYNTHETIC BIOLOGY: REGULATORY ATTEMPTS TO BALANCE RISK AND INNOVATION

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The field of synthetic biology has grown substantially in recent years. Many herald it as an emerging tool with enormous potential for various fields, including health, energy, environmental management and more. Its growth also raises concerns of increased risks because its widespread availability makes improved biotechnology tools more accessible.

The field’s great potential and great risks have lead to its classification as a “dual-use” technology. Its advance carries both a great risk to the environment and public health from accidental release or nefarious use and a great potential to provide innovative solutions to challenging problems. Dual-use fields present a challenge to regulators because while regulation can minimize risks, it also limits the exchange of advances in a field, and therefore, can slow the rate of innovation.

Countries faced with recent growth in the synthetic biology field have interpreted the risks associated with the field differently. In turn, these countries have approached regulation differently. This talk will provide an overview of how the US, the EU and Australia have interpreted the risks of the field. It will also present the current regulation strategies that have emerged in response to each country’s perception of the associated risks. Many countries have not addressed synthetic biology individually with new regulatory frameworks, but have found existing regulation to adequately address risks. This talk will examine what activities, actors and products the various regulation strategies are currently covering and how gaps in coverage vary between countries.

P1.23 IMPACT OF TYPHOON AND HEAVY RAIN DISASTER ON MORTALITY AND DIARRHEA HOSPITALIZATION IN SOUTH KOREA

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Natural disasters have been shown to increase mortality and morbidity across the world. Several studies have analyzed causes of death according to specific types of disasters and surveyed of review for health impacts of natural disasters. But, these studies were not the comprehensive (i.e., according to

disaster type and areas) and quantitative analysis. The aim of this study is to quantitatively examine the associations between disaster (i.e., typhoon and heavy rain) and human health during the special disaster period in South Korea. This study considered 7 metropolitan cities and 9 provinces in South Korea from 2003 to 2009, focused disaster period defined the special disaster. First, we counted health impact counts in the disaster period and the reference period. And then, we calculated the rate ratios (RRs) between health impact counts in two periods in all ages and in those aged 65 years or more. We found increases with death and diarrhea hospitalization, being consistent with previous studies. And, health effects are estimated with higher on mortality in typhoon and on morbidity in heavy rain, respectively. The difference in health impacts of typhoon and heavy rain could be explained from the difference of meteorological exposure pattern in typhoon characterized by strong winds and strong rainfall and heavy rain characterized by only strong rainfall. However, further research including areas, periods and population in larger samples, may clarify whether our findings confirm the difference of health impact according to disaster type. In conclusion, it's time for us to need a proper adaptation plan as a countermeasure against the influence of the further natural disaster on human health, with considering future climate change.

F3-D.4 RISKGATE - AN INNOVATIVE ONLINE PORTAL TO ASSIST RISK MANAGEMENT IN THE AUSTRALIAN COAL INDUSTRY

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RISKGATE, an initiative of the Australian Coal Association Research Program (ACARP), is an interactive online risk management system developed for the Australian coal mining industry to assist in the management of priority unwanted events. Utilising an expert knowledge-base assembled in action research workshops with industry specialists and supported by academic and technological resources, RISKGATE generates substantive and leading edge controls to assist industry stakeholders alike in the design, management and reporting of organisational and regulatory compliance requirements. In 2011, information systems were developed for TYRES, FIRES, ISOLATION, STRATA CONTROL – UNDERGROUND, GROUND CONTROL OPEN CUT, and COLLISIONS. In 2012, the team are working on EXPLOSIONS, EXPLOSIVES, MANUAL TASKS, and TRIPS/SLIPS/FALLS. From a broader industry perspective, RISKGATE provides an environment for knowledge capture and knowledge exchange to drive innovation and best practice in risk identification, assessment and management in the coal industry. This digital platform offers utility for assembly and delivery of risk management know-how across many sectors, including construction, transportation, utilities or heavy industry.

F2-D.6 APPLICATION OF RISK – COST – BENEFIT (RCB) DECISION SUPPORT TOOLS FOR MINING SUBSIDENCE RISK M.

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Technology and research are delivering potential solutions to both financial and personnel risk in the mining industry and surface and underground mining operations often consider implementing major risk-control systems such as collision avoidance technologies, slope stability radars (SSRs) and gas monitoring systems. These solutions are often expensive and both the risk improvement levels and financial benefit are poorly quantified. How then does a mining company make reliable decisions to implement major risk reduction technologies? This is a complex problem facing all operating mines and it is a significant challenge to find an operating solution that identifies the correct balance between risk, cost and benefits.An Australian Coal Association Research Program (ACARP) funded and recently completed project has addressed these gaps and developed novel Risk-Cost-Benefit (RCB) Decision Support Tools, RCBGEN (Risk-Cost-Benefit Generator) and RCEMETHOD (Risk-Control-Effectiveness Method), to determine semi-quantitative to quantitative assessment of the complex risks, costs and benefits associated with safety interventions. The practical tools assist with identifying appropriate controls/technologies, assessing whether an appropriate control/technology reduces that risk, considering and determining an optimal group of controls/technologies and calculating the net financial benefit associated with the controls/technologies selected. The project methodologies were applied on four underground and open-cut mining high-risk areas which have significant and unique risks: 1.Heavy Mining Equipment Collisions 2.Highwall/Lowwall Slope Failure 3.Gas Outburst and 4.Mining Induced Ground Subsidence. This proposed paper will introduce the 'Risk-Cost-Benefit (RCB) Decision Support Tools', RCBGEN, (Risk-Cost-Benefit Generator) and RCEMETHOD (Risk-Control-Effectiveness Method) but mainly focus on their practical application on case study four, Mining Induced Surface Subsidence.

T3-C.2 WORLD RISK SOCIETY REVISITED: DISCURSIVE GOVERNANCE ON NEW GLOBAL RISKS

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Societies have to cope with new global risks (global warming, terrorism, pandemics, financial crises). Effects of these risks go beyond national borders, but governance structures are lacking institutional capacity to deal with them. Therefore new governance arrangements are required. The risks are characterized by 'non-knowing' (U. Beck), but have common features of complexity, uncertainty and ambiguity. What kind of institutional shape in governance institutions would create the problem-solving capacity to handle the 'non-knowing'? To answer this question, I refer to discursive institutionalism and propose three global risk governance approaches channelizing discourse via deliberative and participatory mechanisms and procedures: 1) In epistemic institutions (advisory bodies, research institutes, think tanks) scientific experts address complexity by scrutinizing cause-effect relationships and how its effects and scope can be reduced or handled. They exchange science-based facts, learn about cognitive and evaluative understandings and deliberate about policy-relevant knowledge. 2) Via associational policymaking governmental, economic and civil societal stakeholders reconsider the question how much uncertainty is acceptable and how much regulation is reasonable. 3) Transnational public participation entitles individuals to figure out which values, norms and rules can be justified and collectively accepted when facing ambiguity. The paper concludes in providing a systematic scheme on the variations of discourse, deliberation and participation for global risk governance when complexity, uncertainty and ambiguity needs to be addressed. Albeit such institutional capacity is difficult to realize due to the normative theories of rational discourse and deliberative democracy, yet the approximation enhances the legitimacy and effectiveness of institutional problem-solving in world risk society and leads to an international civilization process.

F2-C.2 ECONOMICS IN DECISION MAKING

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The presentation will focus on the use of economics in biosecurity decision-making, with an emphasis on the economics of surveillance or the 'early detection' of an invasive species. Examples will be drawn from optimal surveillance measures for foot and mouth disease, tuberculosis and hawkweed.

W2-E.4 PHARMACEUTICALS AND PERSONAL CARE PRODUCTS IN THE ENVIRONMENT: CHEMICALS OF EMERGING CONCERNS

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Myriad of organic chemicals are part of our daily lives. It is estimated that about 300 million tons of synthetic compounds are used in industry and consumer products annually, and some 70,000 compounds are in daily use in Europe (Schwarzenbach et al.2006, Science 313: 1072-77). A major group of micro-pollutants, including endocrine disrupting chemicals (EDCs), pharmaceuticals, and personal care products (PPCPs), is of emerging concern around the world. Concerns about the ecological risks of pharmaceuticals have been heightened in recent years due to unprecedented population decline of vultures across Pakistan, India and Nepal, due to the exposure to diclofenac, a non-steroidal anti-inflammatory drug widely administered to livestock across the Indian subcontinent (Oaks et al., 2004, Nature 427: 630-633). Unlike pesticides, PPCPs are often not assessed for their ecological footprints during the registration process and therefore their ecological risks are not well appreciated. Besides these compounds are almost continuously released in the environment though domestic /industrial sewage systems and are not fully removed during wastewater treatment. Therefore, in the environments receiving even treated effluents, aquatic organisms may be exposed to low concentrations of a mixture of compounds, almost continuously (Daughton and Ternes, Environmental Health Perspectives Vol 107, Supplement 6, 907-938). Among personal care products, triclosan and triclocarban are some of the

widely used antimicrobial agents in hospitals, industry as well as around homes in household products such as soaps, shampoos, toothpastes, socks and garments. Due to their toxic and bioaccumulative nature these compounds have come under considerable scrutiny recently and their potential ecological risks are being assessed in several countries. This presentation will highlight the potential ecological risks associated with PPCPs in the environment, especially in the changing world grappling with water security issues.

W3-A.4 UNDERSTANDING VULNERABLE COMPLEX SYSTEMS

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Societies have witnessed tighter integration and growing complexity of systems they increasingly depend on; the gap between our capability to engineer those "critical infrastructures" and our knowledge about their failure behavior has widened. Events like major blackouts have shown a high potential for "surprises" and cascades, the importance of non-technical contextual factors and the dominating role of interdependencies. As we cannot solely rely on experience modeling efforts are needed to better understand the complex behavior of such systems and make them more resilient. Traditional methods like logic trees encounter their limitations and more advanced dynamic, scenario generating methods are needed combined with methods for structural analysis. As part of the Swiss program on Civil Infrastructure Protection, the concept of vulnerability has been further developed, an analytical framework proposed while the set of hazards/threats was broadened to intentional failures. Complex network theory has been applied to identify most sensitive components and topological weaknesses and as well as means for improvements. The agent-based modeling approach has turned out to be most promising as a scenario generator and, in combination with a physical model, to describe the complex behavior of most critical infrastructures like the electric power system (EPS) or industrial control systems. The results of the EPS modeling and simulation have been calibrated against data; results confirm the importance of initial load flows and the time statistical window for corrective actions. To cope with inter-dependencies agent-based models for different systems, i.e. EPS and SCADA as pilots, have been coupled by using High-Level Architecture standards and successfully tested. The results qualify those methods to identify structural weaknesses and "hidden vulnerabilities" and to harden those systems against attacks and wide-area natural events; they can play an important role when building reliable and secure smart or super grids.

F1-A.2 BRIDGING GAPS BETWEEN SCIENTIFIC KNOWLEDGE AND SOCIETAL PERCEPTION OF UNEXPECTED DISASTERS

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Recent developments of scientific prediction of natural phenomena and engineering countermeasures have significantly reduced risks of ordinary natural disasters. However, extreme events, such as the 2011 Tohoku earthquake and tsunami, cause severe disasters, thereby resulting in unexpected and human-induced disasters like Fukushima Daiichi nuclear accident. Highly complex social systems, as well as interdependency under the economic globalization, have decreased social redundancy and increased risks on basic lifelines and production systems, not only on early rescuing stages, but also in long-term recovering processes. For example, on the 2011 Tohoku earthquake and tsunami disasters, some evacuation facilities, which were set right outside projected hazardous zones, were attacked by big tsunami waves, resulting in serious damages of people followed "evacuation plans", where communication between scientific communities and governmental planners had been lacking. It was also revealed that constructive countermeasures for a projected impact based on experiences in the past could not cope with unexpected phenomena. Only transdiciplinary investigations and well-organized planning, so-called contingency planning could help define countermeasures to the unexpected disasters. A disaster mitigation framework will be discussed so as to focus on how to bridge gaps between scientific knowledge and societal perception.

T2-AB.1 SYNTHETIC BIOLOGY AND DIYBIO SAFETY AND SECURITY

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Synthetic biology has become one of the most exciting fields in science and garnered increased attention from governments, venture capitalists, university laboratories, major corporations, and startup companies. Such research is taking place in a range of settings, from sophisticated public and private research institutions to a rapidly growing movement of Do-It-Yourself Biologists operating in their garages and community laboratories. The introduction of new metabolic pathways into organisms and re-engineering of existing genomes raises a host of potential environmental, ethical and security issues across various government agencies impacting research, industry and the public at large. This talk will discuss a series of Congresses which were held in May and June of 2011 bringing together delegates from existing DIYbio regional groups in the U.S. and Europe to collaborate on the development of a draft DIYbio "code of conduct" that may serve as a framework for helping achieve a vibrant, productive and safe global community of DIYbio practitioners, regional groups, and community labs. In addition the results of recent focus groups and polling data on the publics understanding and acceptance of synthetic biology will be examined.

W1-B.3 TRUST AS A DETERMINANT OF INFORMATION SEEKING: THE CASE OF FOOD RELATED RISKS

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Recent years have witnessed a number of incidents involving micro-biological contamination of food products. Examples are the contamination of fenugreek seeds with the EHEC- in Europe which affected Germany in particular, and that of cantaloupes contaminated with Listeria in the US. Both contaminations led to the death of tens of people. Such incidents typically lead to anxiety among consumers, a need for additional information and potentially information seeking behaviour. How these processes function more precisely, is still to be investigated. Models describing the factors that determine risk information seeking behaviour are being put forward. One of the determinants included in these models is trust, in particular trust in the integrity of food industry and trust in the competence of authorities to adequately govern such risks and protect the consumer from harm. This presentation will focus on the applicability of one of these models, the Risk Information Seeking and Processing model, to explain information seeking behaviour related to food risks, specifically those of fresh vegetables. A cross-sectional survey has been carried out among residents of the Netherlands (n= 750). Subjects were questioned regarding their information seeking behaviour and number of potential determinants such as risk perception and trust. Their trust in information channels such as television, newspapers, internet sources and social media was also measured. The presentation of the results will focus on the role of trust in food risk communication. Structural equation modelling will be applied to test a model, describing the significance of trust in predicting risk perception and information seeking behaviour, using AMOS. Sources and channels of information that are most trusted will be identified. Consequences for risk communication will be discussed.

T4-E.3 FOOD HEALTH RISK PERCEPTIONS AMONG CONSUMERS, FARMERS, AND TRADERS OF LEAFY VEGETABLES IN NAIROBI

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With urban population growth, rising level of urban poverty and issues affecting food supply and distribution as well as in accessing food, the development of local supply of perishable produce of safe and good nutritional value could be part of viable national food security strategies. However, this has largely gone unrecognized in agricultural policies and urban planning. The objective of this study was therefore to identify the nature, magnitude and differences of subjective food-related health-risk perceptions held by consumers, farmers and traders related of Kale. Kale plays an important nutritional role in developing countries (WHO, 2004). Risk sources to be included in the study were decided upon by public health specialists. In developing a multi-dimensional model that integrates risk perceptions over several

(7) risk sources, this study extends existing studies in two ways. Firstly, the traditional model of probability and consequences is extended by introducing a third risk component related to the immediacy of health consequences. We motive this addition to the standard model as different health risk sources differ substantially with respect to the time horizon between exposure and time of symptoms. Secondly, this paper introduces a discovered-preference hypothesis to the assessment of perceived risks. Here, people gain successive experience with the particular risk preference. This provided an overall relative demarcation of the negative quality of each specific health hazard. As result, the value of perceived health risk was therefore obtained as an importance-weighted subjective assessment of the inherent health risk in the consumption of kale. Little is known about how individuals in the developing world differ from those in developed countries in the way they perceive food-related health risks. In general, differences were found between respondent categories in terms of both specific source risks and overall risks. Differences were also found with respect to the sociodemographic and structural determinants to the levels of perceived risks.

T4-C.4 APPLICATION OF THE SEVEN PRINCIPLES FOR ECOLOGICAL RISK ASSESSMENT UNDER CLIMATE CHANGE TO THE HG CONTAMINATION AND OTHER FACTORS OF THE SOUTH RIVER WATERSHED, VIRGINIA USA.

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Historic industrial activities in Waynesboro, Virginia from 1929 to 1950 resulted in mercury contamination of the South River. Despite the time that has elapsed from the mercury release, mercury concentrations in the river, fish and wildlife remain. Initially the role of this landscape-scaleecological risk assessment was to assess the potential impacts of mercury and other stressors to fish and wildlife. Conventional regional scale risk assessment using the relative risk model and the Bayesian derivative of this approach have been conducted using current conditions as input. However, the timeframe of the restoration and management program for the watershed will be on a timeframe where climate change can be a contributing factor. Recently Landis et al (in press) have proposed seven principles for conducting ecological risk assessments under climate change. These principles are: 1) consider the importance of global climate change in the risk assessment process and in the management decisions, 2) assessment endpoints should be expressed as ecosystem services, 3) responses of ecosystem services can be positive or negative, 4) the process requires that a multiple stressor approach with multiple responses be taken, 5) develop cause-effect models that consider the relevant management decisions as well as the appropriate temporal and spatial scales, 6) determine the major drivers of uncertainty and continue the process as the managementactivity is implemented, 7) plan for adaptive management and environmental conditions and ecosystem services change. The application of each of these principles to the South River will be presented.

T4-A.1 ADDRESSING THE VACCINE CONFIDENCE GAP

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Vaccines—often lauded as one of the greatest public health interventions—are losing public confidence and rumours continue to emerge and circulate about harm from vaccines and the motives behind vaccine programs. Some vaccine experts have referred to this decline in confidence as a crisis. We discuss some of the characteristics of the changing global environment that are contributing to increased public questioning of vaccines, and outline some of the specific determinants of public trust. Public decision making related to vaccine acceptance is not driven by scientific and economic evidence alone, but is also driven by a mix of psychological, sociocultural, and political factors, all of which need to be understood and taken into account by policy and other decision makers. Public trust in vaccines is highly variable and building trust depends on understanding perceptions of vaccines and vaccine risks, historical experiences, religious or political affiliations, and socioeconomic status. Although provision of accurate, scientifically based evidence on the risk—benefit ratios of vaccines is crucial, it is not enough to redress the gap between current levels of public confidence in vaccines and levels of trust needed to ensure adequate and sustained vaccine coverage. We call for more research not just on individual determinants of public trust, but on what mix of factors are most likely to sustain public trust. The vaccine community demands rigorous evidence on vaccine efficacy and safety and technical and operational feasibility when introducing a new vaccine, but has been negligent in demanding equally rigorous research to understand the psychological, social, and political factors that affect public trust in vaccines.

W3-A.1 DEVELOPMENT, DISASTER & CAUSATION

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Disaster Risk Management (DRM) has moved, over the past several decades, from a focus on disaster management (DM), to a focus on reducing the risks that lead to disasters (DRR), and now increasingly toward a focus on managing the development processes that lead to the creation & accumulation of risk in the first place. The implicit assumption in this paradigm shift is that skewed development processes, and not natural events in themselves, are the principal cause of the increasing incidence and magnitude of disasters. Thus, development processes intended to increase human welfare in many cases lead to the accumulation of risk that inevitably becomes manifest when triggered by an infrequent intense event. We build upon recent global disaster risk quantification advances that highlight this relationship We take this postulated causal relationship between development and disaster as our hypothesis and test its validity against the available empirical data in order to better quantify the risk-related effects of differing development modes. In order to test this relationship, we took advantage of several models that leverage statistical, econometric and systems modeling methodologies and the wider availability of global data sets. We have modeled, on the one hand, disaster loss, exposure and hazard data, and on the other hand, development, governance, health, education & social data. We then tested the “fit” of each of the conceptual models and explored the implications. In order to model and test the empirical relationships between development and disaster, we first aggregated time-series data from many of the leading global, regional and national databases and indicator sets. The data was then processed by several modeling environments, namely Structural Equation Modeling (SEM), all of which can aid in establishing causal relationships between unobserved latent factors. This way, common DRM constructs such as vulnerability, exposure and risk that can’t be directly measured can still be modeled and estimated.

T4-A.5 LEARNING TO LISTEN TO AND ENGAGE WITH PUBLIC CONCERNS ABOUT VACCINES

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Public debates about the safety of vaccines operate on a different terrain than that of the scientific and medical sphere. While technical estimates of risk may establish to the satisfaction of public health officials that a vaccine is largely safe and its benefits outweigh its risks, the public discourse surrounding vaccine safety taps into broader discourses surrounding biomedical technology, trust or distrust in experts and desires for ‘intensive parenting’. As new outbreaks of measles and pertussis affect many countries, many have become concerned about the impact of movements opposing vaccines. Citizens and professionals, often via social media, have begun to ‘fight back’, with their own advocacy and activism. I argue that a war on movements against vaccination is counter productive; it is based on false attributions about what causes outbreaks and it is not grounded in evidence from the social sciences. I argue instead that a new, more comprehensive way forward is required: knowledge from health sciences about vaccine safety must be linked to a better understanding of the cognitive, social, cultural, and political influences on individual vaccine decision making; effective risk communication is key in this context and that requires better listening, better understanding of the contextual factors that matter to people, and true public engagement.

F4-D.2 WHAT IS “VULNERABILITY” IN A PANDEMIC? A CASE STUDY OF THE CANADIAN PH1N1 RESPONSE

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In a pandemic health risk event, vulnerable populations are usually prioritized for information and health services. However, the concept of “vulnerability” is often not well articulated or conceived. This was particularly notable during the H1N1 pandemic response in Canada. Is vulnerability strictly related

to “susceptibility” (people who are more likely to become infected because of differential exposure to a hazardous agent), or should it also be based on “sensitivity” (people who are more likely to become seriously ill or die if they become infected)? Is vulnerability related to belonging to a population group (such as a specific ethnic or age group), or is it related to individual circumstances (such as living conditions or underlying health issues)? Furthermore, is vulnerability only directly related to potential health risk? For example, are some populations “information vulnerable” because they do not receive the information they need to make informed decisions on protective behaviours or are unable to understand this information? Does confusing and ambiguous information targeted to vulnerable populations create additional “emotional” and/or “decisional” vulnerability? Finally, is an inappropriate designation of vulnerability stigmatizing, thus creating a “social vulnerability”? These questions will be explored in relation to a study involving 17 focus groups of pregnant women and seniors conducted in Alberta, Canada in 2010/11 to determine their experiences and perspectives on risk communication during the H1N1 outbreak and vaccination program. The results indicate that public health agencies need to seriously reconsider the concept of vulnerability in pandemic risk communications, and to apply this consistently and responsibly, in order to avoid creating additional and unintentional “vulnerabilities” in the populations they are striving to protect.

P1.22 EXPOSURE TO HEAVY METALS IN BLOOD OF THE POPULATION LIVING IN THE VICINITY OF MWIS IN KOREA

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The purpose of this study was to monitor and present the heavy metal concentrations in the blood of residents of areas near municipal waste incinerators (MWIs), who are more prone to environmental pollution. We also sought to compare and analyze the residents' perception of environmental pollution as one of the factors affecting heavy metal concentrations in the blood using a survey about the perceived damage caused by the facilities. Since heavy metal levels in the blood can be affected not only by local environmental pollution but also by personal and occupational factors, heavy metal levels in the blood need to be verified and consistently monitored. Residents who live within 300 m of MWIs in Seoul are acknowledged to be under indirect influence according to the Waste Disposal Act. A survey was given to 841 residents living within 300 m of a MWI from 2006 to 2009. The concentrations of heavy metals (lead, cadmium, and mercury) in the blood were measured in the 841 surveyed residents and in 105 residents in reference areas. Additionally, the perception of the damage caused by municipal waste incinerators was investigated using scores from 1 to 5 on a Likert scale. The measurements of the heavy metal concentrations in the blood showed that the mean concentrations of lead, cadmium, and mercury were 43.1, 1.7, and 1.3 ug/L, respectively. The blood levels of lead and cadmium were slightly higher in the group of the subjects who had resided the longest near the municipal waste incinerators. When compared with the domestic investigation by the Ministry of Environment, the concentrations of lead and cadmium were a little higher, while that of mercury was a little lower. Overall, there was no significant difference in the distribution of heavy metal levels in the blood among age groups. Additionally, the investigation of the perceived damage from municipal waste incinerators showed that the subjects.

F2-E.3 VALUING THE HEALTH DAMAGE COST OF ACUTE CARDIOPULMONARY MORTALITY OF URBAN PM2.5

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This study evaluated the prospective damage costs of cardiopulmonary risk from PM2.5 inhalation. We performed a health risk assessment based on an exposure-response function to estimate the annual population risk in the Seoul metropolitan city, Korea. Also, we estimated a willingness-to-pay (WTP) amount for reducing the mortality rate in order to evaluate a statistical life value. To evaluate the relationship between PM exposure and daily mortality, we performed a time-series analysis. The association of PM2.5 with daily mortality was examined in Seoul, during the period of 2004~2005. Generalized additive Poisson models controlling for confounders were used to evaluate the acute effects of particle exposures on total, respiratory, and cardiovascular mortality. And PM2.5 caused more than 1,488 of all-cause mortality per year and 146 / 486 of respiratory mortality and cardiovascular mortality, respectively. The monthly average WTP for 5/1,000 mortality reduction over ten years was $25.3(US$2007) per month and the implied value-of-statistical-life (VSL) was 0.61 million dollar per year. We combined the annual attributable number of death and the value of statistical life to calculate the damage cost. The total damage cost of PM2.5 in ambient air was 907.7 million dollar.

W2-D.5 COMPONENT VS MIXTURE: APPROACHES TO CHEMICAL RISK ASSESSMENT AND THEIR APPLICABILITY TO COSMETIC PRODUCTS

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Traditional component-based methods for chemical health risk assessment, although practical and relatively easy to implement, have inherent limitations when employed to assess the safety of consumer products. Recent whole mixture assessment approaches address some of these limitations, although many simplifying assumptions such as dose addition, response addition or an integration of the two are still involved. Cosmetics are a class of consumer products characterised by individuals' unique exposure patters to chemical mixtures. Being widely and frequently used by particular groups of consumers, ensuring the safety of cosmetic products is very important. This paper reviews current approaches to the risk assessment of chemical mixtures and discusses their applicability to cosmetic products. Critical data needs are identified, and areas of significant uncertainty in health risk assessment evaluations of cosmetics, given the simplifying assumptions employed in current mixture assessment approaches, highlighted.

T3-A.2 MAPPING SPATIAL & TEMPORAL HUMAN HEALTH RISK OF DIOXIN IN KAOHSIUNG CITY AREA, TAIWAN

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Human health risk is mainly related to the pollutants of source emissions. In order to estimate the effects of these exposures, it's required to use a human health risk assessment procedure to estimate health impact associated with various emission sources. Moreover, the risk is not only related to the sources but depended on the geographical attributes and the weather condition. In this study, the main goals are going to assess the health risk of receptors in the studied area, identify the spatial distribution of risk, and distinguish the variation in different seasons. Kaohsiung City, the second largest metropolis of Taiwan, is a significant industrial region. There are several stationary emission sources, including power stations, solid waste incinerators, sinter plants, electric arc furnaces, etc. The residential or agricultural regions are near these high-density industries. Despite all the sources are satisfied the emission standard, the health risk is possibly going to be considerable for receptors. The target compound was the dioxin which is usually produced from combustion. The properties of dioxin emissions were determined by directly collecting and analyzing samples from the local stack flue gases. For the purpose of assessing the total health risk due to all types of emission sources, we use AERMOD, an atmosphere dispersion model, to estimate the concentration of dioxins in the environment. Then geographic information system (GIS) is used to calculate the cumulative concentration and to present the spatial distribution. This will help us to identify the high risk area. On the other hand, we are going to evaluate the effect from the seasonal changes. In Taiwan, weather conditions are various in each season, causing chemicals disperse to one place in some season. This will help us to identify the high exposure period. To integrate the spatial and temporal distribution of risks is a way to identify the high risk region and high exposure period, which provide another perspective to modify the emission policy and to reduce the health risk.

P1.17 POPULATION-GROUP EXPOSURE ASSESSMENT OF TRAFFIC-RELATED AIR POLLUTANTS USING INTAKE FRACTION

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Motor vehicle emissions are a major source of urban air pollutants,including particulate matter, nitric oxide (Chan and Yao, 2008).Exposure to these traffic-related air pollutants can contribute to adversehealth effects. Intake fraction, which describes the source-to-receptor relationship for an air pollu-

tion source, is defined as the fraction of total emissions that is nhaled by a receptor population (Bennett et al., 2002).The intake fraction (iF) of constituents of exhaust from mobile vehicles in the urban area of Seoul is nvestigated using available monitoring data for nitric oxides (NOx) and PM10 from Air Korea. Focusing on potentially-high-exposed area in Seoul as a case study, we combine ambient monitoring data to estimate the population intake of nitric oxide and PM10 emitted from diesel vehicles in 2008 and 2011. In addition to exposures to ambient concentrations, four micro-environments are considered in which the exposure concentration of diesel vehicle emissions is higher than in ambient air: near bus and truck terminal, heavy traffic volumes. Incorporating NOx and PM10 data on diesel vehicle emissions estimated from National Air Pollutants Emission of NIER, we estimate that the each Seoul citizen inhale 0.064–0.075 of NOx, 1.353 – 1.990 of PM10 by motor vehicles(0.73 – 1.17 of NOx and 2.986 – 7.389 of PM10 by diesel vehicles). The Health Impact values of constituents of exhaust from diesel vehicles in four micro-environment estimate that over 6 - 8 people died by NOx and 4 – 5 people died by PM10. In sensitivity analysis,there is no relationship between iF value and risk assessment results. In spite of these results, intake fraction values for urban vehicle emissions are usually higher in winter than in summer. The results presented in this work can be used in health risk assessments, cost–benefit analyses, and other investigations that require a summary of the emission-to-intake relationship.

T3-E.4 CHICKEN, DUCK, PIG, GOAT, AND MAN: WHOSE HEALTH? WHOSE RISK?

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In this case study, I explored the local knowledge, regulatory science and risk governance of dioxin-polluted food in Taiwan. The first case was the 2005 “poisonous duck egg” in Zhang-Hua County, and the second case the 2006 goat pollution in Taipei County. The “poisonous duck egg” started with one duck egg from a local grocery store with elevated dioxin level. The scientists, under the governmental commission, traced it to the duck farms in a rural town. It ended with destroying thousands of eggs and ducks, and banning duck framing in the whole town. The actions created wide media coverage, a public scare, and the market price of duck eggs dropped dramatically within one day. To compensate the duck farmers for their losses, the government applied the regulations either for the chicken or for the pig farming. The references of the dioxin level of the duck eggs, however, were from the European Commission for chicken eggs. The second case started with a pot of goat stew with elevated dioxin level in a mountainous area near an incinerator and a fire power plant. The scientists and the government traced it to a goat farm, slaying all 50 goats. In a follow-up study, there was a she-goat with elevated dioxin level in another farm near by. Under the pressure from religion and animal protection groups, the local government did not kill the 146 goats in the farm, but bought and confined all of them. The study indicated that there was much controversies and uncertainty behind the regulatory science of dioxin. In collaboration with the farmers’ local knowledge, there was a lot to improve in the sampling, regulation levels, and compensation policies of dioxin risk governance in Taiwan. Keywords: Dioxin, food pollution, regulatory science, lay knowledge, risk governance.

T2-C.3 REGIONAL RISK ASSESSMENT OF DRINKING WATER SUPPLIES

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Increased water demand and emerging risks due to climate changes among other things affect the public drinking water supply and pose new challenges. Actions taken to manage these challenges may include centralisation of drinking water supplies, where several often smaller water sources are replaced by one larger water source. Such replacements combined with interconnection of distribution networks in adjacent municipalities aim to increasing the redundancy. These actions may, however, increase the risk and cause more vulnerable systems. The World Health Organization emphasises the use of Water Safety Plans, which implies a risk-based and integrated approach considering the entire supply system, form source to tap. This approach may be further extended to not only consider one supply system but an entire region including several systems in different municipalities. A method has been developed that enables regional risk assessment of drinking water supplies. Water quality aspects as well as supply interruptions and the access to reserve water supplies are considered by combining different risk assessment tools. The method and its tools were applied in a case study including thirteen municipalities in the Gothenburg region, Sweden. The efficiency of the microbial barriers was analysed for each treatment plant and compared to required treatment levels defined by the raw water quality. System reliability related to supply interruptions was analysed using a fault tree model considering possible failure events and interconnections between different supply systems. The case study results show that the method can be applied to identify and quantify risks affecting smaller as well as larger pats of the analysed region. Furthermore, the effect of risk-reduction measures and other changes in the systems can be analysed. The method for regional risk assessment facilitates long term planning of water supplies including decisions on risk reduction and contingency planning.

P2.1 URBAN FIRE RISK ASSESSMENT BASED ON GIS AND ITS APPLICATION IN DISASTER MITIGATION PLANNING

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With the development of economy and rapid urbanization process, the number of fire disasters is growing every year, casualties and property losses are more and more serious. Preventing and managing urban fire accidents has become one of the significant urban problems for city fire managers. The purpose of this study is to develop an urban fire risk assessment model, in order to identify, classify and map fire risk areas. Urban fire risk assessment index system was constructed, six influence factors in urban fires were considered. These six components were used for a subjective way to determine weights, which were then multiplied with the factors and added together. After various parameters were superimposed using the spatial analysis function of GIS, risk evaluation results were revealed on GIS thematic map, and the city’s present risk rating map was obtained. Then the disaster prevention and mitigation planning objective were determined base on risk assessment results and acceptable risk level, corresponding measures for disaster prevention and mitigation were adopted. The fire risk conditions after planning were predicted, and urban fire risk rating map at that time was estimated. The model was illustrated with a case study to check up its utility, the results suggested risk mapping is helpful for urban fire management to minimize urban fire risk. This model can also be applied to other cities, by exchanging the variables and the weights with actual situations, and can provide references for the prevention and mitigation of urban fires.

F1-D.1 RAILROAD HAZARDOUS MATERIALS TRANSPORTATION RISK ANALYSIS AND EVALUATION OF TRAIN SAFETY POLICY

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There are approximately 2 million annual shipments of hazardous materials (hazmat) by rail in North America. While people derive significant benefits from the production and use of these chemicals, the associated en-route release risk must be managed and to the extent feasible, minimized. The probability of a hazmat release incident is affected by a variety of infrastructure, equipment and operational factors. In order to accurately estimate the likelihood of a hazmat release incident, we developed a risk analysis model using data from the Federal Railroad Administration (FRA) of U.S. Department of Transportation (U.S. DOT) and several major U.S. freight railroads. This model can be used to evaluate route-specific hazmat release risk given track and train characteristics. U.S. railroads are required to install an advanced train safety technology, named Positive Train Control (PTC), by the end of 2015. The cost of this unfunded safety mandate is approximately $10 billion in the next two decades, whereas the estimated safety benefit is less than $700 million. The unfavorable cost effectiveness led Association of American Railroads (AAR) to initiate dialogues with FRA to amend PTC regulations. Our risk model has been used by AAR to evaluate the risk level of certain operating conditions that were proposed to FRA to consider for PTC exemption. In this presentation, we will explain both the model development process as well as its policy implications. This research provides an example of the close relevance of risk research to safety policy.

P1.3 HEALTH RISK ASSESSMENTS OF SALMONELLA SPP. IN PORK IN HANOI, VIETNAM

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Quantitative Microbial Risk Assessment (QMRA) was used to assess health risk of pork meat contaminated by Salmonella spp. in Hanoi, Vietnam. A total 72 pork samples were collected from 4 formal markets in Long Bien district, Hanoi. Salmonella spp. was analyzed by the MPN method. A survey with 210 households was conducted to determine the consumption of pork and examine cooking and eating habit using self-administered structured questionnaires. The health risk assessment was done for 4 scenarios of cross-contamination of Salmonella spp. from raw meat to cooked food through hands, knife, cutting board and full cross-contamination. Results showed that Salmonella spp. was detected in 25% of pork samples (18/72). Concentration of Salmonella spp. varied from 100 to 27,500 per 25 grams of pork (mean: 673 per 25 grams). Average amount of pork consumption was 86.1 grams/person/day and pork meat was eaten 219 day/per person/year. Infection risk of Salmonella spp. was from 2.1×10-4 to 4.9×10-4 by single exposure (per consumption). The annual risk was from 4.3×10-2 to 9.5×10-2. Although this study considered only one stage of consumption within the "farm to table" chain, the findings showed this stage is critical and represents health risk for consumers. Appropriate practices for preparation and consumption of pork meat at the household level needs to me targeted as risk management measures.

F1-E.2 THE PATTERNS AND HEALTH RISKS OF NO2 AND SO2 POLLUTION IN MONGOLIA

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Mongolia had major urbanization and industrialization since mid-1990s, and air pollution has become a challenging environmental problem in the last two decades for the country, especially in the capital city of Ulaanbaatar, which has an estimated over 1.1 million residents, about 42% of the country's population. This study is designed to fill the information gap in our understanding of air pollution problem and associated health impact in Mongolia. In this study, we used manually monitoring data of NO2, SO2 and meteorological variables, which had completed measurements over 70%, in 5 urban sites and 11 rural sites from January 1, 1996 to December 31, 2009 to describe long-term air pollution patterns in Mongolia. We also used health data from Ulaanbaatar during 2008-2009 to investigate health effects of air pollution on morbidity and mortality of respiratory and cardiovascular diseases. Manual data showed that NO2 and SO2 annual average (±SD) concentrations were 20.13±14.37 μg/m3 and 4.73±9.55 μg/m3 respectively which had a long way increased approximately 35%, 38% respectively from 1996 to 2009. Therefore concentrations of NO2 and SO2 have risen by 52.9% and 71.4% respectively, in the last 14 years in urban. The monthly sequence of the air pollutants NO2 and SO2 showed the greatest values at January as the coldest month in capital city due to increased fossil fuel consumption for heating and cooking in ger areas (Mongolian traditional dwelling). SO2 and NO2 concentrations peaked both at noon and evening in Ulaanbaatar. Low temperature and low wind speed were associated with high SO2 and NO2 concentrations, especially in the cold season. Respiratory morbidity was higher in more polluted areas than that in less polluted areas in Ulaanbaatar, especially for people aged under 5 years old and above 50 years old. This study concludes that air quality is getting worse and health impact of air pollution is occurring in Mongolia.

FL-2 RISK ANALYSIS FOR BIOTERRORISM – A PUBLIC HEALTH FRAMEWORK TO INFORM POLICY AND PLANNING

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Bioterrorism has been a threat to human society throughout history, and remains a high level threat today. It receives less attention than other modes of terrorism in the security sector, and is a threat which requires cooperation and communication between multiple disciplines and public sectors (such as health, defense, emergency response and law enforcement). In developing public health policy and planning for a bioterrorist attack or vaccination of military personnel, the most common method for assigning priority is using the probability of attack with a particular agent as the single criterion. I will demonstrate that priority setting using this approach of risk results in a very different risk analysis to using a multi-dimensional approach. I will present an original framework for risk assessment and prioritizing. Such a framework is useful for developing public policy, stockpiling of vaccines and therapeutics, vaccination of military personnel and planning for public health responses to a bioterrorist attack, and can serve as a template for analyzing other terrorism threats.

T3-D.1 DELPHI ANALYSIS OF ISSUES AFTER THE 2011 GREAT EAST JAPAN EARTHQUAKE: INTERIM REPORT 2

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The Great East Japan Earthquake on March 11, 2011 has catastrophic impacts on Japan. Japan is currently on the way to recovery. However, as the damage on the country as well as society is so serious, Japanese society is urged to change some systems including hazard management, energy policy, information systems and city planning. These changes are accompanied with social group realignments, thus necessarily followed by various risks. In addition to these societal risks, Japan should be prepared for the coming disaster risks in near future. In 2004, Indonesia experienced magnitude 9.1 earthquake, named "2004 Indian Ocean earthquake". After that event, Indonesian society has suffered magnitude 7-8 class earthquakes every year. This could be the case with Japan because of plate movement mechanism: i.e., Japan may have to brace for magnitude 8 class earthquakes again and again in the next several years. To cope with these risk issues, SRA Japan established the special research committee for the 2011 Great East Japan Earthquake. The aim of the committee is, from viewpoints of risk analysts, to create and relate messages about risk issues in the first 2-3 year, in ten years and in thirty years from the earthquake. To do this, the committee garners SRA-Japan member's opinions about possible risks in Japan by using Delphi method. In SRA-Japan, there are over 500 members in interdisciplinary fields from various backgrounds, thus the messages are expected to be helpful for Japanese society to lower its risks and to optimize the resource allocation. The research is still underway. The first interim report will be shown in SRA 2011 Annual Meeting in Charleston. The second report will be presented here.

F3-E.5 RISK PERCEPTION IN JORDAN

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In recent years, the term risk has become increasingly topical, both publicly and academically. The public's preoccupation with risk has been fuelled by a rapid increase in the number of operations and activities that are known to adversely affect the quality of human life and its natural environment. It has also encouraged a growing academic interest in the topic, especially in relation to how ordinary individuals perceive the various risks that confront them. Therefore, this research examines the ways in which Jordanian people perceive the various societal risks that confront them. The research identifies the underlying cognitive processes of such judgments. It also makes comparisons with various other westernized and non-westernized nations.

The research investigates the risk perception within Jordanian society by adopting the psychometric paradigm, which involves using a survey strategy to obtain required data. The methodology included two phases. The first phase utilizes semi-structured interviews to identify the most related risks to the Jordanian society. The second is the distribution of the questionnaire on a wide spectrum of the Jordanian society.

There are two main reasons why such research is vitally important. The first reason relates to the communication of risks. Given that risk communication is designed to provide ordinary individuals with the information they need to make informed decisions about risks to their health, safety and environment, such communication "cannot be effective without a comprehensive understanding of how people perceive and evaluate risks and why risk perception varies so much within a society" (Morgan, 2002, p.4). Secondly, it is essential to know what concerns people and why, so that these views can be incorporated into important political decisions, and an appreciation of the fears and concerns of people from other na-

tions can be used to good effect in the improvement of international relations.

This research will provide a valuable and crucial insight into the current risk perceptions of the Jordanian public. Specifically, at the end of this project, risks that are of more concern to Jordanian society will be identified. Furthermore, the findings of the current project will act as a guide for policy makers in Jordan in order to enable them to see what the risks are that lay people in Jordan are concerned with

P2.2 CHARACTERIZING THE IMPACTS OF UNCERTAINTY AND SCIENTIFIC JUDGMENT IN EXPOSURE LIMIT DEVELOPMENT

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There is a misperception by some that occupational and environmental exposure limits are precise estimates. Some risk managers consider one discrete value to be "correct" and all others as "incorrect". Instead, exposure limits should be evaluated based on whether the value is derived in a manner "consistent with current principles" or "not consistent". An analysis of current risk assessment methods was conducted to identify the bases for variability in occupational exposure limits for individual chemicals. The role of scientific judgments, risk policy perspectives, and evolving science methods were evaluated in the context of exposure limit setting methods; similar principles apply to environmental exposure limits. A systematic methods analysis shows that the important drivers for evaluating acceptability of an exposure limit include: thoroughness of the data review, interpretation of results according to current scientific principles under the regulatory framework being used, and consideration of sources of variability and uncertainty. Sources of variability that may be encountered in risk assessments performed by different industrial hygiene or toxicology professionals using identical data sets include: selection of the point of departure, uncertainty factors used for data extrapolation, use of adjustments for toxicokinetics, among others. These and related considerations form the basis of a "quality evaluation" process proposed for assessing the robustness of an exposure limit. Thus, transparency in methods to assure robustness is a core principle embedded in risk assessment methods harmonization. Application of a systematic quality evaluation process provides for more informed use of exposure limits for risk management. A clear understanding of the basis for disparate values can provide useful information regarding the current level of uncertainty in the science and the level of confidence appropriate in applying different exposure limits.

F2-D.3 RISK COMMUNICATION AND RISK PERCEPTION IN COMPLEX INTERACTIVE AND TIGHTLY COUPLED ORGANISATIONS

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Past research on the relationship of risk communication on risk perception is predominantly focussed on the way the populations deal with risk perceptions and messages about possible danger. Little research on this particular domain is done in organisational contexts, or more specifically in organisations with complex interactive and tightly coupled systems. Evaluations of recent industrial incidents indicate that, despite all existing communication tools and safety trainings, the importance of a sound risk communication and its impact on the employees' risk perception is underestimated. This might indicate a deficiency in the solution-oriented knowledge about the relationship between risk communication and risk perception. This research systematically reviews the existing literature on the relationship between risk communication and risk perception in the domain of organisations with complex interactive and tightly coupled systems since 1990. In order to research the literature rigorously, the so-called 'CIMO-logic' (Denyer et al., 2008) is applied. The CIMO-logic involves a combination of a problematic Context, for which a certain Intervention type produces, through specified generative Mechanisms, the intended Outcome. The rationale is that by examining Context, Interventions, Mechanisms and Outcomes in the specific domain of risk communication and risk perception in organisations with complex interactive and tightly coupled systems, recommendations can be made to improve risk communication practices in these organisations. The main finding indicates different leadership capabilities as dominant interventions. These interventions are among others, adding different expertise to a decision process, the introduction of adapted safety trainings, and comprehensible hierarchical communication that refers to the employees' problem domain familiarity.

T3-E.3 TOOLS, APPROACHES AND INSTITUTION: TOWARDS INTEGRATED FOOD SAFETY GOVERNANCE - PRELIMINARY FINDINGS

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The last several decades have witnessed emergence of issues characterized by high complexity and uncertainty as most represented by climate change. Food sector is not an exception. Food safety crisis such as BSE has proved that unexpected surprise and disturbance to the governance structure can happen. New technologies such as genetically modification applied to food have posed a question of how social value should be treated. The trend in Governance literature acknowledge the limit of traditional linear view in managing risk and put emphasis on the importance of incorporating divergent views including social values in the management of risk. There is a pressing need for restructuring governance structure that can anticipate, respond and adapt to all these changes from integrated inclusive perspective. In the consideration of risk governance, two elements, namely the scientific "technical risk assessment" and socio-economic "other legitimate factors" are essential. The importance of combining those two elements in the governance process and the need for a move toward a more integrated comprehensive structure are now widely acknowledged. However, "how" these elements can and should be incorporated is not sufficiently developed. Moreover, there is little empirical study in practice. This paper reviews the existing tools, methods and approachesof risk governance. It explores how these are placed (or absent)in current institution with particular focus on food safety area.It addresses the preliminary finding from the study and identifies some of the implication which sheds light to the factors that improves and enhances the overall performance of food safety governance.

P2.3 ACHIEVING PERVASIVE RISK MANAGEMENT: OVERCOMING A KEY RISK GOVERNANCE CHALLENGE

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Risk maturity and enterprise risk management models are commonly used to improve and benchmark risk management performance. A core assumption of these models is that risk behaviour and culture must be consistent and coordinated throughout an organisation (1). However, achieving pervasive risk behaviour and culture is challenging for many organisations (2,3). We conducted a case study in a UK government department that is attempting to embed risk management into policy development. We used this case study to investigate the organisational factors affecting risk management pervasiveness. Our results revealed the extent to which formal rules and procedures can embed desired risk management behaviour. Formal rules and procedures were effective in embedding risk management behaviour when combined with strong, top-down, governance structures and adequate resourcing. In these contexts risk management behaviour was explicit and coordinated. Where governance was more flexible and outcome focused, risk behaviour was predominantly affected by individual experience and informal peer groups. In these contexts risk management behaviour was largely tacit and ad hoc. We present our findings and discus the implications for both achieving pervasive risk management and the flexible risk behaviour associated with organisational resilience (4). References 1Mauelshagen, C. D. Denyer, S. Rocks, and S. Pollard. Forthcoming. Risk management pervasiveness and organisational maturity: a critical review. J. Business Continuity and Risk Management. 2Economist Intelligence Unit. 2009. Beyond box-ticking: A new era for risk governance. The Economist. 3FERMA. 2008. Risk management benchmarking survey: Keys to understanding the diversity of risk management practices in Europe. Brussels: Federation of European Risk Management Associations. 4Bigley, G., and K. Roberts. 2001. The incident command system: high-reliability organizing for complex and volatile task environments. Acad. Mgmnt. J. 6:1281-1299.

W4-E.4 ADAPTIVE ADVERSARY DECISION MODELING FOR GLOBAL TERRORISM RISK MANAGEMENT

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The adaptive adversary terrorist is an emerging global threat across international boundaries. We present innovative adaptive adversary decision modeling for terrorism risk management and improved resilience. The key components of the process include: Expert elicitation using random-utility modeling and probabilistic inversion to elicit information on adversary utility functions as basis for modeling their decision processes; Modeling the effects of countermeasures on the success probabilities of attack scenarios and the consequences of successful attacks; & Game-theoretic analysis to determine optimal defensive resource allocations or countermeasure investment strategies, taking into account both adversary & defender preferences and beliefs.; ; Key features developed and piloted can significantly improve resource allocation decisions. We demonstrated that a game-theoretic (vs. a purely risk-based) approach to resource allocation is feasible, in realistic problems & with realistic data sources likely to be available to intended users. In particular, our approach relaxes the "perfect information" requirements of simplistic game-theoretic models, enabling application of the insights of game theory even in situations with noisy data or significant uncertainty, and giving rise to more realistic levels of hedging in defensive resource allocations. Our game-theoretic models are quantified using realistic models of adversary values & objectives, rather than simplistic adversary objective functions, such as "maximize fatalities". To support this, we describe, extend, & apply best-practice methods for expert elicitation. Finally, applying probabilistic inversion reduces the time & difficulty in the expert elicitation process by making it possible to infer estimates of adversary attribute weights from a limited number of ordinal judgments of scenario attractiveness. This approach may contribute to greater acceptance of quantitative methods within the intelligence community.

W3-C.5 HOW EMERGING ARE EMERGING RISKS? A CRITICAL ANALYSIS FROM MANAGEMENT SCIENCE PERSPECTIVE

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The INTeg-Risk project was devoted to develop a new paradigm, framework and set of methods and tools that help stakeholders to tackle those distinctive properties in their risk management policies. Nevertheless, to be useful and used, stakeholders have to be aware that the activities in which they are embedded are or will be dealing with emerging risks. However, if some businesses, like insurance for instance, can easily acknowledge the evolving character of their environment and consequently of their risks; more classical industries tend to develop a more routine based risk management founded on a classical estimation-treatment-communication sequence. By being faithful towards the static representation of risks performed during the risk assessment phase, those organizations place themselves out of the scope of the tools and approaches developed within I INTeg-Risk. Through management science approaches, this paper will tend to demonstrate that the emerging character of risks can sometimes be present even if very difficult to capture in organizations usually dealing with routine activities. We will see that this difficulty is linked to the multiplicity of influencing factors (technical, social and economic) that may contribute to shape the risk profile of an organization. The perspective of complementing the classical management approaches by some early warning tools developed within iNTeg-Risk can be of high interest for risk managers.

F1-E.1 ENVIRONMENTAL STEWARDSHIP FOR GOLD MINING: A CASE OF EPIDEMIOLOGICAL RISK MANAGEMENT IN MALAYSIA

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Mining has gained strong popularity in recent years due to the increase in global demand for metals and other industrial raw material derived from the ground. However, information and good governance regarding activities related to mining is still lacking. In Malaysia, the importance of environmental stewardship in mining is a new phenomena. The new National Mineral Policy 2 calls for compliance with existing standards and guidelines, stresses on progressive and post mining rehabilitation as well as promotes the gathering and dissemination of information, best mining practices, public disclosure and corporate social responsibility.Gold mining and extraction presents two main potential environmental problems: cyanide emissions (to the air or water) and heavy metal contamination of waterways. A gold mine operated since 2009 in Malaysia where gold was extracted through a cyanidation method. Cyanidation is toxic and can cause adverse effects on ecosystem and the nearby population. An epidemiological study was conducted to assess the health risk among the community staying near the gold mining area in Malaysia. A health survey using a standardized questionnaire was conducted in February 2011. A total of 373 respondents participated in the study ; 255 respondents in the exposed area and 118 respondents in the control group. Urine of the respondents were analysed for urinary thiocyanate and heavy metals (As, Cd, Hg). Results showed a significant difference between exposed and unexposed for subjective symptoms and urinary thiocyanate. The mean concentration of urinary thiocyanate and heavy metals were below the guidelines. Multivariat analysis showed significant contribution of smoking and exposure to the urinary thiocyanate level. This study is an important biological monitoring of community for risk analysis. Tools to reduce the impact of mining on the environment and community health are discussed. These tools that link environment and health to development, provide a critical foundation for adaptive governance.

F2-B.2 JUDGMENTS OF EARTHQUAKE RISK BEFORE AND AFTER THE CANTERBURY EARTHQUAKES FOR LOCALS AND NON-LOCALS.

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One element in resilience in regard to natural disasters is people's perception of the risk of natural hazards. Risk judgments are often affected by two factors: experience of a particular hazard and optimistic biases where people judge their vulnerability to a hazard to be lower than that for other people. These two factors and related issues were examined in relation to the recent (2010/2011) earthquakes near the city Christchurch, in the province Canterbury, in New Zealand. Participants in Christchurch, Wellington and Palmerston North judged the likelihood of an earthquake before and after the 2010 Canterbury (Darfield) earthquake and the February 2011 Christchurch earthquake. Whereas many Wellington citizens have long expected an earthquake, this may not be the case in Palmerston North. Thus this group is comparable to Christchurch citizens before the recent earthquakes, as many Christchurch citizens expected an earthquake in Wellington but not Christchurch. Participants judged these 'before' and 'after' earthquake likelihoods for their own city, for the rest of New Zealand and for Canterbury. Christchurch participants also indicated their preparedness before and after the earthquake. Expectations of an earthquake in Canterbury were low before the earthquakes in all three samples and rose significantly after that earthquake. In contrast, Wellingtonians' perceptions of the likelihood of an earthquake in Wellington were higher before the Darfield earthquake and did not rise after that earthquake. In contrast, Palmerston North citizens judged their own earthquake risk to be higher after the earthquake. For Christchurch participants, the relation between their risk perceptions and preparedness was examined. Christchurch participants who suffered damage judged the likelihood of a future earthquake in Christchurch no higher than those who did not suffer damage. These findings are discussed in relation to the leading theories of risk perception.

F3-C.5 HEALTH IMPACT ASSESSMENT IN THE EXTRACTIVE INDUSTRY SECTOR

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Over the past decade a number of major oil, gas and mining companies have developed corporate Health Impact Assessment (HIA) standards. The increased business focus on public health issues has primarily been driven by host communities, Non Governmental Organisations (NGOs), the media and host governments. Reflecting this focus, a number of international organisations have produced HIA guidelines e.g. the International Finance Corporation's (IFC) Introduction to HIA and the International Council on Mining and Minerals (ICMM) Good Practice Guide on HIA to support businesses in their un-

derstanding of this area. Although very knowledgeable on occupational health and safety, businesses still require educating on the process, outcomes and benefits of implementing an HIA. However a number of majors, in recognition of the potential health impacts arising from their activities, have begun to addressing their health impacts either through an HIA or ESHIA.

A current health concern is the increase in sexually transmitted infections (STIs) amongst the Fly In Fly Out (FIFO) workforces in Queensland and Western Australia. This is reportedly due to the general boredom amongst FIFO workers; leading to an increased use of commercial sex workers in and around mining towns and workers behaving recklessly during holidays overseas. As well as STI rates increasing, overstretched country clinics are being utilised at the detriment of the local community. An HIA and health management plan could be used, along with other tools, to better manage an issue such as this.

T2-AB.3 SECURITY RISKS OF SYNTHETIC BIOLOGY – ASSUMPTIONS, METHODS AND SOURCES OF UNCERTAINTY

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This talk assesses the security implications of three features of synthetic biology. First, by facilitating deskilling, synthetic biology may be expected to accelerate diffusion of biological engineering capabilities from advanced industrial to developing nations and from institutionalized university and commercial laboratories to home and community labs of "Do-It-Yourself-Biology." Second, by facilitating repurposing, synthetic biology appears to have minimal security implications in the near term, to create modest offensive advantages in the medium term, and to strengthen defensive capabilities against natural and engineered biological threats and to enable novel potential offensive uses in the long term. Third, the security implications of both an offensive and defensive nature should be assessed in light of the risks associated with sponsored commercial, university, government and entrepreneurial synthetic biology as well as the unsupervised, unregulated and virtual renegade operations that may emerge over the next decade.

T4-A.2 CHALLENGES IN MONITORING AND ANALYZING VACCINE SAFETY

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As diseases preventable by vaccination become better controlled, public concerns have shifted towards vaccine safety. Governments have instituted systems for monitoring the safety of vaccines; these include passive and active surveillance of adverse events following immunization, case control and cohort studies. Data linkage has made possible the systematic analysis of hypothesized relationships between outcomes in individuals and their vaccination status. The emerging discipline of vaccinomics enables the study of vaccine reactions within individuals according to their genetic profiles. These systems have identified rare adverse reactions to vaccines, which have, on occasion, led to the suspension of vaccine programs (Rotashield and Fluvax for children under 5 years in Australia, for example). New capabilities for identifying rare adverse outcomes from vaccines and the magnitudes of those risks, also bring an ongoing array of ethical, policy and communication related challenges; questions include what level of risk is acceptable with what uncertainty, who makes decisions on vaccine use, how are information on risks and recommendations for vaccine use communicated, and what is the role of the public in decision-making about vaccines.

W3-A.5 OCEAN NETWORKS CANADA NEAR-FIELD TSUNAMI RESEARCH FACILITY

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Recent tsunami events in Indonesia, Chile and Japan highlight the importance of understanding the local impacts of devastating tsunamis. These events have also raised awareness of the need for risk assessment for local (e.g. submarine and subaerial landslide-generated) and near-field tsunamis (those that can impact a coastal community less than an hour after generation). Although existing tsunami warning systems such as DART (Deep-ocean Assessment and Reporting of Tsunamis) are highly effective at providing assessment and warning of far-field tsunami events, comparable systems do not currently exist for local and near-field events. Tsunami inundation models can predict coastal run-up yet the lack of wave amplitude, direction, and shape data within a few minutes of a near-field tsunami event limits the generation of information for warning populations at risk. The Ocean Networks Canada (ONC) Observatory, combining the VENUS and NEPTUNE Canada cabled networks, represents the world's largest regional ocean observation system with over 900 km of electro-optic cable connecting over 400 sensors covering a broad range of research themes, including a tsunami monitoring network. The Observatory is located off the east and west coasts of Vancouver Island the Observatory spans the Juan de Fuca tectonic plate and edge of the over-riding North American plate, a region known to produce mega-thrust earthquakes. With the base core technologies and infrastructure for tsunami warning system research, the ONC Observatory is an ideal site for the test and evaluation of near-field tsunami detection technologies. This paper discusses how this unique infrastructure can be used to facilitate international collaboration, combining new technologies, concepts and algorithms to create an international near-field tsunami research facility to develop, evaluate, and test warning technologies and solutions for at- risk populations.

F1-B.5 EXPECT AND ACT: PREDICTING WILDFIRE PREPAREDNESS FROM PERCEIVED RISK, RESPONSIBILITY, AND OBSTACLES

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As the wildland-urban interface is expanding, the number of households threatened by wildfires is increasing. These fires generally form a recurring threat, enabling residents to form expectations and prepare accordingly. Past research has identified two important expectancy based factors that predict people's intention to prepare for a natural hazard: Perceived risk and perceived protection responsibility. We expanded this research by differentiating their influence on different types of preparedness (e.g., preparations for evacuation vs. for defending the house) and by measuring actual preparedness at the time of a fire. In addition, we tested the unique predictive power of two additional threat related expectations: Expecting an official fire warning and expecting obstacles (e.g., losing services) during a fire. A survey completed by 1003 residents of wildfire prone areas in Perth, Australia, revealed that perceived risk (i.e., threat likelihood and severity) and protection responsibility significantly predicted variance in all types of preparedness, although more in some than in others ($.037 \leq R2 \leq .091$). Higher perceived risk (especially threat severity) and greater perceived responsibility for one's own safety generally predicted greater preparedness. Importantly, stepwise regression analyses showed that expecting an official warning and expecting to lose services significantly explained additional variance ($.014 \leq$ additional $R2 \leq .063$). Expecting to lose services (especially water pressure) generally predicted greater preparedness, and expecting an official warning in case of a fire predicted less preparedness. We discuss public policy implications that follow from this research.

W1-A.2 REFRAMING RISK AND UNCERTAINTY IN THE ECONOMICS OF CLIMATE ADAPTATION

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Uncertainty and risk have become buzzwords in research on climate change mitigation and particularly adaptation. Mitigation analyses have embraced the concept of uncertainty and are being operationalized around stochastic estimates of uncertain climate sensitivity leading to probabilistic scenarios of warming. The concept of risk in research on climate change is nothing new and already in the 1990s integrated risk assessments to analyze global climate change have been proposed. Yet, only over the last few years, with the consequences of climate change becoming visible, have assessments of climate change impacts and vulnerability changed in focus from an initial analysis of the problem to the assessment of potential impacts, and finally, to the consideration of specific risk management methods. Recently such framing has prominently gained traction with the publication of IPCC's special report on "Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX)." The suggested focus on risk-based assessments of adaptation is particularly important for fat-tailed (i.e., non-normally distributed) catastrophic impacts that are potentially very large, uncertain, unevenly distributed, and may occur in a distant future. It seems as if a preoccupation with vulnerability is being replaced

by a decision-oriented focus on risk and risk management and the associated uncertainties, with all associated benefits and challenges. Our paper assesses the newly forming landscape on risk analysis for climate adaptation assessment. Informed by case studies conducted in the EU FP7 project MEDIATION, which are serving as a laboratory to further develop thinking on risk management, we critically discuss developments in the newly emerging field of climate risk analysis. We find that risk analysis is being embraced in different facets and forms, all of which may be useful starting points in their own right. We suggest that particularly useful analytical entry points are organized around the concepts of adaptive management, robustness and transformation.

W1-C.1 IMPLICATIONS OF EARLY CANADIAN EXPERIENCE IN CONSIDERING ALL EXISTING CHEMICALS

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Mandates internationally are requiring much more efficient evaluation of larger numbers of chemical substances. This included the early formal systematic consideration under the Canadian Environmental Protection Act of priorities for assessment and/or management from among the 23, 000 Existing Chemicals registered in Canada ("categorization") and the requirement in Europe to consider the hazard of all Existing Substances under the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) legislation. Such mandates have necessitated consideration of the most important determinants of exposure and hazard as a basis for development of more predictive and efficient, increasingly data informed tiered assessment strategies. They have also increased focus on the importance of formal "problem formulation" as a basis to efficiently focus resources in health risk assessment and management, including early engagement of appropriate experts and stakeholders and assessment of potential management options. Background for and practical implications of experience acquired in meeting the early requirement in Canada to systematically consider priorities from amongst all 23, 000 Existing Chemicals will be addressed. This includes considering the relative importance of simple exposure determinants in setting priorities and ensuring "fit for purpose" assessment strategies.

W2-D.3 INTERNATIONAL DEVELOPMENTS IN CONSIDERATION OF COMBINED EXPOSURES

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More efficient methodology for assessing the impact of combined exposures to multiple chemicals has been considered in a project of the World Health Organization (WHO) International Programme on Chemical Safety (IPCS). Following an initial international workshop convened to review advances in this area, a draft framework for assessment of combined exposures was developed by WHO through an expert group process, public review and collaboration with other international organizations, including the Organization for Economic Cooperation and Development (OECD). The framework includes problem formulation, followed by stepwise consideration of both exposure and hazard in several tiers of increasingly data-informed analyses. These analyses build on recent developments in assessment in a range of programs internationally, incorporating predictive approaches in early tiers and increasingly refined, more data-informed and probabilistic analyses in later tiers. The framework is illustrated by a number of case studies and proposed follow-up includes international coordination in the development of a broader range of more encompassing case studies. Evolving experience in application of the framework will be illustrated by example with special emphasis on the critical content of problem formulation, the role of predictive tools in grouping of chemicals for consideration and the importance of explicit delineation of relative uncertainty and sensitivity for tiered exposure assessment.

T4-C.1 ENVIRONMENTAL, HEALTH, TOXICOLOGY, AND NATURAL RESOURCE ISSUES RELATED TO CLIMATE CHANGE: AN OVERVIEW OF A SOCIETY OF ENVIRONMENTAL TOXICOLOGY AND CHEMISTRY

Menzie C

During 2011 the Society for Environmental Toxicology and Chemistry (SETAC) held an international experts' workshop to examine how climate-change may influence the way the scientific community conducts environmental and health risk assessments, evaluate natural resources, and addresses fundamental fate, transport, and toxicological questions. This paper provides an overview of the workshop and presents the conclusions of the scientific working groups that addressed the various topics. Held July 16-21, 2011 at the Johnson Foundation at Wingspread (Racine, WI, USA) it involved some 36 scientists from 11 countries. The central question addressed was: How will global climate change influence the environmental impacts of chemicals and other stressors; and, the way we assess and manage chemical contamination and other stressors in the environment? Six work groups were tasked to address this central question and others specific to their areas of expertise. Some key consensus points are: 1. human actions may have as much or more influence on the fate and effects of chemical contaminants as does GCC, and modeled predictions should be interpreted cautiously; 2. the speed of GCC may be slow and difficult to detect though some species and populations of high vulnerability (polar, coral reefs) may exhibit responses sooner and more dramatic than others; 3. future approaches to risk assessment will need to incorporate multiple stressor, cumulative risks (positive and negative) considering the wide spectrum of potential impacts stemming from GCC; 4. baseline / reference conditions for estimating resource injury and restoration / rehabilitation will continually shift and represent significant challenges to practitioners.

W2-A.1 GOVERNING SUSTAINABILITY OF PUBLIC ORGANIZATIONS. THE FRENCH EXPERIENCE.

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In daily practices, all organizations are facing the complexity of managing the balance between social, environmental and economic risks and opportunities. These kind of reflections became more and more necessary due to a normative (ex. ISO 26 000 "Corporate Social Responsibility") and regulatory (ex. Grenelle 1 and 2 French laws) constraints. On April 15, 2010, institutional member of Sustainable development French Club (more than 60 public organizations) have confirmed the needs of a common reflection on the SD governance. INERIS was mandated by the General Commissioner for Sustainable Development to chair a national working group on sustainable development governance. This paper will present some results of a two years working group on how Public Organizations face and address the challenges of sustainable development: • To what extent sustainable development indicators' can improve decision making processes and therefore the sustainability of public organizations? • In what contexts is it appropriate to use indicators and in what other contexts it would be, however, inappropriate to use them because of possible excessive simplifications they generate? o For contexts deemed relevant, how to develop appropriate indicators and how to ensure continuity throughout the life of the Organization? o For contexts deemed irrelevant to the use of indicators, what other approaches, technical or organizational, that would be relevant to improve the representations of decision-makers or decision-making processes in public organization to increase the level of sustainable development? • Some decisions may involve several actors, to what extent the variety of interpretations that can generate these indicators can be a hindrance to decision-making?

W2-B.2 BETWEEN FRAGMENTATION AND SEGMENTATION: A RELATIONAL MODEL OF CONSUMERS' FOOD RISK PERCEPTIONS

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It is widely acknowledged that consumer risk perceptions of food risks differ not only from expert evaluations(cf. Knox 2000) but also within the heterogeneous group of lay people or 'average consumer' (e.g. Siegrist, Keller and Kiears 2006). The paper presents a model of consumer risk perceptions of everyday food products. As a theoretical point of departure the paper introduces a relational understanding of the risk concept and explains how risk is founded on an ontologically objective relation between objects with specific danger characteristics and objects with specific value characteristics (Boholm and Corvellec 2011; Merkelsen forthoming). Then the paper presents data from a survey (N=800) where a representative sample of Danish consumers rate 8 concrete food products on a 5-point Likert scale according to risks, benefits and control together with attitudes towards 6 value preferences. Through multiple varia-

tion analysis the paper demonstrates how variations in consumer perceptions of food risks at aggregate level are formed by a combination of product (risk) characteristics and value preferences. When variations among and within individuals are included in the analysis a more nuanced pattern emerge which allow for a segmentation of consumer types with regard to food risks. The benefit of the model proposed in this paper is that it enables risk managers to target risk mitigation initiatives (regulation, information, involvement etc.) very precisely. However, the model is less suitable for comparing dissimilar risks at aggregate level as it is usually done in traditional psychometric studies. Finally the paper suggests that the model proposed in this paper as well as the underlying methods can be extended to meet the needs for practice oriented risk management tools in other empirical areas.

F3-B.2 IMPACT OF CLIMATE CHANGE FOR RISK MANAGEMENT: HOW PREPARED ARE FOOD INDUSTRY LEADERS?

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This paper presents the results of a research project undertaken by Wondu Business & Technology Services for the National Climate Change Adaptation Research Facility at Griffith University in Queensland Australia. The Project examines the implications of climate change for risk management skills, products and services and measure the preparedness of food industry leaders for riskier operating scenarios including, but not limited to, the highly 'Black Swans'. The combination of drier and more volatile climatic conditions, limits to supply of arable land, subsidized competition from biofuel crops, other incentives to change land use from food use and a growing population suggests increasingly volatile supplies of foodstuffs and prices in both Australia and offshore. In addition, regulations contain a new set of risk to contend with. There is a growing sense of urgency to protect future food security, both here and offshore, as it becomes clearer that a price will have to be paid to protect resources and enhance sustainability for future generations. That price can be manageable providing best practices are employed in management of risks. A major problem in dealing with this environment is the risks in the tail of the distribution. There is a tendency to not recognize a catastrophic event until it's too late and starts to impact adversely on stakeholders. Irrational decision making is shown, at least in the finance sector, to be more commonplace than previously recognized in efficient market theory. Does it also exist in the food industry? This project attempts to answer that question. It also examines risk management skills among these suppliers and the delivery of risk management training from educators. The research results are expected to lead to improved understanding of risk and risk management practices which would enhance food security.

F3-C.2 THE INTERSECTION OF HEALTH IMPACT ASSESSMENT AND HUMAN HEALTH RISK ASSESSMENT

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Health Impact Assessment (HIA) is an emerging yet structured strategy for incorporating the effects of non-traditional stressors into the evaluation of potential health consequences of projects, programs, or policies on human populations. HIA is both used and promoted as either an alternative or complement to human health risk assessment (HHRA) as a means of evaluating the effects of atypical stressors on human health. In contrast with the more limited use and broad public health perspective of HIA, HHRAs have been widely used for decades to quantitatively evaluate potential adverse health effects of exposures to environmental hazards. In guidance and application, HHRA has focused on individual chemicals or limited multi-chemical exposures, but does not address other factors that may have public health consequences such as economic, social and planning factors.

Most HHRAs do not address cumulative impacts, which may disproportionately affect some racial, ethnic and socioeconomic groups. Indeed, there is little consensus on the methods for assessing cumulative impacts of chemicals, and, proportionate to the recent national recognition of the need for cumulative risk assessments (National Research Council [2009] Science and Decisions, Advancing Risk Assessment), even less consensus on how to incorporate cumulative impacts into HHRA.

HIA offers a strategy to consider cumulative impacts of multiple types of stressors, although the process may be limited by data availability. HIA also provides a framework that extends beyond the NRC mandate to include consideration of benefits, as well as adverse impacts. Consideration of benefits is a critical element in the application of HIA in international development projects that require assessment of sustainability.

This talk will explore the overlap between HIA and HHRA, and discuss the benefits and challenges in implementing these assessments, particularly in the US, which has been slow to embrace HIA.

W2-E.2 SHORTENING THE LONG ARM OF U.S. LAW?

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Since 1987 the process by which courts in the United States garner jurisdiction over foreign companies has been "unclear." Two cases decided by the United States Supreme Court on 27 June 2011 provide clarity but no long term certainty. In each of J McIntyre Machinery Ltd v Nicastro and Goodyear Dunlop Tires Operations SA v Brown, questions arose involving the exercise of jurisdiction by U.S. state courts over foreign-based companies. The two appeals involved product liability claims against companies domiciled in the United Kingdom, Turkey, France and Luxembourg. All had been held subject to US state court jurisdiction even though the companies did not operate in the US and were only involved in the export of products to particular parts of the US. This paper addresses the legal and practical implications of these decisions for foreign firms involved directly or indirectly in U.S. markets.

W2-C.5 ASIA-PACIFIC REGIONAL RISK ASSESSMENT REPORT 2012: RISK GOVERNANCE AND SUSTAINABLE DEVELOPMENT

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The Third Session of the Global Platform on Disaster Risk Reduction, held in Geneva in May 2011, revealed rapidly growing political commitment to risk reduction from all stakeholders. In the case of disaster risks, the "emerging" dimension is marked by increasing loss levels that are surpassing governments' financial provisions; exposure continues to increase while new vulnerabilities are revealed by disasters such as Japan and Thailand in 2011. The complex issues of disaster risk reduction demand an increased level of understanding of disaster risk, risk reduction and development issues. The upcoming Asia Pacific Regional Risk Assessment Report will highlight regional disaster trends and innovative approaches and technologies, share sound practices and lesson learned. The report will aim to: •enhance the understanding of disaster risks: using the Global Risk model of GAR, a Asia-Pacific risk model will provide deeper analysis of growing vulnerabilities and risks for the region. In the context of emerging risks, the vulnerability of rapidly urbanizing areas and megacities with increasingly interconnected and highly technology dependent systems will be analyzed to develop a typology of emerging risks in urban areas. •understand regional progress and progress at local levels •analyse DRR investment •assess regional risk governance and enabling environment for risk reduction: analyze the causality (Why) of the trends and patterns in risk reduction, and inquire into into some of the key elements of risk governance those possibly affecting creation of an enabling environment for risk reduction •showcase innovative approaches to reduce disaster risk and recommend a way forward for strengthened regional risk governance in managing trans-boundary issues.

F1-D.2 CONSEQUENCE MODELING OF FIRE AND EXPLOSION IN COMPRESSED NATURAL GAS(CNG) FILLING STATION

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The object of this study is consequence modeling of fire and explosion in CNG fast filling stations for quantitative risk assessment of these units. Due to the usage of the pressurized gas compressed in multi stages up to the high pressure of 250 Bar in CNG cylinders of automobiles, explosion and fire in CNG filling stations may be caused which has major hazardous effect and brings vulnerability in the surrounding population and civilian parts of the city. These kinds of events have resulted in the much needed risk assessment of explosion and fire of these units. In this project all the hazards of a specified CNG filling station will assist the modeling of the fire and explosion zone. By this modeling the effect of

the consequences on existing population in the station during day and night will be assessed. The fatality of events is signified. By signifying the Frequency of the events the rate of risk of different events is determined. By comparing the index of risk with the accepted standards it's defined that the index of risk in CNG filling station in most areas are at ALARP(as low as reasonably practical) zone or in some parts in the hazard zone. This results in the necessary increase in the Safety levels of these units to decrease fatality and wound rates in the hazardous events.

P2.5 USE OF RISK ASSESSMENT TOOL IN THE BRAZILIAN ENVIRONMENTAL LICENSING

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In Brazil the Vila Soco accident, which happened in 1984 and caused 93 fatalities and the destruction of the residential area, promoted the adoption of risk assessment as a tool for enhanced environmental licensing of industries. In 1990 the Environmental Company of São Paulo State (CETESB) published the first qualitative risk analysis guidance with the focus to prevent the major hazards accidents. It was only in 2003 that CETESB published the Standard P4.261 contemplating the methodology to elaborate a qualitative and quantitative risk analysis with the risk acceptability criteria and the guidelines for the elaboration of a risk management plan (RMP). At this moment this standard is undergoing review and will also include the risk methodology and risk acceptability criteria for pipelines. Nowadays Rio Grande do Sul and Bahia states also have methodologies to quantitative risk assessment based on standard and decree. Furthermore, states as Rio de Janeiro, Minas Gerais and Mato Grosso do Sul and the federal environmental agency of Brazil (IBAMA) use this tool during environmental licensing process based on terms of reference published to each industrial project in focus. Although there are differences in the consequence analysis and in the risk acceptability criteria of each state, the methodologies used to determine the risk are similar. The risk evaluation is based on individual and societal risk only of the industrial site on focus, but not consider the cumulative risk of all industrial sites presents in the same area. In Brazil the land use is an assignment of the municipal agency. Municipal agency of Sao Jose dos Campos city has been adopted the quantitative risk assessment during the municipal licensing process. The purpose of this poster is present an overview of the application of risk assessment in the environmental licensing process in different Brazilian states and the mainly differences between the guidances.

W3-E.2 MIGRATING FROM PROJECT RISK MANAGEMENT TO OPERATIONAL RISK MANAGEMENT

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Risk Management is common to projects and operations, but practiced independently in these two domains, and applies to different objectives: budget, schedule, and specification, on the one hand, and objectives such as business continuity, safety, security, reliability, reputation, etc., on the other. In spite of this seemingly minimal overlap, unmitigated project risks turn to operational risks, or generate them. Unfortunately, the different dedicated risk management methodologies hardly refer to the problem of risk migration from projects to operations. Project risk managers focus on risk reduction within the project, e.g., from design to development or between development cycles, while operational risk managers usually cope with risks in systems in a given operational state, and disregard project risk effects. Project stakeholders have little in common with their operational counterparts, and hence have little motivation, and often some reluctance, to provide the latter with project risk information. Thus, product beneficiaries are forced to spend significant time and resources, and to experience critical faults or even disastrous consequences, in order to rediscover root problems and adverse effects that product engineers are usually aware of. Stakeholders on both sides must acknowledge the migration and propagation of risks from the project phase in the product`s lifecycle, to the operational phase, and collaborate in the mitigation of these risks. In view of this paradigm shift, we present a new overarching framework, which copes with risk migration through risk information communication among various stakeholders and risk analysts. Our framework consists of a structured risk modeling method, based on Object-Process Methodology (OPM), and provides risk analysts with the means to generate and maintain a holistic, coherent risk management plan, while practicing familiar domain-specific risk management techniques. We demonstrate the framework`s application on a commercial airliner shoulder-missile defense system.

F2-B.1 SOCIAL IMPACTS INDUCED BY RADIATION RISK IN FUKUSHIMA PREFECTURE, JAPAN

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An accident of Fukushima daiichi nuclear power plant induced by an earthquake of M9.0 and subsequent tsunami gave various kinds of impacts around the plant. After reviewing arguments of local governments for low dose radiation risk, this paper analyzed social impacts by the risk in terms of a gap of emergency response between national and local governments, corruption of communities in various levels induced by plural statements for risk levels in low level radiation, and economic impacts for agricultural crops made in Fukushima prefecture. Afterwards, clues for improving the situation were discussed, which include understanding of characteristics of public perception, attitudes of experts and interactive risk communication.

F3-E.1 VOLCANOES: HAZARD PERCEPTION TO MONOGENETIC VOLCANISM

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Volcanoes are commonly known as geoforms in the earth with one or more vents associated which can produce eruptions at different times. These natural structures are technically known as polygenetic volcanoes and have been the cause of disasters, most of them probably predictable. However, there exists monogenetic volcanoes too (one eruption) which are hosted in volcanic fields where many of them exist (up to hundreds). The size of their eruptions is usually smaller than eruptions produced by polygenetic volcanoes and their general behavior is easier to predict. Hazard studies in polygenetic volcanism are focused on understanding the development of a next eruption, but in monogenetic volcanism the studies are based on predicting the place where a new volcano will appear. Due to the fact that a monogenetic volcanic field can cover hundreds of square kilometers, the hazard perception is totally different than on a volcano that will erupt in the same place or zone. New studies at different countries help us to understand how the analysis has been performed considering this aspect, and how the hazard is better understood now both by academics and by the general community. Fortunately recent cases of monogenetic volcanism have been well documented (e.g. Paricutin volcano 1943-1952, Mexico; Surtsey volcano 1963-1967, Iceland) and it is easier for people to understand what can happen. Now we know that years or tens of years is the time period over which a monogenetic eruption occurs, but there seems possible to determine the frequency of the eruption for each volcanic field. So, hazard divulgation is necessary to continue this understanding.

P1.12 EMERGING RISK FROM UNCERTAINTY IN EXPERIMENTAL CHARACTERIZATION OF COMBUSTIBLE SOLIDS

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Combustion of solids materials is defined by particular characteristics of dispersion of the particles in the comburent gas. Recently, several standardization techniques have been included in the experimental determination of flammability parameters of solid combustible substances in order to obtain precise and accurate results that describe the explosive behavior of the mixture and also provide useful information for facilities that handle with this type of materials. A computer fluid dynamics simulation based on an Euler-Lagrange approach has been developed to describe the dispersion of aluminum particles in a standardized setup designed for characterization of solid combustible materials known as Hartmann tube or Mike III. The Hartmann tube and the 20 liter sphere constitute the equipment employed for the purposes mentioned above by establishing qualitative and quantitative analysis that determine parameters used for identification of the minimum energy and concentration requirements for ignition In that context, the CFD study was directed towards the assessment of flow conditions pertaining to the agglomeration and fragmentation of particles dispersed in a standardized Hartmann tube setup. This preliminary analysis was focused on the characterization of biphasic turbulent flows within this equipment

in order to study the influence of flow conditions on the agglomeration dynamics. Due to the apparent worsening effects of agglomerates, this study was focused mainly on sub-micronic particles in order to catch relevant phenomena from an industrial safety perspective. The study of dispersion of solid particles inside the Hartmann tube also analyzed the homogeneity assumption defined for experimental characterization of solid combustible materials in order to evaluate the performance of the equipment designed for this purpose. The results evidenced a homogeneous distribution at the bottom of the apparatus and partial concentrations at intermediate locations of the equipment that establish the importance of location of the ignition sources.

T4-E.2 MODELING THE RISK DUE TO INCREASED IMPORTS OF FRESH PRODUCE FROM EMERGING SUPPLY SOURCES TO THE UK

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This paper uses a bio-economic approach to draw inferences about the risk from future import volumes of fresh produce in the UK from emerging supply countries. The study conducts two simulations: (1) forecasting interceptions from future import volumes of fresh produce, and (2) examining the costs and benefits of restricting imports to avoid incursions. The paper adopts a modelling approach which combines estimates of future import volumes with the marginal risk of interception to make country-specific predictions of future interceptions. The marginal rate of interception (used as a proxy for the future rates of species arrivals) were derived from a bio-economic model which links the number of species arrival to the volume of imports. If the predicted increase in exports were spread proportionately amongst current suppliers, and the present UK inspection regimes remain fixed, simulation results suggest that countries such as Kenya, Egypt, Ghana, S. Africa and Zambia could become major sources of future interceptions. However, crude restrictions on imports to avoid plant pests are not desirable based on poor benefit-cost results.

T3-D.4 DEFICITS ON RISK ASSESSMENT OF RADIOACTIVE MATERIALS

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For the first time history, the Japanese experienced an accident of radioactive materials' emission from a damaged nuclear power plant.. The risk assessment on human exposure for radioactive materials could not fulfill its purpose. The author pursues reasons behind this failure with two examples. One example is that risk assessors could not utilize an early-warning system SPEEDI (System for Prediction of Environmental Emergency Dose Information), which can simulate spatio-temporal dynamics of radioactive materials. The government failed to disclose information on the simulation results to the public, and missed out on the timing of announcement for people in a higher risk area to evacuate. This was partly because risk assessors hesitated to inform the simulation results with uncertainty, being afraid of public misunderstanding and social disorder. The other example is the deficit in Food Safety Commission (FSC) in Japan, which was requested to decide an upper limit value of radiation exposure via food. FSC gave up proposing the value, "due to lack of dose-response data at a very low dose of radiation". In other words, FSC abandoned the introduction of an assumption, e.g., a linear non-threshold theory. This might be because FSC thought they should not express their ideas beyond academic science, even though they were risk assessors. The author finds the importance of regulatory science in order to cope with these deficits. Our society has been lacking regulatory scientists who could understand when/how to open predicted results to the public and interpret meaning of assumption and uncertainty for the predicted results. The importance of estimations and projections based on scientific knowledge, here we call them regulatory rules, should be more recognized to the public. The rules enable to facilitate transparent decision making under various kinds of uncertainty and time constraint.

F1-C.3 DEVELOPING ROBUST RISK ASSESSMENT METHODOLOGY FOR REGULATION OF GMOS IN AUSTRALIA

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In Australia, the Gene Technology Act 2000 provides the legislative context for the use of risk analysis in regulating activities with genetically modified organisms (GMOs). The object of the legislation is to protect the health and safety of people, and to protect the environment, by identifying risks posed by or as a result of gene technology, and by managing those risks through regulating certain dealings with GMOs. In particular, the legislation mandates preparation of a risk assessment and risk management plan in consideration of a licence application for GMOs. Licences are required for proposed releases into the environment, and for certain dealings with GMOs in containment facilities. The Gene Technology Regulator has developed a Risk Analysis Framework that guides the assessment of GMOs. This presentation will provide case studies that show the versatility and robustness of the Gene Technology Regulator's approach to risk assessment for different types of GMO with different novel properties.

F2-A.2 HOW DO WE ANALYZE GLOBAL CATASTROPHIC RISKS RATIONALLY? CLIMATE CHANGE AND EXPECTED UTILITY MAXIMIZATION

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More than two decades ago, I published a paper (Social Choice and Welfare 1991) entitled Should we be very cautious or extremely cautious on measures that may involve our destruction?".

W3-D.3A APPLICATION AND POLICY IMPLICATION OF QUANTITATIVE MICROBIAL RISK ASSESSMENT IN DEVELOPING COUNTRIES

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The development of QMRA and its application are seen mainly in developed countries whereas they are still at an early stage in developing countries. However there is a good potential that QMRA can be used more extensively in training and research and to set the standard of water quality and food safety in developing countries. This presentation highlights how training and research on QMRA have been done in Vietnam. As little trainings on risk assessment in general and no training on QMRA were available in Vietnam, we developed a training course of QMRA by gathering existing QMRA trainings, contextualizing and adapting them to the local context. The resulting course teaches participants about the concept of risk analysis, the steps of a QMRA, and how to implement these steps as well as risk communication and management. A first one-week training course was successfully organized. Risk related to wastewater reuse in agriculture and food safety was assessed using QMRA in Vietnam, Thailand and Ivory Coast. Diverse scenarios of exposure to wastewater when working with wastewater for agriculture and consumption of pork meat have been studied to quantify health risk. The results showed that water and vegetables were heavily contaminated with pathogens and risk was high in tested scenarios and largely exceeded the acceptable level set by WHO. Results identified the most critical points where risk is important and intervention can be focused. Findings can serve to improve policy and practices on waste reuse. QMRA training course has been recognised by health staff, lecturers, researchers, and policymakers at the MOH as a useful tool that provides scientific evidence for decision-making and risk management. Thus a book on QMRA was published in Vietnamese with support of MOH and WHO. University has adapted the health risk assessment course for undergraduate and graduate public health students. Other initiatives are going on to increase QMRA research activities.

P2.6 QUANTITATIVE MICROBIAL RISK ASSESSMENT: RESEARCH STATUS AND FUTURE DEVELOPMENT

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Quantitative Microbial Risk Assessment (QMRA) is much more developed and applied in developed countries than in developing world although risk assessment of pathogen exposure is increased in developing countries due to the unhygienic condition and (re)emerging infectious diseases. However, QMRA needs further methodological development to improve its usefulness. We argue that promoting the use and development of QMRA in developing countries and identifying its methodological gaps to be filled in future are needed. This paper aims to have an overview on the usage of this method in scientific community worldwide and discuss possible directions for the application and research of QMRA. We

systematically searched peer-reviewed publication on QMRA from until December 2011. We found 463 papers related to QMRA but the majority of these (91%) were published in the 2000s. Only 3.5% of the papers were published by authors from developing countries, meaning that this method is developed and extensively used in developed world, in particular US, Europe and Australia. QMRA has been applied mainly in the domain of food (54.2%) and water (9.5%, mostly for drinking water) and less focused on sanitation (6.5%), waste and recreational water and others. The number of studies on dose-response assessment increases, whereas information on exposure assessment is limited and relies mainly on assumption. Application of statistics and integration of parameters such as exposure time, age and immunity of the host into the dose-response model is observed. However, dose-response models need to be developed for other remaining pathogens, in particular new emerging infectious diseases and further studies on exposures needed. Researchers from developing countries would need to be more proactive in using and developing QMRA in partnership with experienced researchers from developed countries.

T3-E.5 AN EXPERIMENTAL INTERACTIVE RISK COMMUNICATION ON THE EFFECTS OF RADIOACTIVE SUBSTANCES ON HEALTH THROUGH FOOD

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Risk communication, an interactive process of exchange of information and opinions on risk among stakeholders, is the most important element in risk analysis. However, we have no effective model of interactive risk communication yet. In the present study, we tried to develop an experimental model of interactive risk communication, using as a topic the effect of radioactive substances on health through food related to the accident at Fukushima Daiichi nuclear power plant in Japan in 2011. Our model of interactive risk communication consists of two stages: the first stage is for making basic scientific information responded to questions of public based on "focus group discussions", and the second stage is for the disseminating of this basic scientific information. We experimentally carried out the first stage. The steps were as follows: 1) scientists and communicators make first-step basic scientific information, 2) communicators let some groups discuss this information, 3) scientists and communicators make second-step basic scientific information that responds to critical questions on the first-step scientific information from the group discussions, 4) communicators let the same groups discuss the second-step information, 5) finally, the second-step information is updated. The essential elements of interactive communication and better understanding of scientific information are considered in this model to be as follows: not aiming at achieving a consensus of public opinion; leaving the public understanding of scientific information to discussion among the publics; organizing one group with six or seven members of the public for closer exchange of opinions with each other, and providing scientific information in a step-by step manner to answer people's questions.

W4-B.2 WHAT DOES SUSTAINABLE REMEDIATION MEAN TO US? IMPLICATIONS FOR RISK COMMUNICATION

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There are 80 000 potentially contaminated sites identified in Sweden, and the cost for remediating the most severe ones is estimated to ~60 billion SEK. The Swedish environmental quality objective "A non-toxic environment", which is guiding the controlling authorities, is prioritising removal of contaminants over other types of risk reduction. Construction companies who are redeveloping contaminated land are dependent on quick solutions and no stigma effects, thus prioritising alternatives that might be costly but non-risky. While a risk-based approach would suggest an adoption of a variety of remediation options, excavation and disposal is the most common practice today and furthermore, remediation even below acceptable risk levels is sometimes carried out. Remediation efforts have traditionally been viewed as a sustainable action in itself. Today this is being questioned since remedial activities may also cause negative impacts, e.g. transport emissions and fatality risks, health risks during remediation, consumption of energy and materials. On-going research is developing a practical tool which allows for sustainability appraisal of remediation alternatives, including assessment of impacts and risks in the ecological, economic and socio-cultural domains. To make the tool applicable and effective as a basis for decisions, focus group meetings were carried out to investigate the attitudes and opinions of the general public, authorities and experts about contaminated sites, sustainable remediation and project risks. In total, six meetings in both rural and urban regions in Sweden were carried out. Besides testing the relevance of criteria to use in sustainability appraisals of remediation alternatives, the meetings also provided an increased knowledge on how the general public relate to contaminated sites and what they value. This has implications for how information and communication on sustainable and risk-based management of contaminated sites should be formed.

W4-E.2 FORESIGHT AND INTELLIGENCE FOR ANIMAL BIOSECURITY

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Early in 2003, the Australian Government Department of Agriculture, Fisheries and Forestry (DAFF) initiated a 'pilot' foresight program in animal health. The program started with a series of three two-day workshops that explored of foresight and futures tolls and approaches. These workshops have been repeated annually since then and expose participants to a range of tools (including the futures triangle, backcasting, environmental scanning, causal layered analysis) that can help to improve strategic planning (or 'anticipatory policy planning'). One intention was to lift planning horizons from the three-day 'reactive' response and three-month 'tactical' focus (that tend to dominate organisational planning and operations) to a focus on what might be coming in the next 5 to 10 years so that policy-makers can determine what needs to do now to be best prepared to meet these challenges (i.e. designing coping strategies to improve resilience — 'what is important is not predicting what will happen, but being more prepared to engage with whatever may happen').

DAFF developed a research project with the Australian Centre of Excellence in Risk Analysis (ACERA) on 'intelligence-gathering and analysis' in animal health to complement and extend these activities. The project also included a network analysis of an avian influenza e-mail list that has operated from DAFF since early 2004 and the development of a semi-automated intelligence-gathering system and associated website on diseases of aquatic animals (see website at: http://aquatichealth.net/) that is now being extended to other areas, including plant health.

This presentation outlines the development of foresight and intelligence for animal biosecurity in DAFF, explores similar developments in a range of organisations in other countries, and describes how improved foresight and intelligence can enhance policy development and the delivery of biosecurity services.

W1-A.1 RISK PERCEPTIONS, CAUSAL THINKING, AND POLICY PREFERENCES FOR CLIMATE CHANGE: A SIX NATION SURVEY

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Few comparative international studies describe the climate change policies people are willing to support and the reasons for their support of different policies. Using survey data from 664 economics and business undergraduates in Austria, Bangladesh, Finland, Germany, Norway, and the United States, we explore how perceived risk characteristics and mental models of climate change influence support for policy alternatives. General green policies such as funding research on renewable technologies and planting trees were the overwhelmingly most popular policy alternatives. Around half the students support carbon reduction policies such as requiring higher car fuel efficiency and increasing taxes on fossil fuels. Least popular were engineering alternatives such as fertilizing the oceans and replacing fossil fuels with nuclear power. Variations among nations are generally small. Support for different policy alternatives corresponds with different patterns of risk perceptions. Those who hold a pollution model of the causes of climate change, tend to blame environmental harms (e.g., air pollution from toxic chemicals), see general green policy alternatives as effective, and support general green policies. Support of carbon reduction strategies is associated with seeing carbon emissions as the cause and reducing carbon emissions as

effective solutions. Support of engineering solutions increases with identifying volcanoes among causes and regarding engineering solutions as effective. Although these international students agree that climate change is a threatening problem, their causal thinking about climate change risks correlates with support for different mitigation policy actions, with the most popular ones not necessarily the most effective. Differences between countries are small with few exceptions, such as the higher dread level of the Bangladeshi respondents.

F1-B.2 LONG-RUN EFFECT OF A DISASTER: STRUCTURAL DECOMPOSITION ANALYSIS

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In 1995, the Kobe Earthquake occurred in the second largest economic region of Japan, and its economic damages were accounted around 10 trillion yen. A catastrophic event in this magnitude would have surely created some long-run effects to the regional economy as well as to the surrounding regions. In addition, the recovery and reconstruction activities would have affected the economic structure of the region and interdependencies between regions. While these long-run economic effects may have become sizable, few studies have conducted to empirically measure such effects, due to the significant noises in economic data disturbed by macroeconomic influences from the outside. This paper presents an empirical investigation of long-run economic effects of the Kobe earthquake, using structural analysis methods. The results indicate significant changes in economic structure of the Kobe economy, and the changes are quite different across sectors and among factors. An additional investigation using shift-share analysis yields the regional specific changes; however, the corresponding decomposed factors of structural analysis with shift-share results appear complicated, and the difficulties to factor out earthquake specific effects exist.

T3-D.3 DEFICITS ON RISK MANAGEMENT OF RADIOACTIVE SUBSTANCES IN FOOD.

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Japan government decided on the interim regulatory limits in food on March 17 2011 after the nuclear power plant accident on March 12-14. The deficits on risk management were swelling of the distrust of governmental risk management, victims' discrimination, and harmful rumors to many foods in disaster area. The people's disaffections to food safety were that (1) government did not inspect cesium contamination in "all food", and that (2) regulatory limits appeared to be too high. The disaffection (1) was attributed to that the purpose of food inspection was not understood for both public and risk manager, and that the magnitude of health risk was not assessed. Moreover, the lack of risk assessment was caused by the lack of cooperation between risk assessment and management organizations, and by the segmentation between management organizations of internal exposure and external exposure. The disaffection (2) was attributed to that people felt that the regulatory limits were raised suddenly after the accident. Although that was not right in fact because there were no regulatory limits in food previously, the radiation tolerance limit (2 mSv/year for 131I and 5 mSv/year for 134,137Cs) seemed to have been raised suddenly compared with the 1 mSv/year at the ordinary situation. It was hard to understand the difference between ordinary situation and emergency situation. Furthermore, the disaffection (2) was attributed to that government failed to explain reasonably the basis of regulatory limits at the emergency situation. The basis of deriving regulatory limit was highly complicated and differed from other field of deriving regulatory standard such as pesticide residue, heavy metals in food, and chemicals in drinking water. That is, proper risk communication was difficult under the present risk management system. I will discuss above factors of risk management deficit by reference to the IRGC report "Risk Governance Deficits".

W4-D.3 QMRA IN PLANNING AND DECISION MAKING PROCESSES: SUSTAINABLE DEVELOPMENT AND URBAN WATER SYSTEMS

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Sustainable development must take into account economic, social and environmental aspects; however, one important but often neglected aspect is health and hygiene. Best management practices (BMPs) are those that best attain all of the above mentioned aspects. One helpful tool in order to integrate hygiene in BMPs is quantitative microbial risk assessment (QMRA) for the calculation of health-based targets to provide decision support from a public health point of view. This paper outlines how QMRA can be used in the planning process (in order to prevent unsustainable systems at an early stage) as well as decision support in a scenario analysis to determine the relative risk between different options and compared to a reference scenario.

T2-AB.4 PROACTIVE ECOLOGICAL RISK GOVERNANCE: MULTI-STAKEHOLDER EXERCISES ON SYNTHETIC BIOLOGY APPLICATIONS

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This talk presents the results of risk governance exercises on near term synthetic biology applications, including an E. coli-based arsenic detector, a re-engineered E. coli chassis intended to reduce horizontal gene flow, and a re-engineered version of cyanobacteria designed to produce sugars and fuels. Synthetic biologists, environmental microbiologists, regulators and civil society met at the Smithsonian Woodrow Wilson Center to evaluate ecological risks associated with applications, to promote redesign of organisms to reduce risks, to flag key sources of uncertainty, and to design tests to generate information on policy relevant sources of uncertainty.

W2-B.5 EXPLORING THE RISKS AND BENEFITS OF VISITS TO MARINE ENVIRONMENTS: COMPARING EXPERT AND VISITOR PERCEPTIONS

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Intertidal marine environments are important because they provide essential benefits to ecosystems (e.g., nurseries and habitats for a vast range of species) and human well-being (e.g., opportunities for outdoor exercise with mental and physical health benefits). However, human activities, especially in densely populated areas, may endanger the habitat and compound other risks that already threaten this environment, such as climate change. To our knowledge, the present research is the first to explore jointly the risks and benefits associated with human leisure activities in intertidal zones. Two studies examined perceived frequency and impact of different activities on the environment and on the visitors. We used expert samples (local wardens and international academics) and compared their views with those of the general public, specifically regular visitors. In both samples visits to rocky shores were perceived to have benefits to emotional well-being in visitors. Experts stressed the detrimental effects of specific exploratory behaviour (e.g., 'rockpooling') on the environment, whereas visitors highlighted the detrimental impact of litter. Current research extends the findings by investigating actual behaviour in this environment. Together the findings will allow us to make recommendations for the governance and management of intertidal zones by identifying activities that are highly beneficial to visitors yet have low impact on the environment. This research was funded by an ESRC/NERC interdisciplinary doctoral studentship awarded to the second author.

W3-C.3 HOLISTIC RISK MANAGEMENT OF ATYPICAL ACCIDENT SCENARIOS

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Several of the major accidents that occurred in Europe in recent years showed unexpected scenarios not considered by their site safety reports, such as the accidents at Toulouse (France) in 2001 and Buncefield (United Kingdom) in 2005. This contribution tackles this emerging risk of "atypical" accident scenarios, not captured by standard risk assessment because deviating from normal expectations, which has been firstly introduced by the EC project iNTeg-Risk. A synergy of tools developed or used within the this project is adopted as way of prevention of atypical accident scenarios. Lessons learned, recommendations and the new methodology DyPASI (Dynamic Procedure for Atypical Scenarios Identification) is completed by the REWI (Resilience based Early Warning Indicators) method. The first technique is built for the identification of atypical scenarios and is based on systematization of information from early warnings, represented by past events, near misses and in-depth studies related to the industrial process considered. The second one is a proactive methodology for the development of resilience based early warning indicators and can unveil early deviations in the casual chain of potential accident scenarios. The

composition of the two represents an advanced approach to tackle this topical issue from different slants for a more complete result. However, the core of the whole project is always kept as a reference point: the Emerging Risk Management Framework (ERMF), defined to provide the basis for integration of the research and management activities in the area of emerging risks.; ; This approach has been applied with the purpose to assess risk in new and emerging technologies, such as the cases of Carbon Capture and Sequestration or Liquid Natural Gas regasification, where relative lack of experience can possibly lead to atypical accident scenarios. The results produced are described in this contribution as demonstration of effectiveness of this new holistic approach.

W4-D.1 APPLICATION OF QMRA TO SELECT AMONG DRINKING WATER INTERVENTIONS IN THE DEVELOPING CONTEXT: INCORPORATING RELIABILITY AND COMPLIANCE RATES

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The aim of the study was to use Quantitative Microbial Risk Assessment (QMRA) as a decision support tool, by predicting the impact of different point-of-use drinking water interventions on the overall diarrheal disease burden in the developing context, without relying on assumed source water pathogen concentrations. The concepts of QMRA were applied to construct a framework for the calculations. The framework was then implemented in the construction of a mathematical model using Analytica® (Lumina Decisions Systems, Inc. version 4.3). For the case study setting of Nepal, epidemiologic information on the incidence of diarrhea and prevalence of different pathogenic agents were combined with treatment performance data from challenge testing for different technologies; infectivity data; and disease burden weightings, in order to prioritise intervention selection for the specific local setting. The model was run firstly under a baseline scenario; secondly with consideration of variable compliance rates; and thirdly with consideration of non-continual daily usage rates. The outputs of the model under each set of conditions are presented, and their applications for decision support are discussed. While the QMRA model provided unique, invaluable information to support the selection of interventions, the calculations were based on limited data. The robustness of the model output; and requirements for communicating the risk calculations and associated uncertainties to decision makers are discussed.

W2-B.4 TRAVELING TO THE OZONE HOLE THROUGH POLLUTED AIR: PERCEPTION OF ENVIRONMENTAL RISKS BY TOURISTS

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Air pollution and ozone depletion are environmental risks which are likely to have an impact on global tourism. However, little is known about how tourists perceive such risks when they consider traveling to an afflicted destination, and how tourists respond to environmental risks they encounter. We present a study examining two travel destinations with typical environmental risks: Australia with ozone depletion, and Bangkok with air pollution. We compared tourists who actually traveled to these destinations with non-travelers, that is, participants who only imagined a hypothetical journey. We examined if risk perceptions, emotional responses, and assessments of quality of life differ between actual travelers and non-travelers before making their journey, and after returning from the journey. A sample of 155 German tourists who traveled for the first time to Australia or Bangkok was compared with a matched sample of 55 non-travelers who had never traveled to Australia or Bangkok. Measurements were taken before and four weeks after travel. We found that non-travelers perceive the general risk at the destination to be higher than actual travelers. Travelers also indicated less negative emotions concerning the risks. Air pollution was judged to be more risky but less severe for humans than ozone depletion. Furthermore, we assessed several aspects of life quality, before and after traveling. We found that life satisfaction changes depending on whether one travels or not. Whereas satisfaction with the environment is higher for travelers than non-travelers before their journey, this difference disappears after their journey. In sum, results suggest that tourists who decided to travel perceive the risks as less severe than non-travelers. Results also suggest that an actual journey might change one's attitudes, and that the experience of environmental risks might serve as a new point of reference and trigger a re-evaluation of one's satisfaction with life.

W3-D.3B INFECTION RISKS OF DIARRHEA ASSOCIATED WITH WASTEWATER AND EXCRETA USE IN AGRICULTURE IN VIETNAM

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When untreated wastewater and excreta are used for agricultural production, enteric pathogens may be a primary hazard to human health through different routes of exposure, as in direct contact with wastewater and excreta while doing field work. A quantitative microbial risk assessment was conducted to predict the risk of diarrhoea related to the use of wastewater and excreta for agricultural production in Hanam province, Vietnam. A total of 173 wastewater and excreta samples were collected from 5 critical sampling points. Three pathogens were analyzed quantitatively: E. coli by the MPN and the protozoan parasites G. lamblia and C. parvum by immunofluorescent antibodies and microscopy. A survey with 235 households was conducted using a structured-questionnaire to assess people's exposure to wastewater and excreta. The most hazardous exposures included direct contact with the Nhue River and pond water, field water and composted excreta during field work. The highest mean concentration of diarrheagenic E. coli (DEC) (6.3 x 108 MPN/100 ml) and C. parvum (30 oocysts/100 ml) was in household sewage; whereas G. lamblia was highest in composted excreta (119 cysts/gram). Estimated annual infection risks in all the exposures were much higher than the commonly proposed thresholds of 10-4, the estimated annual risks of diarrhea values were at least 3-fold greater than maximal risk of 10-3 pppy; and the annual burden of diarrhoeal disease was extremely greater than the health target of 10-6 DALYs recommended by WHO. The assessment indicated exceeded risks for G. lamblia, C. parvum and DEC infections among people exposed to wastewater and excreta. Study results are useful in developing an integrated strategy for pathogen management and public health control in the agricultural settings where wastewater and excreta are intensively used as irrigation water sources and fertilisers and where household wastewater is freely discharged into irrigation channels.

F2-C.5 NETTING LIKELIHOODS

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Netting Likelihoods: The Resource Allocation project involves multiple, interacting pathways. Bayesian networks are a convenient representation, but we have had to make multiple nets work together to represent the whole system.

F4-B.1 QUALITATIVE OCCUPATIONAL RISK ASSESSMENT MODEL – A FUZZY APPROACH

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When conducting ORA (occupational risk assessment), there is often inadequate data or imprecise information available and safety practices encountered at construction sites are as variable as the sites themselves. The use of quantitative occupational risk assessment models based on probabilistic techniques, using data collected at different construction sites and in various types of construction projects can lead to distorted results and do not reflect the reality of the site under analysis. Several authors have discussed the limitations of probabilistic methods for ORA and stated that the kinds of uncertainties include scarce or incomplete data, measurement error, data obtained from expert judgment, or subjective interpretation of available information cannot be treated solely by traditional statistical or probabilistic methods. Probabilistic ORA methods are not objective: it simply fails to acknowledge its subjectivity. By other hand, man is capable of abstracting, thinking and reasoning, thus, can assess the risks without having necessarily to experience their consequences. Safety cannot genuinely be improved only by looking to the past and taking precautions against the accidents that have happened, it must also look to the future. The use of Fuzzy Set Theory (FST) may help to produce more realistic representations and solutions, because FST presents a natural way of modelling the intrinsic vagueness and imprecision of everyday concepts by providing a very precise approach for dealing with uncertainty which grows out of the complexity of human behaviour and enable us to produce more realistic models that can get better

results and allows the inclusion of human creativity and intuition, which is an essential ingredient for successful ORA. The objective of this paper is to present the capabilities and limitations of the new developed fuzzy QRAM (Qualitative Risk Assessment Model) to assess safety risks on construction industry.

W3-E.1 THE DEVOLVED MANAGEMENT OF RISK: NEW RISKS, NEW RISK MANAGERS

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Under localism, power is transferred from the State to organisations, communities and citizens[1]. Its acceleration poses significant implications for the management of public risk; historically a role for central government[2]. Responsibilities for risk management will be shared widely between civic society, social enterprises and businesses, with government retaining a role in identifying risks, examining credible futures and exploring mechanisms for sharing risk and cost. Fundamental challenges exist on risk and responsibility; on roles for government and its agencies in the management of risk; for the 'firm'; for citizens; and the coherent management of risk to and from environmental systems.

This presentation will address the themes of: (i) managing systemic risk in technological and natural systems; (ii) future trajectories for regulating the low carbon economy; (iii) how accountabilities for shared risk governance can be enhanced; and (iv) practical tools for the analysis of environmental futures. For example, 'networked risk' now compromises infrastructure resilience through unforeseen knock-on impacts [3]. System oversight is critical because latent flaws within engineered systems, and the organisations that manage them, are known sources of failure [4]. Environmental regulation will become more risk-informed and facilitative in style. For the low carbon economy, new processes (e.g. CCS, nanomanufacturing) will pose new exposure pathways requiring analyses, engagement and regulatory oversight. The expectations of devolved environmental risk governance have not been articulated. We anticipate a need for greater capacity in local decision-making and a clear sense of agency for new risks among new devolved risk managers. References: (1) Cabinet Office (2010) Building a stronger civil society, London; (2) Risk and Regulation Advisory Council (2009) Response with responsibility, London; (3) Barker K & Santos J.R (2010) Risk Anal. 30: 962-974; (4) Reason, J. (1997) Managing the risks of organizational accidents, Ashgate, Aldershot.

T4-B.1 INCORPORATING METAGENOMICS INTO PUBLIC HEALTH DECISIONS: ANTIBIOTIC RESISTANCE IN PUGET SOUND, WA

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Human impacts on marine ecosystems that have direct relevance to human health are increasing on both spatial and temporal scales. Traditional indicators for environmental health monitoring and microbial risk assessment have relied on single species and provide limited spatial and temporal information. More high-throughput, community-level approaches to evaluate these impacts are therefore needed to inform public health. Metagenomics, or the direct sequencing of DNA from environmental samples, allows for access to the complete genomic information from microbial communities. We collected metagenomic DNA from a number of different locations within the Puget Sound estuary in Washington State, USA and used next generation sequencing to generate sequence data for bioinformatic analyses. We analyzed the data for evidence of antibiotic resistance determinants using a public health specific analytical dashboard. The results were then incorporated into a public health translational framework to inform adaptive monitoring and management of resistance determinants in the environment.

P2.7 THE INFLUENCE OF FLOW RATES CALCULATION METHODS ON INDIVIDUAL RISK ASSESSMENT OF ETHANOL PIPELINES

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In Brazil the requirement for major hazards risk assessment in the environmental licensing process was established in 1986, by the first resolution of National Environmental Council (CONAMA). Methodologies for qualitative and quantitative major hazards risk assessment for the industrial sites have been established in guidelines since then. However methods for evaluate the physical effects for liquid pipelines during the consequences step are not standardized, complicating comparisons between risks from similar pipelines. This lack of uniformity is further aggravated by the models of physical effects normally used in the quantitative risk analysis, which do not have appropriated codes to determine flow rates of hydraulic columns in the irregular topographies. Additionally the use of ethanol in Brazil has expanded, increasing the number of environmental licensing process of pipelines to transport this fuel. In this research was analyzed the impact caused by the use of different calculation methods for determining hydraulic columns flow rates due the leakages caused by catastrophic rupture and holes scenarios in a quantitative risk analysis of ethanol pipelines. It was considered constant flow rates scenarios and transient flow rates scenarios over time. To obtain the flow rates were considered scenarios with and without the system head loss. The purpose of this research was evaluating the relevance of each calculation method in the individual risk assessment of ethanol pipeline systems. In addition was identified the possibility of use simplified calculation methods for the environmental licensing process of liquid pipelines.

F3-E.3 THE IMPORTANCE OF CHEMICAL REACTIVITY IN QUANTITATIVE RISK ASSESSMENT FOR THE ENVIRONMENTAL LICENSING IN BRAZIL

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In Brazil, mechanisms to prevent industrial accidents have been established since Vila Soco accident, occurred in San Pablo state on 80's. After this event environmental agencies, such as Cetesb (San Paulo), FEPAM (Rio Grande do Sul), INEMA (Bahia), INEA (Rio de Janeiro), among others, have adopted the quantitative risk assessment of major hazards accidents as a decision tool during the environmental licensing process of industrial and pipeline transportation systems for chemical hazardous substances. As a result of this some environmental agencies have been published standards and technical manuals containing methodologies to be considered for development of quantitative risk assessment. These methodologies consist in evaluate individual and social risks according to criteria established by each Brazilian environmental agency. During the environmental licensing these methodologies have been focused on loss of containment of chemical substances presents in the industrial sites, and the physical effects from the interaction between different chemical substances in the same industrial site is usually not identified. However, major hazards accidents such as Seveso, occurred in 1976 in Italy, and Bhopal, occurred in 1984 in India, make clear the potential damages of the physical effects arising from the interaction between different chemical substances. This study aims to elucidate the importance of the reactivity analysis between different chemical substances present in the same industrial site. This study consisted in a quantitative risk assessment using the techniques of PHA and HAZOP to identify potential situations risk, and a reactivity analysis from the chemical substances taking into account the possibility of contact between them. The individual and social risks were calculated based on damages from loss of containment and substances originated from the chemical interactions, considering the frequencies of these events.

F3-D.1 QUALITATIVE INDUSTRIAL HYGIENE RISK ASSESSMENT – A BASIC TOOL FOR RISK CONTROL AT WORKPLACE

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The Industrial Hygiene profession needs a comprehensive and systematic approach to assess and control occupational risks. These risks span several occupational health and safety disciplines, emphasized by multiple international occupational health research programs that include slips, trips and falls, electrocution, noise, thermal stress, indoor air quality (IAQ), bio-hazards, welding fumes, and musculoskeletal disorders. The Qualitative Industrial Hygiene Risk Assessment (QIHRA) is a tool used to evaluate and prioritize the risk of exposure to physical, chemical, ergonomic as well as biological hazards in the workplace. The QIHRA approach goes beyond routine observation-based occupational exposure assessments to systematically review the workplace hazards and evaluate the exposure risks. Interaction with employees, employee supervisor is vital in assessing risk level qualitatively and becomes a basis for the need to conduct quantitative risk assessments. British Standard (BS) OHSAS 18001 (occupational health and safety management systems) is particularly of interest to companies providing products or services that could represent health and safety hazards for the people working at said companies. As

part of risk assessments in the workplace, all processes must be evaluated in terms of potential health risks, and suitable measures must be taken to reduce these risks to a reasonable and controllable level. Employee awareness on health, safety, security, and environment (HSSE) is a valuable tool and one of the risk mitigation and risk communication methods used by organizations in addressing risk control measures adopted. To ensure success in the business basic awareness programs be provided to a wide variety of employees and multiple levels of groups. The use of QIHRA is becoming popular among employers. It is a challenge to an industrial hygienist to build rapport with employees as well as employers to associate and involve them in qualitative risk assessment.

W3-E.4 LOOKING INTO THE FUTURE: CHALLENGES TO THE SUCCESSFUL INTEGRATION OF RISK AND FORESIGHT MODELS

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The distinctive qualities of environmental foresight research have impacted on the understanding, uptake and use of its outputs by strategic, decision-makers, particularly in the public sector. Foresight research often uses unusual or controversial language, mixes qualitative and quantitative data, and makes assumptions from, what some consider as, too few facts. Furthermore, foresight has often suffered from a supposition that futures research methods are too creative and imaginative to provide useful evidence[1]. Therefore, foresight uptake has been variable in sectors where more conventional methods of evidence-based decision-making are the norm and where risk assessment tools are well characterised and used[2].

Using horizon scanning tools, foresight analysts undertake "The systematic examination of potential threats, opportunities and likely future developments which are at the margins of current thinking and planning" (Defra, 2002). Environmental horizon scanning can generate 100s of potential risks for analysis. However, challenges arise when these results are filtered by decision-makers to determine 'What are the potential future risks that my organisation needs to spend resources understanding and preparing for?'

This presentation provides a discussion of how the synergies between foresight and risk analysis tools can be identified and used to enhance the evidence-based environmental decision-making process to help risk mature organisations: (i) identify those potential future risks which need further analysis; (ii) prepare for events that may happen in the future, which are uncertain and not necessarily under their control, and; (iii) gain the efficiencies required in a resource constrained environment, by ensuring that policies and strategies are robust and resilient over time. [1] Defra (2006). Looking Back at Looking Forwards, Defra, London [2] Prpich G., et al. (2011). Character of Environmental Harms: Overcoming Implementation Challenges with Policy Makers and Regulators. Env. Sci. Tech.

F4-A.2 REGULATION OF GMOS IN MALAYSIA

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The domestic regulatory instrument for modern biotechnology in Malaysia is the Biosafety Act 2007 and it was enforced on 1 December 2009. The scope of the Act is to regulate living modified organisms (LMO) and products of such organisms for the purposes of release, import, export and contained use. This law is aligned to the provisions of the Cartagena Protocol on Biosafety. As such risk assessment is required before a decision is made for any activity regulated under the law. In addition, a risk management strategy as well as an emergency response plan must be provided for the assessment to be carried out. The ultimate goal is to protect human, plant, animal health, the environment and biological diversity from any possible risks of modern biotechnology activities. Malaysia faces a delicate balancing act, whereby the country is moving forward devoutly is its pursuit to gain the maximum benefit from modern biotechnology but at the same time minimizing risks to the environment and health. This is clearly seen from the recent field trial of genetically modified mosquito which had taken place in Malaysia. Dengue is a serious problem in Malaysia with increasing number of deaths and the cost of medication due to dengue. New technologies are explored to address the urgent need to strengthen the integrated pest management programme. Based on internationally recognized standards and practices for risk assessment, a novel activity such as a field trial on GM mosquito was evaluated. A rigorous risk management mechanism was set in place to ensure that risks were managed effectively. Implementation in phases was also one of the strategies to ensure that with experience gained, a larger scale release may be reassessed with more confidence. Public consultation proved to be a critical component that must be carried out in an effective manner with enough time provided for all queries to be given due consideration and to be appropriately answered.

F2-B.3 PROGRESSION OF PSYCHOLOGICAL TYPHOON EYE IN THE 2008 WENCHUAN EARTHQUAKE

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On May 12, 2008, an earthquake measuring 8.0 on the Richter scale jolted Wenchuan, China, leading to 69,227 deaths and 374,643 injured, with 17,923 listed as missing as of Sept. 25, 2008, and shook the whole nation. We assessed the devastating effects on people's post-earthquake concern about safety and health. We conducted three sequential surveys of 7,478 residents on their post-earthquake concern about safety and health in non-devastated and devastated areas in June-July, September-October 2008 and April-May 2009. Residents in non-devastated areas (Fujian and Hunan Provinces, and Beijing) and devastated areas (Sichuan and Gansu Provinces) responded to a questionnaire of 5 questions regarding safety measures, epidemic disease, medical workers, psychological workers, and medication. A MANCOVA showed a significant inverse effect of residential devastation level on the estimated number of medical and psychological workers needed, the estimated probability of an epidemic outbreak, and the estimated number of self-protective behaviors needed.

F1-C.1APVMA REGULATORY STRATEGY FOR NANOMATERIALS

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The Australian Pesticides and Veterinary Medicines Authority (APVMA) is the national regulator of agricultural and veterinary (agvet) chemicals in Australia. This role includes the responsibility for ensuring that pesticides and veterinary medicines which contain, or are enabled by, nanomaterials are safe for people and the environment. The uptake of chemical nanoproducts in the agricultural and animal health sectors has been slow to date. However, many nanosized agvet chemicals are at the research and development stage. The APVMA has reviewed the adequacy of its regulatory framework for agvet chemical products against the Commonwealth Government's "Review of the Possible Impacts on Nanotechnology on Australia's Regulatory Framework". The APVMA's existing regulatory framework is considered adequate for nanomaterials, albeit with relatively minor amendments. Importantly, the existing legislation has provisions for assessing the conventional form and the nanoform of agvet chemical products as distinct chemical entities. However, the challenge of applying the existing regulatory framework is likely to increase as more sophisticated materials are developed. The APVMA also continues to develop a preparedness strategy for regulating products of nanotechnologies. As our understanding of the link between physicochemical properties of materials and their biological behaviour increases, a reduced focus on physical dimensions and an increased focus on the properties and functionalities of nanomamterials is likely. The APVMA is also adopting a project management approach involving pre-submission meetings with companies at an early stage of product development to assist with nanoregulation. This presentation will highlight the salient features of the strategy with emphasis on risk analysis aspects.

W2-E.3 MEASURING RISK EXPOSURE WHEN USING GLOBAL SUPPLIERS

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Global product manufacturers continue to go to the far ends of the world to find the most cost-effective suppliers. However, many consumer product industries must comply with diverse safety regulations from different countries, particularly in the United States and within the European Union, and manufacturing standards differ significantly in different parts of the world. Despite the number of regulations, with tens of thousands of chemicals in commerce, companies must manage risks for unregulated or ambiguously regulated materials that nonetheless could pose real or perceived risks to consumers. Safety as-

sessments will often include some uncertainty depending on the level of product testing that a company does. For example, it is very difficult to precisely estimate consumer exposure to complex materials with numerous chemicals. Also, publicly available toxicity information varies widely among chemicals. Solutions for managing these diverse risks are discussed.

W2-C.1 AN ORIENTATION FOR RISK MANAGERS FOR DEALING WITH EMERGING RISKS

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Emerging risks denote future threats where the potential losses as well as the probability distribution of their occurrence are either unknown or contested. Emerging risks may be further broken down into three distinct, but overlapping categories. These categories are described as follows: • Emerging technologies with emerging risk profile based on high uncertainty and lack of knowledge about potential impacts and interactions with the affected risk absorbing systems. Nanotechnology and many other new technological developments would fit that description. • Emerging technological systems with emerging interactions and systemic dependencies. The main issue here is the not the risk of the technologies (that may be known or well estimated) but the interactions of these risk (and also benefits) with other types of risks or activities that could lead to non-linear impacts and surprises. Examples here are biofuels, climate change impacts, all kind of IT-related risks, and critical infrastructure issues. • Established technologies in a new emerging context or environment: The main problem here is that familiar technologies are operated in a new context or in different organizational settings that may change both the probability as well as the magnitude of potential impacts. One could also include here risks driven by complacency and overconfidence on one's own ability to cope with sudden crisis. Conventional approaches to projecting loss size, relative frequencies or probability distributions over time or severity of consequences are usually ineffective if applied to emerging risks. Therefore, adaptability and flexibility are vital to manage emerging risks in terms of individual, social, and economic impacts. This paper aims at developing a conceptual orientation for risk managers to better address emerging risks and be better prepared for the challenges of the future.

F2-C.3 PERFORMANCE INDICATORS

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I will discuss the definition, measurement, statistical handling, and interpretation of a performance indicator that can be used by an inspectorate. The performance indicator comprises measures of inspectorate action that themselves have useful interpretations, and that should be a fundamental part of every inspectorate`s toolbox!

T3-B.4 RISK ASSESSMENT OF NEW TECHNOLOGIES: BRIDGING THE REGULATORY DIVIDE BETWEEN HIGH AND LOW INCOME COUNTRIES

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Do expensive risk assessments result in better decisions? Risk assessment of genetically modified organisms (GMOs) is used as the foundation of sound regulatory decision making in most countries. This includes both high income countries such as Australia and low income countries such as small developing countries in Central America. However, there exists considerable disparity in the regulatory capacity to evaluate risks from this rapidly advancing technology. Regulation of GMOs in Australia involves a dedicated agency with about 50 staff, of which more than dozen have PhDs. Risk analysis training is integral to the agency's operations. In small developing countries, GMO regulation relies on a few government staff largely unfamiliar with risk analysis and the unpaid services volunteered by a few national researchers struggling to sustain their own activities. GM plants approved for commercial release in Australia are intended to reduce crop production costs. In Honduras, the only country in Central America that has approved commercial GM crops, GMOs offer the potential to manage important crop pests and improve weed management practices (often done by women and children as unpaid labour) or the potential to slow the spread of rampant diseases such dengue fever (exacerbated by climate change), improve the nutritional value of staple food crops, and increase production to address chronic, widespread poverty. However, regulation has a high cost, especially when complying with international requirements that assume regulatory approaches in high income countries are necessary and appropriate for all. Consequently, capacity building activities may fail to provide enduring solutions. Additional approaches are required to allow local knowledge and skills to satisfy local and regional needs for sustainable development. These include online access to external knowledge and resources, adoption of regulatory decisions in other countries, use of checklists and other simple risk assessment tools, as well as regional sharing and outsourcing of risk assessments.

F2-D.2 A TRADE-OFF BETWEEN EXPECTED COSTS AND BENEFITS: THE 60 YEAR HISTORY OF NUCLEAR ENERGY

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Nuclear energy was developed to increase and diversify the electricity supply at an affordable price. The idea was also to substitute fossil fuels with nuclear energy in order to reduce emissions into the atmosphere. The success of this type of innovation depends upon several political and techno-economical variables which are characterised by high margins of uncertainty. In the case of nuclear power, one must also take into consideration the risk of a very serious accident, where socio-economic costs can be excessively high. The probability of occurrence of such an accident must then be very low. The trade-off between expected costs and benefits raised strong controversies and may explain the refusal of nuclear energy in some countries and its acceptance in other. Our article analyzes how this trade-off was made between the Windscale accident in England in 1957 and the Fukushima disaster in Japan in 2011. The key factors to examine are the probability of occurrence of a very serious accident, the estimation of its socio-economic costs and the techno-economical potential of nuclear power as a source of energy. We develop an historical analysis of risk assessment and perception based on a well defined conceptual framework. Two sources are used: several technical reports that made history in this field and a number of articles from English weekly revues. We carry out an interdisciplinary analysis taking into consideration the technical and socio-economical aspects. The originality of our article lies in the analysis of how the trade-off between expected costs and benefits was assessed and perceived in the past 60 years. In the aftermath of the Fukushima accident, which cast serious doubts on nuclear energy's future, we show that there are lessons to be learnt from the past.

W4-A.1 INSTITUTIONAL TRANSFORMATION TOWARD GLOBAL RISK AND ENERGY GOVERNANCE

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Contemporary societies are increasingly confronted with new challenges arising from energy risks. Although it is apparent that the global climate has changed due to our energy structures, the global demand for cheap energy is still growing. However, oil resources will run short in 25-30 years according international studies. Coal resources will run out 30 years later because we will use more coal to compensate oil that in turn aggravates CO2 emissions. These risks cause significant harm throughout the world because their scopes and effects go beyond national borders. Current global governance structures are lacking institutional, procedural and adaptive capacity to deal with these risks. They also fail to meet the new challenges of structural changes and a new distribution regarding renewable natural resources for energy generation. It requires a fundamental institutional transformation toward global risk and energy governance structures with a holistic and interdisciplinary approach taking into account the sustainable management of energy resources combined with climate protection. This significant institutional transformation addresses two core issues. First, existing international institutions which seem to be paralyzed by traditional approaches need to adapt themselves to a new, more active role in global energy and risk governance. They need to begin to transform themselves into sustainable and globally responsible public good providers with the capacity to influence domestic politics and the lives of every day citizens. Second, new governance institutions need to be designed which look fundamentally different than the intergov-

ernmental organizations with powerful states that traditionally dominate and control the international energy structures. New institutions need to constitute a new interplay between the states, experts, business and civil society via new forms of discourse and deliberation. It is however essential that traditional, new and climate protection institutions develop a dense network of global energy and risk governance.

W3-D.1 MOLECULAR TOOLS FOR DEVELOPING A RECREATIONAL QMRA

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The bio-contamination of water systems whether intentionally or through natural events remains a considerable challenge for assessment, response and remediation. Impact on the public by water contamination events generally effect a large portion of those exposed resulting in a range of illnesses and even death. Assessment and control of microbial threats relies on the ability to quickly ascertain the quality of the water and to address the exposure component in the Microbial Risk Assessment (MRA) paradigm. Molecular tools particularly methods like quantitative PCR (qPCR) have the ability to produce results rapidly, identifying and quantifying the hazard which can advance the decisions needed to determine water treatment and public health protection strategies. A new framework has been developed to include alternative indicators, microbial source tracking and pathogen monitoring particularly for protection of public beaches to address same day assessment of potential exposures. Public health laboratories are now being trained to use rapid qPCR tools for these beaches. In addition, during outbreak and contamination events sampling has provided information for the public and officials on the level of risk and remediation needs. Using qPCR data transport models for viruses were developed for two test beaches; Silver Beach in Saint Joseph, MI and Washington Park Beach in Michigan City, IN. A QMRA tool was then developed using a Java application. The software provides a graphic user interface, generates the pathogen concentration, estimating risk to children, adults and the combined population.

W4-D.4 UNCERTAINTIES IN THE APPLICATION OF QMRA WHEN PRIORITIZING DRINKING WATER INFRASTRUCTURE FOR COMMUNITIES LACKING SATISFACTORY WATER SUPPLIES

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Conceptually Quantitative Microbial Risk Assessment (QMRA) has enormous potential for improving the management of poor water supplies. QMRA can be used to estimate potential community pathogen risks and the benefits that may be obtained by providing improved supplies via different strategies and technologies. However, in practice this concept is more challenging and clear answers emerge less easily. Using case studies from South Africa, a QMRA framework was applied as part of assessing the impact of new water supply services in small rural communities. QMRA was used to estimate potential faecal contamination and container re-contamination and assess the microbial risk posed by drinking water stored in domestic containers, using 5 pathogenic strains of E. coli as indices. Numerous uncertainties were identified that impacted on the reliability of the risk estimates, and hence the value of the risk assessment process. It was unclear if human-virulent E. coli strains were identified by PCR/microarray analysis of specific genes, and what dose-response relationships to use when undertaking the QMRA. Additional limitations were also identified and are discussed including practical constraints to the collection of locally relevant data and the assessment of what constitutes 'tolerable water quality' when water quality is partially improved but still well below that in developed nations. To adequately address these uncertainties and to support the implementation of QMRA, there is a need for the development of principles and a practical framework for the ongoing harmonisation of QMRA methods and models that is relevant to both developed and developing regions. We suggest less emphasis on specific risk quantification, more use of sensitivity analysis, more focus on the relative merits of different management options and identification of hazardous events/scenarios that could provide tangible health benefits.

F1-C.4 MANAGING RISKS ASSOCIATED WITH MEDICINES

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The Australian community expects medicines in the marketplace to be safe, of high quality and of a standard at least equal to that of comparable countries. The Therapeutic Goods Administration (TGA) regulates therapeutic goods through: •pre-market assessment; •post-market monitoring and enforcement of standards; and •licensing of Australian manufacturers and verifying overseas manufacturers' compliance with the same standards as their Australian counterparts In assessing the level of risk, factors such as side effects, potential harm through prolonged use, toxicity and the seriousness of the medical condition for which the product is intended to be used, are all taken into account. For example, some blood pressure medications may include side effects such as a tickle in the throat or persistent cough, but this risk is outweighed by the proven benefits of reducing the risk of a heart attack or stroke. The level of TGA regulatory control increases with the level of risk the medicine or device can pose. Risk information is used by the TGA when deciding how to approve a medication for supply. For example, a low-risk product may be safely sold through supermarkets, while higher-risk products may only be supplied with a prescription. The TGA's approach to risk management involves: •identifying, assessing and evaluating the risks posed by therapeutic products •applying any measures necessary for treating the risks posed; and •monitoring and reviewing risks over time. The risk-benefit approach assures consumers that the products they take are safe for their intended use, while still providing access to products that are essential to their health needs.

F2-A.5 REGULATING GLOBAL CATASTROPHIC RISK

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Global catastrophic risks—like climate disruption, global warfare, ecological collapse, pandemic and disruptive emerging technologies—pose particular challenges for regulatory design, because they pair high stakes with limited information. What role does law have to play in identifying, managing, and responding to these risks? Which legal institutions should be responsible for managing global catastrophic risks, and should those institutions be local, national, or global? Should laws focus on global catastrophic risks as a category, or should regulatory strategies be tailored to the specifics of each risk? If tailoring is appropriate, what legal strategies are available for managing key global catastrophic risks, and what are the characteristics of circumstances where law is no longer helpful?

F3-E.6 BALANCING ECONOMIC, SOCIAL AND ENVIRONMENTAL ASPECTS - SUSTAINABILITY FAILURE AND THE TUNISIAN REVOLUTION

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The work of Ibn Khaldun on the philosophy of history and sociology continues to be a landmark of social thinking. Once again we witness the brilliant reflections on the meanings, trends and laws of society and the profound insights into the nature of social processes and interconnection of politics, economics, sociology and education that Ibn Khaldun once laid in his Muqaddimah (known as Prolegomenon in English). Facebook and other social networking tools have proved in this century the theory well established by Ibn Khaldun that Humans are social by nature. And that the concept of "generation" is well reiterated on. He once conceived a theory of "social conflict" that predicts the inevitable loss of power that occurs when marginalized citizens conquer the city of power. For him, human society is necessary since the individual acting alone could acquire neither the necessary food nor security. In honor of the Tunisian revolution and its reaffirmation of all these theories, I will be discussing sustainability as a crucial element to maintain the well being of humans as it interfaces with economics through social and ecological consequences of economic activities. Special focus will be on energy related issues as a common commodity for developing and developed countries alike and the challenges of a globalized economy for countries in developing stages with very limited natural resources (such as Tunisia, Egypt and the ones impacted by the so called "Arab Spring"). Traditionally, energy policies were focused mainly on urban and industrial development. The needs of rural households, farmers and small businesses were generally less of a priority. Regional disparities in combination of social, environmental, and market pressures

require the development of new perspectives on energy policies. I will discuss energy as it relates to economic development, social and environmental justice and the impact of its abundance or scarceness on sustainability.

W4-C.3 BIOGAS SAFETY AND REGULATION: OVERVIEW OF THE EUROPEAN SITUATION AND FUTURE NEEDS USING THE INTEG-RISK FRAMEWORK

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New energies are experiencing a great development in the world and particularly in Europe. The main purpose is to find an alternative energy replacing the fossil energy dependence which is more sustainable and reduce CO2 emissions. Biogas has a special major advantage: it reuses the waste as raw materials. The production of biogas is positioned as energy which can not only generate a source of energy known as green" but also which can recycle waste. In a context of sustainable development

P2.8 MANAGING RISKS: LESSONS FROM NATURE AND EVOLUTION

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Risk management has shown to be essential in evolution. The theory of the "survival of the fittest" is somewhat supported on the idea that only those that are able to understand and assess the dangers of the environment can make decisions that allows them to survive. Since the appearance of autotrophic animals (those who are capable of synthesizing energy from inorganic material) about three billion years ago, the driving force of evolution of living beings is the perfection their "risk management" skills to survive. In the modern world, risk management has become a key issue in almost any human activities. Many short and long-term strategies have been proposed and developed but little attention has been given to the lessons from evolution. Within this context, this paper presents a set of generalized principles from Nature and evolution that can be applied to risk management in engineering projects and enterprise-wide applications. The paper describes examples of resource allocation plans, information processing, as well as social structures that support responses and adaptation of living beings to changing environments and needs. For example, the paper formalizes the principle of human self-preservation, and transformation of the risk management strategies to respond to new needs and make predictions to manage more elaborated risks and threats. It is argued that by analogy, "bio-inspired" strategies for risk management can be used to handle risks more efficiently.

F2-D.1 ANALYSIS AND ASSESSMENT OF RISK IN AN INDUSTRIAL CHEMICAL PLANT

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The risk assessment for the safety of industrial plants with a gaseous mixture explosion hazard is very important. As a first step an industrial plant is divided into groups of modules, defined by their size, shape, and constructional properties. Then the relevant explosion scenarios are determined together with their frequency of occurrence. These include scenarios in which one module participates, as well as domino scenarios. The frequency is partly based on casuistry. In general, the risk associated at the presence of gaseous mixture as biogas, if generated in controlled conditions, is low. But a recent case teaches that incidents with gaseous mixture like this to occur. The example of a serious incident with gaseous hydrogen, methane, in presence of ammonium ions, is the explosion occur in a chemical industry in Italy. Knowledge of biogas safety characteristics is a very important practical issue. This explosion was a typical example of a low knowledge of chemistry reactions that, if not controlled, can produce hazard consequences. In the present study were investigated properties of the biogas, produced during an anaerobic digestion process, to determine the relationship between gaseous hydrogen, methane (present in biogas) and substances, like ammonium ions, present in growing medium to production of active principle) and to highlight hazards arising from a low knowledge of reactions developed during not controlled chemical process.

W2-C.2 CASCADING FAILURES AND COMPLEXITY: A CHALLENGE FOR REGULATORS?

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In line with recent work by OECD on Future Global Shocks, it can be argued that the propagation of local events to a global scale is quite often a "complex" issue and creates specific challenges to regulators, particularly in the case of critical infrastructure. In order to share common terms of reference and to better understand the implications of this concept of complexity, the presentation will first provide some insights into the definitions and will highlight differences between simple, complicated and complex systems. The specific dimensions associated with complex systems can then be discussed from the standpoint of regulators or safety agencies. Since we are in a "changing world", the pace of evolution of systems (economic, technological, social, and environmental) is introducing a level of dynamism over time and space which regulators are in a difficult position to tackle. This can be illustrated by a typology of three kinds of systems according to their level of complexity: systems that are now becoming "unstable", systems that are subject to a change in their order of magnitude of complexity, and orphan systems. Potential discrepancies in responses to complexity by governments, regulators and the private sector among the three categories of systems, within or between countries, are themselves a factor leading to more emerging risks or global shocks. Challenges and preliminary recommendations for governments, regulators and the private sector can be further discussed since the level of cooperation required between actors is of particular importance.

WL-1 FUTURE GLOBAL SHOCKS: A NEW CLASS OF RISKS?

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This presentation will cover a particular class of large scale disasters or catastrophes: those which reach a global or near-global scale. This is not to say that local, national or regional disasters cannot have huge damaging consequences but that a "global" shock is a different animal. Perhaps, as an emerging class, global shocks deserve special attention since they are frequently confused with large scale disasters as soon as characterisation, frequencies, propagation, impacts or key policy challenges are discussed.

The OECD has just completed a two year project on Future Global Shocks with active contributions of eight governments, the private sector and the research community in order to provide clarification, views on the future and a better understanding of policy challenges and policy options.

During the course of the Project, a number of dimensions were covered: knowledge base about potential shocks (typology of shocks, data and models), assessment of a sample of potential global shocks such as pandemics, financial crisis, cyber security, social unrest, geomagnetic storms; discussion on available tools, regulatory gaps, policy options. Questions about frequency, drivers, direct or indirect impacts, role of models, access to resources, interoperability of instruments, role of actors and many others were raised.

Eventually, the question of "commonalities" between potential threats, as opposed to idiosyncrasies, is key when it comes to policy options: are there priorities that governments, the private sector and society should endorse whatever the case? It can be argued that to a large extent the answer is yes.

Recommendations point to the need of a better understanding of global shocks as a particular class, a request for increased international or multilateral efforts on data acquisition, models, surveillance mechanisms, rules for action for a number of key global threats, and a call for "diversity" at an optimal level. These recommendations will now feed into the current OECD activities on risk, following the setting up of the OECD High Level Risk Forum in 2011, to help countries and policy makers in government and the private sector share policy practices in terms of assessment, prevention, mitigation, response and governance of major risks

W3-D.4 USER-FRIENDLY COMPUTATIONAL FREE TOOLS FOR QUANTITATIVE MICROBIAL RISK ASSESSMENT FOR DRINKING WATER

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QMRAspot is an interactive easy-to-use computational tool to conduct Quantitative Microbial Risk Assessment (QMRA) for drinking water produced from any surface water in the world. Raw microbial data are automatically read and analysed to demonstrate compliance with a health-based target for microbial safe drinking water of less than one infection per 10 000 persons per year for the index pathogens enterovirus, Campylobacter, Cryptosporidium and Giardia. QMRAspot has now been extended to conduct QMRA without the need to have actual location specific raw data, thereby greatly enhancing its applicability, especially for drinking water suppliers in developing countries. The extensions also make QMRAspot a useful tool for the design of a drinking water treatment utility. The extensions are: - Data of default parameter values for distributions of pathogen concentrations in wastewater; given dilution in river water and a travel time, pathogen concentrations at the intake point for drinking water production are calculated. - Default distribution parameter values for the removal by drinking water treatment steps. - Any other (emerging) pathogen can be considered if dose response parameter values are known. The groundwater protection calculator (GWPCalc) is a computational tool to calculate setback distances for the protection of groundwater against any (bio)contaminant. It uses a removal rate coefficient, pumping rate, aquifer depth, pumping well screen depth, and aquifer anisotropy, accounting for dilution and for horizontal and vertical transport. GWPCalc is developed for sandy aquifers and includes a removal rate coefficient for passage through a unsaturated zone. Because contaminant source concentration is included, GWPCalc can be used for risk assessment. QRMAspot and GWPCalc are freely available as Computable Document Files with the free CDF Player (Wolfram Inc).

T3-B.1 RISK ANALYSIS IN SYNTHETIC BIOLOGY: GLOBAL AND EMERGING

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Synthetic biology (SB) is an interdisciplinary science and engineering field built on genetic engineering, synthetic chemistry, information technology and electronic engineering. SB is the design and construction of new biological functions and systems not found in nature. Acknowledging the potential benefits of SB for the knowledge based bio-economy, the European Group on Ethics in Science and Technology in 2009, and the US Presidential Commission for the Study of Bioethical Issues in 2010, published recommendations that both contained a request to investigate novel biosafety and risk analysis issues in SB. Based on previous analysis and ongoing work in risk analysis of SB, this presentation will discuss why SB needs new methods of risk assessment. In particular, the following cases warrant an adaptation of current practices: DNA-based bio-circuits consisting of a larger number of modular bioparts; the survivability and evolvability of novel minimal organisms—used as platform/chassis for DNA based biocircuits—in different environments; and exotic xenobiological systems based on an alternative biochemical structure, e.g. genetic material based on novel types of nucleotides. An important task for risk analysis is to explore how SB itself may contribute towards overcoming existing and possible future biosafety problems by contributing to the design of safer biosystems. These systems, meant to mitigate the risks without limiting the potential benefits, entail e.g. the design of less competitive organisms changing their metabolic pathways; replacement of metabolic pathways that have an in-built dependency on artificial biochemicals (auxotrophy); construction of xenobiological systems based on an alternative biochemical structure to avoid horizontal gene flow to and from wild species (genetic firewall); or the synthesis of protocells that lack key features of living entities, such as growth or replication.

W3-D.5 DRINKING WATER QMRA: NECESSARY CONSIDERATIONS FOR DECISION-MAKING

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Quantitative microbial risk assessment (QMRA) is an increasingly popular tool to facilitate decision-making concerning the identification, management, and mitigation of risks due to pathogens in our environment. In the drinking water sector, it has been used to enlighten source water protection, treatment, operational, and regulatory decisions. These decisions, however, are only as strong as the information upon which they are based, so it is imperative that QMRA results provide a complete and accurate representation of the available information. The objective of this research was to develop a statistically rigorous approach to quantify the risk (and the variability and uncertainty therein) associated with consumption of water contaminated with protozoan parasites. In pursuit of this objective, it was necessary to develop tools that enable 1) quantification of the measurement error associated with pathogen count data, 2) quantification of uncertainty in the parameters of the temporal concentration variability distribution, 3) quantification of uncertainty in the parameters of the dose-response model, and 4) a simple approach to represent the impacts of variability and uncertainty upon the computed risks. The bias introduced to QMRA by inappropriate, yet common, strategies to address measurement error (particularly with respect to non-detect results and imperfect analytical recovery of microbial enumeration methods) is evaluated using a case study dataset. Relatively simple Gibbs sampling algorithms and second-order risk assessment techniques are then applied to provide information about the temporal variability of risk and the uncertainty therein. Rather than just providing a single risk value (or a distribution that may represent the combined effects of variability and uncertainty), the presented approach provides decision-makers with information about the uncertainty in risk metrics that is analogous to a confidence level.

F3-C.1 SYNERGIES OF HIA AND ECOSYSTEM SERVICES IN INTERNATIONAL DEVELOPMENT PROJECTS

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HIA provides a framework that enables the consideration of an expanded set of stressors beyond those evaluated in health risk assessments and typically includes an examination of both benefits and adverse impacts. Benefits consideration is a key element in the application of HIA in international development projects that require assessments of sustainability. Humans are increasingly viewed as a part of the larger ecosystem, so considering how to sustain healthy human populations and healthy ecosystems are inextricably linked. HIA can be tailored to address issues of human and ecosystem sustainability on a case-by-case basis and thus has the inherent flexibility to evaluate such concerns before non-sustainable decisions or actions have been implemented. Ecosystems provide valued resources and functions to people; because of these benefits, they are identified as Ecosystem Services (ES). Assessments of ES are increasingly being incorporated into international development projects, often as a requirement from international lending institutions. There are both distinctions and areas of overlap between HIAs and ES assessments. This talk will explore the areas of overlap and possible synergies of integrating planning for both efforts early in project development.

W4-A.5 ENERGY-USING DURABLES: THE RISKS OF INCREASING COSTS AND DECREASING BENEFITS

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Sustainable development requires to increase energy efficiency and to decrease CO2 emissions. In industrialized countries, households' energy consumption behavior is essential in this context. Households should buy more high-efficiency energy-using durables. They do not do so because of the risks involved in such purchases. Individual households have to pay a high upfront purchase price which over time could be compensated by energy cost savings. Yet, there are two major risks involved. One is that the future savings may be smaller than expected due to energy price changes, low service reliability or short product life. The other risk consists in future liquidity constraints for households. An additional risk which hinders consumers from buying energy efficient durables consists in incomplete or wrong information on future running costs of energy-using durables. The sum of all risks becomes manifest in households' high discount rates. The objective of the current research was to develop a descriptive model of discounting be¬havior which disentangles the effects of pure time preferences from the risks mentioned above and to test the model with novel experimental data. The data was collected from a representative sample of the German speaking Swiss population. We elicited discount rates, measures

of risk aversion and other individual data relevant for decisions on energy-using durables. It turned out that participants were averse towards risks concerning future energy costs and that they were hardly able to assess monthly energy costs. Both factors contribute to an undervaluation of future energy costs savings. In addition, liquidity constraints proved to be considerable obstacles to investments in energy efficient durables. Based on our experimental results we are able to develop policy recommendations in order to increase households' purchases of efficient energy-using durables and hence to foster sustainable development.

W3-A.2 MODELING THE EFFECT OF SEA-LEVEL RISE ON RISKS TO COASTAL INFRASTRUCTURE USING BAYESIAN NETWORKS

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Coastal storms can cause damage to navigation and utility infrastructure, interfering with the functional performance of commercial and military ports. Sea-level rise will exacerbate these risks. An assessment of these risks and an understanding of how they might change in response to changes in sea-level are essential for maintaining resilient coastal infrastructure systems. However, few methods have been developed to assess and model these risks. This study develops and implements an innovative method to assess these risks for the mission to provide at-berth support for large aircraft carriers at a naval installation in Chesapeake Bay region. Coastal storm risks to the infrastructure network and the effects of sea-level rise are modeled using a Bayesian network approach. The risk model is parameterized using the outputs of several hydrodynamic models that forecast coastal storm loadings and their probabilities, damage functions that estimate the level of damage to infrastructure assets as a function of storm loadings, and fragility curves for infrastructure assets that estimate the probability of realizing each damage state. Mission performance is related to the state of networked infrastructure using multi-attribute value functions considering command-level priorities for at-berth support. A fully parameterized Bayesian network model enables installation managers to explore, evaluate and prioritize alternative strategies for retrofitting infrastructure while accounting for the uncertainties associated with future sea-level rise. Although the details of the infrastructure network at the study site cannot be presented, a comparable analysis is developed for a proxy infrastructure network to demonstrate the methods and show how changes in sea level might affect coastal storm risks and the ability to perform missions at commercial and military ports. (Public release, Distribution unlimited.)

T3-E.2 RISK GOVERNANCE ON RADIONUCLIDE CONTAMINATION IN FOOD

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A large scale nuclear power plant accident happened after the great earthquake with a huge tsunami in the Eastern part of Japan in March 2011. After this tragic natural disaster, there were several critical mismanagement of the accident which resulted in the core meltdown in the nuclear power plant. Furthermore the information delay and the lack in delivery of clear and comprehensible explanation of the risk have been causing huge anxieties and worries among people in the nation. Appropriate responses and coordination among the risk managing authorities are indispensable especially in this kind of huge accident which may entail vast scale and long lasting risk. Author has been trying to straighten the large amounts of data on radionuclide contamination in foods of the Ministry of Health, Labour and Welfare, so as for people to easily understand the real situation and to take appropriate actions in facing the risk. Part of such trials in this half year after the accident will be reported together with the responses of people who received succinct messages explaining risk. He will also propose that a new paradigm of the food safety governance is required in Japan to cope with this unprecedented large scale nuclear power plant accident.

T2-D.5 HOW DOES A DISASTER OVERWHELM SOCIAL PRECAUTIONS: AN EMPIRICAL STUDY OF 3.11 TSUNAMI-FUKUSHIMA CASE

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In 2011.3.11, the earthquake of magnitude 9 attacked north-east Japan. The earthquake caused more than 30 meters tsunami that killed almost 20,000 people in Sanriku, and triggered serious accident of nuclear power plants in Fukushima.~~Japan has experienced earthquakes and Tsunami again and again in the history: and therefore, significant costs to mitigate risks have been spent. Most of suffered areas of 3.11, for example, were protected by high sea walls. One in Kamaishi was the world deepest and 2 k-meters long, which was supposed to protect the area from tidal bore.~~Power plants in Fukushima were also designed robust to earthquakes. At 3.11, all power plants there were stopped by the quake. Also, plants were protected by 5 meters sea walls. In retrospect, expecting tide come beyond the sea wall, alternative power generator should have been placed at higher place, but at least, risk of Tsunami had never been ignored. ~~Not only modern hard measures, soft measures of risk mitigation worked well. Warning system informed people 30-40 minutes before tide reached. In short, both hard and soft measures were installed. Despite of those preparations, large number of human loss and more than 20 billion US-dollars of economic loss were not avoided. In some cases, measures of risk mitigations even enlarged damages.~~One year after 3.11, not only risks of the events still continue but indirect risks are rising. Those risks includes poverty and health problems of sufferer because of slow recovery, economic loss from energy shortage, geopolitical and environmental risks of heavy dependence on petroleum, discriminations spread by mass media, economic/social impacts by political confusion and many problem/constraint by financial difficulties. We are going to see how damages had been enlarged and how Japan managed/or failed to manage the situation: the purpose is to clarify the questions to apply current risk analysis for LPHC risk events.

P1.21 SEARCHING FOR DETERMINANT AND CHANGE IN ATTITUDE TOWARD NANO-TECHNOLOGY

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Our study empirically analyzes the determinant and change in risk perception and acceptance toward nanotechnology which is one of emerging new technologies. We noticed the limits which previous studies had and then will reflect those into our study. First, in risk perception studies about nanotechnology, although there are lot of existing researches, they have focused partially on one or other specific factors among various determinants; for example, 'sociodemographic variables' such as age (older people tend to agree with nanotechnology, Bainbridge, 2002) and gender (women did less support nanotech, Scheufele & Lewenstein, 2005; Brossard et al., 2009) or 'social constructed variables' such as trust (Cobb & Macoubrie, 2004: Seigrist et al., 2007a), knowledge (Scheufele & Lewenstein, 2005), religiosity (Scheufele et al., 2008) and affect's role in nanotechnology (Seigrist et al., 2007b). Hence our study will adopt more balanced approaches that include all of related variables in judging the acceptance or the perceived risk/benefit from nanotechnology. Second, although there are many studies searching for static determinants of attitude for nanotechnology, there are very few studies to discover how such attitude can be changed by external stimuli and conditions, Hence, to know the possibility of attitude change rated with nanotechnology, our study provides, to the respondents, two persuasive stimuli e.g., mitigating the perceived risk and increasing the benefit about nanotechnology). Then we compare the original risk/benefit structures with them which are measured after giving those stimuli. From the analysis, we can know the structure and determinant of attitude change. We believe that our research will find out the variant determinants and structure of attitude change about acceptance or risk perception toward nanotechnology.

W4-B.6 PROBABILITY-TIME&SPACE TRADE-OFF IN ENVIRONMENTAL RISK PERCEPTION

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A model of probability-time&space trade-off (PTST) in a multidimensional framework involving perceived risks in both time and space contributes to better understand environmental risk perception

and communication. Environmental risks typically occur at distant locations, with strong delayed consequences in addition to the high uncertainty, so probability judgment can not be independent from the temporal and spatial distances. People perceive things with regard to their construal of objects while their construal depends not only on the actual attributes of the object but also on the psychological distance of observers. Psychologically distant objects are those that are not present in the direct experience of reality. Distance in time, probability and space similarly affect people's prediction, evaluation, and behaviour. Do people treat spatial distance, time distance and risk distance (probability) in a psychologically equivalent way? How to formulate psychological distance if it were a shared meaning of various distance dimensions? We argue that people evaluate an environmental risk (x,p) with delay t and distance s as such: V(x, p, t, s) = V(x, pexp(-rt-ks), 0)= ω(pexp(-rt-ks)) v(x) = ω(exp(-Π)) v(x) r and k measure the degree to which the delayed and remote probability is discounted respectively, which adjust the units of time and spatial distance, so that risk, time and spatial distance can be added in the total distance Π = rt+ks-lnp. ω(exp(-Π)) is a non-linear psychological distance function which bond non-linear probability weighting with probability discounting. PTST formally formulate the concept of psychological distance and accommodate the intuition of the temporal and spatial distances being a source of uncertainty. In a survey experiment on the residents' reactions towards a water pollution incident in China, the subjects typically believe they are less likely to suffer health problems when the temporal and spatial distances of pollutants extend longer.

F2-A.3 CATASTROPHIC RISK AND CLIMATE CHANGE

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Global warming is fundamentally different from typical "doomsday" scenarios. A rise in global temperatures unprecedented in human history is no longshot possibility, it is overwhelmingly likely without dramatic policy changes. We do now know how serious this will be, and do not expect changes to be sudden, but the huge inertia involved means mitigation must begin very early to be effective. While some potential catastrophes are like being hit by a bus, climate change is more like a cancer, of uncertain prognosis, that gradually becomes less treatable as the patient procrastinates or remains in denial. Basic physics implies that the warming expected from likely fossil fuel reserves and climate sensitivity values, even in the absence of "tipping points," would produce enough warming within a few centuries to bring some portions of the Earth to the brink of inhabitability just from summertime heat stress alone without even considering other impacts. In the worst case, large portions of the tropics would be pushed over the brink. The future of civilisation is threatened unless we can either confirm that climate sensitivity and/or fossil fuel reserves are smaller than currently expected, or somehow ensure that a large portion of our fossil fuel endowment (or at least the carbon it contains) remain permanently in the ground. This appears unlikely without strong policies of self-restraint. An interesting link between societal threats may occur through the so-called discount rate used by economists when comparing costs and benefits of emissions controls. The universal practice of discounting future economic impacts compared to present ones often causes mitigation to appear uneconomic, even though future damages far exceed mitigation costs. It can be argued that the primary reason that individuals discount is to hedge against the risk of unexpected events spoiling the deal. If we adopt the same philosophy toward climate, our mitigation decisions hinge largely on how pessimistic we are about other threats to society.

P2.10 SIMPLIFIED HEALTH RISK ASSESSMENT FOR NUMEROUS SOURCES

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Since the opening statement of the Red Book had been captured in 1983, the developing of human health risk assessment is from individual sources to numerous sources to extend the applications, including pollution reduction, environmental impact assessment, and total quantity control and so on. However, even though the human health risk assessment has been ripe and completed for individual source, it returns to uniform simulation for numerous sources, lacking identification of the environmental sensitizing areas and receptors, such as human toxicity potential in life cycle assessment. In order to maintain the integrity of human health risk assessment for numerous sources, containing sensitizing area and receptor characters were emphasized, and simplifying the assessment for analyzing simultaneously the harm from numerous sources. This assessment is classified into two parts: database and procedure. The sources, environmental sensitizing area, and receptor character in Taiwan were analyzed and created in the database. Source database consists of the identified locations of source and the feature of stoke; environmental sensitizing area database is based on the concentrated sources and the accumulated pollutants area; as for receptor character, behaviors and population of resident are screened. Following up the set database, the procedure is conducted by source identify, environmental sensitizing area confirmation, receptor selection and risk analysis to quantify the harm from numerous sources, such as strategy and substance management. First, according to the recognition of the location of emission and the feature of stoke, an environmental concentration slope is picked. Second, environmental sensitizing areas are confirmed, and these areas are ranked in sequence by environmental sensitivity; then the environmental concentration slope is put into these corresponded areas. Finally, the receptor characters of environmental sensitizing areas are selected, and the human risk of these affected residents are estimated.

W4-B.1 A COMPARATIVE STUDY OF RISK PERCEPTION FOR WASTE INCINERATION FACILITY IN JAPAN AND KOREA

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The construction of waste management facility like incinerations, are sometimes opposed by residents nearby. These oppositions are regarded as NIMBY syndrome by many researches. The objective of this study is to identify the consciousness of the residents' regarding 'the perceived risk of incineration' as the greatest potential factor for social acceptance. Also, this research is aimed to clarify policy issues in order to guide waste treatment management approach with acceptance of the residents. Questionnaire surveys were conducted in Seoul, Busan, and Gwangju city in Korea and Nagoya city in Japan which is known as the 'largest city' with unique local color. We have also conducted factor analysis using the questionnaire results in order to evaluate the characteristics of risk perception in 4 cities. Characteristics of incineration risk perceptions according to the survey of the cities were classified as dread risk and unknown risk. The questionnaire developed for the purpose of this study consists of two parts. The first part was a survey with attention to waste problem and the second part is focused on risk perception of residents about incineration and related treatment. It consists of 6 questions : 1. feeling dread or dislike, 2. It affects me and my family, 3. It could be controllable, 4. I know these risks accurately, 5. It is new and strange risk, 6. It could be much solved scientifically. These questions were selected based on Slovic's risk model (Slovic, 1987). The questions in this survey were in six point scale format. We can conclude that the risk perception of waste incineration is quite different among cities. Especially, residents in Korea have little direct experience of incineration because of the short history of incineration treatment. Therefore it is supposed that residents risk perception is deeply related to indirect information exchange such as mass media or internet in Korea.

W1-B.1 THE IMPORTANCE OF TRUST AND CONFIDENCE FOR ACCEPTANCE OF TECHNOLOGIES

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The present paper examines how trust is influenced by a severe accident. Furthermore, the paper examines whether trust and confidence factors can not only be theoretically, but also be empirically distinguished from each other. Only a few studies have compared perceptions of a technology before and after a catastrophe. We conducted a longitudinal mail survey (N = 786). The first wave was in autumn 2010 (before the accident in Fukushima), and the second started at the end of March 2011 (two weeks after the accident in Fukushima). In our model, we assumed that benefit and risk perceptions determine acceptance of nuclear power. We further hypothesized that trust influences benefit and risk perceptions, and that trust is correlated across the two waves. Trust had a strong impact on perceived risks and

benefits in 2010, the impact was a bit lower in 2011. Trust in 2011 was strongly influenced by the level of trust in 2010. Our survey results suggest that even after a severe accident trust remains important for people's risk and benefit perception. Whether it is possible to empirically distinguish trust and confidence was tested in the domain of green gene technology. Because Swiss citizens endorsed a moratorium on gene technology, the commercial cultivation of genetically modified crops and growth of genetically modified animals is prohibited there until 2010. In 2008, GMO field experiments were conducted, and we examined the factors that influenced public acceptance of them (N=999). A PCA revealed three factors: "Economy/Health and Environment " (value similarity based trust), "Trust and honesty of industry and scientists" (value similarity based trust), and "Competence" (Confidence). Results of a regression analysis showed that all three factors significantly influenced acceptance of GM field experiments. Results are interpreted in the framework of the TCC (Trust Confidence Cooperation) model.

F3-A.1 A TRANSFERRABLE SYSTEM FOR IDENTIFYING UNCERTAINTIES WITHIN ENVIRONMENTAL RISK ASSESSMENTS

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Uncertainties in environmental risk assessments (ERAs) must be addressed if the results are to be communicated with a high level of confidence. An important tool in this context is the uncertainty typology. However, current typologies of uncertainties are difficult to implement. This research introduces an evidence-based system to help identify uncertainties in ERAs in order to resolve this problem. Previously, the different types of uncertainties present in ERAs were identified and the relationships between them and other aspects of the assessments were analysed. The resulting uncertainty typology and statistical analyses are applied to case studies consisting of peer-reviewed articles from the fields of genetically modified crops, air-borne particulate matter, and pesticides. These research areas have large evidence bases from which observations can be drawn, involve an array of assessment processes, and contain well-documented uncertainties. The collated articles were interrogated for instances of uncertainty, and the strengths of the previously highlighted relationships were investigated further. An analysis of the collected data, in combination with structured expert-elicitation exercises, enabled the development of three field-specific uncertainty identification systems. These distinct systems were then adapted into a transferrable and transparent generic tool. The testing and validation phase focuses on the emerging risk area of engineered nanomaterials and full results are presented. It is intended that this research will be of use in the formative stages of ERAs and uncertainty assessments, and that it will promote an understanding of the potential failings. Furthermore, when used in conjunction with relevant guidance materials it will help practitioners design and perform assessments with these uncertainties in mind.

F4-A.1 REGULATION OF GMOS IN AUSTRALIA

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Regulation of genetically modified organisms (GMOs) in Australia occurs through the Gene Technology Act 2000 administered by me as an independent, statutory office holder. The main purpose of the Act is to protect the health and safety of people and the environment using risk analysis as the cornerstone of regulatory decision making. However, the science of gene technology and approaches to risk analysis have evolved rapidly over the past decade, presenting a number of challenges. Genetic changes can now be made by a number of emerging technologies, obscuring the definition of a GMO and posing potentially new avenues for risk. In addition, new types of GMO with new properties are facing regulatory scrutiny, challenging the robustness of our risk assessment methodology and our ability to specify data requirements that distinguish essential information from scientific curiosities. In the face of this ongoing change and to stay at the forefront of GMO regulation, my office participates in a range of international forums that provide guidance on risk assessment for GMOs. As well, we incorporate relevant ideas and practices from other fields of risk analysis. This includes adapting a national protocol for weed risk assessment into our evaluation of GM plants.

P2.12 TESTING THE HSM IN JUDGING THE RISK OF NUCLEAR POWER ACCIDENTS FROM FUKUSHIMA, JAPAN

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The accidents of Fukushima, Japan produce too much of information about risk related with the nuclear power. It generally assumed that when the people receive the information, they try to interpret and judge the risk by utilizing the specific mode of information process. Our study will test the heuristic-systematic information-processing model (HSM) suggested by Shelly Chaiken. HSM suggested two information process modes in heuristic or systematic ways; the heuristic mode used the least amount of cognitive processing utilizing the logistic of availability, accessibility, and applicability whereas the system mode did the effortful processing, which is depending on comprehension, analysis and reliability of information. To test the workings of those two modes, we applied them to judge the risk information related with Fukushima nuclear power accident by utilizing survey data. The main topics in analysis will include as follow; First, examine the tendency of using two modes and relationships between those two modes; Second, analyze the impact of determinants of two modes on information processing, such as self-efficacy for judgment, motivation to make judgment, and information insufficiency; Third, investigate the contextual variables to mediate or moderate the relationships between the determinant and two modes of information processing.

T4-C.5 SCREENING ECOLOGICAL RISK ASSESSMENT OF REWETTED ACID SULFATE SOILS IN THE LOWER MURRAY RIVER, SOUTH AUSTRALIA

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The River Murray, adjacent wetlands and the Lower Lakes (Alexandrina and Albert) in South Australia have been classified as wetlands of international importance under the Ramsar Convention, due to their unique ecological and hydrological significance. Prolonged drought, compounded by over allocation of water upstream, resulted in very low water flows from 2005-2010. Consequently, the Lower Murray River system was being seriously impacted by a combination of low water levels and the presence of acid sulfate soils (ASS). If detected and managed appropriately, ASS may not pose a major risk, however, if disturbed or left unmanaged, they pose risks to humans and the environment. To better understand the risks associated with rewetting of these ASS, and to provide recommendations for appropriate management options, a screening level ecological risk assessment was undertaken. The aim was to protect ecosystem services from the risks of ASS that may alter a balanced community of aquatic biota. Risks to aquatic biota from stressors including metals, acidity, major ions and nutrients released from Murray River dried soils that had been rewetted via rainwater or river water were determined. Predicted environmental concentrations, with correction for background water quality data, were calculated from metal release data for the soils in laboratory leachate experiments for current water levels (about -0.5 AHD) for four geographical areas using a range of exposure scenarios. These were compared to predicted no effect concentrations derived from hardness-corrected water quality guidelines, both acute and chronic. This SERA provided the first semi-quantitative assessment of risks to aquatic biota associated with rewetting of ASS following climate change-induced drought.

F2-E.4 ENVIRONMENTAL HEALTH IMPACT ASSESSMENT ON RECEPTOR POPULATIONS IN A MUNICIPALITY

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A study was carried out on a complaint in a municipality for possible air pollution, odour, and industrial effluents. A cross-sectional study resulted with noise levels assessed in the factory (n=12; 8 in-situ and 4 ex-situ). 66.67% locations (n=6) did not comply. Ventilation, lighting and humidity were measured (n=9) where relative humidity recorded was highest at the Banbury mixer (70.7%) and highest temperature recorded was at the oven area (39.9 0C). Air pollution parameters recorded didn't exceed the PEL except for NO₂ and as the highest risk it was >1. The public survey n=32) in Taman Gembira and Taman Aman residential area showed 3 sources of odour problems i.e. drains, factory effluent, and

solid waste. Risk assessment identified hazards showed air pollution for NO2 as the highest risk (risk score=16 as extremely high with the likelihood and consequences to be either major or critical) (DOSH, 2008). The noise levels at the Banbury and Dump mill machine exceeds standard for dose exposure at 93.5 dB (A), while the lowest reading of dose exposure of noise is 74.7 dB (A). Boundary noise to west is 40 dB (A) [standard = 60 dB (A)], the readings in east (85), north (75) and south (70) are above the limit. The factory does not have sufficient buffer zone

W4-A.3 THE ETHICAL ACCEPTABILITY OF MULTINATIONAL NUCLEAR WASTE REPOSITORIES

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The safe disposal of nuclear waste is a global challenge that faces humanity. There is international consensus that the producing country remains responsible for geological disposal of its own waste, but there is also a growing urge to consider regional or multinational repositories, particularly in Europe where ten EU countries are currently exploring their feasibility (please see http://www.erdo-wg.eu). These joint solutions will precipitate very many legal, political and financial issues that should be addressed but the ethical considerations they spawn deserve serious attention too. I argue that we should contemplate their ethical acceptability within the realm of a conflict between intergenerational and intragenerational justice; i.e. they are favored from the perspective of justice to future generations and disfavored from the viewpoint of justice among contemporaries In this presentation, I will first explore how the issue of long-term protection against radiological risk has been approached in various publications of the ICRP, IAEA and the NEA. Two types of future exposure to radiation risk could happen: namely 1) natural leakage due to the degradation of waste packages and the transport of radiation into the biosphere and 2) (unintentional) human intrusion into these repositories. I argue that multinational repositories could help reduce the risk of future exposure by choosing a favorable geological environment and by reducing the number of these facilities holding risks for the future. Multinational repositories, however, give rise to intragenerational injustice, since one nation is supposed to accept other nations' waste. This gives rise to the question of which of these two justice notions is morally more compelling. I will finalize the presentation with discussing the philosophical challenges of comparing spatial and temporal risks, and at a more fundamental level, of reconciling intragenerational and intergenerational justice.

F2-A.4 THE INTELLIGENCE STAIRWAY AND GLOBAL CATASTROPHIC RISK

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I present a model for the succession of optimisation processes on our planet, culminating in a new process that could cause a global catastrophe. The optimisation arguably began 4 billion years ago with the emergence of life and evolution. Evolution can be viewed as a set of competing optimisation processes that optimise the fitness of species for survival and reproduction. A succession occurred about 100 thousand years ago with the emergence of humans. The optimisation power of humans exceeded that of evolution, and so human-driven technological progress replaced evolution as the dominant force. There seems to be a pattern in which optimisation processes tend to produce agents whose optimisation power exceeds that of the process that produced them. I call this pattern the Intelligence Stairway. Recent developments in computer technology suggest a possible new step in the Intelligence Stairway dominated by computers who are smarter than their creators. If this step occurs, then according to the model, the emergence of such computers (artificial general intelligence, AGI) marks the end of human-driven technological progress and the beginning of a new phase: AGI-driven "intelligence explosion". Moreover, the relative time scales and environmental impacts of evolution and technological progress suggest the uneasy conclusion that the intelligence explosion could be a global catastrophe. Two qualitatively different approaches could avoid the catastrophe. One approach is to mathematically prove that the intelligence explosion will be favorable to humanity (the "Friendly AI" approach). The other approach is to limit AIs to narrow domains so they could not dominate humans. I argue that the latter approach is more pragmatic. We need a coordinated effort to establish and enforce a safety protocol for AI developers so they do not produce AGIs by accident.

P1.1 INCORPORATING SUSTAINABLE DEVELOPMENT IN RISK ASSESSMENT: AN APPROACH THROUGH COST-BENEFIT ANALYSIS

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Risk is the probability (possibility) of occurrence of a hazard multiplied by its consequences. Risk assessment mainly involves four stages: identifying the hazard and determining the types of effects expected if exposure occurs, determining the dose-response ratio for exposure to a particular hazard, exposure assessment and characterizing the exposed population. Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. So safeguarding the environment for future generations, while achieving present economic growth, should mark an optimal balance between medium and long-term risks and shorter benefits. However these types of concern are not addressed in risk assessment In short risk assessment lacks several necessary conditions for sustainable development. Further sustainable development hardly considers human health. For achieving environmental protection along with promotion of human health and economic development, it is essential that risk assessment and sustainable development be clustered together In this paper we have emphasized the use of incorporating economic sustainability in risk assessment as a holistic approach for preserving a better environment for the future generation. We have argued that Cost Benefit Analysis (CBA) can be used as a tool in this regard. Using the principles of CBA to set regulatory priorities will help bring risk assessment and sustainable development closer together. However a major shortcoming of traditional CBA is that uncertainty aspect is ignored. We have suggested some means for addressing this limitation. Modeling the uncertain parameters (especially the intangible ones) will be a crucial step in CBA. Further risk assessment by definition involves uncertainty. So characterizing the input parameters as uncertain variables will highly influence the risk calculation and hence the decision making process.

P2.13 DEVELOPMENT OF A PROBABILISTIC COASTAL HAZARDS MODEL: COUPLING STORM-SURGE AND INLAND PRECIPITATION

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Community vulnerability to coastal hazards can be difficult to analyze at a local level without proper modeling techniques. Many existing deterministic models are used for hazard planning and mitigation, but they are created for state or regional scale analysis, and do not provide sufficient detail for a local scale hazard analysis. Therefore, development of probabilistic models is necessary if the goal is enhancing local hazard mitigation. To aid local communities in completing more comprehensive vulnerability assessments, a holistic probabilistic coastal hazards model is developed. This type of model would depict the varying level of hazard exposure within a community, as well as provide a greater understanding of where hazards are more likely to occur, which could help local planners allocate limited resources in an efficient manner. Presented here is a case study in Sarasota County, Florida that illustrates the efforts of creating and testing a probabilistic coastal hazards model that couples the effects of storm surge, inland precipitation flooding and the effects of sea level rise. This model was developed by expanding and manipulating the SLOSH storm surge model and an inland precipitation flood model so that they are probabilistic in nature and customizable for local scale analysis. A sea-level rise component was then added to the existing output to depict possible climate change effects on current flood inundation patterns in the future. The resulting probabilistic outputs were then overlayed with socioeconomic data from Sarasota County, Florida in order to determine the county's socioeconomic and physical vulnerability. Preliminary results of the model indicate that utilizing probabilistic modeling techniques coupled with deterministic modeling helps in creating more accurate local hazard mitigation planning and policies.

P2.14 MANAGEMENT (GOVERNANCE) OF REGIONAL RISK BASED ON UNIFIED CRITERIA

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The key element when considering territorial risk is the assessment of the network of interdependent critical infrastructures (ICI) behavior under the influence of natural, technogenic hazards, and/ or

all types of vandalism. The ICI can be considered as some type of conduit and at the same time some intermediary between the environment and the society (population living in the region). It is also the main source of technological hazards. The CI is designed for providing safety and well being of the population and sustainable development of the territory, and also for supporting effective operation of a potentially dangerous object (PDO), or a whole industry. A catastrophe or incident of the ICI will immediately be transmitted on the environment and the regional population. Hence, assessment of the full damage and of all its main components is the first part of the problem. The second part of the problem is to design means and methods which would allow mitigating the potential consequences of an incident or catastrophe of the ICI.

The formulated above problems can be meaningfully solved only through interdisciplinary approach, and by convoluting the plethora of the heterogeneous parameters, which define the operation of the ICI, into just a few integral parameters, which should be simple to understand and use, taking into account that I) the dimension of the problem is huge (could be tens of thousands of interdependent parameters); 2) the problem is multi-disciplinary, and the parameters involved are from different sciences and branches of engineering; 3) the ICI resilience cannot be adequately described without explicitly accounting for the human factor. Hence, before attempting to solve the problem in consideration, it is necessary to introduce some unified measures (parameter) of safety/risk, which allow accounting for the human factor. Currently following generalized parameters are used: ICI resilience; the CI entropy; the territorial life expectancy criteria; the life quality index.

Safety per se is an important but not the only goal of the society. The share of resources that is being devoted by society for achieving safety should be continuously updated, having in mind other needs of the society, such as clean air and water, healthy food, housing, health care, pensions, education, and other social services, which also improve the longevity and quality of life. Therefore, the central problem of ICIs risk management becomes optimization of the distribution of the limited resources to improve the overall safety of systems. The paper describes some algorithms which lead to achieving this goal.

F2-E.5 RISK DURABILITY EVALUATION UNDER MULTIPLE RISK CONDITIONS WITH THE ILLUSTRATION OF TRAFFIC AND ENVIRONMENTAL SYSTEM

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Most of the environmental risk management has focused only for single risk owing to its regulatory context, however, risk-risk trade-off is inevitable and ubiquitous for our environmental systems. Actually, we have been facing the problem on actualizing low carbon society and risk reduction through supply chain of material and products. In order to prepare for management of multiple risks, we focus risk durability concept that complements single risk assessment methodology. In this study, we pick up traffic related risk issue as an illustration. To make structure of risk durability evaluation methodology, we have examined following three research topics. 1) To build risk durability method that makes up traditional risk assessment and enable us to understand the real situation of multiple risk. Regarding this issue, we combined value of information analysis and trade-off analysis method considering about health, ecological, resources and global risk aspect. 2) To carry out specific case studies relevant to automobile industry, here, we picked up substance substitution, fuel switching and automobile switching. In each case study, we integrated lifecycle analysis and risk assessment for environmental hazard. 3) To evaluate acceptance of risk reducing options for automobile at the sacrifice of benefit of transportation service, we employed the concept of environmental housekeeping book method and did public questionnaire survey. We discussed the balance of risk reduction and burden for each options.

W1-A.4 NEW TECHNIQUES TO TAKE NONLINEARITY INTO ACCOUNT FOR INDICATOR BASED CLIMATE CHANGE VULNERABILITY ASSESSMENT

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Vulnerability assessment is a form of risk assessment that takes into account the adaptive capacity of communities which is largely determined by social, economic and institutional capitals at their disposal. The earth's climate system is highly nonlinear (Rial, Pielke et al. 2004) and the vulnerability of a valuable attribute of a community to a climate hazard is no exception (Hinkel 2011). While this fact is widely accepted, indicator-based vulnerability assessment methods hardly ever take such nonlinearity into account. This is mainly due to the fact that the majority of such assessment studies use methods based on Multiple Attribute Utility Theory (MAUT) for aggregation of indicators which convert all indicators into a global utility function and produce only a linear, threshold-free scaling of the effects of an indicator on vulnerability. In a previous paper (El-Zein and Tonmoy, under review), we showed that 'Outranking Procedures' developed in decision-making science offer a more theoretically sound approach to aggregation than MAUT-based ones because they allow the analyst to incorporate incommensurability and uncertainty. In this paper, we show how non-linear relationships can be represented in outranking procedures through a new definition of difference thresholds. We illustrate the proposed approach with an example related to urban vulnerability to heat, focusing on the non-linear relationship between mortality and temperature above a 'comfort temperature', found in epidemiological literature, (McMichael, Wilkinson et al. 2008). We assess the effect of linear and non-linear characterizations of the relationship on the rankings of communities in terms of their vulnerability to heat stress and argue that the proposed method can be used in more comprehensive assessments of vulnerability to any specific climate stressors.

T2-D.4 COMPARING DISASTER PERCEPTIONS IN JAPAN AND THE US

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The Tohoku Disaster 3.11 with earthquake M9.0, tsunami, and the Fukushima accident brought the inhabitants horrible damages. And they showed remarkably disciplined behavior in the disaster. To investigate the Japanese mind in disaster, we carried out online (web) survey in Japan and the US on October and November 2011. At the Japan survey we focused on Tohoku area people [N=1,000], Tokyo people [N=500], Osaka people [N=500], and Kyushu people [N=500] (Total N=2,500) and they were targeted at Online survey which was designed to figure out the people's responses to the disaster and their psychological factors. The US survey was nationwide and total of 800 people were targeted.

T3-D.2 DEVELOPMENT OF RISK ASSESSMENT SIMULATION TOOL FOR OPTIMAL CONTROL OF A LOW PROBABILITY - HIGH CONSEQUENCE DISASTER

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In order to control low probability - high consequence disaster which causes huge social and economic damage, it is necessary to develop simultaneous risk assessment simulation tool based on the scheme of disaster risk The proposed new risk assessment simulation tool includes diverse effects of primary disaster of earthquake or tsunami and secondary damages of industrial plants and atomic power plants or supply chains of various products including production and transportation. The risk assessment simulation tool is composed of the three sub-systems, the sub-system of primary disaster predictive simulation, the sub-system of hazard assessment of secondary damages and the sub-system of risk assessment. National Institute of Advanced Industrial Science and Technology (AIST) has been promoting this research project by a cross-departmental team of the Active Fault and Earthquake Research Center and the Research Institute of Science for Safety and Sustainability.

W3-B.3 PERCEPTIONS OF MERCURY RISK AND ITS MANAGEMENT

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The impacts of mercury exposure on human health and wildlife are now well-documented. While the developed countries have some regulations in place to control mercury, regulation is still new to much of the developing world. For example, in the U.S., most of the known large point sources of mercury, except the coal-fired power plants, are regulated. Despite the now well-established risk of mercury, we know little about the perceptions of general population regarding mercury risk and its management. Most of the extant research focuses on fish advisories, and typically the subjects for these studies are sensitive sub-populations such as women of childbearing age and recreational and subsistence fishermen.

The aim of this paper is to provide a broader understanding of the perceptions of the general population regarding mercury in the environment, including their perceptions of mercury risk, trust in the institutions managing mercury, and various individual actions that can reduce mercury. We report results from two structured questionnaire surveys of the general population: a mail-in survey of New England residents and an internet survey of a representative U.S. national sample. Results from our surveys suggest that the respondents (i) do not actively seek information related to mercury risks, (ii) have a limited understanding of the sources of mercury and institutions that manage risks, and (iii) are not sufficiently aware of the individual actions that can reduce mercury. Our model of mercury risk perceptions finds that general environmental beliefs are the strongest predictors of mercury risk perceptions. We discuss the implications of our results to the communication of mercury risks.

W4-C.1 THE INTEG-RISK LNG BLUE BOOK: AN INTEGRATED APPROACH TO LNG SAFETY

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A growing risk aversion affects the exploitation of LNG technologies throughout Europe. The iNTeg-Risk project is dedicating an important research effort to the development of a transparent and integrated approach to the management of emerging risk related to LNG terminals. The present contribution will focus on the results obtained to date

F3-A.2 NEW TECHNOLOGIES AS SOCIAL EXPERIMENTS

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Technologies like biotechnology, nanotechnology and nuclear energy technology not only bring large social benefits but also introduce potentially catastrophic hazards. Many of the conventional approaches to risk assessment and governance are not directly applicable to these fields due to high levels of uncertainty and ignorance about potential hazards. To overcome this problem, I propose to conceptualize technology as a form of social experimentation and to investigate the conditions under which such social experiments are morally acceptable. In this perspective, introduction of technology into society is not seen as a one-off decision but rather as an ongoing social experiment. On the basis of a conceptualization of technology as social experimentation, conditions for responsible experimentation will be proposed. In my contribution, I will give illustrations of how developments in three technical domains - nuclear energy technology, biotechnology and nanotechnology - may be insightfully conceived as social experiments. I will then investigate possible conditions for responsible social experimentation building on three sources: the ethics of experimenting with human subjects, the ethics of technological risks and insights about the management of technology in society. I will discuss the implications of the proposed perspective for risk assessment, risk governance and regulation and for social discussions about the acceptability of risks. Van de Poel, I. (2009). The introduction of nanotechnology as a societal experiment. In S. Arnaldi, A. Lorenzet, & F. Russo (Eds.), Technoscience in progress. Managing the uncertainty of nanotechnology (pp. 129-142). Amsterdam: IOS Press. van de Poel, I. (forthcoming 2011). Nuclear energy as social experiment. Ethics, Policy and Environment, 14(3). Jacobs, J. F., Van de Poel, I., & Osseweijer, P. (2010). Sunscreens with titanium dioxide (TiO2) nano-particles. A societal experiment. Nanoethics, 4, 103-113, doi:DOI: 10.1007/s11569-010-0090-y.

P1.2 RISK BASED CLASSIFICATION OF TOXIC FLUIDS AND GASES

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In a number of European countries a quantitative risk assessment (QRA) has to be performed in order to obtain a permit related to industrial activities in which considerable quantities of dangerous substances are involved. This QRA involves the calculation of the risk to persons in the environment to be killed during accidents involving the dangerous substances. The risks depend on a large number of parameters such as the identity, quantity, location and conditions (pressure, temperature…). For certain industrial activities, e.g. storage, the identity may vary over the years requiring frequent updating of the QRA. To simplify this process a study was undertaken regarding the impact of toxic liquids and gases during accidental releases on persons in the environment. It is found that the spatial impact of the toxic vapors of toxic liquids depends mainly on their toxicity, vapor pressure and molecular weight. These parameters can be combined to a toxicity index. On the basis of this index toxic liquids can be divided into five classes of severity. With respect to toxic gases it is found that they can be divided up in four classes depending on their toxicity and their atmospheric boiling temperature. For each of these classes the most severe fluid was identified and lethal effect distances were determined with fluid quantity as a parameter. This classification is a very useful tool when estimating the impact on risks of the variation in toxic chemicals in industrial plants.

P2.15 THE REMOVAL OF SHIPWRECKS IS A RISKY BUSINESS – METHODS AND THE FRAMEWORK

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This paper presents a hypothetical yet realistic case study of a wreck removal approach for a sunken passenger vessel; hence, it offers an introduction to all of the procedures and factors needed to be considered during the preparatory and/or operational phase of a shipwreck removal effort. The wreck removal operations depend on various parameters that are both dynamic and uncertain.Hence, the process includes a wide range of risk factors, such as the local sea currents, the type of the sea bottom, the weather and most importantly the weight and the condition of the shipwreck itself. These variables are extremely difficult to factor in the applied framework and procedure: the methodology that was followed includes the detailed calculation of some of these parameters such as the suction of the sea bottom, during the first phase of the shipwreck removal and the weight of the sedimentation settled in time within the hull and superstructures of the sunken vessel. Due to the great uncertainty in the calculation of these parameters, we decided to apply a scenario based approach by examining two basic scenarios with regards to the selected method of wreck removal and four sub-scenarios by simulating the estimated values of selected parameters. In particular, the first basic scenario examines the removal of the shipwreck in one piece; the paper shows that this method is not feasible, and therefore there is no need to examine sub-scenarios for this case. For the second basic scenario we examined the removal of the shipwreck by cutting it in several pieces. This scenario proved to be more realistic and feasible and therefore we expanded the analysis by creating four sub-scenarios as described above. Wreck removal operations are extremely complex due to the large number of risk related factors involved in such efforts. These variables are extremely difficult to calculate accurately, fact that inherits a great deal of uncertainty for the whole operation.

T3-B.3 METABOLIC ENGINEERING THROUGH SYSTEMS AND SYNTHETIC BIOLOGY

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Metabolic engineering is the rational re-design of cells and organisms for the production of specific industrially-useful compounds. My research focuses on engineering microbes (yeast and E. coli) for production of biological replacements for materials currently produced from petrochemical feedstocks. Production via microbial fermentation is more environmentally friendly, uses renewable feedstocks, and results in higher-purity products (thereby decreasing production costs). We are interested in developing microbes capable of efficiently using sucrose, a major agricultural product in Australia, as a feedstock for industrial bioprocesses. Microbial platforms are being developed for production of a range of biochemicals, including polyhydroxybutyrate (a biodegradeable plastic) and isoprenoids (a group of biochemicals with a wide range of industrial applications, including rubbers and biofuels). The tools of systems and synthetic biology are used to develop these industrial biocatalysts.

W4-B.3 A SHIFT IN NATURAL HAZARD PERCEPTION: IMPLICATIONS FOR RISK GOVERNANCE

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Natural hazards such as floods, droughts or avalanches, and technical hazards, such as industrial accidents or pollution, follow different routes of individual and cultural perception in most societies. The link to "fate" or "given by God" is more associated with risks imposed by "nature" than with "human-made"

technical risks. This difference between "natural" and "human-made" has implications on risk preparedness and the willingness to act. However, the allegedly clear distinction between these categories has been blurred in recent natural disaster, in particular in relation to flood and flood protection : First, technical risks can be caused by "natural" catastrophes such as tsunamis (Fukushima), secondly, the vulnerability of areas to natural disasters depends on human planning and building actions and, thirdly, management measures such as flooding of retention areas deliberately involve human actions to cause damage that previously was only attributed to nature or God. What are the implications of this shift in perception on risk governance? How can the empirically observed changes in natural hazard perception and evaluation be considered in risk management and contingency planning, in particular when societies strive for precautionary approaches? Based on an interdisciplinary approach, we propose a method for integrating these changes in risk perception into a new risk governance concept of natural hazards. It is based on the IRGC risk governance framework but is specifically tailored towards the new type of hybrid between natural disasters and human-induced risks. This approach includes improved methods for stakeholder and public participation involving experts, decision makers and representatives of the concerned public. The major structure of the model, the challenges and critical success factors and the potential for enhanced participation will be discussed. The ultimate goal of the model is to provide guidance for a more sustainable solution for coping with the interactions between natural and human-induced hazards.

F2-C.1 LOGIC TREES

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Most of us find it difficult to think coherently about elements of decision-making under risk. The mental short-cuts we use commonly lead us to place undue emphasis on consequences and associated value judgments and insufficient consideration is given to probabilities. I'll outline how routine use of simple logic trees can buffer against poor decisions in biosecurity.

F2-C.4 TOOLS DEVELOPED FOR RESOURCE ALLOCATION

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Tools Developed for Resource Allocation: The Department of Agriculture, Fisheries and Forestry, with assistance from PricewaterhouseCoopers, has commenced a multi-phase project with the objective of enhancing Australia's risk based approach to the allocation of resources for managing biosecurity risks. A number of tools are being applied with special adaptations to handle the size and complexity of the task.

P2.16 THE STRUCTURE AND PROCESS OF EMOTIONAL JUDGMENT IN CASE OF THE NUCLEAR POWER ENERGY OR STATION

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This study will analyze the structure and determinants of emotional judgment about nuclear power energy/station. A lot of previous studies found that emotion or affect are one of important factors in judging the nuclear power acceptance. There have been a great divides between rational thinking and irrational thinking in risk perception judgement; the former stresses perceived benefit/risk's role in judgment and the latter focuses on the feeling and stigma reflecting image of risk.

We will specify the emotional judgment model or mode in case of the nuclear power. At first, we review the previous theoretical or empirical research, then suggest new model for understanding the emotional judgment model. Second, to test the causal model for emotional judgment, we will analyze how the emotional judgment occurs differently according to demographic variables. We can prove the previous study's main results that the younger, more educated, the female rather think emotionally than the older, more educated and the male do. Additionally, we explore the relations between dependent emotional judgment and independent social-constructed variables such as trust, benefit/risk and knowledge. Third, since there are varieties of emotional response, we will analyze how the different kinds of emotion, for examples, gloomy/good, weak/strong, dirty/clear, retrogressive/progressive, are determined by different causal factors. In short, we expected that this study would contribute to elaborating the structure and content of emotional judgment in risk perception studies.

P2.17 TRADEOFF OF HEALTH RISKS CAUSED BY LEGIONELLA AND DISINFECTION BY-PRODUCTS IN PUBLIC BATHS

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About 700 cases of legionellosis are reported every year in Japan. Most of the cases probably get infected in baths, especially public baths recycling water since it provides a good environment for growth of amoeba in which Legionella can multiple. Ministry of Health, Labor and Welfare in Japan established a guideline for preventing legionellosis in public baths by keeping chlorine residual of 0.2 to 0.4 mg/L as well as keeping high temperature and routinely cleaning to remove biofilms. The guideline also includes a suggestion that chlorine residual should not exceed 1.0mg/L to reduce the generation of disinfection byproducts such as trihalomethanes (THMs). However, a report demonstrated Legionella was detected from 15% of public baths even if the chlorine residual was controlled between 0.5 and 2.0 mg/L, while it was not detected in case of >2.0mg/L. We quantified the risks of legionellosis and cancer due to THMs for users of public baths recycling water in the following two scenarios of disinfection. In Scenario I, the tap water was recycled which contains chlorine residual according to the above guideline, while the chlorine disinfection was intensified (up to 2.0mg/L) in Scenario II. The risk of legionellosis was assessed based on the data of legionella detection at public baths in Japan (n=75). The cancer risk was calculated using parameters recommended by U.S. EPA. As the result, the risk of legionellosis estimated based on the most frequently detected concentration was 10-3 to 10-2 per event in Scenario I. The risk corresponding to the highest concentration reached 0.68. In Scenario II, the intensified chlorine disinfection could reduce the risk to

W3-D.2 QUANTITATIVE MICROBIAL RISK ASSESSMENT FOR AIRBORNE PATHOGENS

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Quantitative Microbial Risk Assessment (QMRA) has been mainly developed and implemented for waterborne pathogens. It has successfully provided valuable risk information for setting water quality standards, and also for designing water/wastewater treatment and disinfection facilities. In comparison, there are few reports of QMRA applied to airborne pathogens although we recently experienced two pandemics of respiratory infectious diseases (i.e. SARS in 2003 and new H1N1 influenza in 2010). In this presentation, I will introduce our latest outcomes from QMRA studies for airborne pathogens such as SARS coronavirus (Risk Analysis, 30(7), 1129-1138, 2010), seasonal influenza virus (Risk Analysis, published online on Oct 6, 2011), adenovirus (unpublished data) and so on. As a whole, dose-response relationship for airborne pathogens can be expressed by biologically plausible dose-response models, that is exponential and beta-Poisson models, commonly to waterborne pathogens. On the other hand, there is a difficulty to assess exposure to airborne pathogens that can gain entry to human bodies by inhalation. The main reason is that behavior of inhaled mists or aerosols containing pathogens in the bodies highly depends on the size, while such a size effect is not necessarily considered in QMRA for waterborne and foodborne pathogens. In general, smaller aerosols can reach the deep part of lower respiratory tract more easily and pathogens transported with the aerosols may be hardly removed. Our dose-response assessment for adenovirus actually revealed that aerosol exposure results in significantly (41.9 times) higher incidence of infection than nasal inoculation. In the influenza season, hand-washing is recommended for preventing viral transmission from hand to nose, mouth or eye through which viruses can enter human bodies. Wearing masks is also recommended in Japan and some other countries. QMRA would contribute to evaluating the effects of hand-washing and mask on reduction of influenza risk.

T4-B.5 RISK ASSESSMENT OF DNA RECOMBINATION TECHNOLOGY IN ECOLOGICAL ASPECTS

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There is a dramatic development in modern biotechnology in recent years. DNA recombination technology becomes the most advanced technology that is closely related to living organisms, including human being. By definition, the DNA recombination technology refers to genetic engineering (GE) and

synthetic biology (SB) here. Since the beginning of GE, its safety issues were intensely debated. Disregarding of intense resistance and argument from the public, plenty of GE products became available to be purchased in the market currently. People were most worried about the healthy risk of GE foods. However, I think that the most dangerous risk probably comes in the ecological aspects. Every step forward in technology should be careful to assure the absence of serious damage to the environment and the biodiversity on the earth. There is only one earth that we all live on and the precious environment is unique for human being to live in. Many scientific issues exist in ecological assessment, such as transgene escape in nature due to the gene flow. Although many measures were presented for the biocontainment of the engineered DNA, their efficacy should be carefully evaluated in real. Now comes the SB, that promises to enable the safety of DNA recombination. SB had claimed to be able to create new nucleotide that is not compatible with any known DNA to block any potential gene exchange. However, the compatibility should be tested and the effect in whole should be evaluated in advance before any release and application. The recombination DNA technology brings us possible solutions in coping with the troubles we are facing in current days, such as food security and population expansion, especially in the senses of sustainable development and climate change mitigation. To achieve the goal that the technology promises to us, risk assessment should be elaborated and management strategy should be developed in advance to assure a real sustainability.

W1-B.2 BUILDING AND LOSING PUBLIC TRUST IN RISK MANAGEMENT

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Broadly speaking there are two types of hazard: Those individuals can assess for themselves (e.g. crossing the road) and those they can't (e.g. microbial contamination of the water supply). For this second set of hazards people are not really "perceiving" the risks themselves but rather "interpreting" messages about safety and danger from risk managers. Whether or not recipients of these messages accept them depends on the extent to which those communicating the messages are trusted. We present a summary of our research into how public trust in such risk managers is built and lost across a range of hazards including nuclear incidents, contaminated land and terrorist threats. Results from a series of surveys and experimental studies have identified the following aspects as important: a) Prior attitudes towards the hazard and the managers; b) Prior political beliefs; c) The valence of the decision outcome; d) The specificity of risk action plans; e) The accuracy of risk forecasts; f) The tendency of risk managers to assume that an ambiguous situation is dangerous vs. safe; and g) The willingness of managers to communicate openly with the public. Most recently we have also investigated the psychological processes underlying changes in trust over time and the possibility that different actors in the hazard management system are trusted in different ways. Our central messages are a) that when members of the public have an impoverished understanding of a hazard they focus on trying to assess the motives and capabilities of those responsible for managing it and b) that the growth and loss of trust can be understood in terms of established psychological theories and processes.

T4-D.1 EMPIRICAL EVALUATION OF FRAMEWORK FOR COMMUNICATING RISK ASSESSMENTS

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Communication about risk assessments poses serious challenges for the messenger. In addition to the need for clear, comprehensive, transparent and reasonable messages, the communication should be presented in way that enhances its trustworthiness. For this reason we developed CORA (acronym for Communication Of Risk Assessment). It is a framework designed to help general readers, i.e. policy-makers and the interested public, to evaluate the trustworthiness of risk assessments. CORA will also facilitate better reporting of those assessments. The framework was developed with respect to ElectroMagnetic Field (EMF), but is not limited to this type of application. The CORA framework consists of 22 criteria grouped into seven sections. They pertain, in part, to the risk assessment itself (the report), in part to the organisation of the risk assessment process and in part to the risk assessor (the organization). In spring 2011, an online survey was conducted in Germany. The sample consisted of medical doctors (N= 68, mean age= 39, 44% female) as well of members of the interested public (N= 233, mean age= 26, 50% female) . All in all, the empirical evidence collected in the survey supports proposed the CORA framework with regard to the significance of the selected criteria for evaluating the trustworthiness of a risk assessment.

W1-B.4 DO YOU BELIEVE IN RISK ASSESSMENTS? FINDINGS OF AN EXPERIMENTAL STUDY

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Key issue for non-experts is trust in risk assessments that are conducted by experts. This issue becomes difficult when various risk assessments come to different conclusions. Then the question is: What should the non-experts believe? Our past research suggests - in line with the concept of biased assimilation - that prior beliefs serve as filter for selecting and interpreting scientific evidence. Usually, people weight the evidence higher that supports their already existing beliefs. In a new experiment we analyze under which circumstances people will accept a risk assessment that do not support their beliefs. For that reason we draw our sample of respondents from three different belief groups (those who believe that wireless technology is risky, those who do not believe that, and those who don't know). Taken the recent IARC classification of mobile phones as potentially carcinogenic to humans as a model, we conducted an experiment focusing on a (fictional) risk assessment of a (fictional) wireless electric power transmission technology. For all experimental conditions, we labeled the technology as "potentially carcinogenic". However, we changed the "authorship" of the labeling (NG0, industry, academia, intergovernmental organizations) as well as the framing of the use of the technology as " strong sustainable" "weak sustainable" or as "questionable sustainable". Thus, our respondents were confronted with various levels of source trustworthiness and sustainability. The results of the experiment as well as the conclusions for communication will be reported.

W2-C.4 DYNAMIC FINANCIAL PLANNING: MAKING ENTERPRISE RISK MANAGEMENT MATTER

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More than a decade after the rise of enterprise risk management (ERM), most organizations find ERM is only moderately effective in supporting decision making. Many executives view these programs as costly, slow, and frequently overlapping with other risk management processes. Often ERM efforts generate lengthy lists of unmeasured risks or over-simplified heat mapsthat mainly satisfy internal compliance related activities. These provide little insight on the true impact of risk to financial forecasts or strategic plans. Quite simply, ERM programs focus too much on "risk" identification and almost no time on improving the integration of risk into managing the enterprise. Given increasing uncertainty in the global environment, organizations need effective tools to understand risk impacts. This is achieved through explicit linkage and alignment of risk data, especially emerging risk data, with strategic planning and financial projections. Our research with numerous global organizations reveals that organizations are particularly challenged by emerging risks, which can include "new" risks or "familiar risks in new or unfamiliar conditions." This presentation will outline a new approach to ERM - dynamic financial planning. This approach takes a top-down examination of the core material risks to the organization and the underlying drivers. It involves three primary steps. First, organizations define and prioritize the core material risks to the entire organization. Second, the risks are aggregated and quantified to determine likely impacts on financial projections. Third, organizations integrate the management of these risks into strategic plans. The resulting analysis enables executives to evaluate the impact of different scenarios involving multiple risks on financial statements - easily, quickly and accurately. Management is provided not only risk information but more importantly, insights on how the risk could affect the organization, and how to prioritize resources for effective risk response.

F2-B.5 HAZARD WARNING DECISION-MAKING: ISSUES OF LAW, PROBABILITY AND RISK

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Despite sustained progress in threat monitoring and surveillance, a large human toll of casualties continues to be taken by disasters, both natural and man-made. Where a threat is clear, timely measures can be taken to remove people from harm. However, in many situations, the threat is vague, and uncertain in occurrence, timing, location and severity, and any responsive action has to balance the desire to maintain the routine of daily life, and economic well-being, with the need to avoid casualties. Often, there may be some precursory threat information available to assist civil protection authorities in their decision-making. With the increasing resolution of technology to scan farther the threat horizon, such early warning information may be spatially uneven in quality and of dubious reliability. A survey is presented of alternative decision-making methods, and the broad spectrum of possible mitigating actions, varying in cost and resources, that are practical and societally acceptable. These are illustrated by cases drawn from natural and man-made hazard crises, ranging from terrorism to geological hazards. A particular case study of unparalled seismological significance is the indictment for manslaughter of senior Italian geoscientists and civil protection officials, following the deaths of several hundred people arising from the L'Aquila, Italy, earthquake of 6 April 2009. Earthquakes are not predictable, but the trial is not so much about seismology as about the public communication of risk information. Tremors were felt for several months before the earthquake, encouraging some local inhabitants to seek refuge outside their homes. This legal case raises important new issues of scientific liability and responsibility emerging within the expanding inter-disciplinary domain of law, probability and risk.

T3-C.4 A SYSTEMS ENGINEERING APPROACH TO COMMUNICATING MEASURES OF GLOBAL SYSTEMIC FINANCIAL RISK

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Abstract— Systemic risk in the global financial system has drawn the attention of leaders in government and business alike. The abundance of systemic risk measures and risk models has added to the complex task of understanding, and acting on the implications of that risk. Tools that assist decision makers to interpret risk measures may lead to deeper understanding and more effective communication. This paper describes a multi-disciplinary effort to demonstrate the impact of using an integrated modeling and analysis environment on the communication effectiveness achieved while assessing complex financial data. The modeling environment is engineered to support execution of quantitative models including agent based and network models against equivalent scenarios of economic conditions. The environment also provides tools to compare and visualize model outputs. The presentation will provide an overview of the effort and outputs produced to date. This effort was organized into five major tasks: • Data Management Environment • Model Hosting and Execution Environment • Component Models of Risk • Comparison and Measurement Across Risk Models • Aggregation and Communication of Disparate Risk Measures The models used to assess components of systemic financial risk include models of: • Bank defaults and default contagion • Equity market volatility • Tax compliance Techniques used to compare related assessments of financial risk include: • Multi-objective comparison of time series data • Heat map representations of multiple time series Techniques used to communicate the emergent global financial systemic risk include: • Granger causality • Principal component analysis • Visualization of clustering analysis

T3-E.1 PROBABILISTIC RISK ASSESSMENT FOR VARIANT CREUTZFELDT-JAKOB DISEASE (VCJD) RISK FROM DAILY CONSUMPTION OF BEEF BY INCORPORATION OF THE PRION CONVERSION MECHANISMS

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The objective of this study was to assess the potential risk of variant Creutzfeldt-Jakob disease (vCJD) resulting from daily consumption of beef-related products in a Bovine. The BSE agent, protease-resistant prion (PrPRes). has been considered as a possible cause of vCJD, mainly due to oral ingestion of beef and beef-related products contaminated with PrPRes. The presence of PrPRes in neuron could lead to the conversion of normal prion into PrPRes, and a mathematic equation was formulated to describe time-dependent accumulation of PrPRes from the prion conversion. The daily consumption of beef-related products containing PrPRes was assumed to belong a Poisson process and to solve the mathematical equation. This model was used to fit the total number of vCJD cases in UK due to daily consumption of beef and beef-related products from 1980 to 1989. The numbers of BSE infected cattle were estimated from 900,000 to 1,130,000; among which there were about 460,000 to 482,000 cattle might enter food chain. The total number of cattle in the period of 1980 to 1989 was estimated to be 77,913,400. The average weekly intake of beef for British is 438g/week (65 g/day) for those 68% beef consumers in total population. The doubling time of PrPres varied from 40 to 80 days with a mean of 60 days. The average cross-species barrier at 26.7 was adopted for this assessment. Our final assessment result shows that the mean CJD cases is 236 with 95% confidence interval of 434 cases, which is very close to the Valleron's number with a mean at 205 and a 95% confidence interval in 403 cases. These results demonstrate that a new model for the assessment vCJD risk for beef consumers is validated and can be used for further assessment.

P2.19 THE IMPROVEMENT OF STRATEGIC ENVIRONMENTAL ASSESSMENT-THE APPLICATION OF CRITICAL LOAD

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Strategic environmental assessment (SEA) is regarded as a valid tool to achieve sustainable development. Since the SEA Directive has been enacted in Europe, the significance of SEA has increased rapidly in recent years. SEA is defined as a formalized, systematic process that integrates environmental considerations into decision making and aims to achieve sustainable development. Usually there is a sequence of stages involving in the SEA framework for assessing a policy, plan, or program, and each of stage depends on quantitative or qualitative tools to evaluate. In Taiwan, according to the SEA rules, there are nine items should be assessed in the stages of evaluating the potential impacts, and each of item may contain several impact categories. For the purpose of assessing potential environmental impacts quantitatively, life cycle analysis (LCA) has been incorporated into the SEA framework in practice, such as Taiwan energy policy. Quantitative assessment results make policy maker easily integrate environmental considerations into decision making process. Although LCA could help decision-maker compares relevant alternatives by environmental impact results, the gap between environmental impacts and environmental carrying capacity could not be known. Therefore, in addition to LCA, other methods for assessing carrying capacity need to be demonstrated. This research attempts to improve the defect of assessing environmental carrying capacity. Based on an energy policy case in Taiwan, this paper suggests that the critical load concept could be applied to carrying capacity problems of SEA. By integrating critical load into SEA process, more systematic SEA structure would be demonstrated, so environmental impacts of each alternative would not exceed environmental loading. Moreover, after calculating critical load of pollutants, the more sensitive ecosystem area can be identified, which would assist in planning follow-up projects.

P2.20 COLLABORATION AND COMMUNICATION OF GLOBAL RISK ASSESSMENT INFORMATION

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With limited resources to keep up with a high demand for risk assessment products, it is critical that existing information is readily available and that risk assessors collaborate during the risk assessment process. Several global risk assessment tools are available to address these issues. First, the Alliance for Risk Assessment (ARA) is a collaboration of organizations dedicated to supporting public health protection by working together on projects to improve the process, efficiency, and quality of risk assessment. Second, the International Toxicity Estimates for Risk (ITER) is a free Internet database of chronic human health risk assessment data from organizations around the world for 650+ chemicals. ITER is available at www.tera.org/iter and on National Library of Medicine's TOXNET system (http://toxnet.nlm.nih.gov/). Finally, the Risk Information Exchange (RiskIE) is a free Internet database that contains notifications

about a variety of human health risk assessment projects that are underway or recently completed. RiskIE is available at http://www.allianceforrisk.org/ARA_tools.htm. ITER and RiskIE provide risk assessors essential tools for easily identifying and comparing available human health risk data, for sharing in progress risk assessments, and for enhancing interaction among risk assessment groups to decrease duplication of effort. ITER and RiskIE were developed by Toxicology Excellence for Risk Assessment (TERA) and are also resources that support the mission of the ARA by tracking up-to-date information on risk assessment activities.

W2-C.3 EMERGING RISKS IN EMERGING MARKET: AN EXPLORATORY STUDY ON RISK PROFILE IN CHINA

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China is undergoing rapid changes in multiple dimensions, including industrialization, urbanization and marketization, which bring about more risks for Chinese society. It is needed for us to think about how we can improve our strategies and institutions in order to adapt to a more complex world. With this in mind, we are planning to launch a research project to identify and describe the risk profiles in China. First of all, we intend to figure out the subjective cognitions regarding risks in public in China. We design a study in attempt to outline contemporary risk profile by a large scale survey in China. The respondents in our study include experts in risks analyzing field as well as public randomly sampled in major cities in China. We are planning to invite 50 experts to take part in our survey based on expert elicitation method. 500 sample points of public will be obtained in our survey for analyzing. By coding risks and data analysis, we try to answer the following questions: What risks are Chinese people concerned about? What are emerging risks in China compared to the similar researches carried out ten years ago? How do these risks vary across different demographic characteristics ? What are the differences in susceptibilities to risks across geography, experience and wealth? We will take use of survey data from experts to form a basic risk typologies. Then, we are going to draw information from public investigation which is classified based on the typology standards and is used as supplementation for the description of Chinese risk profile. This would make contributions to understand the gaps between experts and public in risk recognition. Second, based on our study about subjective cognitions of risks in China, we will develop a holistic framework to analyze the emerging risks in two dimensions. First of all, we focus on the novelties of risks. Second, we'll utilize complexity of risks correlations to indicate the relationships among different risks.

F1-E.5 SUB-CHRONIC EFFECTS OF ENVIRONMENTALLY RELEVANT PM2.5 EXPOSURE ON MYOCARDIAL AND RENAL TUBULES

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Background: Association between particulate matter (PM) air pollution and cardiovascular diseases have been shown in epidemiological studies. The biological plausibility has further been demonstrated by toxicological studies using intratracheal instillation or concentrated ambient particulate matter inhalation. However, there was no study to investigate the effects of "real-world" ambient PM exposure. Objective: The purpose of the research is to investigate the sub-chronic toxicity of "real-world" ambient PM in DM rats. Method: We constructed an environmentally relevant PM2.5 exposure system, the Taipei Air Pollution Exposure System for Health Effects (TAPES). Sprague-Dawley rats were fed with high-fat-diet and then received a single-dose of 35 mg/kg-body weight of streptozotocin to induce a diabetic rat model. Rats were sacrificed after 13 weeks of TAPES exposure. Results: The estimated PM2.5 in the exposure chamber during study period were 12 μg/m3. After 3 months of exposure, plasma fibrinogen level was significantly increased (130.9±19.0 v.s. 183.7±54.5 mg/dL, p

F2-E.1 HUMAN EXPOSURE AND HEALTH RISK ASSESSMENT OF CHILD AND ADOLESCENTS BY USING ARTIFICIAL TURF IN SCHOOL

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In this study, an exposure pathway was assumed targeting on hazardous chemicals (metals, VOCs, aldehydes, PAHs, Phthalates) that can be released from products constituting artificial turf in school-playgrounds. We sampling and measured the 16 pollutants from artificial turf in 50 school-playgrounds such as elementary, middle and high schools. The infill chip was shown to exceed the domestic product content standard (90 mg/kg) in eight schools (16%) out of 50 schools. PAHs were shown to exceed the standard (10 mg/kg) in two schools (4%) out of 50 schools. The excess cancer risk (ECR) for individual chemicals was shown to be less than 10E-6, that is to say, 10E-8~10E-7 according to the mean exposure scenario where artificial turf playground was used. The ECR of carcinogens was shown to be 1E-6 in most users according to the worst exposure scenario. In children with pica who are the most extreme exposure group, the ECR was expected to be up to 10E-4, showing the low risk level of carcinogens. The hazard index (HI) for individual chemicals was shown to be low, 0.1 or less except for children with pica according to the mean exposure scenario that uses artificial turf ground. However, the HI was shown to exceed 1.0 in children with pica according to the worst exposure scenario. Therefore, no direct health risk was found in the case of using artificial turf playground and urethane flooring material track according to the mean exposure scenario except for children with pica. However, an institutional strategy should be prepared to reduce Pb and Zn among metals essentially contained in product manufacturing and construction for the healthy and continuous operation of artificial turf playground project.

F4-C.4 ESTIMATING THE RISKS OF REDUCING EMISSION FROM DEFORESTATION AND FOREST DEGRADATION (REDD) PROGRAMS

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Reducing Emissions from Deforestation and forest Degradation (REDD) programs are considered an attractive option to mitigate the global warming problem in the short term as it is cost effective to pay farmers to stop deforestation as compared to other options such as sequestration through afforestation or conventional abatement. However, REDD programs suffer from implementation challenges and there are several uncertainties as well as risks associated with them. The key risks associated with REDD programs are— natural hazards (such as fires, flooding and diseases) climate change risks (temperature rise), economic risks (such as leakages) and institutional risks (such as political instability of participating nations). First, forests are impacted by a variety of nature disasters, such as fires, flooding, pest and disease outbreaks. Economic factors can cause leakages through increased food and timber prices effected by reduced agricultural land as well as reduction in the volume of logging. Finally, institutional risks caused by policy instability and corruption lead to illegal timber and unplanned withdrawal from REDD programs. We develop models that help calibrate such risks for key REDD participating nations such as Indonesia and Brazil. Next, we estimate the effects of the above mentioned risks on the success of REDD programs. Additionally, an Integrated Assessment Model of global carbon mitigation incorporating REDD options is developed to derive the implications of such risks on the desirability of REDD options. Our key findings highlight the discounting effect of various risks associated with REDD programs. However, despite such risks, the integrated assessment model indicates that they could still be desirable options due to their lower costs, provided such risks are adequately managed. The endogeneity of certain risks such as of forest fires due to global temperature increase and biomass loss due to droughts calls for a much integrated response to managing REDD programs.

T3-D.5 DEFICITS IN RISK GOVERNANCE AND COMMUNICATION

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Exposure to radioactivity is a new risk to the general public, even to the experts, as proved by the fact that there existed no standards for emergency and for the existing exposure situations before the earthquake. Therefore, the general public was at a loss as to how to how to address the new situation and the experts' advises have been divided. A lack of the governance structure to tackle with new and emerging risks seems be one of the major causes of this turmoil. It has been noted that there is no official organizational body to decide the total exposure limit of radioactivity in Japan, although to treat the total exposure first is a common sense among the experts of chemical risk area. In April, the Food Safety Commission (FSC) received a commission to set the intake limit of each nuclear species, because food and drinking water pollution was the earliest issue immediately after the earthquake. They

could not, however, set the intake limit, as shown by their report released in October. Therefore, Ministry of Health, Labour and Welfare proposed a new intake limit based on ICRP and Codex without utilizing FSC's report. While setting the total exposure limit and allocating them to internal and external exposure is widely regarded as normal procedures, the Cabinet Secretariat who said to be in charge of management of total exposure did not start the discussion about total exposure. Since FSC did not carry out risk assessment but did nothing more than a literature review (see "deficits in risk assessment"), risk communication activities do not function well. In addition to the lack of risk assessment, regulatory impact assessment (RIA) is absent. A recent proposal to revise the intake limit of radioactive materials did not accompany the assessment of socio-economic impact especially on polluted areas, so the general public could not judge the proposal during the public consultation. This paper discusses proposals to establish efficient risk governance structure that prepares new and emerging risks.

P1.24 RISK ATTITUDE VS. PERSONAL CHARACTERISTICS: PERSPECTIVE FROM TWO REPRESENTATIVE POPULATION GROUPS IN CHINA

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It is of vital importance to understand people's decision-making under risk, particularly in the era risk governance in which collective decision-making is emphasized. Risk perception and risk attitude are the two pillars essentially determining people's behavior in front of risks. For years, researchers have been working on the metrics of both items. Nevertheless, the inherent difficulty in the measurement and their controversial linkages to personal characteristics still requires further investigation. In this study, two questionnaire surveys were carried out on two completely different representative population groups in China to discuss the metrics of risk attitude and its relationship to demographic characters. Group 1 consists of 192 farmers from rural area in Central China. Group 2 contains 200 freelance in the media and advertising industry from Beijing. The metric of risk attitude was obtained by asking each respondent to choose among 5 pay-off combinations. The answer to each question is transferred into a score of degree of risk aversion. In spite of the lower scores of the group of freelance, the major findings from these two groups were consistent. First, the distribution of risk aversion scores among 4 questions answer by each respondent shows no statistically significant change when pay-off combinations were scaled up. Therefore, risk aversion does not increase with the size of risk. Second, among the demographic factors, annual cash income and self-assessed risk level are found to be significantly correlated to risk attitude. Besides, gender works for group 1 while education level works for group2. It rejects the hypothesis that risk attitude is related to age, experience of farming/ working, and household size, etc. We therefore proposed the arguments that: 1) the effects of gender and education have mutual dependent effect on risk attitude; 2) a person's risk attitude is his/her natural characteristics or the emotional response of perceived risk.

W3-B.5 THE STUDY OF THE PERCEPTION GAPS BETWEEN ORDINARY PEOPLE AND MEDICAL DOCTORS

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Introduction Risk communication has been stipulated on the Food Safety Basic Law in 2003 in accordance with the BSE problem. But this activity has not yet spread to the medical care field because of some gaps between ordinal people and medical workers. We are facing the aging society and people are requested to care their health by their one decision. We think it is better for Japanese nations to introduce the forum-style risk communication in the medical field. Therefore the purpose of this research is to make clear the big perception gaps about medical technical terms and the medical knowledge among them. Method Internet research was conducted in this research. In advance of investigation, our research was approved by the Ethics Committee of Nagoya University. We adapted 90 medical terms. 58 out of them were derived from the previous examination of the National Institutes of Language of Japan. 32 terms were newly adapted which were belonged to the clinical trial relating words and the drug adverse reaction words. The respondents marked the most appropriate point out of 5 point ordinal score. Result 211 medical doctors and 315 citizens were responded. About deviation between citizen's cognition and cognition that medical doctor think patient must recognize, Mann-Whitney U-tests were used to compare the score. The statistical significant difference was found out about the 66 medical terms (73.3%) in total 90 medical terms. As of deviation between citizen's cognition and paraphrasing by medical doctor, the statistical significant difference was also found out about the 68 terms. Discussion We found that medical doctors tended to think patients knew the medical words more than the patients knew with significant differences. In case of risk communication in medical care field, medical doctor should recognize that patient dose not necessary understand the medical words as much as they estimate to conduct it smoothly.

T2-AB.2 PROACTIVE SYN BIO SECURITY RISK GOVERNANCE: OPEN ENGAGEMENT OF LAW ENFORCEMENT WITH THE TECHNICAL COMMUNITY

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To engage with security risks associated with diffusion and to maximize benefits and minimize illegitimate use of synthetic biology, this talk suggests a combination of policy approaches including open community-based efforts, regulation and oversight, and the deliberate design of security into the technology. Given significant uncertainty over the development and application of synthetic biology, adaptive approaches to addressing security risks will be needed. These approaches emphasize the interdependence and need for open communication between the technical, security, and policy communities to reshape policies in light of emerging information on risks and benefits associated with synthetic biology.

F1-E.4 SPATIOTEMPORAL IMPACT ASSESSMENT OF ASIAN DUST STORM ON CHILDREN'S CLINIC VISITS

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Studies have shown that the increase of certain cause-specific hospital admissions of medical centers during the period of Asian dust storm, which primarily comes from the northwest and north China in every winter and spring. However, few studies have investigated the relationship between the ADS and clinic visits of all-causes respiratory diseases for children. This study investigated the general impact to children's health across space and time by analyzing the daily respiratory clinic visits for preschool and school children registered in 12 districts of Taipei City during 1997-2007 from the National Health Insurance dataset. A structural additive regression model is applied to investigate the association between ADS episodes and children's clinic visits of respiratory diseases controlling space and time variations. Results showed that, compared with the period of one week before ADS events, the relative risk of clinic visits during one week after ADS events significantly raised 2.54% (95% credible interval=2.43, 2.66) and 5.03% (95% credible interval=4.87, 5.20) for preschool children (0-7 year-old) and school children (8-14 year-old), respectively. The spatial heterogeneity in the risk of children's clinic visits is also identified. The locations of significantly elevated risk are closely associated with the accessibility of large hospitals and medical centers in Taipei City. To our knowledge, this study is the first population-based study to assess impact of children's respiratory health by ADS exposure. Our analysis shows that children's respiratory health was ultimately affected by ADS events across entire Taipei, especially for school children.

WL-2 GLOBAL CLIMATE CHANGE AND WAR OUTBREAKS IN THE PRE-INDUSTRIAL ERA

Zhang DD, University of Hong Kong

There exists long debate about the climate-war relationship. Those who conceive the climate-crisis linkage cannot prove it scientifically. Their associated studies are qualitative or based on individual countries and shorten-term incident. Alternatively, those who argue socio-economic factors to be the major determinants of human armed conflicts cannot explain why various countries, which are characterized by different socio-economic modes, cultures, religions and civilization stages, underwent war outbreaks simultaneous in history. Using fine-grained paleo-climate data and historical datasets, we statistically proved that China and Europe suffered more often from frequent wars, population collapses, and dynas-

tic changes in cold phases in the past millennium. Further studies exhibit long-term fluctuations of war frequency around the world also followed cycles of temperature change. During 800–1900AD, ~90% of population collapses in various countries/regions in the Northern Hemisphere (NH) occurred during climate-deteriorating periods, which is the consequence of war, famine and epidemics. Recently, we scientifically verified identified a set of causal linkages between climate change and war and other human crisis. Using temperature data and climate-driven economic variables, we simulated the alternation of defined 'golden' and 'dark' ages in Europe and the NH during the past millennium. Our findings indicate that climate change was the ultimate cause, and climate-driven economic downturn was the direct cause, of large-scale war outbreaks and other human crises in preindustrial Europe and the NH. Our research provides a new perspective in interpreting human history and a warning to the consequence of future climate change.

W3-B.4 EFFICACY OF THREAT, INCENTIVE AND RISK APPEAL ON PERCEPTION OF HEAVY METAL RISK AMONG THE PUBLIC

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Studies show that threat strategy contributes to message involvement and implied behavioral change. But how people respond differently to various appeals and their coping mechanism remain unclear. This research aims to assist risk analysis and policy-making by (i) providing a comparison of efficacy of risk appeal by stating consequences, incentive appeal by arousing positive affect, and threat appeal by describing hazardous conditions on perception of heavy metal pollution among the public and (ii) analyzing different responses between urban and rural subjects. In a sample of 840 subjects with equal number of urban and rural area, aroused attention, evoked fear, perceived risk etc. is investigated. As a result,(i) risk appeal promotes to arouse urban subjects' attention, evoked fear, willingness to recycle, perceived risk to children and necessity of protection, while other two appeals cause insignificant or even negative effect;(ii) risk appeal is risky when applied to rural subjects where it reduced their level of evoked fear, perceived risk to children and necessity of recycling;(iii) dominant positive effect of threat appeal is shown among rural subjects especially in terms of recycling heavy metal. Obvious urban and rural differences are shown that (iv) urban subjects are relatively insensitive to different ways of appeal but (v) risk, incentive and threat appeal exerts negative, positive and significant positive influence on rural subjects, respectively. Implication can be made that applying risk appeal to urban area and threat appeal to rural area would lead to more action. Direct benefit of this study includes providing for risk governance and communication with effective advertising approaches and policies. Decision-makers should understand how lay people perceive and respond and which type of appeal should be applied to their targeted subjects. Negative responses may be caused by well-intended policies using inappropriate approach on specific subjects.

XP2.21 EFFICACY OF THREAT, INCENTIVE AND RISK APPEAL ON PERCEPTION OF HEAVY METAL RISK AMONG THE PUBLIC

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P2.22 AN EXPOSURE ASSESSMENT OF MERCURY FROM SEAFOOD FOR CONSUMERS IN DALIAN, CHINA

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Seafood consumption is promoted due to its positive effects on human health. But on the other hand, bio-accumulated chemical contaminants (e.g. mercury, PCB) in seafood are consumed simultaneously. Consequently, an exposure assessment of mercury from seafood is important to obtain more detailed information for risk regulation. Dalian is the famous seashore in China, the amount of seafood consumption is relatively higher than that in other regions. To grasp the mercury exposure from seafood consumption, we conduct this study of mercury exposure assessment via seafood in Dalian. Methyl mercury exposure via seafood was quantified by determining its concentration distribution in seafood consumed by individuals through questionnaires. Both deterministic and probabilistic mercury exposure assessments were simulated from short-term consumption to long-term consumption, in which women with child-bearing age and children (1 to 6), who are vulnerable to the mercury exposure, are highlighted. The simulated hair levels of mercury for sub-population were compared with the real analysis results. This study is to develop the simulation method for mercury exposure assessment via seafood consumption, which is suitable for Chinese population.

F2-D.4 DESIGN AND IMPLEMENTATION OF RISK TRANSFER MECHANISM IN DEVELOPING COUNTRIES USING CATASTROPHE RISK MODELS

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High level of natural hazards in some of the underdeveloped and developing countries, coupled with relatively high degrees of vulnerability within the built environment, can result in dire consequences. In addition to the short-term human and social ramifications, such events usually entail long-term economic and financial consequences that survivors must endure for months, if not years after the disaster. Many mega cities in developing countries are exposed to the sources of natural catastrophes. Risk mitigation through the implementation and inspection of a seismic design code on one hand, and the sourcing of necessary funds to cope with post-disaster reconstruction and rehabilitation on the other, are placing pressure on governments in these states. Risk transfer is considered to be an important step towards transferring responsibility for post-disaster recovery from the government to households in risk zones. In recent years, many governments have considered active risk management on a national scale. Financial authorities in such countries are seeking ways to transfer risk responsibility to households and businesses in exposed areas through insurance mechanisms. This approach has been effective in many developed countries with well-established private-sector insurance structures that are capable of spreading risk nationally and internationally. The risk transfer concept is structured laterally through the involvement of several actors; householders, insurers, reinsurers, capital market and government managed pools. In addition to pricing issues, insurance companies must evaluate and control their financial capacity, the number and the sum values of insured properties, and the amount of risk to be transferred to the upper layers. Such estimates are only achievable through full probabilistic risk analyses, taking into account all potential natural events and associated uncertainties.

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