Sponsors of the SRA-Europe 2010 conference

Environment Agency
Food Standards Agency
Health and Safety Executive
King's College London

Organising Committee

Professor Ragnar Lofstedt (Co-chair)
Dr Henry Rothstein (Co-chair)
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Welcome to the 19th SRA-Europe Annual Meeting

Welcome to King's College London - one of England's oldest and most prestigious university institutions - for the 19th SRA-Europe Annual Meeting. The special theme of the conference is 'Risk, Governance & Accountability', reflecting the increasing centrality of risk analysis to decision-making in a wide range of policy and organisational contexts that range far beyond its association with any specific hazard or peril. The financial crisis, the Gulf oil spill, and the eruption of an Icelandic volcano are just some recent examples of the seemingly regular societal and environmental crises that have put risk analysis centre stage as decision-makers are put under pressure to account for their actions and outcomes.

The embedding of risk analysis in modern systems of societal and organizational governance, as well as the increasing need for the public to grapple with risk ideas, is reflected in the wide variety of topics discussed in this year's conference. We have over 200 papers and posters that range in subjects from farmed fish to the financial crisis, from toys to patient safety in hospitals. These papers demonstrate that risk analysis spans the natural and social scientific disciplines, such as toxicology, social psychology, sociology, political science, and geography. Moreover, the papers demonstrate that risk concerns are very international, with presentations not only from our friends throughout Europe, but also Asia, North America and Africa.

This event would not have been possible without the generous support of the Environment Agency (EA), the Food Standards Agency (FSA) and the Health and Safety Executive (HSE). All three agencies have contributed to the transformation of risk governance in the UK. The FSA has been one of the first regulatory agencies in the world to stream its board meetings on the web; the HSE was ahead of most of Europe's regulators when it developed its Tolerability of Risk framework in the 1980s; and the Environment Agency has taken a leading role in developing risk based regulatory strategies. We are also grateful to the *Journal of Risk Research*, the official journal for the Society for Risk Analysis Europe and Japan, for sponsoring the opening reception, as well as to King's College London for supporting the conference organisation.

Putting together this event has taken time, hard work and enthusiasm from a great number of people and organizations, many of whom we are unable to thank in person. That said we would like to offer a special thank you to Dr. Renee Miller for her hard work and patience in organizing the conference administration, as well as to Leonie Taylor and Joan O'Mahony for putting together the website and programme book under a tight timetable. We are also grateful for the enthusiastic support we have had from our colleagues at the London School of Economics, particularly from its Deputy Director, George Gaskell. We would also like to thank the Executive Committee for the Society for Risk Analysis-Europe for their continued support and encouragement throughout the 18 months of preparation for this conference.

We hope that you enjoy the conference, and that it provides you with many opportunities to listen to a wide range of papers, put faces to names you may only know through journal articles, and stimulate interesting research ideas, proposals and papers. Of course, we also hope that you will take advantage of King's central location to enjoy being in the heart of London (without getting too distracted by the minor sporting events taking place in S Africa and SW London!) We look forward to meeting everyone during the next three days and please don't hesitate to ask us or any of the stewards if you need any further information about the conference or your stay here.

Henry Rothstein and Ragnar Lofstedt

Society for Risk Analysis (SRA) Europe

What is the Society for Risk Analysis?

The Society for Risk Analysis (SRA), founded in 1981, represents the leading platform for interdisciplinary academic risk research. Its membership is multidisciplinary, interdisciplinary and international.

SRA provides an open forum for those who are interested in all aspects of risk analysis to share experiences, exchange ideas and to build co-operation in research and mutual support. It provides a fruitful opportunity for inter-generational and multinational exchange as well as for communication with stakeholders in industry, politics and society.

Why a European Section?

The Society for Risk Analysis Europe (SRA-E) was founded in 1987 as a section of SRA international to develop a special focus on risk related issues in Europe. SRA-E aims to bring together European individuals and organisations with an academic interest in risk assessment, risk management and risk communication. SRA-E emphasises the European dimension in the promotion of interdisciplinary approaches of risk analysis in science. Our activities are highly relevant to practical application in industry and governance. The Charter of SRA-E which sets out all the aims of the organisation can be found on our website at **www.sraeurope.org**.

To foster strong and healthy relations between SRA-Europe and SRA International there is a "Memorandum of Understanding" that describes key principles of good practice and support. This can also be found on the website. There are a number of other active regional organisations in North America, Japan, Latin America, Australia, New Zealand and Russia. Most recently SRA-E has been developing a Framework Agreement for Cooperation with the Risk Analysis Council of China Association for Disaster Prevention.

What are the activities of SRA-Europe?

The SRA-E encourages and facilitates the communication among experts in all risk domains via general conferences and targeted meetings. The annual conference of SRA-E offers academics, researchers, students, policy makers, and industry representatives an opportunity to discuss 'state of the art' theory, research and policy relating to risk. We also discuss future directions and challenges in risk analysis and risk management. The annual conference takes place in various countries in Europe in order to enhance the access to SRA-E for members and risk interested people all over Europe. We are always keen to hear from SRA-E members that are interested in hosting the conference. Additional meetings and workshops focus on specific risk topics of SRA-E interest – building links with other associations or institutions helps to communicate, collaborate and develop new methodologies for risk analysis and risk management.

In the past we have addressed issues such as Natural Hazards, Risk Communication & Electromagnetic Fields, Risk Regulation & the Precautionary Principle. Furthermore, SRA-Europe provides its members with risk related information with regard to activities & initiatives at the scientific, political and industrial levels. SRA-E offers also the platform for working groups on particular risk issues which need to be developed and enhanced.

How is SRA-E organized?

The functioning of SRA-E is ensured by an Executive Committee comprising eight members who are elected by the Society members. For certain tasks (e.g. conference host) co-opted members join the committee. A permanent secretariat is established to strengthen the liaison between members and the organization, **secretariat@sraeurope.org**.

Why become a member? What are the benefits?

Membership of SRA-Europe carries automatic membership of the international Society for Risk Analysis, founded in 1981, with over 2000 members worldwide. SRA-Europe has around 300 members. Being a member of SRA-Europe offers multiple benefits. Members are part of the scientific community and can stay in touch with the latest news in research and practice in risk analysis. Members will also receive news of events and conferences worldwide. SRA-E helps members to become familiar with national and international policies on risk analysis.

Furthermore, SRA-E encourages members to network and exchange ideas with other professionals working on different areas of risk research. The quarterly Newsletter of SRA informs all members four times a year about what's going on in the Society. In addition, SRA-Europe regularly provides Europe specific risk

related information to its members. All members receive the journal Risk Analysis as part of their membership privileges and also have the opportunity to subscribe at a reduced rate to the Journal of Risk Research. You can become a member of SRA-Europe through the SRA website **www.sra.org** and by selecting the option to belong to the SRA Europe regional organisation.

How can members become active in the society?

SRA-E welcomes new ideas and initiatives from members. Active members are the basis of the Society and of its future. If you have views or suggestions for improving SRA-E then please do get in touch.

You could also become involved by standing for election to the SRA-E or helping us with organizing a conference. You can contact the Executive Committee members directly or through emailing the secretariat, **secretariat@sraeurope.org**.

SRA Europe Executive Committee

President: Ann Enander
Past President: Roberto Bubbico
Secretary: Julie Barnett
President-Elect: Margôt Kuttschreuter
Treasurer: Lars Bodsberg
Councillor SRA: Michael Siegrist
Member: Sophie Gaultier-Gaillard
Secretariat: European Virtual Institute for Integrated Risk Management (EU-VRi)

SRA Europe Secretariat

The secretariat is run by the European Virtual Institute for Integrated Risk Management (EU-VRi)
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Studentship Scholarship Awards

SRA-Europe Conference Studentship Scholarships (each worth €500) have been awarded to:

Jörgen Sparf

Mid Sweden University, SHV, Department of Social Sciences, Sweden.
Ability and vulnerability – everyday life dilemmas for people with disabilities
(Session 6, P30)

Karen Boll

IT University of Copenhagen, Design of Organizational IT, Danmark.
Tax risks - construction and representation
(Session 2, P7)

Awards committee: Julie Barnett (Chair) Margôt Kuttschreuter

Plenary Sessions

Welcome

Monday 21 June, 10.45am, Room B5

Sir Lawrence Freedman

Lawrence Freedman has been Professor of War Studies at King's College London since 1982, and Vice-Principal since 2003. Before joining King's he held research appointments at Nuffield College Oxford, IISS and the Royal Institute of International Affairs. Elected a Fellow of the British Academy in 1995 and awarded the CBE in 1996, he was appointed Official Historian of the Falklands Campaign in 1997. He was awarded the KCMG in 2003. In June 2009 he was appointed to serve as a member of the official inquiry into Britain and the 2003 Iraq War.

Professor Freedman has written extensively on nuclear strategy and the cold war, as well as commentating regularly on contemporary security issues. His most recent book, *A Choice of Enemies: America confronts the Middle East*, won the 2009 Lionel Gelber Prize and Duke of Westminster Medal for Military Literature.

Ann Enander

Ann Enander is an associate professor at the Department of Leadership at the Swedish National Defence College in Karlstad. She is a qualified psychologist and her teaching and research focus is on risk perception and communication, emergency preparedness, leadership and crisis management in both civil and military contexts. She is a member of the scientific board of the Swedish Emergency Management Agency, the Supervisory Board of the Swedish Chemicals Inspectorate and a fellow of the Royal Swedish Academy of War Sciences. Ann is current President of SRA-Europe.

Rick Reiss

Dr. Reiss is an experienced environmental health scientist with expertise in risk assessment, exposure assessment, environmental chemistry and fate, mathematical modelling, and applied statistics. He provides consulting services related to scientific issues associated with numerous environmental statutes, and has expertise in both air quality and chemical risk assessment. Dr. Reiss is actively involved in several scientific societies and he is the President of the Society for Risk Analysis, the leading scientific society devoted to the field of risk assessment. Dr. Reiss was the Managing Editor of Risk Analysis: An International Journal, the leading scholarly journal for risk analysis, from 2001 through mid–2008. He was the winner of the 2001 Chauncey Starr award from the Society for Risk Analysis. This award recognizes a risk analyst less than 40 years of age that has made major contributions to the field of risk analysis. Dr. Reiss was also a councillor in the Society for Risk Analysis (term 2005–2008).

Plenary 1 Risk Governance and Precaution

Monday 21 June, 11.00am, Room B5

Jonathan Wiener

Jonathan B. Wiener is the William R. and Thomas L. Perkins Professor of Law, as well as professor of environmental policy and professor of public policy studies, at Duke University. He has been a University Fellow of Resources for the Future (RFF) since 2002. He has been a visiting professor at Harvard Law School (2010 and 1999), the University of Chicago Law School (2007), Sciences Po (2008), and EHESS and CIRED (2005-06) in Paris. In 2008 he served as President of the Society for Risk Analysis (SRA), and in 2003 he received the Chauncey Starr Young Risk Analyst Award from the SRA for the most exceptional contributions to the field of risk analysis by a scholar aged 40 or under. From 1989 until he came to Duke in 1994, he served in the US Government during both the first Bush and Clinton administrations, as senior staff economist for environmental and regulatory matters at the White House Council of Economic Advisers (CEA), as well as at the White House Office of Science & Technology Policy, the U.S. Department of Justice, and the Americorps National Service program. In those capacities he helped negotiate the Framework Convention on Climate Change, assisted in the IPCC, and attended the Rio Earth Summit. From 1987-89, he served as a law clerk to Judge Stephen G. Breyer on the U.S. Court of Appeals in Boston, and to Judge Jack B. Weinstein on the U.S. District Court in Brooklyn, NY. He received his A.B. (1984, economics) and J.D. (1987) from Harvard University, where he was an editor of the Harvard Law Review.

Nick Pidgeon

Nick Pidgeon is Professor of Environmental Psychology at Cardiff University, where he currently directs the interdisciplinary Understanding Risk Research Group. This group's research looks at how public attitudes, trust and institutional responses drive environmental and technological risk controversies: including those of Nuclear Power, Climate Change and Nanotechnologies. He was a member of the Royal Society / Royal Academy of Engineering nanotechnology study group in July 2004. Co-author (with the late Barry Turner) of *Man-Made Disasters* (2nd ed) 1997 Butterworth-Heinemann, and co-editor (with Roger Kasperson and Paul Slovic) of *The Social Amplification of Risk*, Cambridge University Press, 2003. From October 2008 he took up a 3 year Economic and Social Research Council Professorial Climate Leader Fellowship investigating public risk perception, climate change and public engagement. He is also currently studying the social and ethical challenges of climate geoengineering. For further information on his research group see: www.understanding-risk.org

Ethel Forsberg

Ethel Forsberg has been the Director General of the Swedish Chemicals Agency (KemI) since 2001. KemI has 220 employees (e.g. toxicologists, ecotoxicologists, legal advisors, inspectors). KemI works to promote rules and legislation which contribute to achieving 'A Non-Toxic Environment', one of Sweden's sixteen environmental objectives.Ethel Forsberg has a Master of Science Degree in Landscaping Architecture. Before joining KemI she held positions at several sectors within the Swedish society: as environmental manager in the Federation of Swedish Farmers, senior administrative Officer at the Ministry of the Environment, Manager of Food Safety, Environment and Consumer Affairs at COOP (Head office of Cooperative Retailers in Sweden) and as Director of Administration of Health, Food and Environment in the City of Stockholm. At present she is on the board of European Chemicals Agency (ECHA).

Plenary 2 Science, Risk and the Public

Monday 21 June, 5.00 pm, Room B5

Baruch Fischhoff

Baruch Fischoff, Ph.D., is Howard Heinz University Professor, Carnegie Mellon University, where he heads the Decision Sciences major. A graduate of the Detroit Public Schools, he holds a BS in mathematics and psychology from Wayne State University and an MA and PhD in psychology from the Hebrew University of Jerusalem. He is a member of the Institute of Medicine of the National Academy of Sciences and a past President of the Society for Judgment and Decision Making and of the Society for Risk Analysis. He currently chairs the Food and Drug Administration Risk Communication Advisory Committee and the National Research Council Committee on Behavioral and Social Science Research to Improve Intelligence Analysis. He has co-authored or edited four books, *Acceptable Risk* (1981), *A Two-State Solution in the Middle East: Prospects and Possibilities* (1993), *Preference Elicitation* (1999), and *Risk Communication: The Mental Models Approach* (2001).

Alan Irwin

Alan Irwin has been Dean of Research at Copenhagen Business School since 2007. He chairs the UK BBSRC (Biotechnology and Biological Sciences Research Council) Strategy Panel on 'Bioscience for Society'. Alan Irwin has published widely on issues of science and technology policy, scientific governance, risk, and science-public relations. His books include *Risk and the Control of Technology* (1985), *Citizen Science* (1995), *Sociology and the Environment* (2001) and (with Mike Michael) *Science, Social Theory and Public Knowledge* (2003). He was also co-editor (with Brian Wynne) of *Misunderstanding Science?* (1996). His most recent research has been on the governance of science – including work with the UK Department of Environment, Food and Rural Affairs on expert advice in the policy process. In 2009 his paper on the 'Politics of Talk' (*Social Studies of Science*, Vol 36(2) 2006) won the first David Edge prize for best paper in Science and Technology Studies.

David Demeritt

David Demeritt is Professor of Geography at King's College London specializing in social theory and the environment. His research focuses on the articulation of environmental knowledges, especially scientific and technical ones, with power and the policy process. He is currently completing a 3 year ESRC-funded project entitled: 'Europeanizing flood forecasting and the geographies of risk and science in the EU'.

Plenary 3 Risk Management & Regulation in the 21st century: Lessons for Europe

Tuesday 22 June , 9.30am, Room B5

Geoffrey Podger

Geoffrey Podger has been Chief Executive of the Health and Safety Executive since November 2005. Since graduating from Oxford University in 1974, Geoffrey has worked for three Government Departments, two international organisations and three British agencies. In particular he worked extensively on a range of issues for the Department of Health in London. He was chosen in 2000 to be the first Chief Executive of the UK Food Standards Agency and in 2003 as the first Director of the European Food Safety Authority. Geoffrey was awarded the CB in 2003 and is Honorary Vice President of IOSH, an Honorary Fellow of IIRSM and a Companion of the Chartered Management Institute.

Steve Wearne

Steve Wearne is Director of the Food Standards Agency in Wales. Following a period of post-graduate research, Steve joined the Ministry of Agriculture Fisheries and Food in 1990 as a Higher Scientific Officer. He was soon promoted to Senior Scientific Officer and to Head of Branch (Grade 7 level) in 1997. He transferred to the Food Standards Agency and initially headed the Private Office and was the first Private Secretary to the first Chair of the FSA (Sir John Krebs, now Lord Krebs). Steve was promoted to the Senior Civil Service in September 2001 as Head of Chemical Contaminants and Animal Feed Division. He served as Interim Director for Wales in Cardiff from July 2003 for some 15 months before returning to London as Head of Regulation, International and Openness Division where he has remained until returning to the Agency in Wales during October 2007 as the substantive Director.

Mikael Karlsson

Dr. Mikael Karlsson, Södertörn University, Sweden, is President of the European Environmental Bureau and of the Swedish Society for Nature Conservation. He is an agronomist and holds a PhD in Environmental and Energy Systems. His scientific work focuses on environmental policy and risk governance concerning e.g. chemicals and energy issues. He participates in multidisciplinary projects on risk governance of the Baltic Sea and chemicals in textiles, and conducts studies on energy systems, nanotechnology and nuclear waste. Dr. Karlsson is senior lecturer in environmental sciences and has worked on international development in East Africa and Eastern Europe. Dr. Karlsson works as expert in several EU and Swedish committees and agencies, including High Level Groups of the European Commission, the Board of the Swedish Chemicals Agency and the Swedish Environmental Objectives Council. He has been representative at WTO and UNEP meetings. Dr. Karlsson lives in Stockholm with his family.

Plenary 4 Finance, Risk and Governance

Tuesday 22 June, 5.00pm, Room B5

Michael Power

Michael Power is currently Professor of Accounting and Research Theme Director of the ESRC Centre for the Analysis of Risk and Regulation (CARR) at the London School of Economics, where he has worked since 1987. He is a Fellow of the Institute of Chartered Accountants in England and Wales (ICAEW) and an Associate member of the UK Chartered Institute of Taxation. He has held visiting fellowships at the Institute for Advanced Study, Berlin and at All Souls College, Oxford. In 2009 he was awarded an honorary doctorate in Economics by the University of St Gallen, Switzerland. His research and teaching focuses on regulation, accounting, auditing, internal control and risk management. His major work, *The Audit Society: Rituals of Verification* (Oxford University Press, 1999) has been translated into Italian, Japanese and French. *Organized Uncertainty: Designing a World of Risk Management* was published by Oxford University Press in May 2007.

Steve Priddy

Dr. Steve Priddy has spent his working life in accountancy, first in public practice, then in business, and latterly he was director of technical policy and research at the Association of Chartered Certified Accountants. He has wide experience of statutory and management accounting, strategic tax planning in property and construction, project accounting and commercial negotiation, business turnaround, and risk management. He has been an employer nominated pension fund trustee. His current areas of interest are "carbon cut out" and the road to a low carbon economy; the evolving role of audit in society; public private partnerships as a means of delivering social programmes; and the barriers to internationalisation of the accounting profession.

Jon Danielsson

Jon Danielsson has a Ph.D. in the economics of financial markets and is a reader in finance at the London School of Economics. His research interests include financial stability, extreme market movements, market liquidity and financial crisis. He has published extensively in both academic and practitioner journals, and has presented his work in a number of universities and institutions.

Plenary 5 Accounting for Risk-Based Governance

Wednesday 23 June, 9.30am, Room B5

W. Kip Viscusi

Professor W. Kip Viscusi is Vanderbilt University's first University Distinguished Professor, with tenure in economics, law, and management. He has previously been Cogan Professor of Law and Economics at Harvard, Allen Professor of Economics at Duke, and Professor of Economics at Northwestern. He is the Founding Editor of the *Journal of Risk and Uncertainty*. Professor Viscusi's research focuses primarily on individual and societal responses to risk and uncertainty. He has published over 20 books and 290 articles, most of which deal with different aspects of health and safety risks. Viscusi's estimates of the value of risks to life and health are currently used throughout the U.S. government. In 2003 the *Journal of the European Economic Association* ranked him as number seven among economists in the world based on journal articles published, 1990-2000, and number twenty-five based on citations in journal articles over that period.

Julia Black

Julia Black joined the Law Department at the London School of Economics in 1994. She completed her first degree in Jurisprudence and her DPhil at Oxford University. Her primary research interest is regulation. In 2001-2 she received a British Academy / Leverhulme Trust Senior Research Fellowship to develop her work on regulation, and in 2007-8 was a Visiting Fellow at All Souls College, Oxford. She has written extensively in the area of regulation, and also advised policy makers, consumer bodies and regulators on issues of institutional design and regulatory policy.

Ronan Palmer

Ronan Palmer is Chief Economist and Head of Economics, Statistics and Social Science at the Environment Agency. His work spans the Agency's portfolio, including environmental protection and the management of water resources and flood risk. Before joining the newly established Agency in 1996 he had worked with the National Grid Company and the Department of Environment. Ronan studied Economics and Philosophy at University College Dublin.

Conference Programme

Monday 21 June	Tuesday 22 June	Wednesday 23 June
9.00 Registration and coffee	9.00 Coffee	9.00 Coffee
	9.30 Plenary 3 (Room B5) **Risk Management & Regulation in the 21st century: Lessons for Europe** Geoffrey Podger Steve Wearne Mikael Karlsson	9.30 Plenary 5 (Room B5) **Accounting for risk-based governance** Kip Viscusi Julia Black Ronan Palmer
10.45 **Welcome** (Room B5) Sir Lawrence Freedman Ann Enander Rick Reiss		
11.00 Plenary 1 (Room B5) **Risk Governance & Precaution** Jonathan Wiener Nick Pidgeon Ethel Forsberg	11.00 Session 3 Symposia & oral presentations	11.00 Session 6 Symposia & oral presentations
12.30 Lunch and poster session	12.30 Lunch, SRAE business meeting & awards ceremony (Room B5)	12.30 Lunch
1.30 Session 1 Symposia & oral presentations	1.30 Session 4 Symposia & oral presentations	1.30 Session 7 Symposia & oral presentations
3.00 Tea	3.00 Tea	3.00 Concluding remarks
3.30 Session 2 Symposia & oral presentations	3.30 Session 5 Symposia & oral presentations	3.30 End
5.00 Plenary 2 (Room B5) **Risk, Science & the Public** Baruch Fischhoff Alan Irwin David Demeritt	5.00 Plenary 4 (Room B5) **Finance, Risk & Governance** Michael Power Steve Priddy Jon Danielsson	
6.30-8.00 Reception	6.30 End	
	7.30 – late Dinner on Hispaniola, River Thames	

Monday 9.00 – 10.45			**REGISTRATION & COFFEE**
Monday 10.45 - 11.00			**WELCOME**
Room B5		**Sir Lawrence Freedman** **Ann Enander** **Rick Reiss**	
Monday 11.00 – 12.30			**PLENARY 1**
Risk Governance & Precaution Chair: Henry Rothstein Room B5		**Jonathan Wiener** **Nick Pidgeon** **Ethel Forsberg**	
Monday 12.30 – 1.30			**LUNCH & POSTER SESSION**
Monday 1.30 - 3.00			**SESSION 1**
Symposium S1 Room 1.10	**Symposium S2** Room 1.67	**Symposium S3** Room 1.70	**Parallel P1** Room 1.62
Risk and Decision making (a).	**Mapping risk management and analysis as knowledge-intensive processes: Towards a visual risk process language**	**Assessing, managing and communicating the risks and benefits of aquaculture: A synergy of natural and social sciences (Part I)**	**Risk assessment**
Chair: Asa Boholm	Chair: Martin Eppler & Nicole Bischof	Chair: Ragnar Lofstedt	Chair: Robert Tardiff
Hermans M; vanAsselt M; Passchier W; Zeiss R The dynamics of uncertainty in risk decision making - A case study on the controversy around base stations for mobile communication technology	**Aeschimann M** Risk visualization in an enterprise context	**Bell G** Production of contaminant low salmon by dietary manipulation	**Busschaert P; Geeraerd AH; Uyttendaele M; Van Impe JF** Fitting distributions to censored data using a Bayesian model for application in microbiological risk assessment related with foods
Fox T The role of uncertainty intolerance in the chemical risk regulation of toys	**Brundl M** Visualisation of natural hazard and risk - chances and constraints	**Noakes PS; Miles EA; Kremmyda LS; Vlachava M; Diaper ND; Calder PC** Effects of dietary supplementation with oily fish in pregnancy on maternal and infant nutritional status. Results from the Salmon in Pregnancy Study (SIPS)	**Jerrett M; Su J; Morello-Frosch R; Jesdale B; Kyle A** The Cumulative Environmental Hazard Inequality Index and Air Pollution Exposures in Three Large Metropolitan Areas of California
Boholm A, Corvellec H A relational theory of risk (RTR)	**Fuchs S** Evaluating flood risk maps – Towards a visual risk language	**Haave M; Jayashankar S; Bernhard A; Brattlid T; Glover CN; Hogstrand C; Lundebye AK** Effects of contaminants and nutrients in Atlantic salmon on the tissue composition, gene expression and development in mice offspring	**Leonte, D** Accounting for non-trivial influences of rainfall on water quality
Bennett C Which hazard and what response? Two elements in decision making about behavioural responses to perceived risk		**Carroll TS; Rasinger JD; Reffatto V; Tassinari R; Maranghi F; Moracci G; Patriarca P; Haave M; Mantovani A; Menditto A; Macrì A; Lundebye A; Hogstrand C** Effects of four contaminants (2,3,7,8-TCDD, CB-153, BDE-47 and HBCD) commonly found in seafood	**Tardiff R; Carson L** Estimation of Safe Levels in Drinking Water for Perfluorooctanoic Acid (PFOA) Using State of the Art Approaches
Discussant: **Marjolein van Asselt**			

REGISTRATION & COFFEE			**Monday 9.00 – 11.00**
WELCOME			**Monday 10.45 - 11.00**
	Sir Lawrence Freedman **Ann Enander** **Rick Reiss**		Room B5
PLENARY 1			**Monday 11.00 – 12.30**
	Jonathan Wiener **Nick Pidgeon** **Ethel Forsberg**		**Risk Governance & Precaution** Chair: Henry Rothstein Room B5
LUNCH & POSTER SESSION			**Monday 12.30 – 1.30**
SESSION 1			**Monday 1.30 - 3.00**
Parallel P2 Room 1.11	**Parallel P3** Room 1.71	**Parallel P4** Room 1.20	**Parallel P5** Room 1.60
Governance, economics and the precautionary principle	**Risk communication**	**Individual risk behaviour**	**Public perception of risk**
Chair: Paul Illing	Chair: Michael Siegrist	Chair: Ann Enander	Chair: Julie Barnett
Hernandez JC; Silva Zambrano A *Governance and accountability of risk in European drugs authorization procedures*	**Zingg A; Brunner T; Siegrist M** *Culling or Vaccinating Animals: Risk Perception and Acceptance of Strategies to Fight Animal Epidemics and Zoonoses*	**Skorna A; von Watzdorf S; Loock C-M Bereuter A** *Individual risk perception vs. reality: the case of alpine winter sports*	**Wang J; Hyun Jung L** *Multi-dimensionality of Risk Perceptions and Determinants: The Case of Debates on Genetically Modified Organisms(GMO) Technology in Korea*
Torriti J *The Value of Statistical Life in the Light of Climate Change and Distributional Impacts*	**Fage-Butler A** *The text is the matter - how discourse analysis may help*	**Ohman S; Olofsson A** *The Impact of Gender and Sexual Orientation on Risk Perception and Risk Behaviour*	**Dawson I; Johnson JEV; Luke MA** *When Things Just Don't Add Up: Assessing the Influence of Concept Plausibility in Subjective Understandings of Synergistic Risks*
Udovyk O; Gilek M; Karlsson M *Improving assessment and management of hazardous chemicals in the Baltic Sea: towards an ecosystem-based approach*	**Modin P** *Ethical responsibilities when communicating dietary advice*	**Borjeson M; Enander A** *Relationships between personal characteristics, safety attitudes and safety related activities*	**Kari M; Litmanen T; Kojo M** *In spite of the perceived risks… Analysing acceptance of spent nuclear fuel repository in the Municipality of Eurajoki, Finland*
Illing P and Taylor D *Risk & Precaution in an imperfect world*	**Watts D; Driedger SM** *Mosquitoes, Media, and Messaging: A Case Study of Government Communication through the Media*	**Skorna A; Ippisch T** *An Analysis of Post-Accident Driving Behavior*	**Dohle S; Keller C; Siegrist M** *Affect and risk perception: Insights from free associations to mobile phone base stations*

Monday 3.00-3.30			**TEA**
Monday 3.30 - 5.00			**SESSION 2**
Symposium S4 Room 1.10	**Symposium S5** Room 1.67	**Symposium S6** Room 1.70	**Symposium S7** Room 1.71
Risk and Decision Making (b)	**'Nuclear renaissance' in Switzerland? Results from a multi-method, multi-perspective, multi-actor research program on nuclear waste and nuclear power**	**Assessing, managing and communicating the risks and benefits of aquaculture: A synergy of natural and social sciences (Part II)**	**Food regulatory regimes and the challenges ahead**
Chair: Herve Corvellec	Chair: Roland W Scholz & Michael Siegrist	Chair: Ragnar Lofstedt	Chair: Alessandra Arcuri
Boholm M *Decision-making as a conceptual component of risk: a linguistic perspective*	**Visschers V; Keller C; Siegrist M** *The general public's spontaneous associations with nuclear power stations (NPS)*	**Karunasagar I** *FAO/WHO Risk Assessments to Support Codex and National Risk Management: Examples of Aquaculture Products*	***Alemanno A*** *The European approach to food import safety and the melamine contamination*
Karlsson M *Risk Governance in Practice: A case of interorganizational risk management*	**Dhum M; Herwig U; Bruhl A; Stauffacher M; Scholz RW** *Gender and sex difference in information processing and risk perception: A neuropsychological perspective*	**Schlag AK** *Risk perceptions of farmed fish and fish farming in seven European countries*	***Fagotto E*** *A global food supply: A perspective on strengthening the FDA to ensure import safety*
Boholm A *Formal risk management in practice: A case of railway planning decision making*	**Kruetli P; Stauffacher M; Moser C; Flueler T** *Justice issues in repository site selection processes for nuclear waste*	**Sudborough B** *Consumer acceptance of Sea Bream produced in the Aquamax farming trials*	***Poto M*** *Hong Kong: "a high degree of autonomy"? A case study in food safety law*
	Moser C; Stauffacher M; Kruetli P; Scholz RW *The influence of temporal representations on risk perception of nuclear waste*	**Margiotta F** *Consumer communications about farmed fish: Outlining both benefits and risks*	***Pieterman R*** *Food Safety in the precautionary culture: reflections on problems associated with applying the precautionary principle at the molecular and the global level.*
Monday 5.00 - 6.30			**PLENARY 2**
SCIENCE, RISK AND THE PUBLIC Chair: George Gaskell Room B5		**Baruch Fischhoff** **Alan Irwin** **David Demeritt**	
Monday 6.30- 8.00			**RECEPTION**

TEA			**Monday 3.00-3.30**
SESSION 2			**Monday 3.30 - 5.00**
Parallel P6 Room 1.11	**Parallel P7** Room 1.20	**Parallel P8** Room 1.62	**Parallel P9** Room 1.60
Communicating risk Chair: Peter Wiedemann	**Risk and organizations** Chair: Stephen Ward	**Risk and public participation** Chair: Tom Horlick-Jones	**Risk and climate change** Chair: Euan Mearns
Espluga, J; Prades A; Gonzalo J *Risk communication processes and structural conflicts in high industrial risk areas. An interpretative approach*	**Boll K** *Tax risks - construction and representation*	**Hernandez JC; Martin AT** *Deliberative administrative procedures and risk decision-making: the case of energy and environmental conflicts*	**Hemming D; Hartley A; de Gusmao D; Kay G; Kaye N; McNeall D; Taylor I.** *Climate Impacts and Risk assessment Framework (CIRF)*
Ormandy D; Ezratty V *Communicating the Risk from Carbon Monoxide in Dwellings*	**Etienne J** *The risks of self-reporting incidents: a case study and further hypotheses*	**Mazri C; Chantelauve G; Chevalier M** *Towards a decision support tool for the management of participative approaches: Theory and application within the French regulatory context*	**Mearns E** *Risks from Energy Decline, Climate Change and Appropriate Energy Policies*
Pighin S; Bonnefon JF; Savadori L *Overcoming Number Numbness in Prenatal Risk Communication*	**Meliou E; Kakouris AP** *Changing organizational culture towards safety and risk*.	**Prades A; Horlick-Jones T; Oltra C; Navajas J; Sala R; Espluga J** *Towards a participative dialogue with society about the risks associated with fusion energy: knowledge, practical reasoning and design process*	**McNeall D; Daron J** *Challenges in risk analysis of the impacts of climate change*
Wiedemann P; Schuetz H *Improving communication about unclear hazards*	**Ward S** *Operational risk in major infrastructure*		**Mearns E; Mearns K** *Risk Perception and Knowledge of Climate Change and Energy Issues*
PLENARY 2			**Monday 5.00 - 6.30**
	Baruch Fischhoff **Alan Irwin** **David Demeritt**		**SCIENCE, RISK AND THE PUBLIC** Chair: George Gaskell Room B5
RECEPTION			**Monday 6.30- 8.00**

Tuesday 9 – 9.30			**COFFEE**
Tuesday 9.30 – 11.00			**PLENARY 3**
Risk Management & Regulation in the 21st century: Lessons for Europe Chair: Ragnar Lofstedt Room B5		**Geoffrey Podger** **Steve Wearne** **Mickael Karlsson**	
Tuesday 11.00 – 12.30			**SESSION 3**
Symposium S8 Room 1.71	**Symposium S9** Room 1.62	**Symposium S10** Room 1.10	**Parallel P10** Room 1.60
Risk Governance and Public Participation	**Emerging Risks in Industry – results from the iNTeg-Risk project**	**The reality of precaution - Comparing risk regulation in the United States and Europe**	**Risk perception and behaviour**
Chair: Pia-Johanna Schweizer	Chair: Aleksandar Jovanovic ; Olivier Salvi	Chair: Michael Rogers	Chair: Ian Hall
Petts J *Public Participation*	**Jovanovic A; Veres A; Loscher M** *Comparing experiences from different industries when dealing with emerging risks*	**Wiener J** *The pattern of precaution*	**Ayton P; Murray S; Hampton J** *Terrorism, dread risk and bicycle accidents*
Rauws G *The Role of Science and Risk in Public Participation*	**Bodsberg L; Oyen K** *Emerging risks related to industrial plants in sensitive areas*	**Rogers M** *Different approaches to precaution – GM and BSE*	**Elmieh N; Dowlatabadi H; Teschke K; Copes R; MacDougall L; Fraser M; Henry B** *The role of risk perceptions in creating messages for emerging infectious diseases: the case of West Nile virus*
Schweizer P-J *Risk Governance and Public Participation*	**Vetere Arellano AL; Christou, M; van Wijk, LGA; Mengolini A; Fass H; Fulli G; Venahoorn L** *Preliminary results of an analysis of emerging risks for the EU in the energy supply arena*	**Alemanno A** *Precaution and better regulation*	**Hall I** *A Canadian, an American and a Brit were walking down a street..... Can mental models derived from scenario analysis accurately predict risk taking behaviour of actors in a risky situation?*
	Cozzani V; Rota R; Uguccioni G *Emerging risks related to advanced LNG regasifcation technologies*	**Bergkamp L** *Legal and administrative systems: Implications For Precautionary Regulation*	
	Dien Y; Duval C. *How to build Key Performance Indicators? A contribution to ensure a proper management of industrial safety taking into account technical, human and organisational aspects*	**Lofstedt R** *Closing comments*	

COFFEE			**Tuesday 9 – 9.30**
PLENARY 3			**Tuesday 9.30 – 11.00**
	Geoffrey Podger **Steve Wearne** **Mickael Karlsson**	**Risk Management & Regulation in the 21st century: Lessons for Europe** Chair: Ragnar Lofstedt Room B5	
SESSION 3			**Tuesday 11.00 – 12.30**
Parallel P11 Room 1.67	**Parallel P12** Room 1.11	**Parallel P13** Room 1.70	**Parallel P14** Room 1.20
Pharmaceutical risk regulation Chair: Sweta Chakraborty	**Risk perception** Chair: Michael Siegrist	**Risk governance – historical perspectives** Chair: Adam Burgess	**Risk assessment in the workplace** Chair: Michael Howard
Boon W; Moors E; Meijer A *Balancing drug innovation and safety: governing drug risk surveillance*	**Kusev P; Johansson P; van Schaik P; Tsaneva-Atanasova K** *Relative Theory of Choice: Preference Change for Risky Choices*	**Agnew J** *Education, child labour and legislation for factories and mines in the mid-nineteenth century: parliamentary arguments about risks and benefits*	**Trainor M** *Risks to health and safety from workplace activities: new and ongoing challenges*
Grantham S; Connolly-Ahern C; Ahern L *Communicating the Risk of HPV and Cervical Cancer through Social Amplification: Merck's Strategic Marketing of Gardasil*	**Kewell B** *Narrative and Risk: A Theoretical Exploration*	**Fintz M** *Lessons Learned, Lessons to Be Forgotten or the Ambiguous Role of Historical Information in Risk Governance*	**Healey N; Stacey N; Gauthier F; Chinniah Y** *Theoretical Evaluation of Methods for the Qualitative Estimation of Risk*
Hess R; Visschers V; Siegrist M *Understanding medical risks depicted in arrays of pictographs: The role of numeracy and reference risk information*	**Evans D; Jakobus B** *Risk intelligence: what is it, and how can we measure it?*	**Delvenne P** *Democratic Accountability in Governance of Science and Technology: on Reflexivity in European Parliamentary Technology Assessment Offices*	**Grotan TO** *Risk Governance of Complexity in Integrated Operations*
Chakraborty S *Public Perceptions of Ex-Post Regulation Towards Pharma Sustainability*	**Connor M; Siegrist M** *Consumers' cognitive map of biotechnology: MDS results of sorting data applied to different biotechnology applications*	**Burgess A** *From moral to risk-based policy discussion*	**Albrechtsen E** *New technology and changed work processes – new approaches to interdisciplinary risk assessment*

Tuesday 12.30 – 1.30	**LUNCH, SRA BUSINESS MEETING & AWARDS CEREMONY** (Room B5)		
Tuesday 1.30 – 3.00			**SESSION 4**
Symposium S11 Room 1.11	**Symposium S12** Room 1.60	**Symposium S13** Room 1.10	**Parallel P15** Room 1.20
Risk, place and power: local community attitudes to new low carbon energy developments in the UK and the rest of Europe	**Uncertainty in human and environmental risk assessment: Part 1 Methodology**	**Risk, governance and accountability in the National Health Service**	**Risk and organizations**
Chair: Richard Eiser	Chair: MarkoTainio	Chair: Anneliese Dodds	Chair: Asa Boholm
Pidgeon N; Venables D; Parkhill K; Henwood K; Simmons P *Living with nuclear power: sense of place, perceived risk, proximity, and attitudes to new build in existing host communities*	**Pohjola MV; Tuomisto JT; Tainio M** *The properties of good assessments: The factors that contribute to assessment performance*	**Dixon-Woods M; Yeung K** *Accountability and design-based regulation in patient safety*	**Kinder KE; Boos D; Busby JS; Grote G** *Pervasive technologies, risk and accountability*
Eiser JR; Aluchna K; Jones CR *Local wind or Russian gas? Contextual influences on Polish attitudes to wind energy developments.*	**Boriani E; Fernandez A; Benfenati, E** *Uncertainty in risk characterization of chemicals for REACH, integration of data from different sources*	**Jack L** *Communities of practice in patient safety*	**Bodsberg L; Herrera I; Hobrekke S; Krokenes T** *The use of risk influencing factors for risk assessment of offshore helicopter transport*
Jones CR ; Orr, BJ ; Eiser JR *How many wind farms are acceptable? Identifying predictors of perceived regional capacity for wind development in the UK.*	**Ciffroy P; Tanaka T; Stenberg K** *Methods for deriving Probability Density Functions for parameters involved in multimedia modelling*	**Holland M** *Improvement in Patient Safety in Mental Health: Getting to Zero – A description of the methodologies used by Henry Ford System to reach zero suicides .*	**Hede S** *Perceptions of societal risks, preparedness and management capability at government agency level. An interview study*
Orr BJ ; Jones, CR ; Eiser JR *Environmental attitudes and community attachment, and the local acceptance of carbon capture technology in the UK and Sweden.*	**Knol A; Slottje P; Jeroen P. van der Sluijs JP; Lebret E** *Using expert elicitation to deal with uncertainty in impact assessment*	**Howe A** *How to develop adequate accountability to the self and peers against professional criteria to avoid risk to patients*	**Schiller F; Rocks S; Pollard S** *Risk maturity models as blueprints for better risk management – issues for a government department*
Tuesday 3.00-3.30			**TEA**

LUNCH, SRA BUSINESS MEETING & AWARDS CEREMONY (Room B5)			**Tuesday 12.30 – 1.30**
SESSION 4			**Tuesday 1.30 – 3.00**
Parallel P16 Room 1.70	**Parallel P17** Room 1.71	**Parallel P18** Room 1.62	**Parallel P19** Room 1.67
Media and risk communication	**Resilience and adaptation**	**Risk assessment and standards**	**Institutional dimensions of risk governance: Climate change and flooding**
Chair: Gabriella Rundblad	Chair: Judith Petts	Chair: Michael Rogers	Chair: Kristian Krieger
Revuelta G; Cugat G; Gosalbez P; Santamaria M; Escurriol V *Food safety and food security issues in the Catalan press: The SAM report*	**Harries T** *Individual adaptation to climate change in conditions of uncertainty*	**Simoncini M** *Regulating catastrophic risks by standards*	**Correlje A; Broekhans B** *Flood protection in the Netherlands: The institutionalization of residual risk*
Hurrell C; Nicol AM; Hodgins K *Asbestos exposure in the news: a historical content analysis of French- and English-language newspapers*	**Therrien MC** *Building intra and inter-organizational resiliency: adaptive fit for better crisis management*	**El Yamani M; Brunet D** *Setting Occupational exposure limits: between risk assessment and risk management*	**Baldet B** *Renewal of public policies for flood risk management. Between globalized approach and localized stakes : Is there still a place for threat ?*
Jönsson AM *Risk communication and the European Public Sphere*	**Tanguay GA; Normandin JM; Therrien MC** *City Strengths in Times of Turbulence: Strategic Resilience Indicators*	**Illing P** *Issues in toxicological risk analysis for chemicals*	**Ellison D; Keskitalo C** *On the Institutional Governance of Mitigation and Adaptation to Climate Change*
Rundblad G; Knapton O *Media communication during a natural disaster*	**Petts J** *Building Climate Change Adaptive Capacity: Institutional Challenges*	**Rogers M; Smriga M** *Risk Governance of Food Supplements – The Case of Amino Acids*	**Krieger K** *Rational adaptation to increasing flood risk? Institutional barriers to and drivers of risk-based flood management in Germany and Britain*
TEA			**Tuesday 3.00-3.30**

Tuesday 3.30 - 5			**SESSION 5**
Symposium S14 Room 1.10	**Symposium S15** Room 1.60	**Parallel P20** Room 1.70	**Parallel P21** Room 1.71
Global governance of risks: WTO, Codex Alimentarius and Private Standards	**Uncertainty in human and environmental risk assessment: Part 2 - Case Studies**	**Risk perception**	**Risk governance: International perspectives**
Chair: Alessandra Arcuri	Chair: Alexandre Zenié	Chair: Ellen Townsend	Chair: David Levi-Faur
Gruszczynski L *A Standard of review in international SPS Trade disputes: Some new developments*	**Tainio M; Karvosenoja N; Kupainen K; Kukkonen J; Pekkanen J; Tuomisto JT** *The uncertainties of risk assessment for fine particulate matter: Implications of a European and Finnish case study?*	**Siegrist M; Connor M** *The influence of social trust, confidence and fairness on the acceptance of GMO field experiments in Switzerland*	**Orru K** *Europeanisation of risk regulation: drinking water safety case in Estonia and Lithuania*
Herwig A *The contribution of global administrative law to the legitimacy of the Codex Alimentarius Commission*	**Kunseler EM; Hage M; Dassen TGM** *An analytic-deliberative approach to urban sustainability appraisal*	**Assmuth T** *Bias in risk and uncertainty assessment: Cultural clashes and evolution of epistemologies and eschatologies*	**Van Oost B** *Uncertainty as a trigger for precautionary action? The controversy on drilling for gas on the Dutch Wadden Sea*
Arcuri A *Rethinking the risk paradigm at the WTO*	**Ragas A** *Dealing with uncertainty in ecological risk assessment*	**Kuttschreuter M** *Determinants of food safety practices at home*	**Hendrickx K; Fallon C; Joris G** *The Good, the Bad and the Ugly. Integrating multiple frames in Flanders and Wallonia air policies by using the Delphi method.*
Alemanno A *Private sector food-safety standards between European and WTO level*	**Dimosthenis, S; Kuhn, A; Denby, B; Gerharz, L; Sabel, C; Shaddick, G; Zenié, A.** *Uncertainty analysis of the Heimtsa/Intarese case study on health impacts of climate change mitigation measures*	**Townsend E; Spence A; Knowles S** *Investigating the processes that underpin the affect heuristic*	**Justo-Hanani R; Levi-Faur D; Dayan T** *The limits of international harmonization in nanotechnology risk regulation*
Tuesday 5.00 – 6.30			**PLENARY 4**
Finance, Risk & Governance Chair: Michael Power Room B5		**Michael Power** **Jon Danielsson** **Steve Priddy**	
Tuesday 7.30 - Late			**DINNER ON HISPANIOLA**

SESSION 5			Tuesday 3.30 - 5
Parallel P22 Room 1.11	**Parallel P23** Room 1.67	**Parallel P24** Room 1.62	
Graphical risk communication	**Public perceptions of risk: an international perspective**	**Risk and decision making**	
Chair: Peter Wiedemann	Chair: Tom Horlick-Jones	Chair: Frederic Bouder	
Spangenberg C; Krug HF; Fleischer T; Kastenholz H; Hocke-Bergler P; Quendt C *Summarising and communicating evidence in the assessment of data uncertainties: practical application of evidence maps in the field of inflammation by engineered nanoparticles*	**Cooper E** *"Never Say Die": Differing Perceptions of Risk in Aklavik, NWT, Canada*	**Fox J; South M** *Arguing about risk: the role of logic*	
Keller C *Using a familiar risk comparison to overcome low numeracy: A study of visual attention*	**Litmanen T** *The utmost ends of the nuclear fuel cycle How Finns perceive the risks of uranium mining and nuclear waste management*	**Duffey RB; Saull JW** *The principles, practice and prediction of risk governance: enabling strategic resource allocation*	
Boerner F; Schuetz H; Wiedemann P *Evidence maps as a risk communication tool – An empirical evaluation*	**Horlick-Jones T; Prades A** *Some conceptual and methodological considerations about interpretation and context in cross-cultural risk studies*	**Prpich G; Rocks S; Pollard S** *Strategic Environmental Risk Assessment for Informing Decision Making Processes*	
		Bostrom M; Borjeson N; Jonsson AM; Gilek M; Karlsson M *Responsible procurement and complex product chains*	

PLENARY 4		Tuesday 5.00 – 6.30
	Michael Power **Jon Danielsson** **Steve Priddy**	**Finance, Risk & Governance** Chair: Michael Power Room B5

DINNER ON HISPANIOLA	Tuesday 7.30 - Late

Wednesday 9 – 9.30			**COFFEE**
Wednesday 9.30 – 11.00			**PLENARY 5**
Accounting for risk-based governance Chair: David Demeritt Room B5		**Kip Viscusi** **Julia Black** **Ronan Palmer**	
Wednesday 11.00 – 12.30			**SESSION 6**
Symposium S16 Room 1.10	**Parallel P25** Room 1.11	**Parallel P26** Room 1.60	**Parallel P27** Room 1.62
Public engagement with climate change mitigation strategies	**Risk perception in an international context**	**Risk and communities**	**Public perception of food risks**
Chair: Nicholas Pidgeon	Chair: Frederic Bouder	Chair: Tim Harries	Chair: Ragnar Lofstedt
Whitmarsh L *Public uncertainty and scepticism about climate change*	**Pietrantoni L; Prati G; Picheca A; Zani B** *Perception of environmental and health hazards and the influence of general trust and ecological worldview in a sample of Italian adults*	**Nicol AM; Murphy D; Corbett K** *Communicating risk in a multimedia, multicultural context: pesticide safety and farm families*	**Turcanu C; Perko T; Carlé B** *Attitude towards radiocontamination in food products: what should we bear in mind before taking decisions?*
Spence A *Perceptions and support for climate change mitigation strategies*	**Chauvin B** *Risk perception and personality facets*	**Moura Arroz A; Sao Marcos R; Gabriel R; Borges PV** *"United we stand, divided we fall" – empowerment and commitment in the local action. A risk communication program on the governance of an urban termite plague in the Azores*	**Sabry S** *Attitudes of Hawaii Producers Toward Genetically Modified Products*
Corner A; Pidgeon N *Geoengineering: The social and ethical implications*	**Van Poll R; Devilee J** *Environmental-Health risk characterisation by British residents*	**Di Mauro C; Bouchon S; Chinaglia V; Zaccone A** *Industrial risk perception and risk communication: the case of the Lombardy region (Italy)*	**Dijkstra A; Gudde L; Pin R; Gutteling J** *Public acceptance of implementation of nutrigenomics application according to the experts*
Parkhill K; Butler C; Pidgeon N *Weird Science? An Exploration of Public Perceptions of (Geo)Engineering the Climate*	**Kurzenhaeuser S; EppA; Bol GF** *Food risk perception before and after reading scientific risk assessments*	**Zwarterook I; Le Blanc A; Hellequin AP; Calvo-Mendieta I** *An Assessment of Risk Information and Participatory Processes in the Industrial Area of Dunkirk, France*	**Lores Garcia M; Coma JF; Lozano Monterrubio N** *The Catalan Food Safety Governance in the Spanish and European Context*

COFFEE			**Wednesday 9 – 9.30**
PLENARY 5			**Wednesday 9.30 – 11.00**
		Kip Viscusi **Julia Black** **Ronan Palmer**	**Accounting for risk-based governance** Chair: David Demeritt Room B5
SESSION 6			**Wednesday 11.00 – 12.30**
Parallel P28 Room 1.67	**Parallel P29** Room 1.70	**Parallel P30** Room 1.71	
Deconstructing risk and risk expertise	**Managing disease risks**	**Risk and different sectors of society**	
Chair: Ana Prades	Chair: Ann Enander	Chair: Jonathan Wiener	
Giorgi L *Putting Risk Governance to the Test or Why the Separation of Risk Assessment from Risk Management did not Improve Accountability*	**Hänninen O, Knol A, Lim TA, Conrad A, Carrer P, Kim R, Prüss-Üstün A, Kollanus V,Leino O,Jantunen M** *Environmental burden of disease in European countries*	**Dahlgren J** *Making sense of gender in risk policy and crisis management*	
November V *Recalcitrance of risks: a management failure?*	**Rush-Sirkski A; Driedger SM; Cooper E** *The role and importance of risk communication in pandemic planning*	**Filipsson M; Samuelsson L; Oberg T** *Variability between individuals when reviewing environmental risk assessments at a public authority*	
Todt O; Lujan JL *Risk assessment and methodological learning*	**Marcu A; Barnett J; Uzzell D** *Information sufficiency and the timing of precautions: the case of Lyme disease*	**Von Watzdorf S; Skorna A** *The role of preventive services in the insurance purchasing decision*	
Horlick-Jones T; Prades A *Beyond the critique of the deficit model; risk, lay expertise and practical reasoning*		**Skorna A; vonWatzdorf; Weiss M** *My home is my castle - claims prevention within the home insurance sector*	
		Sparf J *Ability and vulnerability – everyday life dilemmas for people with disabilities*	

Wednesday 12.30 – 1.30			**LUNCH**
Wednesday 1.30 – 3.00			**SESSION 7**
Symposium S17 Room 1.10	**Parallel P31** Room 1.11	**Parallel P32** Room 1.60	**Parallel P33** Room 1.62
The changing nature of risks and benefits in the medical area: towards a two-way proactive model?	**Risk assessment and health**	**Risk, experts and the public**	**Environmental risk communication**
Chair: Frederic Bouder	Chair: Rick Reiss	Chair: Herve Corvellec	Chair: Anne Katrin Schlag
Bouder F *Balancing benefit and risks: a three case review of EMA's risk communication*	**Di Bartolo C; Triolo F; Lopez F; PiazzaT; Gerlach JC; Gridelli B** *A Quality Risk Management Model Approach for Cell Therapy Manufacturing*	**Carrere G** *Road safety experts and the subjectivation of public action*	**Devilee J; de Vos M; van Poll R** *Risk communication on soil pollution and clean-up in The Netherlands*
Raine J *TBA*	**Ferri M** *Microbiological risk assessment and the decision-making process in Italy. A proposed road map*	**Sao-Marcos RS; Arroz AM.; Gabriel R; Neves I C; Rego I E; Palos A C** *Child Obesity: Blessings for the family table, in the children´s name we say. Family enrolment in risk communication - a local tryout in the Azorean islands*	**Bründl M; Rheinberger C** *Perception of Natural Hazard Risks Related to Climate Change in the Alps*
Le Louet H *A clinical perspective on benefit-risk communication at EMA*	**Giannopoulos G; Arvanitis A; Zenie A; Kotzias D; Kephalopoulos S** *Assessing consumer exposure using GExFRAME*	**Arroz AM; Estrela Rego I; Caldeira SZ** *What if 'it' happened now? How do families communicate and prepare for seismic hazards in the Azores*	**Gonzalo Iglesia J; Farré J; Espluga J; Prades A** *Communicative strategy of risk construction in the European Union: climate change case study*
Szafir D *Risk communication or Comparative Benefit Risk communication?*	**Zenié A; Jantunen M; Torfs R; Reina V; Kotzias D** *The European Exposure Factors (ExpoFacts) Sourcebook - Supporting risk and exposure assessment of European populations*	**Corvellec H** *Narrative structure of Risk Accounts*	**Smith N; Joffe H** *Common sense understanding of global warming: A social representations investigation*
Wednesday 3.00			**END**

LUNCH			**Wednesday 12.30 – 1.30**
SESSION 7			**Wednesday 1.30 – 3.00**
Parallel P34 Room 1.67			
Industrial risk management Chair: Jean-Pierre Galland			
McKenna SA; Alkaner S; Das PK *Modelling Risk in the Ship Dismantling Industry*			
Bozek F; Bumbova A; Dvorak J *Risk Management at Landfills*			
Stacey N *Integrating Risk Concepts into an Undergraduate Engineering Degree*			
Louzis K; Koimtzoglou A; Ventikos NP *Ship Wreckage in Greece: A Fairytale Or A Nightmare To Be?*			
Galland JP *France/UK : two regimes of regulating industrial risks*			
END			**Wednesday 3.00**

POSTERS
Room: Restaurant

Bareno, J	*Cost Analysis in Compliance Management Models with MASTER*
Bayramov A	*About Nuclear Threat Risk Assessment*
Blust SA; Lemyre L; Markon MPL; Lee JEC; Krewski D; Lemus C	*Perceived CBRN Terrorism Threats and Public's Intent to Cooperate with Authorities: The Role of Uncertainty*
Boulanger G; Solal C	*General population and workers exposed to formaldehyde: a different approach to assess the health risks*
Brown LE; Dinan W	*Governance, Planning and Risk: an analysis of industrial and community change in Grangemouth*
Carvalho H; Martins M; Loureiro E	*Anthropic risk analysis and archeological data in the area around Braga (North of Portugal)*
Dagonneau J; Prpich G; Rocks S; Pollard S	*Technical Development of a Strategic Environmental Risk Appraisal Tool*
deNazelle A; Rojas D; Nieuwenhuijsen M; on behalf of the Transportation, Air Pollution and Physical Activities (TAPAS) workshop participants	*Results of an international workshop on integrated health assessments of active transportation policies*
Farre J; Horlick-Jones T	*The communicative turn in risk communication: towards a new research agenda*
Fleming P	*HPV vaccination perceptions in the UK and the USA*
Gibson S; Lemyre L	*Social environment and emergency preparedness: Who we are, where we live, and what we do*
Hartley A; Hemming D	*The impacts of climate change on a UK fire and rescue service: a risk-based approach*
Hanninen O; Knol A; Lim TA; Conrad A; Carrer P; Kim R; Pruss-Ustun A; Kollanus V; Leino O. Jantunen M	*Environmental burden of disease in European countries: Quantification, comparison and ranking of environmental stressors within and between participating countries – the EBoDE project*
Kang S; Song S; Kim S	*The Survey Experiment about Perceived Risk/Benefit from MCD(Mad-Cow Disease) and the Possibility of Attitude Change*
Kim HJ; Kim Y	*A maze in risk: Analysis of Government's Dilemma in Managing the Real-estate-Bubble Crisis in Korea*
Kim S; Seo HJ; Pak SB	*Does Value Matter?: The Difference and its Effect on Risk-Benefit Perception among Expert and Public*
Kim T; Kim H	*The Empirical Survey about the Effect of Personal Risk Characteristics on Credit Information Management*
Kollanus V; Knol A; Tainio M; Kunseler E; Leino O; Tuomisto JT	*The Impact Calculation Tool (ICT) – A Model for Quantifying Health Impacts of Environmental Exposures*
Lee LK; Lee KL	*Risk Dynamics and Network Bottlenecks: Considerations in Enterprise Risk Management*

Leino O; Hanninen T; Priha E; Carrer P; Fanetti A; Jantunen M	*Controversy in indoor air health risks: Formaldehyde and cancer – serious risk or a lot of concern for nothing?*
Leino O; Pekkanen J; Hanninen T; Komulainen H; Kuusisto E; Priha E; Kauppinen T; Karjalainen A; Kurttio P; Hallikainen A	*SETURI – a project for ranking environmental health risks in Finland*
Markon MPL; Lemyre L	*Governmental Risk Communication: An Experimental Investigation of Presenting Different Types of Uncertainty to the Public*
Mauelshagen C; Schiller F; Denyer D; Rocks S; Pollard S	*Risk maturity models: accounting for organisational cultures*
Park C; Kim J; Kim S	*The Specification of Affective Image's Role in Risk Judgement about Nanotechnology*
Park SS; Cha HY	*Risk and Politics: Conflicting Discourses on the Korean Candlelight Demonstration against the Import of the US beef*
Park S	*A Democratic Crisis: The Coexistence of a Low Turnout and a Vehement Demonstration*
Redaelli, M	*Impact of after-treatment technologies on nitrogen dioxide (NO2) emissions from diesel vehicles, and associated health issues*
Schaffner, D	*Preliminary risk assessment Salmonella in formulated dry foods*
SendaY; Kosugi M; Tsuchiya T	*Public Perception on Judgment with regard to Certainty of Health Information*
Skinner D; Drew GH; Rocks SA; Pollard STJ	*Addressing Uncertainty in a Weight of Evidence Framework*
Song S; Kim J; Cha HY; Wang J	*Knowledge or Feeling?: Its Effect on Risk Perception of Genetically Modified(GM) Foods in South Korea*
Ward S	*Scoping risk analysis for best practice risk management*

Session 1, Monday 1.30pm

Symposia

Symposium S1. Risk and Decision making (a).

Decision making and risk are essentially linked. Either that risk emerges from decisions taken or that decisions are taken about risk, decisions are crucial to the creation and management or governance of risk. In terms of understanding, though, the rational model of decision making is an intellectual project rather than an accurate description of the social and organizational reality of decision making practices (or processes). In practice decisions are often elusive and it is hard to understand how and by whom they are taken. High level of technical complexity, situations where a variety of actors are involved, and diffuse societal impacts make it uncertain to assess the nature or even point in time of decisions. In some cases, decisions are not understood before long after they have had an impact. Some would even say that they are mere ex-post constructions. But risk follow from decisions taken and it is a practical as well as a theoretical imperative to better understand how decisions affect risk and how they are affected by it.

Chair: **Asa Boholm**

Hermans M (Maastricht University Netherlands); van Asselt M (Maastricht University Netherlands; Passchier W; Zeiss R

The dynamics of uncertainty in risk decision making - A case study on the controversy around base stations for mobile communication technology

Protests against the siting of base stations in municipalities have been the most recent development of the controversy around mobile communication technology (e.g. Burgess, 2004; Borraz et al., 2005; Stilgoe, 2007; Soneryd, 2007). This case seems to challenge well-established risk controversy theory. It stands out from other controversies (e.g. nanotechnology or GMOs) as a well-embedded, continuously developing and ubiquitous technology, whose benefits are not contested – not even by opponents (e.g. Drake, 2006). Moreover, risk governance of mobile communication is a multi-level process in which European, national and local regulators interact. While studies on this controversy have centered on explaining the differences in opinion between citizens and experts, e.g. by using insights from psychometric risk perception studies (e.g. Wiedemann et al., 2003; Barnett et al., 2008; Cousin & Siegrist, 2008), this paper focuses on the practice of risk decision making in complex actornetworks around uncertain risks (e.g. citizens, city councils, WHO, etc) and the various ways in which scientific knowledge is used, mobilized and evaluated. We argue that decision makers try to manage the controversy by framing it as and reducing it to a scientific problem, i.e. whether the interaction of radiofrequency electromagnetic fields with biological tissue poses health risks. This framing does not only equate public concern with the opposite of expertise, as something that needs to be balanced against scientific evidence, but also puts science in a problematic position, since there is no univocal conclusion. Citizens increasingly engage with experts and familiarize themselves with scientific knowledge to challenge 'scientific' claims made by scientists, governments, city councils and legal courts. Empirically, the paper draws upon an interdisciplinary literature analysis and exploratory case study research on several municipalities in the Netherlands.

Fox T (Maastricht University Netherlands)

The role of uncertainty intolerance in the chemical risk regulation of toys

Chemical risk has a longstanding tradition in risk regulation (Leiss et al, 1994; Leiss, 2004; Fischoff et al, 1981, Fischhoff, 1996; Slovic, 1996, 1999; Halffman, 2003, Halfmann et al, 1998) and has been institutionalised in a classical risk regulatory approach. Contrasting this, risk governance looks at complex, uncertain and ambiguous risks and puts uncertainty centre stage. Although the contours of risk governance have been marked, it remains unclear within regulatory regimes how to transfer from the classical risk paradigm to risk governance. This paper investigates how these risks are currently regulated in order to gain insight, understand and identify the various mechanisms that may challenge, pose obstacles or facilitate a regime change to risk governance. The article focuses on chemicals in children's toys as a case study.

Chemicals such as phthalates (i.e DINP, DEHP) and Bisphenol A (BPA) are used to optimise the manufacturing process of many toys and bathing products for children under the age of three. For several decades both Phthalates and BPA show signs of a similar path in raising controversy about adverse health effects to children. However, there are crucial differences in the risk regulation of phthalates and BPA when comparing the EU, USA and Canada. This paper investigates these differences in risk regulation. The comparative approach helps to gain insight into the challenges,

obstacles and possible points of departure that a shift to risk governance can bring along.

Building upon work by van Asselt and Vos (2006; 2008; 2009) this article addresses whether the uncertainty paradox has manifested itself in the risk regulation process of BPA and phthalates. They argue that the uncertainty paradox is a situation in which on the one hand it is increasingly recognised that science cannot provide decisive evidence on uncertain risks, while on the other hand policy-makers and authorities increasingly resort to science for more certainty and conclusive evidence. Situations in which the uncertainty paradox seems prevalent are interesting because these situations often are critical in view of a regime change to risk governance. Van Asselt and Vos have suggested that uncertainty intolerance is an important mechanism in understanding various manifestations of the uncertainty paradox.

This concept, which originated in Psychology, has not been a subject of sociological risk research so far. The paper argues that the role of uncertainty intolerance on the side of industry and regulators regarding adverse health risks of chemicals in children's toys, possibly poses an obstacle in the regime change to risk governance. My research will zoom in on its effect on this process. Empirically, the paper draws upon document analysis, desk study research and interviews with various actors.

Boholm A (University of Gothenburg Sweden), Corvellec H (Lund University, Sweden)

A relational theory of risk (RTR)

The purpose of this paper is to present a relational theory of risk (RTR). According to this theory, risk is a situated way of relating two objects, a risk object (RO) and an object at risk (OaR), in a causal and contingent way so that the RO is considered, in some way and under certain circumstances, to threaten the OaR and potentially hurt the value that is attached to it. The RTR is an interpretive theory of risk that not only answers to the key theoretical and practical question of why and how something is considered as a risk (as opposed to not). The RTR provides also an array of new ways of understanding and dealing with risk communication, risk governance, risk management, and, more generally, risk decision making.

Bennett C (King's College London UK)

Which hazard and what response? Two elements in decision making about behavioural responses to perceived risk

This paper explores some of the links between perceptions of risk, decision making and behavioural outcomes by assessing empirical evidence on decision making in response to perceived risk in real-life situations. It argues that individuals and groups are always aware of multiple hazards in their environments and hence, that at any one time decision choices are composed of two elements. First, a need to select which of the many perceived hazards to respond to, and then (only secondly) how to respond to the chosen hazard.

The arguments set out are based on three very different sets of qualitative empirical data. The first set comes from ongoing doctoral research investigating the contribution of multiple, qualitatively different perceptions of risk to the aetiology of adverse events in UK National Health Service (NHS) hospitals; the second data set comes from an ethnographic account of the adoption and implementation process of a new tool to improve patient safety in an NHS hospital; and the third from a recently completed research project looking at the management, impact and performance of networks in the NHS.

The first set of data comprises observations of and interviews with staff in an NHS hospital trust. Every year, around 14 million people are admitted to hospital in England. Of these around 7% will be put at risk of harm through a potentially dangerous occurrence (adverse event). Some 20% of adverse events relate to failure of routine procedures instituted specifically to prevent their occurrence and are potentially avoidable. Respondents in this study were 1) ward-based clinical staff observed during their working day and then interviewed in depth about how they prioritised (made choices about) what they did and why; 2) managers interviewed using the same protocol; and 3) staff involved in an adverse event interviewed retrospectively about their recollections of the incident and the choices they had made at the time. Data from the study supports the hypothesis that staff perceive a wide range of qualitatively different hazards in their surroundings and select (sometimes deliberately, sometimes without conscious thought) a focal hazard to which to respond. This hazard may not necessarily relate to patient safety, even where such issues are high on their agenda.

The second set of data considers decision-making about perceived risk at a more organisational level. These data trace the development and introduction into an NHS hospital trust of a new tool to address a particular patient safety issue, the monitoring and recording of fluid balance. A relatively simple task, fluid balance recording is nonetheless notorious for being inadequately and inaccurately completed. At the trust concerned incidents of this type rank among the top ten of adverse events due to failure of safety procedures. A new chart designed to raise awareness of fluid balance problems was adopted by the executive nearly 18 months ago. Despite this, implementation is still at a very early stage and in the interim further serious adverse events involving fluid balance have occurred. A contemporaneous ethnographic account of the implementation process suggests that much of the delay has been occasioned by competing

perceptions of qualitatively different risks at organisational and managerial level within the Trust, affecting the decision making and behaviour of those involved in the implementation process.

Finally, moving from the individual and single organisational levels to a much broader level of analysis, the third set of data comes from a major qualitative study of 8 managed networks in the NHS. Managed networks play an increasingly central role in the governance of service delivery within the health service and these data explore the extent to which network functioning is mediated by multiple, qualitatively different perceptions of risk from different interest groups. Externally, regulatory mechanisms, such as evidence based policy changes and government targets, are frequently driven by perceptions of risk emerging at governmental, or even societal level. Internally, network performance may also be influenced by differing perceptions of the degree of risk posed by various hazards from within the member groups. Hence individual and group behaviour in response to perceived risk will vary according to the choices they make about which hazard should be prioritised.

This paper, therefore, offers a contribution to understanding the complicated links between risk and decision making by presenting data from non-laboratory settings on how different individuals and groups make choices about perceived risk. Specifically, the paper argues that there are two elements to response decisions; the primary choice of which perceived hazard should be prioritised and, only secondly, how to behave in relation to that focal hazard. It is suggested that in considering risk decisions, investigation of the primary prioritising process is often overlooked, but may pay dividends in illuminating the decisions about behaviour which follow.

Symposium S2. Mapping risk management and analysis as knowledge-intensive processes: Towards a visual risk process language

The multi-layered sequences of risk management, including the steps of risk analysis, risk evaluation and decision making, can be considered as knowledge-intense processes. To analyse, understand and improve these working steps, it has been shown that visualization of theses processes can be a useful analysis and improvement practice, as has been the case for other processes such as R&D or strategy (Eppler and Aeschimann, 2009). In our scientific work, we thus advocate the use of a knowledge modelling and description language (KMDL) developed by Gronau (Gronau et al., 2005) to improve risk processes. While our focus of research is on risks due to natural hazards and their prevention or mitigation as a national, country-wide initiative, we are interested in risk modelling and process description for a variety of sectors, such as policy-related, financial or health risk. We expect presentations which give scientific examples of model-based descriptions and visualizations of risk-related management processes. This proposed special session thus focused on the current practices and future potential of process modelling for risk management. It aims to present research achievements and their integration into operational practice through case studies, best practice examples and lessons learned – all focusing on the graphic modelling of risk management to improve its efficiency and effectiveness.Beside studies about single processes, we would like to address presentations on complex process descriptions as well. Among other international contributions, findings of a national science foundation project on the topic will be presented.

Expected outcomes:
The session addresses the complexity of risk-related decision and analyses processes, which can be characterised as knowledge-intensive. Such processes are characteristic e.g. in the field of policy deployment or operational risk management of natural hazards. We propose that KMDL can be fruitfully applied to risk management processes in practice. By presenting examples and scientific studies from different European countries we can achieve a review of the state of the art, and an evaluation, adaptation, and improvements of existing methods and tools for modelling risk management processes. With this session the conveners want to address stakeholders ranging from university level over scientific experts and practitioners to politicians interested in improving risk management through a process mapping and modelling perspective.

Chairs: **Martin Eppler & Nicole Bischof**

Aeschimann M (Daniel Swarovski Corporation AG Switzerland)

Risk visualization in an enterprise context

The goal of enterprise risk management is to identify and analyse uncertainties with potential negative consequences, to prioritise them and to decide about adequate mitigation measures. In this context, risk visualisation designates the systematic effort of using (interactive) images to augment the quality of risk analysis and communication along the entire risk management cycle. A recently developed Risk Visualisation Framework is presented. One aim of this framework is to provide a checklist of the key factors to consider.Three real-life examples of risk visualisations are discussed and respective learnings are shared. It is shown that visualisations can, inter alia, improve the common understanding in the discussion of risk-related topics between specialists, risk managers and decision makers. However, risk visualisations bear also some dangers, e.g. the risk of misleading or being misinterpreted. Therefore, visualisations should be used deliberately and some basic guidelines should be obeyed.

Brundl M (WSL-Institute for Snow and Avalanche Research SLF Switzerland)

Visualisation of natural hazard and risk - chances and constraints

Information on hazards and risk is based on text and graphical illustration, while the latter has become more important during the past years. Transforming a complex technical content into simple, easy understandable signs, icons or maps is a challenge. All relevant key information should be included but experts and laypersons must be able to rapidly and safely interpret graphical symbols or areal signatures. In this paper we illustrate this challenge with natural hazard examples. Firstly, we present the depiction of hazard or risk and the problem to integrate complex information into one map. Secondly, we present recently introduced icons visualizing the avalanche danger outside controlled snow sport areas. We conclude that standardisation of symbols and graphics is crucial and we believe that visualization of hazard information on mobile devices will become more important in the future.

Fuchs S (University of Natural Resources and Applied Life Sciences Austria)

Evaluating flood risk maps – Towards a visual risk language

In order to mitigate flood hazards, maps which indicate endangered areas by different cartographic symbols supplement technical mitigation measures. However, available information is sparse concerning the impact of such maps on different stakeholders, i.e., specialists in flood risk management, politicians, and affected citizens. In order to overcome this information shortage the current study used a circular approach such that feed-back mechanisms originating from different perception patterns of the end user would be considered. This resulted in a suggestion for a map template which fulfils the requirement to serve as an efficient communication tool for specialists and practitioners in hazard and risk mapping as well as for laypersons (Fuchs et al. 2009). Consequently, this template will enable authorities responsible for flood mitigation to create more disaster-resilient communities.

Symposium S3. Assessing, managing and communicating the risks and benefits of aquaculture: A synergy of natural and social sciences (Part I)

Today, aquaculture is the world's fastest growing food-producing sector, growing more rapidly than all other animal food producing sectors. The industry accounts for almost 50% of the world's food fish supply and is perceived as having the greatest potential to meet the growing demand for aquatic food (FAO, 2006).

In 2001, global seafood consumption was estimated at 100 million tons, and a further increase of 65 million tons is expected by the year 2030. Fisheries will be unable to meet this demand and, as a consequence, the role of aquaculture will become more and more pronounced.

To achieve the position where a sustainable aquaculture industry can produce safe and healthy seafood products, the sector has to cope with several important challenges. A major issue is the shortage of marine resources. As such, there is a growing concern as to whether there is sufficient fishmeal and fish oil to meet the increasing demand of aquaculture and, therefore, whether this growth will be limited by their availability.

Thus the expansion of aquaculture requires the development of sustainable feed resources. On the one hand, eating seafood has a broad range of widely recognized health benefits. On the other hand, fish – farmed as well as wild – can be contaminated with undesirable substances, like PCB's and dioxins, which may pose risks to human health. This makes it essential that the risks and benefits of aquaculture are efficiently assessed, managed and communicated.

Presenters of this symposium come from both natural as well as social science backgrounds and will discuss a wide range of interrelated issues. The symposium will begin with an examination of the development of fish feeds based on sustainable alternatives to fishmeal and fish oil. Gordon Bell will outline the effects of altering the diets of farmed salmon, which on the one hand, can reduce the fish's contaminants but on the other hand, also reduces essential fatty acids.

In the second presentation, Paul Noakes discusses the results from a large-scale study investigating the health benefits of fish consumption, especially for pregnant woman and in relation to allergic diseases. Noakes et al studied the effects of giving women oily fish (salmon) during pregnancy on the amount of EPA and DHA measured in the blood, concluding that eating two portions of oily fish may confer long-term health benefits for the baby.

Anne-Katrine Lundebye and Christer Hogstrand will discuss the safety of fish farmed on new feeds developed in Aquamax examining the interactions between nutrients and contaminants (persistent organic pollutants) in salmon on perinatally exposed mice. (Aquamax - The present studies are part of the EU 6th Framework integrated project "Sustainable AquaFeeds to maximise the Health Benefits of Farmed Fish for Consumers" (http://www.aquamaxip.eu/).-

Moving towards regulatory issues, Iddya Karunasagar explains risk assessments to support CODEX and national risk management using the example of aquacultural products. He argues that these guidelines are of significant interest to the

aquaculture industry as well as the food safety sector in general.

Anne Katrin Schlag will provide a social science perspective to the symposium, addressing the perceptions of farmed fish and fish farming by various European publics and comparing those to scientific assessment. Parallels are drawn with previous food-related controversies. This highlights the challenges of developing effective risk communication strategies with the public about farmed fish.

Basil Sudborough will present the findings of various consumer taste studies conducted to investigate the acceptance of sea bream fed the Aquamax diets. His results show that Greek consumers tend to prefer the taste of fish fed the novel diets, indicating that utilizing reduced levels of fishmeal and fish oil might be a sustainable alternative for aquacultural developments in the future.

In the final presentation of the symposium, Francesca Margiotta will outline the difficulties of designing communications about (farmed) fish consumption in detail, taking into account the findings of earlier speakers. Using a newsletter about fish consumption as a case study she outlines the importance of balancing both scientific benefits and risks of fish consumption, whilst also addressing potential consumer concerns about regulation.

FAO (2006). *The State of World Fisheries and Aquaculture 2006.* Rome: Food and Agriculture Organisation of the United Nations.

Chair: **Ragnar Lofstedt**

Bell G (University of Stirling UK)

Production of contaminant low salmon by dietary manipulation

Atlantic salmon were produced using diets with reduced fishmeal content and replacement of all added fish oil (FO) with a blend of vegetable oils (VO). Three salmon strains were used which were selected based on their varying flesh adiposity. The diets were produced in 3, 6 and 9 mm pellets plus a 9 mm finishing diet containing decontaminated FO. The 3 and 6 mm FO diets contained ~7.5 and 9 ng TEQ/kg of PCDD/F + DL-PCBs while the 9 mm diet, that used a different FO, contained ~3 ng TEQ/kg and the finishing diet ~1.0 ng TEQ/kg. The 3 VO diets contained very low contaminant levels being 0.22, 0.18, 0.47 ng TEQ/kg, for the 3, 6 and 9 mm pellets, respectively. Diet values for the 7 main PBDE congeners showed a similar pattern to PCDD/F + PCBs with levels in the 3, 6 and 9 mm FO diets being ~5.5, 7 and 3 ng/g, respectively. In the VO diets the values were ~0.1, 0.2 and 0.5 ng/g and in the FO finishing diet the value was ~1 ng/g. The current EU limit value for PCDD/F + DL-PCBs is 7 ng TEQ/kg. Flesh values for PCDD/Fs + DL-PCBs and PBDEs are presented after 55 weeks on the experimental diets plus a further 24 weeks on the decontaminated finishing feed. Results showed large reductions in contaminants when using VO but reduced n-3 fatty acids. The latter could be restored using a decontaminated FO finishing feed.

Noakes PS (University of Natural Resources and Applied Life Sciences Austria); Miles EA; Kremmyda LS; Vlachava M; Diaper ND; Calder PC

Effects of dietary supplementation with oily fish in pregnancy on maternal and infant nutritional status. Results from the Salmon in Pregnancy Study (SIPS).

Background:
Before birth the baby requires a complex range of nutrients from its mother to grow and develop and this very early nutrition has important effects on long term health (1). In particular, the long chain polyunsaturated fatty acids [PUFAs] found in oily fish and fish oils (containing docosahexaenoic acid [DHA] and eicosapentaenoic acid [EPA]) are important for the growth of nerve, brain and other cells. The amount of oily fish eaten in the normal UK diet is low and this may not be good for the health of the pregnant mother and her baby (2).
Aim:
We have studied the effect of giving women oily fish (salmon) during pregnancy on the amount of EPA and DHA measured in the blood.
The Study:
Women who normally ate little oily fish (≤ 2 portions/month) were selected to either eat two portions per week of salmon from week twenty of pregnancy until the birth of their baby (n=61) or to continue their normal diet (n=62). Blood was collected form the mothers at 20, 34 and 38 weeks of pregnancy and a sample of the baby's blood collected at birth from the discarded placenta (n=101).
Results:
Will be presented
Conclusions:
Eating two portions of oily fish (salmon) per week in pregnancy as recommended by the UK government (2) increased the concentrations of EPA and DHA in the plasma of mothers and babies. This may confer long-term health benefits on the baby.
1 Barker DJP, Ed. Fetal and infant origins of adult disease. London: BMJ Books, 1992.
2 Advice on fish consumption: benefits and risks. Report form the SACN/COT Fish Inter-committee Subgroup. London: TSO, 2004.

Haave M; Jayashankar S; Bernhard A; Brattlid T; Glover CN; Hogstrand C (King's College London); Lundebye AK(NIFES Bergen Norway)

Effects of contaminants and nutrients in Atlantic salmon on the tissue composition, gene expression and development in mice offspring.

Seafood intake has been a subject of dilemma for consumers, especially pregnant women, owing to the reported risks and benefits associated with its consumption. *In vivo* studies have shown that nutrients may ameliorate the negative effects of contaminants. The present studies examined the interactions between nutrients and contaminants in salmon on perinatally exposed mice. Persistent organic pollutants POPs polychlorinated biphenyl (PCB153) and polybrominated diphenyl ether (PBDE47) and methylmercury were chosen be investigated. Oily fish are a rich source of n-3 fatty acids such as decosahexaenoic acid (DHA) which has neuroprotective effects, and which plays an important role during the prenatal development of the central nervous system. Parallel diets were fed to female mice during gestation and lactation. The difference consisted of the sources of protein and fat, which were standard rodent feed or with a high inclusion of salmon fillet. Stomach contents of BDE47 were significantly lower in offspring of the fish-fed dams compared to casein-fed dams. This was also seen in the liver and fat, with the same trend in brain, and indicates that maternal lactational transfer is affected by the dietary composition however BDE47 had only subtle developmental effects. In the mercury study supplementation with DHA reduced MeHg accumulation in brains of mice offspring, and DHA accelerated the development of grasping reflex in mice offspring. Concomitant exposure of MeHg and DHA affected functional groups of genes related to the cytoskeleton suggesting that DHA influences genes involved in maintaining the cellular architecture of the brain, possibly to compensate for the neurotoxic insults of MeHg. Taken together, the results indicate modulatory effects of dietary composition on accumulation, transcriptomic and neurobehavioural endpoints impacted by environmental contaminants.

Carroll TS; Rasinger JD; Reffatto V; Tassinari R; Maranghi F; Moracci G; Patriarca P; Haave M; Mantovani A; Menditto A; Macrì A; Lundebye A (NIFES Bergen Norway); Hogstrand C (King's College London);

Effects of four contaminants (2,3,7,8-TCDD, CB-153, BDE-47 and HBCD) commonly found in seafood

Fish is an important food source. However, fish with high fat content tend to accumulate lipophilic contaminants and are therefore a source of human exposure to such compounds. We have studied four contaminants that may be found at elevated concentrations in salmon. These toxicants were a dioxin (2,3,7,8-TCDD), a non-dioxin PCB (CB-153), and two polybrominated flame retardants (BDE-47 and HBCD). Whereas TCDD has a well-described mechanism of toxicity, acting via the Ah receptor, the toxicities for the other three compounds are less understood. Effects of the four contaminants were investigated in juvenile female balb/c mice fed either of the toxicants for 28 days as a part of a salmon-based diet. Abundance profiles of mRNA and protein were measured in brain along with histological metrics on endocrine glands and reproductive tissues. In addition, transcriptome profiling was carried out on neuroblastoma (N2) cells exposed to BDE-47 or HBCD. Results showed that all the toxicants induced changes in gene expression and protein abundance in brain. Many of the genes were uniquely expressed in 2,3,7,8-TCDD exposed mice while the non-dioxins showed less distinct profiles from each other. Histopathological aberrations were observed in thyroid, spleen, thymus and liver, but not in brain, adrenals or uterine tissues. Dietary exposure to BDE-47 and HBCD also showed disturbances in serum thyroid hormone levels. Gene expression in cultured N2A cells exposed to BDE-47 or HBCD revealed bias of regulated genes involved in cell development and differentiation, genes encoding membrane-bound proteins, and genes implicated in cellular metabolic processes.

Oral presentations

Parallel P1: Risk assessment

Chair**: Robert Tardiff**

Goldstein BD (University of Pittsburgh USA)

Nanotechnology as a Challenge to Risk Governance

Using the tools of toxicology to predict and assess risk is a foundation for the management and global governance of risks caused by chemical and physical agents. Nanotechnology presents a challenge to each of the three "laws" of toxicology on which this edifice is based. These "laws" are that the dose makes the poison; there is specificity in biological effects; and humans are animals. But simple concepts of dose underlying dose-response assessment are not applicable when smaller is more potent; the specificity underlying the hazard identification step of risk assessment is contrary to a central facet of nanotechnology, that of novel and unexpected qualities of nanomaterials; and predictive animal-based toxicological testing is confronted with unusual dose delivery issues . Such challenges to the standard risk assessment paradigm are not novel and have previously been

met by national and international approaches to risk management an! d governance that may provide insight into the control of the growing field of nanotechnology. The toxicity of radioactive chemicals is primarily dependent upon physical attributes but is guided by chemistry and biology, e.g., radioiodine preferentially collects in the thyroid. International governance of radioactive chemicals began with scientific organizations. Many countries regulate homeopathic drugs, for which the basic concept is that lower doses lead to greater potency. Recently there has been consideration of the implications of the controversial concept of hormesis to risk management. The applicability to nanotechnology of these other situations in which the "laws" of toxicology are challenged will be discussed.

Busschaert P (Katholieke Universiteit Leuven Belgium); Geeraerd AH (KULeuven / MeBioS Belgium) Uyttendaele M; Van Impe JF

Fitting distributions to censored data using a Bayesian model for application in microbiological risk assessment related with foods

Despite increasing efforts of governments and food industry, foodborne pathogenic micro-organisms are still important sources of illness.Quantitative microbiological risk assessment (QMRA) aims at estimating risk of illness caused by a pathogen and is an important tool for risk managers to mitigate risk of foodborne illness. Typically, QMRA is executed in the form of a Monte Carlo simulation in which representative distributions are proposed for all input variables based on available data or expert opinion (such as storage temperature and duration, initial contamination, etc.) and a variety of predictive models are used to estimate a distribution of the risk of illness. Moreover, since about a decade, risk assessors have started to characterize uncertainty (epistemic uncertainty) and variability (i.e., aleatory uncertainty) separately for input variables and propagate this separation by means of a two-dimensional Monte Carlo simulation.However, often data are censored, i.e., their value is known only to be smaller than or greater than a threshold value or within an interval, and therefore it is not always straightforward to fit a distribution to available data, while ignoring censored data or substituting them leads to biased results. In this research, it is illustrated how Bayesian inference can be used to fit a parametric proposal distribution to a set of (partially) censored data related with microbial contamination of foods. Moreover, it is shown how this Bayesian model can be extended hierarchically to include effects caused by covariates and to estimate and compare the importance of covariates to the data.

Jerrett M (University of California at Berkeley USA); Su J; Morello-Frosch R; Jesdale B; Kyle A

The Cumulative Environmental Hazard Inequality Index and Air Pollution Exposures in Three Large Metropolitan Areas of California

The U.S. National Research Council recently highlighted the need for research on cumulative risk assessment. Researchers and policy-makers concerned about environmental justice have argued that low-income communities and communities of color face a higher frequency and magnitude of impact from environmental hazards as well as psychosocial stressors. Thus, additional research is needed to assess the cumulative impact of multiple environmental hazards and their toxic effects on the vulnerable communities. The potential interaction of elevated environmental hazards, combined with socioeconomic stressors, has been described as a form of “double jeopardy”. This paper uses a novel Cumulative Environmental Hazard Inequality Index (CEHII)1 to assess the cumulative inequalities of air pollution in socially disadvantaged groups. The inequalities within and between the three major metropolitan regions in California were compared, including Alameda, Los Angel! es and San Diego. We used land use regression and dispersion models to estimate traffic pollution and air toxics, respectively. Exposures to fine particulate matter were estimated using geostatistical kriging interpolators. We find evidence of significant social inequalities in environmental exposure in all three metros, and in all instances, the inequalities are worsened when multiple environmental exposures are combined rather than investigated separately. Comparing the three regions underscores some of the important policy tradeoffs. For example, Los Angeles has the highest absolute levels of pollution, while Alameda has lower levels of pollution but the highest level of relative inequality in cumulative exposures. (1. Su et al. Environ Sci Technol. 43(20):7626).

Leonte, D (University of New South Wales Australia)

Accounting for non-trivial influences of rainfall on water quality

Estimating long-term trends in water quality is an important undertaking in catchment management. Improved governance of water resources depends on, among other factors, the availability of tools capable to analyse large and complex repositories of monitoring data on many water quality, hydrological and meteorological variables, to estimate long-term trends.

Rainfall is a variable that can affect water quality trends substantially: a statistically significant trend might disappear when rainfall is accounted for, while for other water quality variables the reverse could occur. The patterns are complex and, for

individual wet weather events, further exacerbated by the fact that rainfall influence on water quality decreases with time. Water quality monitoring data has complex statistical characteristics such as autocorrelation and seasonality, with time series showing significant variation in sampling frequency during dry and wet weather periods. Together, these characteristics pose considerable challenges to the long-term trends estimation process.

The standard approach to account for the impact of rain on water quality is LOWESS (locally weighted scatterplot smoothing) – a semi-parametric, rather ad-hoc statistical method, with many limitations. In this presentation we propose a novel approach to account for non-trivial patterns of rainfall influences on water quality, which was recently introduced in financial applications: Mixed Data Sampling (MIDAS) regression, a flexible statistical model, the advantage of which is parsimony. We give the theoretical formulation of the model and implement it on a water quality data set, to demonstrate its benefits.

Tardiff R (The Sapphire Group, Inc. Bethesda MD USA); Carson L

Estimation of Safe Levels in Drinking Water for Perfluorooctanoic Acid (PFOA) Using State of the Art Approaches

Perfluorooctanoic acid (PFOA) is a water soluble compound persistent in humans and the environment. A critical examination was performed on PFOA including human exposure, kinetics, epidemiological and animal toxicity studies: and a reference dose and drinking water equivalent levels (DWELs) were calculated for PFOA in tap water by consideration of modes of action (MoAs). The Benchmark Dose-Uncertainty Factor approach was used for dose-response for noncancer and cancer assessment based on internal doses, which are considered superior to external dose in estimating risks and safety from systemic exposures to chemicals when appropriate dose metrics are employed and the MoAs are recognized (for PFOA, primarily a receptor-based process in rodents). The estimated noncancer DWELs based on data from the monkey range from 0.88 ug/L (ppb) (liver-to-brain-weight ratio) to 2.4 ppb (body weight reduction). From rodent data, the estimated DWEL was approxima! tely 0.9 ppb; however, this value is likely to be conservative since PFOA's PPAR-alpha MoA in rats and mice is unlikely to be relevant to humans.

A value between 0.88 and 2.4 ppb PFOA would be protective of all noncancer and cancer properties of this compound. The DWEL for cancer (namely, testicular adenomas in rats) of 7.7 ppb of tap water should be protective, since PFOA is not genotoxic, its dose-response relationship is most likely non-linear, and the epidemiology evidence indicates that PFOA is unlikely to be a testicular carcinogen and probably not a human carcinogen. These DWELs can be considered a reliable basis to set drinking water limits.

Parallel P2: Governance, economics and the precautionary principle

Chair: **Paul Illing**

Hernandez JC (University of Navarra Spain); Silva Zambrano A

Governance and accountability of risk in European drugs authorization procedures

The aim of this study is to clarify the elements of governance and accountability in the risk management procedures for approval of medicines in the European Union. The study was conducted considering the uncertainty that is always present in the risks of medicines. This has caused a marked dependence on the technique to determine the possible effects that drugs have. Therefore, a preliminary conclusion is that science indirectly decides on the approval of medicines. However, the study considers that such influence of the technique weakens the social legitimacy of decisions approving drugs, pose some questions about the extent of judicial review, and even about the scope of Administrative liability.

The study has four stages that provide an overview about the activity of the European Medicine Agency in the licensing procedures and its subsequent judicial review. The first one studies the activity of creating and developing drugs through clinical trials. The second one studies the scientific evaluation of drugs, its technical appraisal and the problem of uncertainty in determining risks. The third chapter studies the decisions, its political appraisal, the risk management measures and the influence of uncertainty in the decisions. The last one mainly concerns with accountability of those decisions from a Law perspective. In this way the extend of judicial review and administrative lialibility is studied. Also we proposed some regulatory reforms that would improve participation and legitimacy.

Torriti J (Surrey University UK)

The Value of Statistical Life in the Light of Climate Change and Distributional Impacts

The Value of Statistical Life is a technique that provides monetary figures for the benefits associated the saving lives in health and environmental risk regulation. Research in economics (Viscusi et al, 2003) and years of practice in Cost-Benefit Analysis (EPA, 2006) show that the Value of Statistical Life varies depending on the method used for estimating life-saving monetary benefits. Whilst in the U.S. the use of Value of Statistical Life has been implemented within Cost-Benefit Analysis for several years, in Europe only certain areas of regulation have been making use of

such technique to provide fully quantified and monetised figures for saving lives. Besides the ethical concerns (Ackerman and Heinzerling, 2003), some of the long-standing methodological issues with regards to discounting and distributional issues are becoming increasingly topical because of issues of climate change and fuel poverty issues. Is discounting feasible for climate ! change policies considering that the benefits of the current generation count more than the ones of future generations? Can distributional issues be included in a "Humanized Cost-Benefit Analysis"? This paper reviews the methods for turning the number of human lives saved by risk regulation into fully monetised benefits. It analyses a database of existing studies and examines case studies from health and environmental regulations. It is concluded that in Europe a discussion is needed both at research and policy levels to fully understand and use Value of Statistical Life.

Udovyk O (Sodertorn University Sweden); Gilek M (Sodertorn University Sweden); Karlsson M (Sodertorn University Sweden)

Improving assessment and management of hazardous chemicals in the Baltic Sea: towards an ecosystem-based approach

In this study we evaluate how chemical risk assessment and risk management approaches have attempted to cope with challenges posed by hazardous chemicals in the Baltic Sea. The analysis is based on the so-called ecosystem approach, which focuses on integrated risk management adjusted to the sensitivity and resilience of the specific ecosystem. We detail and analyse a set of timelines with milestones for risk assessment-relevant topics, such as monitoring and development of theoretical scientific knowledge, as well as for risk management policies in national, EU, regional and international contexts. We can clearly see that society – with more or less of time lag – responds on both national and international level to growing scientific knowledge, for instance by issuing full or partial prohibitions. On the other hand, it is also obvious that the ecosystem approach so far has not been guiding for chemicals management and, in particular, that the capac! ity to manage chemicals under scientific uncertainty is very limited. In spite of improved legal instruments, a number of policy shortcomings and challenges can thus be identified. The new EU chemicals regulation REACH is not in line with the criteria for the ecosystem approach to management, and it suffers from a number of implementation problems. Based on the results of the study, we discuss a set of proposals on how to improve the management of uncertainty-related problems, in particular strategies based on the precautionary principle, such as group classification of chemicals, management based on intrinsic properties, preventive action, and reversed burden of proof.

Illing P (PICS Ltd UK) and Taylor D

Risk & Precaution in an imperfect world

The current scientific paradigm is that hazards are measured, risks are assessed and management action is taken & communicated based on this assessment. However, this process cannot operate satisfactorily where the hazard cannot currently be measured (e.g. nanomaterials) or where the risk is not yet known (i.e. the issue of 'unknown unknowns').

Some scientists continue to dismiss the precautionary principle as being unscientific. Indeed, the precautionary principle is frequently used in an unscientific way, but this does not mean it is inherently irrational. Society at large, as opposed to lobby groups, appears to have adopted a utilitarian approach to the application of the precautionary principle; accepting its use where there is no significant loss of societal benefit but objecting where its use would lead to significant loss of benefit. Contrast the public acceptance of restrictions on brominated flame retardants with the attitude of parents to the use of cell phones by very young children.

Lobby groups are successfully, using the precautionary principle to argue for the 'elimination' of all risk from the use of chemicals and increasingly for the elimination of the use of all 'hazardous' chemicals. If current trends continue there will be severe impacts on the further development of the chemical sciences and adverse consequences for innovation.

This presentation describes the work being done by the Royal Society of Chemistry in exploring ways in which the precautionary principle might be integrated into the conventional paradigm to provide guidance where hazard data is currently absent or where the risks are currently unknown

Parallel P3: Risk communication

Chair: **Michael Siegrist**

Zingg A (ETH Zurich); Brunner T; Siegrist M (ETH Zurich)

Culling or Vaccinating Animals: Risk Perception and Acceptance of Strategies to Fight Animal Epidemics and Zoonoses

To prevent animal epidemics and as a strategy to fight them, either a vaccination or a non-vaccination strategy can be implemented. To assess the public's perception and acceptance of a culling versus a vaccination strategy in animal epidemic situations, data from a survey conducted in the German- and French-speaking parts of Switzerland were collected (N 93). The results suggest that knowledge of vaccinations' effects influences

people's acceptance of a vaccination strategy. Trust in the government plays a major role in the acceptance of a culling strategy; trust in veterinarians, farmers and industrial organisations negatively affects people's acceptance of a culling strategy. Next to trust, people's perceived uncertainty in an animal epidemic situation, their concepts of animal welfare and their concepts of vaccination influence their risk perception. Investigating the differences between the acceptance of strategies to fight animal epidemic! s versus zoonoses, it was found that a culling strategy that culls only ill animals has similar acceptance to a vaccination strategy for zoonoses; whereas for animal epidemics, a small but significant effect shows that people prefer a culling strategy to vaccination. When many animals need to be culled (e.g., all animals in a defined radius), people strongly prefer a vaccination strategy to a culling strategy for both animal epidemics and zoonoses. More than half of the people asked would also accept consuming the meat of animals vaccinated against an animal epidemic. These results' practical implications will be discussed.

Fage-Butler A (Aarhus School of Business Denmark)

The text is the matter - how discourse analysis may help

Given the acknowledged difficulties in communicating risk effectively (captured metaphorically by Finkel (2008, p.121) as "a task for Sisyphus"), this paper argues for the need for a closer analysis of risk texts, as it is texts that mediate between sender and receiver (whether one relies on the sender - receiver model of Shannon and Weaver (1963), or more interactional 'democratic' models (Heath, Bradshaw & Lee, 2002)). Risk texts have been analysed in a number of ways, including semantic networks (Rothkegel, 2006), rhetoric (Sauer, 2002), and qualitative content analysis (e.g. Musso & Wakefield, 2009). I take here a social constructionist approach and argue, like Lupton & Tulloch (2002), that the risk knowledges of both experts and lays are discursively constituted. Therefore, an obvious choice when analysing texts that communicate about risk is discourse analysis.

The main analytical approach outlined and critiqued in the paper is critical discourse analysis. I show its potential to address a number of interesting questions in risk communication research, not only because it provides tools to characterize discourses of risk and trust, but also because of its theory of "subject positions", the positions which are occupied by risk-stakeholders and implicated by discourses. As such, discourse analysis has the potential to provide a much-needed analytical bridge between text and receiver in risk communication research.

Modin P (KTH - Royal Institute of Technology Sweden)

Ethical responsibilities when communicating dietary advice

Dietary advice permeates the media in western society, but is often of poor quality. It is commonly based on weak scientific evidence, given by self-proclaimed but not particularly knowledgeable "experts", or playing on people's anxieties about their health for the purpose of selling various products or services. Since clearly established links exist between a person's food intake and her health, dietary advice is arguably a type of health risk communication. In this paper, various relevant aspects of dietary advice are analysed, with particular focus on the responsibilities of various actors providing such advice. It is argued that in addition to all risk communicators' responsibility to tell the truth, the scientific quality of the information provided must be on par with the quality explicitly or implicitly stated by the communicator. Sufficiently detailed statements about the quality of the information must thus be provided by the communicator ! that the recipient can evaluate to what extent the information can be trusted. In addition, those who give advice should attempt to provide well-founded and comprehensible estimates of what the effect would be if their advice is followed.

Watts D (University of Manitoba Canada); Driedger SM (University of Manitoba Canada)

Mosquitoes, Media, and Messaging: A Case Study of Government Communication through the Media

Government officials are responsible for many different activities. One of the responsibilities of the government is to communicate (health) risks to the public. Good risk communication can be can be helped or hindered by the media in a health risk situation. The purpose of this case study is to delve into the Government risk communication messaging of the mosquito borne West Nile Virus (WNV) as (re)presented in the media in Manitoba, Canada.

This study includes analysis of three types of data: Daily Newspaper Articles published between 1999 and 2008, Government News Releases published between 1999 and 2008, as well as recent reflective interviews with selected public health officials responsible for WNV risk communication. The news releases were used in a unique way to establish the key elements of the Government messaging. These key elements were then used in the analysis of the newspaper stories. The interviews provide self-report reflections on official risk communication uptake by the media.
How risk messaging is delivered to the public is a key part of how the public will perceive a risk. It is important to understand how the risk of WNV has

been presented to the public and how government risk messages are delivered to the public. This research will help Government Officials become cognisant of how their messages are being used by the media, and thus help inform health risk communication policy related issues.

Parallel P4: Individual risk behaviour

Chair: **Ann Enander**

Skorna A (University of St. Gallen Switzerland); von Watzdorf S (ETH Zurich); Loock C-M Bereuter A

Individual risk perception vs. reality: the case of alpine winter sports

More than a quarter of sports accidents occur in alpine winter sports activities every year. Effective prevention programs against injuries and accidents are therefore of major interest even though several programs have been launched in the last few years. But the risky behaviour of some people and the courses of many on- and off-piste accidents bring up the question: Has the average alpine winter "sportsman" enough knowledge to self-evaluate injury risks and does he adopt his driving behaviour to certain environmental conditions? The state of risk awareness was evaluated in five European countries through an online survey in September 2009 among 3.989 skiers and snowboarders from Austria, Croatia, Germany, Luxembourg and Switzerland.

The results were examined by a cross-national and country-specific approach to draw out major differences in between. Besides demographic data (i.e. gender, age, skill level) risk related information (e.g. individual risk attitude, usage of injury protection equipment) are included in the analysis of self-reported patterns regarding e.g. body injury locations, dangerous slope areas and various risk factors as snow, weather and sight conditions. We compared findings of the survey then with other winter sport-related studies and discussed final results with an expert panel, which contained opinion leaders from hospitals, insurance companies, safety councils and national ski federations.
Based on this study it can be explored how risk perception differs between specific groups of people and weather those under/overestimate risks. The results may provide valuable input for identification of risk profiles and target-group specific communication of prevention strategies.

Ohman S (MidSweden University); Olofsson A

The Impact of Gender and Sexual Orientation on Risk Perception and Risk Behaviour

There are groups in modern societies, such as women and gays and lesbians, who do not experience their life and their life conditions as secure. This does not mean that structural variables such as gender or sexual orientation by themselves can explain these differences. It is more likely that individual life experiences such as hardship or discrimination lead to these variations in risk perception. It can therefore be assumed that there are latent factors expressed through these structural factors, e.g. experiences of vulnerability, risk exposure, lack of power, sub-cultural allegiances and exclusion. Furthermore, individual values can also be mediated through these factors and consequently, explain differences in risk perception and behaviour. This study sets out to find differences in risk perception and behaviour in Sweden in order to investigate the social factors behind these differences. The empirical analyses are based on a national survey ! (n 80) conducted in Sweden 2008. The results confirm differences in risk perceptions and behaviours between men and women, and depending on sexual orientation. The results also show that earlier experiences and values explain some of these differences between the groups. Women have a higher risk perception concerning dread risks (e.g. natural disasters and terrorism) than men have and they also engage in more safety behaviour than men do. Homo- and bisexuals worry less about controlled risks such as smoking and drinking than others and there are also differences in behaviour, they have a higher risk awareness related to sex and exposure to violence (e.g. not walking home alone at night and not having unprotected sex) than others.

Borjeson M (Swedish National Defence College); Enander A (Swedish National Defence College)

Relationships between personal characteristics, safety attitudes and safety related activities

Much of the work related to personal safety has focused either on specific lifestyle and health risks, or on behaviours in highly regulated environments such as road traffic, working life and organizational contexts. Considerably less interest seems to have been directed towards those risks and safety issues which are a part of people´s daily life in home and leisure time settings. Research within the areas of road traffic and working life suggest that a relationship exists between personal characteristics and safety attitudes, and that safety attitudes could mediate the relationships between personality and behaviours. In the present study, we examine if such relationships also do exist within the area of home and leisure settings.

Data from a previous questionnaire study (2007) were used. The sample comprised 332 people from five different respondent groups: rescue service students, training nurses, military personnel, police and social science students. Measures included different personality traits such as thrill-seeking behaviours and conscientiousness, safety attitudes such as importance of safety measures, safety skepticism and safety fatalism as well as safety related activities expressed in terms of safety communication, precautionary safety behaviours and safety equipment.

Preliminary results indicate that there is a relationship between the personality traits and safety attitudes. The results also indicate that personality traits and safety attitudes could explain a significant amount of the variation in scores of safety related activities. Finally, the result also gives support for a mediating effect of safety attitudes for the relationship between personality traits and safety related activities.

Skorna A (University of St. Gallen Switzerland); Ippisch T

An Analysis of Post-Accident Driving Behavior

The rising popularity of telematics-based vehicle insurance (a.k.a. Pay-as-you-drive) offers new, unprecedented data quality on driving behavior to insurance companies. Consequently, questions on driving risks can now be answered which could not be approached before owing to a lack of suitable data. In our research, we report findings from a case-control study with 1500 Italian motorists where we use GPS data to analyze post-crash driving behavior. We apply research methodology from different domains (i.e. GPS data analysis, insurance and actuarial science, and epidemiology) to aggregate GPS raw data to individual trips, filter erroneous trips and drivers, and derive indicators on individual driving performance. A covariance analysis is applied to look at how the number of monthly trips, trip length, and travel speeds are changing after an accident. Subsequent analyses study whether these effects are persistent. Our findings indicate that accident-! involved drivers cut down the number of monthly trips by about 11% in the first month that follows the accident. This effect remains persistent for the second to the fifth month following the accident. Other driving style indicators exhibit similar changes. Our research concludes with suggestions on how to apply our findings on post-crash driving behavior in the insurance sector. We outline further steps to apply the new information for studying different driver populations, which could be used to support motorists at risk by driving trainings after they were caught in an accident. This could keep motorists from falling back into old, negligent driving behavior, thereby lowering their risk exposure.

Parallel P5: Public perception of risk

Chair**: Julie Barnett**

Wang J (Ajou University Korea); Hyun Jung L

Multi-dimensionality of Risk Perceptions and Determinants: The Case of Debates on Genetically Modified Organisms (GMO) Technology in Korea

This proposed paper exams how risk perception on modern biotechnology, focused on Genetically Modified Organisms(GMO), is constructed to various dimensions and what are the impact factors of these dimensions. So we suggest following research questions; First, what factors influence multi-dimensional risk perceptions on GMO technology? Second, how these risk perceptions influence actually intentions of GMO food purchase? This research suggests four concepts as dimensions of risk perception on GMO technology. And using the survey data, include 1,000 Koreans, we will analyze empirically impact factors of multi-dimensional risk perceptions.

Dawson I (University of Southampton UK); Johnson JEV; Luke MA

When Things Just Don't Add Up: Assessing the Influence of Concept Plausibility in Subjective Understandings of Synergistic Risks

Previous research suggests that synergistic risks are perceived as additive or sub-additive by lay individuals. However, the metrics employed in these studies to measure the perceived risk attributable to combined hazards suffer from a number of limitations. Consequently, the veridicality of lay assessments of synergistic risks remains unclear. More specifically, there is an absence of empirical data indicating the extent to which non-experts are aware, tacitly or explicitly, of the concept of synergistic risk. We present the results of an experimental study aimed at addressing this issue. Participants (N = 110) examined additive and synergistic risk scenarios and judged whether or not they regarded these as plausible. The results indicate that lay people are more aware of the concept of synergistic risk than previous findings suggest. However, we found additive (cf. synergistic) risks were regarded as more plausible, and people are less aware of higher synergistic risk magnitudes. Additionally, lay awareness of different synergistic risk magnitudes varied between health and social domains. Implications of the findings for future research and risk communications are discussed.

Kari M (University of Jyvaskyla Finland); Litmanen T (University of Jyvaskyla Finland); Kojo M

In spite of the perceived risks… Analysing acceptance of spent nuclear fuel repository in the Municipality of Eurajoki, Finland

The vast majority of people share the view that there is no safe way of disposing of high-level radioactive waste. Studies have revealed that there is a wide discrepancy between the public's perception of the risks associated with spent nuclear fuel (SNF) repository and the view of the experts. The public tend to fear nuclear technology regardless of how well it is engineered; the radiation risks are perceived qualitatively differently than other risks and strong negative cognitive images are associated with nuclear wastes. Thus local residents, often supported by the general public, have rejected SNF siting attempts time after time and, so far, no country has been able to establish a final waste repository for SNF.

The situation in the municipality of Eurajoki is unprecedented. People there have now lived the post site selection phase for a decade as the site decision was issued in 2000 and final construction licence application is due by 2012. The municipality has given its approval to repository and several repository expansion plans and there seems to be no considerable opposition to the project from the local residents. At the same time, however, great majority of residents perceive that repository poses threats to health, safety and well-being.

Aim of the paper is to analyse views of the local residents and grounds of the acceptance of the repository. Eurajoki and its neighbouring municipalities are the first municipalities in the world where the views of local residents on the construction of a SNF repository have been elicited after the decision of the site selection. Survey was carried out in June 2008. Questionnaire was sent to 3,000 recipients in the area (chosen by stratified sampling). Response rate was 20% and the number of respondents N`6

Dohle S (ETH Zürich Switzerland); Keller C (ETH Zurich Switzerland); Siegrist M (ETH Zurich)

Affect and risk perception: Insights from free associations to mobile phone base stations

Experts' and lay people's perception about risks associated with mobile communication differs remarkably. Lay people and base station opponents, on the one hand, are often concerned that mobile communication turns out to have severe health effects. Experts, on the other hand, have concluded that adverse health consequences at exposure levels below international guideline limits are very unlikely. Using a free association method, we explored expert-lay differences in risk perception of mobile communication in more detail. We systematically captured and categorized images and words that were associated to "mobile phone base station", and also examined the affective rating of those associations. In our first study, considerable differences in free associations between experts and base station opponents were found. The prevalence of free associations in a large random sample from the general population was explored via correspondence analysis in a seco! nd study. Results of Study 2 indicate that free associations to mobile phone base stations were different for participants with high and low risk perception, and also for respondents of different age groups. In sum, our research is in line with the "affect heuristic" that guides risk and benefit assessments, and also highlights the role of affect in risk communication.

Session 2, Monday 3.30pm

Symposia

Symposium S4. Risk and Decision Making (b)

Chair: **Herve Corvellec**

For a description of the Symposium see under Risk and Decision Making (a)

Boholm M (University of Gothenburg Sweden)

Decision-making as a conceptual component of risk: a linguistic perspective

Risk and decision-making are intimately inter-related. There are decisions on risk (e.g. how to minimize and avoid them) and decisions involving risk, i.e. decisions potentially resulting in losses or unwanted outcomes. It has even been asserted that decision-making is an essential component of the concept of risk. The sociologist Niklas Luhmann has argued that the decision element distinguishes the notion of risk from that of danger. The linguists Charles Fillmore and Beryl Atkins using frame semantic analysis of the lexeme RISK have identified decision-making as an important semantic element. By a corpus linguistic approach, theoretically influenced by frame semantics and the notion of meaning potential, this study empirically analyses the concepts of risk and danger. The structure of sentences in English and Swedish containing the words “risk” and “danger”, respectively “risk” and “fara” (Swedish), are analyzed for testing the hypothesis that the concept of risk has a semantic orientation towards decision-making, lacking for the concept of danger. A main result is that the word “risk” (in both English and Swedish) occurs in linguistic contexts denoting situations involving decisions and that these contexts are not as common for “danger” (and the Swedish word “fara”). This suggests that there is indeed a contrast in natural languages between the concepts of risk and danger in terms of decision-making.

Karlsson M (University of Gothenburg Sweden)

Risk Governance in Practice: A case of interorganizational risk management

reviR vlɔ

in Sweden focuses on the intersecting and interorganisational management of dam safety, landslide alleviation and flood risk. Regulators, local authorities and private companies comprise a governance network shaped by organizational functions and working arrangements that have a long history fostering mutual trust. A main finding is that risk decision-making takes place in close networks, composed of experts and elite stakeholders (government authority and industry) whose knowledge derive from situated past experience of managing dams, landslides and floods. Risk management networks align diverse organizational objectives through negotiations and interpretations of risk problems, embedded in an existing regulatory framework and informal practices. This study suggests that risk governance can stretch over several risks issues, forming through historical interdependencies and continuous practice rather than through adaptation of formal general models.

Boholm A (University of Gothenburg Sweden)

Formal risk management in practice: A case of railway planning decision making

In government and business, there is a growing trend towards using standardized tools and guidelines under the assumption that formal (rule-bound, standardized, and context independent) approaches will make risk management decisions effective and successful. However, studies of organizational practice show that risk and safety management rather is intuitive and experience based. The relationship between *formal* risk management and risk management *as practice* in decision making therefore needs critical assessment. This case study of railway planning found that, although risk identification and assessment was orchestrated according to a formal risk management protocol, the process was guided by practical reasoning based on expert, intuitive, and socially situated knowledge drawing on experience. Probability assessment as practised lacks even a remote affinity with statistical calculation; it derives from practical experience, what planners know from past projects, and the inferences they draw about the success or failure of future events and actions. A main result is that there is a creative tension in railway planning between a bureaucratic mode of organizing in terms of a formal ordering and an informal (intuitive, practiced-based, and context-dependent) approach.

Symposium S5. 'Nuclear renaissance' in Switzerland? Results from a multi-method, multi-perspective, multi-actor research program on nuclear waste and nuclear power

Countries worldwide are currently discussing or planning to build new nuclear power plants to meet their electricity demand – often referred to as

'nuclear renaissance'. Both nuclear power and related nuclear wastes have been studied extensively by social researchers in the 1970s and 1980s. However, social research remains important as the renaissance may have been accompanied by a shift in perception and decisions. This symposium aims at examining different aspects of social perception of nuclear waste and nuclear power from various methodological and disciplinary perspectives. Furthermore, all papers stem from a transdisciplinary cooperation project with partners from practice. This allows us to examine unique research questions that require specific, innovative methods in the field of risk research. Consequently, these questions are highly relevant both for science,and societal and political decision making processes.

Chairs: **Roland W Scholz & Michael Siegrist**

Visschers V (ETH Zurich Switzerland); Keller C (ETH Zurich); Siegrist M (ETH Zurich)

The general public's spontaneous associations with nuclear power stations (NPS)

This presentation examines the general public's perception of nuclear power stations (NPS). In a telephone survey among a large representative sample of the Swiss population, people's instantaneous mental images related to NPS were investigated. Most people appeared to have a relatively neutral association with NPS, e.g. synonyms for energy and visual descriptions of a NPS. Less frequently but still often mentioned were negative concepts, such as risks and accidents. Using correspondence analysis, we related respondents' associations with their acceptance of NPS. Different levels of acceptance were related with different types of associations. The associations of the undecided appearedcloser to those of proponents than those of opponents. The findings of this survey provide new insights on the influence of mental models on people's risk perception, as well as on risk communication.

Dhum M (ETZ Zurich Switzerland); Herwig U; Bruhl A; Stauffacher M; Scholz RW

Gender and sex difference in information processing and risk perception: A neuropsychological perspective

This presentation focuses on gender and sex differences, specifically in the field of information processing. Gender differences have been demonstrated in a multitude of risk issues, but are most marked in the domain of nuclear power and nuclear waste. Explanations for these differences consider different variables. However, the underlying neural mechanisms still remain unclear. In this study we apply functional magnetic resonance imaging (fMRI) to investigate the neural correlates of the gender/sex differences in information processing and related risk perception of nuclear power and nuclear waste. We hope to identify cortical networks that account for the observed differences. By drawing on the knowledge about these specific brain areas we strive for a better characterization andexplanation of the mental processes underlying the gender/sex gap.

Kruetli P (ETH Zurich Switzerland); Stauffacher M; Moser C (ETH Zurich); Flueler T

Justice issues in repository site selection processes for nuclear waste

This presentation is about the role of justice, more specifically about fairness in repository site selection processes for nuclear waste. It has repeatedly been demonstrated – mainly in laboratory experiments or surveys – that a fair procedure positively affects the perception of the allocation outcome. Complex decision-making processes, however, are embedded in a wide-ranging, real-world context. Employing an indirect measurement technique which is able to account for contextual effects (conjoint analysis), we investigated in a series of three consecutive studies fairness in site selection. Respondents (N = 53-83) ranked 11 vignettes covering aspects of distributive justice, procedural fairness, relevant context. All three studies yielded similar results: vignettes representing fair procedures were top ranked by respondents. We discuss the role of fair procedures for acceptance of a nuclear waste repository.

Moser C (ETH Zurich Switzerland); Stauffacher M; Krutli P; Scholz RW

The influence of temporal representations on risk perception of nuclear waste

This presentation will highlight an essential characteristic of nuclear waste: the extensive timescales. Technical experts consider a period of up to one million years for the disposal of spent fuel and for high-level nuclear waste. Based on qualitative interviews we found two distinct types of how such timescales can be understood: a more determined, cyclical and a more undetermined, open type. The aims of a subsequent experimental study are i) to explore if subjects can be primed with the two types and ii) to examine their effects on predictability of future events and on risk perception. We expect subjects in the determined, cyclical condition to perceive future as more predictable and controllable and therefore to perceive less risks. We conclude by demonstrating implications for nuclear waste management, focusing on the communication of extensive timescales.

Symposium S6. Assessing, managing and communicating the risks and benefits of aquaculture: A synergy of natural and social sciences (Part II)

For a description of the Symposium see under Assessing, managing and communicating the risks and benefits of aquaculture: A synergy of natural and social sciences (Part 1)

Chair: **Ragnar Lofstedt**

Karunasagar I (FAO Italy)

FAO/WHO Risk Assessments to Support Codex and National Risk Management: Examples of Aquaculture Products

Food safety has considerably improved following adoption of Hazard Analysis Critical Control Point (HACCP) based preventive measures. Nevertheless, public health concerns regarding foodborne illnesses are the drivers for risk management measures such as setting of microbiological criteria. When *Listeria monocytogenes* was recognised as a foodborne pathogen during the mid 80's, some countries adopted 'zero tolerance' approach, but subsequent risk assessments carried out by FAO/WHO led to a science based risk management.

The risk assessment showed that *L. monocytogenes* is widely present in the environment and with good hygienic practices; it is very difficult to achieve absence of this organism in raw foods including fish. The risk assessment prioritised ready to eat foods (RTE) including smoked fish (e.g. smoked salmon) for risk management actions. The risk assessment also showed that multiplication of *L. monocytogens* in RTE is the major contributing factor for increased risks and risk management measures need to focus on prevention of multiplication.

The FAO/WHO risk assessment of *L. monocytogenes* has led to development of Codex Guidelines on the Application of General Principles of Food Hygiene to the Control of *Listeria monocytogenes* in foods. Risk assessment for pathogenic *Vibrio* spp in fish is another example that has led to development of Codex guidelines that would be of interest to the aquaculture and food safety sector in member countries.

Schlag AK (King's College London)

Risk perceptions of farmed fish and fish farming in seven European countries

Fish consumption is estimated to increase. As such, more and more seafood will be the product of aquacultural activities. Aquaculture, at present, seems to follow the development of agriculture, becoming progressively intensive with the overarching aim of increasing production. But modern agriculture has long run into trouble with negative consumer perceptions of for example environmental and health risks. Likewise, modern aquaculture with its diverse production methods and novel technologies may incur public perception problems.

Thus in addition to the scientific issues outlined by previous presenters, there is an urgent need to understand lay perceptions of fish farming and farmed fish in order to be able to communicate effectively about the related risks and benefits.

This presentation summarizes the results of 28 focus group discussions conducted in the capitals of seven European countries: France, Germany, Greece, Italy, Spain, Norway and the UK. Focus groups commenced between January and March 2009 and data was analyzed with the qualitative software Atlas/ti.

Results show notable knowledge and attitude divergences between countries. Moreover, similar to previous food-related controversies, lay risk perceptions of aquaculture often differ from the scientific risk assessments. This broad range of cross-cultural and social differences indicates the challenges that lie ahead for developing effective risk communication strategies with various countries' publics.

Sudborough B (Selonda Aquaculture Greece)

Consumer acceptance of Sea Bream produced in the Aquamax farming trials

Today, Sea Bream is Europe's most popular Mediterranean fish species with an annual global consumption of approximately 200.000 tons, of which over 95% is farmed. The focus of this presentation is a summary and analysis of consumer acceptance of Sea Bream produced as part of the Aquamax project's farming trials.

After growing for over two years in open-sea cages as part of the farming trials, Selonda distributed Aquamax Sea Bream to consumers in one of Athens' largest supermarket outlets over a three-month period. While waiting at the supermarket's fish counter for the Sea Bream purchased, 1265 consumers filled out a questionnaire with demographic data as well as information about their preferences regarding fresh fish. Consumers who purchased Aquamax Sea Bream could view and print a complete traceability report on each fish by scanning the corresponding sticker's barcode at an "infokiosk" (e.g. where the fish was farmed, the composition of the fish feed used and when it was harvested). A post-consumption telephone interview was conducted with consumers who submitted the questionnaire.

The results showed that 95% of respondents perceived Aquamax Sea Bream as tastier than

usual farmed Sea Bream. Consequently, it seems that the use of Aquamax fish feeds, with reduced levels of fish meal and fish oil using alternatives such as vegetable oil, is a feasible option for widespread implementation in the near future.

Margiotta F (Federation of European Aquaculture Producers, Liege Belgium)

Consumer communications about farmed fish: Outlining both benefits and risks

With increased public concern regarding food safety, greater demands are placed on risk communicators to involve the public and other interested parties in an interactive dialogue and to explain food borne hazards in clear and comprehensible terms. This requires communicators to recognize and overcome gaps in knowledge as well as obstacles inherent in the uncertainties of scientific risk assessment.

The AquaMax project offers a framework for the realisation of a transparent and effective communication, since a great amount of scientific knowledge has been produced on matters concerning food safety and consumer health. This presentation takes as a case study the 5th AquaMax newsletter on the assessment of the safety of fish farmed on the new feeds developed by the project as outlined by previous presenters.

In this newsletter, information was given on the different nutrients contained in fish (e.g. omega 3 fatty acids) and on the benefits of fish consumption (e.g. the reduction of risk of cardiovascular disease). Moreover, recommendations on the minimum number of servings of oily fish per week were given based on the European Food Safety Authority's scientific opinion.

Further information was provided on the possible presence of contaminants in seafood, underlining the risks but also explaining the origin of the contaminants and the capacity of this potential harm. To clarify this aspect an overview of the existing legislation concerning food safety and on how EU legislation concerning contaminants in seafood is developed was presented. This was important because of the lack of knowledge about regulations shown in above consumer research.

In conclusion, for consumers to get a balanced view, it was highlighted that aquaculture is a controlled means of farmed food production as it can assure the safety of seafood through the choice of secure feed and feed ingredients.

Symposium S7. Food regulatory regimes and the challenges ahead

Regulating the risks from food proves an extremely difficult and controversial task. The regulator has to balance different values attached to the production and consumption of food. On the one hand, increasing food safety levels is a desirable goal, as it reduces mortality and morbidity risks as well as the social and economic costs of hospitalization and loss of work time. On the other hand, food safety regulation is problematic for a number of reasons. First, the food industry is an important generator of wealth and imposing excessively stringent safety measures could be burdensome for the industry, undermine the competitiveness of smaller players and bring about higher food prices, ultimately reducing the availability of food and food security. Secondly, safety measures are likely to reduce the variety of food, as evidenced for instance by the case of cheese regulation; safety regulation may then clash with other cultural values, and contemporary regulators have to deal with these issues as well. Last but not least, a growing number of the foods we eat are imported, or include imported ingredients, which renders risks more mobile and difficult to be rapidly detected.

By bringing together both well-established and young scholars in the field of food regulation, the Symposium will identify the most urgent challenges of contemporary food safety regimes and generate new insights for this debate. Participants will present emerging features of contemporary safety regulations in some of the most important world's economies, including Europe, the US, China and Hong Kong. Being food products one of the most traded goods worldwide, particular attention will be devoted to the evolution of import safety rules, an unavoidably contentious issue. The Symposium will be concluded by a thought-provoking presentation on the misplaced emphasis on food safety.

Chair: **Alessandra Arcuri**

Alemanno A (HEC Paris France)

The European approach to food import safety and the melamine contamination

Ensuring that European food imports are safe presents special challenges as production takes place in third countries, outside the direct control of the member states. However, contrary to conventional wisdom, besides a few exceptions regarding high-risk products (such as animals and animal products), the regulation of food import safety in the Community is not the focus of direct legislative attention. As a result, the safety of food imports in Europe is pursued not through the application of special conditions governing the import of third-country products, which would impose systematic and Herculean checks at the external borders, but rather through the decentralized enforcement by member states' market surveillance authorities of a harmonized set of product safety regulations: the European food safety acquis.

This article provides for a critical analysis of this regime by choosing as a case study the recent melamine dairy scandal. Although representing one

of the most challenging food contaminations the world has ever faced, the melamine dairy scandal did not produce any tangible negative health effects on the European population. This article, by examining into details the main features and mechanisms of the EU food safety regime, by focusing in particular on the rapid alert system (RASFF), will assess to what extent this outcome can be ascribed to the European regulatory framework or to other factors

Fagotto E (Erasmus Univeristy Rotterdam Netherlands)

A global food supply: A perspective on strengthening the FDA to ensure import safety

Recent scares in the United States originated from imported foods, highlighting the vulnerabilities of an increasingly global food supply. Demand for year-round availability of a wide variety of foods has contributed to a steady growth in imports, which now originate from 150 countries and account for approximately 15% of US foods. Ensuring the safety and security of distant food chains presents substantial challenges abroad, as some countries have poor protection standards and inadequate regulatory infrastructures, and domestically, since US regulations have failed to keep up with a global food market. Especially the Food and Drug Administration (FDA) has been criticized for a reactive approach, based principally on inspections at port of entry, an impracticable solution given the enormous volume of imports. A new bill passed by the House and to be imminently discussed in the Senate promises to reform the FDA, including its ability to address food safety risks coming from abroad. This article examines this legislative proposal, assessing its shift from a responsive approach to one centered on risk-based prevention. We will also discuss a new tendency to enlist private and non-government entities in import safety governance and the promise and pitfalls of these approaches.

Poto M (Wageningen UR University Netherlands)

Hong Kong: "a high degree of autonomy"? A case study in food safety law

The presentation deals with a comparative analysis of the way in which the issue of food safety is being tackled in the People's Republic of China and in Hong Kong. The first part of the article looks at three problematic areas in the Chinese situation. A brief history of Hong Kong's institutions and its relationship with Mainland China will be given first. Secondly, sources of law and reciprocal interference between the Chinese and Hong Kong legal systems will be examined. Thirdly, food safety rules and their impact in China will be described. The second part of the article will examine the impact of food safety law at local level, in particular in the Hong Kong (Special Administrative Region) legal system. The conclusion shows the possibilities and the opportunities in the field of Food Safety in case that the system will comply with the International standards

Pieterman R (Erasmus School of Law Netherlands)

Food Safety in the precautionary culture: reflections on problems associated with applying the precautionary principle at the molecular and the global level. (J.C. Hanekamp, J. Kwakman, and R. Pieterman)

While food security was the concern for the 20th century, food safety is a prime concern for regulators in the 21st century. We argue that concerns over food security still deserve precedence over concerns for food safety. First, because precautionary approach to food safety as adopted by the EU produces serious adverse effects. We show this for two cases. At the molecular level we tackle the issue of determining unwanted human interference in food production. At the global level we discuss the regulation on Illegal, Unreported and Unregistered Fisheries that came into effect January 1, 2010. Second, we contend that even the EU problems of food security have a much bigger impact on life expectancy.

Oral presentations

Parallel P6: Communicating risk

Chair**: Peter Wiedemann**

Espluga, J (Universitat Autonoma de Barcelona Spain); Prades A(CIEMAT/CISOT Barcelona Spain); Gonzalo J (Universitat Rovira i Virgili Spain)

Risk communication processes and structural conflicts in high industrial risk areas. An interpretative approach

Grounded on an empirical study carried out in the petrochemical complex of Tarragona (Spain), this communication examines how the key actors involved in this specific social and organizational context perceive risk communication processes. Data from a set of stakholders interviews (n0) and focus groups with lay citizens (n= are drawn together and re-analyzed from an "interpretative" perspective in an effort to capture the underlying "situationally-specific logics". Results will allow us to discuss the advantages and limitations of different theoretical models of risk communication (i.e. Social Amplification of Risk Framework; Stakeholders in

Risk Communication (STARC); Multi-Stage Risk Communication Process). Finally, the paper will highlight the potential contribution of interpretative research to the social perception of risks and its implication to risk communication processes.

Ormandy D (University of Warwick); Ezratty V (EDF France)

Communicating the Risk from Carbon Monoxide in Dwellings

Unintentional poisoning from Carbon Monoxide (CO) in dwellings is acknowledged as a serious public health problem, and certain groups of the population are considered potentially more vulnerable to the risk than others. One group is the student population, potentially vulnerable as they may be unaware of the risks, and away from home from the first time. To raise awareness of the risks from CO, there are annual campaigns (usually starting in November), some targeting students and others aimed at the public generally.

This pilot study conducted at Warwick University aims to investigate the effectiveness of the campaigns. The objectives are to assess whether the campaigns raise awareness of the dangers from CO, and whether they influence behaviour.

In October 2009, 440 students were questioned in controlled conditions by trained interviewers. To assess the effectiveness of the campaigns, the same students will be interviewed again in March 2010, using the same questions and conditions. To avoid raising awareness of CO, the questionnaires cover other possible indoor pollutants, and interviewers and interviewees have been told the study is about indoor air quality in general. National and local campaigns on CO awareness are being monitored throughout the study.

A report on the study will be issued after Phase 2. Where analyses of Phase 1 show more than 70% of students are aware of the risk from CO, it will question the need for the targeted campaigns. Campaigns will be considered effective if Phase 2 shows an increase in knowledge of at least 20%.

Pighin S (CNRS and University of Toulouse France); Bonnefon JF; Savadori L

Overcoming Number Numbness in Prenatal Risk Communication

Two experiments investigated pregnant women's probability evaluations of prenatal negative events. Experiment 1 aimed to examine how the severity of the outcome affects pregnant women's probability evaluations. Participants (336 pregnant women) read a scenario concerning the communication of a probable negative prenatal event. The experiment employed a 2 (Severity: Down syndrome vs. insomnia) x 2 (Risk: 1 in 28 vs. 1 in 307) between-subjects design. Participants evaluated the probability of the outcome on a 7-point scale ranging from 'extremely low' to 'extremely high'. Results showed that, coherently with past literature, the same numerical risk was evaluated greater when associated with a severe outcome (Down syndrome) than when associated with a not-severe outcome (insomnia). Moreover, pregnant women discriminated between the two different risk levels only referring to the severe outcome.

Experiment 2 aimed to investigate the influence of conversational aspects associated with the presence of a comment. It resembled Experiment 1, but the presence of a doctor's comment (i.e., 'This risk value is above average') was also manipulated. The experiment employed a 2 x 2 x 2 between-subjects design and involved 461 pregnant women. Results showed that participants' evaluations were affected by the severity of the outcome. Overall the comment increased participants' probability evaluations. More interestingly, the comment had different functions according to the outcome: it didn't affect significantly participants' evaluations referring to Down syndrome, but it acted as a clue of the relevance of the communication referring to insomnia, resulting in a discrimination between the two different risk levels.

Wiedemann P (ITAS, Research Centre Juelich GmbH Germany); Schuetz H

Improving communication about unclear hazards

The way in which risk assessment data are reported to non-experts can have a pro-found impact on risk perception and trust In risk assessors. Therefore, risk communi-cation is acknowledged as an essential component of risk management. Various guidelines exist which provide recommendations and advice how to avoid miscom-munication and how to improve content and process of risk communication.

However, a closer look reveals that many of these suggestions concern general recommendation such as careful listening or empathic understanding and are not specifically tailored for risk communication purposes. Fortunately, the body of research on risk communication is growing and provides valuable clues for better risk communication based on solid evidence.

As special challenge is the information about unclear hazards - such as RF EMF - where the hazard idetification is inconclusive. These type of hazards pose the following communication challenges:
-How to characterize the scientific evidence?
-How to describe the relevance of scientific studies for risk assessment?
-How to report uncertainties of the risk assessment?
-How to summarize the overall result of the risk assessment?
-How to build trust in risk assessors?

Based on the current available risk communication research these five issues will be discussed in detail. Starting with examples, possible risk communication biases will be highlighted, and based on empirical research suggestions will be outlined for better communication about unclear hazards.

Parallel P7: Risk and organizations

Chair**: Stephen Ward**

Boll K (University of Copenhagen Denmark)

Tax risks - construction and representation

This paper investigates how the Danish Tax Authority constructs representations of tax risk.

Theoretically the paper draws on a constructivist analysis of risk and on the notion of 'sociotechnical networks'. This is inspired by Michael Power's Organized Uncertainty (2004) and by science and technology studies more generally.

Methodologically the project builds on an ethnographic study of how tax inspectors conduct risk analysis and audits. The ethnographic material stems from a ten months engagement with the Danish Tax Authority, where I have been able to observe 'risk management' work in practice. From the fieldwork I focus on two instances in which tax inspectors construct representations of risks; a case of black market car dealings and a case of forced closing-down of businesses where there is a risk of continued business activity.

The ethnographic accounts of the cases present the practical work of how tax inspectors conduct risk analysis and audits. The analysis shows that it is not easy to construct representations of risks in practice and shows that there is a constant struggle between actors that attempt to present reality in specific ways. In this struggle multiple tricks are used: forgetfulness, handwritten invoices, window peeking, unexpected phone calls, intuition, anonymous informing, statements of accounts etc.

My focus in the project is on the mundane work practices, which goes on everyday as risk management is played out in a Danish taxation unit. By getting a thick description of these practices I hope to get closer to the question as to how uncertainties become organized, ordered, rendered thinkable and thereby made amenable to governmental intervention.

Etienne J (LSE UK)

The risks of self-reporting incidents: a case study and further hypotheses

This paper focuses on how hazardous organisations respond to obligations to self-report bad news about themselves to public regulators. The paper begins with elements from a case study in the chemical industry in France. The empirical picture is clearly mixed: the regulatee self-reported minor problems and violations to the inspector; but it repeatedly failed to report serious incidents although disclosure for these was obligatory. Besides, collected opinions on the quality of their interactions show a good level of trust between regulator and regulatee at the time. Survey data suggests that this picture (trust, self-reports of relatively minor importance and no reporting of near misses) fits other cases as well. Then, a review of the literature on self-reporting does not find any explanation for these facts. It is hypothesized that self-reporting near misses is risky because separate and increasingly self-referential social spheres (politics, law, science, economy) react differently to hazard (Luhmann). For instance, as a response to uncontrolled hazard, actors from law might search for violations and prosecute individual or corporate actors, while actors from politics might bring organizations to a halt so as to avoid being pilloried for letting citizens exposed. Thus, self-referential social segments will mean that there are significant risks in reporting near misses. But there may be consensus across social spheres as well, which minimizes these risks (Kringen). Or else, there may be complete closure of a sphere onto itself, which enables risk-free reporting within that sphere, but not across spheres (Rees).

Meliou E (University of the Aegean Greece); Kakouris AP

Changing organizational culture towards safety and risk.

Recent literature highlights that organizations, especially those dealing with dangerous materials, have begun tentatively to change and focus more on safety and security requirements standards. Movement towards safety issues can be seen as largely depends on organizational culture change and management philosophy. Safety culture is concerned with minimizing exposure of employees to workplace accidents and reflects a desire to operate in a safely manner. An organization's safety culture it is expressed and manifested through the values and behavioral norms of its managers and workforce and it is evident in the organizations' policy, practices and management systems. Managers play a key role in culture change process. Their perceptions, behaviours and actions in relation to the safety of the workforce, form the starting point for the safety behaviour of workers, and therefore, the safety performance of the company. The objective of this study is to ! understand managers' perceptions and representations on safety culture and risk. Semi-structured interviews were conducted in fifteen managers, holding major decisional roles in national and international companies dealing with petroleum production in Greece. Findings reveal managers' concerns and preoccupations of safety culture and risk and highlight important aspects of the

organizational culture and change, shedding light to the problem of workplace injuries.

Ward S (Southampton University)

Operational risk in major infrastructure

Operating risk is associated with uncertainty about the performance of infrastructure once it has been constructed, during the long-lived operating phase of infrastructure projects. This paper outlines the findings of a study undertaken in 2008, and funded by the UK Institution of Civil Engineers, to explore the extent and significance of uncertainties driving operational risk during the operation of infrastructure, and related management issues.

The study involved a literature review and a programme of interviews with 17 industry practitioners identified by the ICE Sector Boards in four sectors: energy, transport (road and rail), material resources and waste management, and water (supply and wastewater).
The study adopted a broad definition of operational risk as 'uncertainty about the level of operational performance achievable during the operating life of infrastructure assets'. Interviewees readily recognised risk in relation to different performance criteria and that risk is not just associated with particular events that could adversely affect operational performance, but that risk is driven by a range of uncertainties some with strategic implications.

In developing approaches to operational risk management , the study identified a number of issues that require attention: interdependencies between elements of infrastructure, the need for clarity about operational performance objectives and their interdependence, the problem of short-termism, the need to consider operational risk throughout the infrastructure asset life cycle, and the importance of effective and efficient asset management.

Parallel P8: Risk and public participation

Chair**: Tom Horlick-Jones**

Hernandez JC (University of Navarra Spain); Martin AT

Deliberative administrative procedures and risk decision-making: the case of energy and environmental conflicts

The controversy about the creation of a Centralised Temporary Storage facility for spent fuel and high level wastes, has shown some deficiencies of the spanish regulatory responses to risk analysis and decision-making in energy and environmental conflicts. Although most of the discussion focused on the National, Self-governing Communities or local jurisdiction to take action or make decisions, this paper argue that rules for distributions of jurisdiction are unsuitable to deal with Governance and Risk Regulation. We suggest that these rules should be replaced by participatory and deliberative administrative procedures in order to attain democratic and legitimate decisions.
Furthermore, it would be appropiate to review and ensure that standard setting are carried out in a accountable and transparent manner. Therefore issues related with risk acceptability, limits to public and expert judgement participation in decision-making, and even judicial review of these decisions (including discretionary powers) should be considered. Once again we argue that design of adequate administrative procedures, could improve legitimacy and ensure the reliability and social acceptances of decisions.

Mazri C (INERIS France); Chantelauve G; Chevalier M

Towards a decision support tool for the management of participative approaches: Theory and application within the French regulatory context

Social acceptance has become a major issue when evaluating the success or the failure of public policies in general, and risk governance policies in particular. All major risk governance models developed today at national or international levels (IRGC model, ISO 31000) have widely integrated this fact by promoting risk communication as a central issue.

In France, the AZF catastrophe in 2001 has deeply changed the national accidental risk governance policy by implementing innovative land use planning processes around upper tier Seveso sites (about 420 sites in France).
Called Technological Risk Prevention Plans (TRPP), those processes aim to both correct existing situations considered as dangerous because of the proximity of hazardous sites and human stakes and prevent the occurrence of such situations in the future.

In line with the risk governance models evolution described above and considering the high stakes potentially impacted by those processes, governmental agencies in charge of the implementation of those policies at the local level are asked to develop an exemplary participative approach.The technical and administrative processes associated with the TRPP are standard. Nevertheless, the social, economic and technical contexts in which those processes have to be implemented might highly vary. Therefore, adapted participative policies need to be developed and implemented in order to fit the various specificities of every context.

This paper presents an innovative approach developed with the aim of helping governmental

agencies in the analysis of their social and economic context when designing an adapted participative approach. Based on an iterative process allowing a progressive and in depth analysis of local contexts, the proposed approach comes out with a technical and organizational model highlighting:
- the stakeholders to be considered within the participative approach and a description of their resources and stakes;
- a structured description of the issues to be debated and an agenda to tackle them;
- an organizational model specifying the participation levels that should be affected to every stakeholder according to both his expectations and competences.

Even if such a model needs to be updated very regularly once the participative process is launched, we believe that it still provides governmental agencies, and more generally, every stakeholder in charge of the management of a participative process, with high value insights that help to reinforce the quality and the legitimacy of the decision process.

Prades A (CIEMAT/CISOT Barcelona Spain); Horlick-Jones T (Cardiff University); Oltra C; Navajas J; Sala R; Espluga J (Universitat Autonoma de Barcelona Spain)

Towards a participative dialogue with society about the risks associated with fusion energy: knowledge, practical reasoning and design process

The European nuclear fusion R&D community has increasingly recognized the need to move towards creating a dialogue with society about fusion energy. Our recent collaborative work has been closely aligned with the research directions necessary to create the pre-conditions for this objective. In this paper, we set out the key findings from our three-year programme of research, which includes a review of the international literature; extensive Spanish-UK cross-cultural investigations of lay and stakeholder practical reasoning about fusion power; examination of the effectiveness of different informative materials in promoting understanding among lay publics; and the identification of communication and participation options, set within the context of a design-based approach to citizen engagement.

Parallel P9: Risk and climate change

Chair **Euan Mearns**

Hemming D (Met Office, UK Government); Hartley A (Met Office, UK Government); de Gusmao D; Kay G; Kaye N; McNeall D (Met Office, UK Government; Taylor I.

Climate Impacts and Risk assessment Framework (CIRF)

Risk management techniques are increasingly employed to understand and manage the impacts of current and future climate. This has been facilitated by recent advances in climate research that have enabled the routine production of probabilistic climate change projections. To utilise these projections using appropriate risk management techniques we developed the Climate Impacts and Risk assessment Framework (CIRF). CIRF provides a generic and flexible process that is designed to guide consistent assessments of the risks of weather and climate impacts for a wide range of sectors and locations.

CIRF has already been utilised to guide climate risk assessments for many projects. Here, we demonstrate the practical utility of CIRF through its application to a project to assess the current and future weather and climate risks to the West Midlands Fire Service in the UK.

Mearns E (University of Aberdeen UK)

Risks from Energy Decline, Climate Change and Appropriate Energy Policies

Rising production of oil, natural gas and coal powered the twentieth century bringing with it population growth, industrialisation, economic growth and prosperity to many. This growth spiral is largely dependent upon ever increasing supplies of energy from fossil fuels (FF). Growth has also come at a price with major changes in land-use, pollution and emissions to the atmosphere, that are likely interfering with natural climate cycles. As FF reserves are depleted, the time of more is set to become the time of less before mid twenty first century with unpredictable outcomes for human society.

For decades, most countries and the world got by without any form of energy policy. This has now changed, but somewhat ironically, energy policies are being formulated around concerns of carbon dioxide emissions and global warming and not focussed on providing society with sufficient supplies of affordable energy from secure sources (see for example IEA WEO 2009). The belief that energy security issues can be met from climate driven energy policy seems to have taken root. This unfortunately is fallacy. In particular, policies such as carbon capture and storage, biofuel production

and the concept of a hydrogen economy, promoted by climate concern, are all energy intensive and not suited to our energy-declining world. Nuclear, wind and solar energy combined with energy saving and energy efficiency measures will mitigate for both energy and climate concern and these should form the core of global energy policy.

McNeall D (Met Office, UK Government); Daron J

Challenges in risk analysis of the impacts of climate change

We present a case study demonstrating the challenges in risk analysis for the impacts of climate change. Our example is health infrastructure in the UK.

Well-functioning hospitals are vital to the health of the nation and climate change poses substantial risks to the provision of health services. Increasing summer temperatures in hospitals may compromise working conditions and endanger vulnerable patients.

Hospital managers must balance cost, the needs of patients (e.g. thermal comfort), clinical needs (e.g. cool operating theatres), and energy consumption when considering hospital cooling options for the coming decades. They must account for uncertain information from climate predictions such as UKCP09, and convey this information in the context of regulation, and knowledge about their local environment.

The complex nature of climate predictions presents further challenges to end-users. They are probabilistic, conditional on socio-economic scenarios and rapidly evolving scientific understanding, and are often at an unusable spatial and temporal scale.

We use a Bayesian Network (BN) approach to study the risk of climate change to UK hospitals, and to aid the decision making process. BNs are ideal for this purpose because they allow i) the intuitive structuring of a specific risk problem, ii) the combination of many uncertain parameters in a formal statistical model, and iii) the ability to clearly communicate the consequences of decisions.

The results from interviews conducted at two NHS Trusts (Guy's and St. Thomas, and the Royal Devon and Exeter) are presented to highlight the issues faced by decision makers using climate information and demonstrate the advantages of using the BN approach.

Mearns E (University of Aberdeen UK); Mearns K

Risk Perception and Knowledge of Climate Change and Energy Issues

The UK Government established the Department of Energy and Climate Change (DECC) in 2008 in order to merge energy and climate change policies. But to what extent does the general population understand the complex issues behind the climate change and energy agendas? And should the government be concerned about public opinion?

The current study determined knowledge levels, risk perception and opinions about consultation on energy and climate change policy in two groups of first year psychology students (nv&79). One group received a simple 10-question multiple-choice test (5 choices) about Climate Change (CC) and the other received a similar test about Energy Issues (EI). The students were also asked to rate how concerned they were about CC/EI (5 point scale) and whether they thought the public should be consulted about policy in these areas. The results show poor levels of factual knowledge about CC and EI, with average scores of 2.4 for CC (barely above the chance level) and 3.7 for EI. The average level of concern was 3.78 for CC and 3.68 for EI and respondents were generally favourable towards consultation of the public with a score of 4.00 for CC and 3.78 for EI. Women were more concerned about both CC & EI and perceived a greater need for public consultation than men.

Results suggest our sample lacks the basic knowledge to formulate valid opinions on both CC and EI and yet they believe that government should seek public opinion on these issues.

Session 3, Tuesday 11am

Symposia

Symposium S8. Risk Governance and Public Participation

Inviting the public to be part of risk governance has long been a noble goal in many countries. The popularity associated with the concepts of deliberation and direct democracy, however, obscures the challenge of how to put this noble goal into practice and how to ensure that the resulting policies reflect substantive competence, sensitivity to public concerns and preferences, efficiency, and fair burden-sharing. How can and should policy-makers ascertain public preferences, integrate public input into the management process, and assign the appropriate roles to technical experts, stakeholders (socially organized groups that are – or perceive themselves as – affected by the decision) and members of the public? Who represents the public: the elected politicians, administrators, stakeholders, or all those who will be affected by the decision?

Organizing and structuring such a process goes beyond the well-meant intention of having the public involved in risk decision-making. Discursive processes need a structure that ensures the integration of technical expertise, regulatory requirements and public values. Decisions on risk must reflect multiple goals such as effective regulation, efficient use of resources, legitimate means of action and social acceptability.

The symposium “Risk Governance and Public Participation” investigates the opportunities and limitations of risk participation. At the same time, new approaches towards public participation in risk governance will be explored.

Chair: **Pia-Johanna Schweizer**

Petts J (Birmingham University UK)

Public Participation

The inclusion of stakeholders in complex risk decisions is not a trivial task. Many stakeholders are driven by personal interest and want to assure that risk management addresses their specific concerns. Others are highly motivated by personal values that impede the process of making tradeoffs. The talk will identify some of the major obstacles to effective stakeholder involvement and will demonstrate how these problems could be overcome in practical discourses.

Rauws G (King Baudouin Foundation Belgium)

The Role of Science and Risk in Public Participation

The King Baudouin Foundation has spearheaded the first pan-European participation projects with respect to science and risk. In conjunction with a consortium of competent organizations and scholars, the Foundation assembled citizens in all EU countries to deliberate about issues such as brain sciences, the future of Europe, and other technology and science oriented issues. The most important result of these innovative exercises has been that language and cultural barriers are less of a problem than anticipated. Furthermore, the idea of bringing people from Europe together to co-shape European future was highly welcomed by all participants even by those who had been skeptical about the EU as an institution. Evaluation results demonstrate that the procedures of involving ordinary citizens deliver what they promise in principle. However, issues such as time management, fair review of all contributions and dissemination into the public arena are still not optimal and need to be further revised.

Schweizer P-J (University of Stuttgart Germany)

Risk Governance and Public Participation

The concept of inclusive risk governance is based on a normative belief that the integration of knowledge and values can best be accomplished by involving those actors in the decision making process that are able to contribute all the respective knowledge as well as the variability of values necessary to make effective, efficient, fair and morally acceptable decisions about risk. In the risk arena the major actors are: governments, the economic sector, scientific communities and representatives of civil society. One approach towards integrating these heterogeneous demands is the International Risk Governance Council’s Risk Governance Framework. The Framework assigns risk communication and participation a prominent role in the risk governance process. The Framework addresses the conceptual issue of how to integrate the contributions of different actor groups and the public in risk governance. Thus, the Framework offers a way of tapping the full potential of risk participation while being aware of its limitations.

Symposium S9. Emerging Risks in Industry – results from the iNTeg-Risk project

The large EU FP7 "flagship project" iNTeg-Risk (“Early Recognition, Monitoring and Integrated

Management of Emerging, New Technology Related, Risks", www.integrisk.eu-vri.eu), involving a budget of almost 20 million €, more than 80 leading European companies and more than 400 professionals working on the project directly, has entered its second year of work and yields now its first results to the "outside world". Some of these results will be highlighted in the session of the 2010 SRA-Europe conference. The presentations will focus onto the industry related results and take examples from some of the 17 target applications in the iNTeg-Risk project.

Chairs: **Aleksandar Jovanovic & Olivier Salvi**

Jovanovic A (EU-VRi Stuttgart Germany); Veres A; Loscher M

Comparing experiences from different industries when dealing with emerging risks

The reports show the first results of the analysis performed over the 17 ERRAs (Emerging Risk Representative Applications) in iNTeg-Risk project. The purpose of the analysis has been to (a) establish the basis for the comparison, (b) compare features where possible (based on the limited data available do far) and (c) search for common features. ERRA-solutions for the single, specific problems related to emerging risks allow to capitalize upon and, by generalizing the solutions, build the common European approach to emerging risk. ERRAs provide test-bed for the developed integrated methods, tools and the whole system. Starting from the the agreed template the comparison has been made using a living data warehouse of the project results: containming both input data and the results of single activities within ERRAs.
Integration of common issues, comparison and analysis leading to possible conclusion related to the applied approaches and solutions in SP1 takes place on the level of ERRAs grouped around the emerging risks related to:

- **A.** new materials, technologies and products (e.g. nano, H_2, CO_2, advanced engineering materials, bio-fuels, renewable energies, underground storage)
- **B.** new production processes and management (e.g. unmanned aerial surveillance, outsourcing, resilient IT safety systems)
- **C.** complex industrial systems and networks (e.g. integrated HSSE, on-line risk monitoring, use of bio-inspired models, virtual plants/reality), and
- **D.** new global / EU / local emerging risk policies (e.g. EU safety legislation for SMEs and non-EU European countries, regional interaction nature-technology (NaTech).

Main practical result of the comparison of ERRAs so far show that the similarities in the emerging risk management process can be identified and based on them ERRAs can be grouped. That consists the first step in the process of the definition of the common EU practices and policies. Nevertheless, differences in the vocabulary, usual way of reporting, place of risk issues in the respective activity priorities and absence of common scales and metrics, have often made the comparison difficult. These difficulties were, albeit, expected. The differences in choices of methods and low acceptance of some of proven solutions in some of the industry applications remain more difficult to explain.

Bodsberg L (SINTEF Technology and Society Norway); Oyen K

Emerging risks related to industrial plants in sensitive areas

Exploration of oil and gas in certain sensitive areas such as the Barents Sea and Lofoten constitutes an emerging risk, and is a controversial topic of social debate in Norway, particularly due to environmental and fisheries interests. Political acceptance for opening of these prospective exploration acreages depends on public confidence in the ability to produce oil and gas without any harmful spills. Some limited exploration activity is presently taking place in the Barents Sea and the oil company (Eni Norge AS) has been granted permission to produce oil from an oil field (Goliat) for the first time in this area. Further expansion depends on the ability of the involved companies to avoid harmful spills during this initial activity. A zero tolerance regime for oil spills has been introduced for this area. One strategy to avoid accidents is to be continuously vigilant through the use of indicators. Often, hindsight has shown that if signals had been detected and managed in advance, the unwanted event could have been prevented. This includes, e.g., the accident at the Esso natural gas plant in Longford, Australia in 1998, killing two workers, and the accident at the BP Texas City refinery in 2005, killing 15 workers. Recognizing signals before an accident occurs will improve safety, and there have been many attempts in the past to develop proactive safety indicators. This presentation describes a new method for the development of early warning indicators based on resilience and Resilience Engineering.

Vetere Arellano AL (European Commission Joint Research Centre Italy); Christou, M; van Wijk, LGA; Mengolini A; Fass H; Fulli G; Venahoorn L

Preliminary results of an analysis of emerging risks for the EU in the energy supply arena

The unique and critical role of energy in society is self-evident, as without it no activity can take place. As technology advancement in the last half of the 20th Century has brought energy comfortably to EU industries and households, energy often is taken for granted. This perception of perennial energy supply

security has been questioned due to a series of events such as the blackouts of 2003 (Sweden, Denmark, Italy), 2005 (Sweden) and 2006 (Central Europe) and the Russia-Ukraine gas crises of 2006 and 2009. These wake-up calls, along with other events such as 11 September 2001 and the recent financial crisis, have reminded the EU of its energy vulnerability, triggering a paradigm shift in looking at and managing such complex and interconnected risks. Thus, securing the energy supply and managing its related risks have recently taken centre stage in the EU political agenda. In fact, energy governance within the EU gravitates mainly around the intricately linked economic, environmental and security strategies. This also brings socio-political aspects into the traditionally technical area of energy security, thereby requiring public acceptance and open dialogue.

Against this background, this paper will portray the results of an analysis of emerging risks for the EU in the security of energy supply area, focusing in particular on the electricity sector. The Emerging Risk Management Framework (ERMF) and the IRGC Risk Governance Framework models are used to assess lessons learned from past events, such as blackouts. These will hopefully act as beacons to identify possible emerging risks, related to technology, regulatory, human/organizational management and public perception factors in the EU energy supply arena.

Cozzani V (Bologna University Italy); Rota R; Uguccioni G

Emerging risks related to advanced LNG regasifcation technologies

Natural Gas is an important part of the European energy market and more than 50% of the Natural Gas used in Europe is imported (almost all from three only countries: Russia, Norway and Algeria). The Natural Gas import is expected to increase up to 70% in 2020. Reliability of the supply, where the diversification of the sources plays an important role, is an important issue for the energy future of Europe. 13 LNG receiving Terminals are presently operating all throughout Europe, and approximately 20 more are planned or are waiting for the authorisation by the Competent Authorities. New technologies, mainly related to advanced floating and off-shore LNG terminals are now tackling the market of the new regasification plants proposed both in Europe and in the US. However, new and emerging risks related to floating or off-shore installations were not fully explored to date and the hazards associated to these installations is highly perceived by the population. The emerging risks related to these issues will be explored within the "LNG ERRA" (Task 1.2.4) of Integ-Risk project. In this framework, the safety issues related to new and existing technologies will be assessed. The current state-of-the art technologies as well as proposed innovative designs were analyzed. Three main categories of installation were identified: on-shore terminals, off-shore gravity-based terminals and floating terminals. For each of these categories, a reference process scheme was defined, and key equipment as well as reference potentialities were identified on the basis of the technology survey carried out. The MIMAH methodology, developed within the ARAMIS project, represented the starting point to identify the reference scenarios that should be considered for each of the alternative design modes. An improved table of scenarios was obtained applying a self-learning methodology to fill-in gaps in the MIMAH procedure. For each scenario, best available models were investigated. A set of leading KPIs aimed at the assessment of risk performance allowed a breakthrough in the assessment of the emerging risks. Preliminary results were obtained. concerning inherent safety and sustainability indicators for the assessment of emerging risks related to technological issues. A preliminary application of these KPIs to the assessment and comparison of new technologies, still under development, demonstrated the potentiality of the approach in the identification and comparison of the critical safety issues in LNG regasification technologies.

Dien Y (EDF France); Duval C.

How to build Key Performance Indicators? A contribution to ensure a proper management of industrial safety taking into account technical, human and organisational aspects

One important aim of the iNTeg-Risk Project is to define Key Performance Indicators (KPis) in order to ensure a proper management of industrial safety.

In this presentation, we will focus on how to build efficient KPis in order to help the management of an industrial socio-technical system. As we intend to deal with an integrated management of these systems, we must pay attention to the consistency between indicators ”linked” to each side of the integrated risk management framework, and mainly between the technical one, on the one hand and, on the other hand, the human and organisational one.

Based upon a brief history and some methodological recommendations in order to build efficient KPis (Duval, 2009), an approach currently developed in the iNTeg-Risk Project will be presented. The indicators are built at different levels of a functional breakdown of the studied system. However the relevant data provided by operational feedback systems could feed the design of these KPis. Thus, a new KPIs building method is proposed: it is based upon data resulting from systems actual failures as well as from their consequences on the safety and the performance of the studied systems.

The principles of this method will be complemented by the lessons provided by the analysis of industrial accidents or incidents. They tell that direct or immediate causes (i.e. technical failure and/or “human error”) are induced or accelerated by

underlying organizational conditions which are complex factors. In addition, in-depth analyses of numerous accidents, incidents and crises of different sectors (process industries, transportation sectors ...) have shown presence of some similar repetitive, organizational phenomena as root causes of events (Dien, 2006). In reference to James Reason (Reason, 1990; Reason 1997), we can call these phenomena Pathogenic Organisational Factors (POFs). A first set of seven POFs were defined (Pierlot et al. 2006):

- Weakness of safety organizational culture;
- Failure in the daily management of safety;
- Weakness of Control Authorities;
- Poor management of organizational complexity;
- Failure of Operational Feedback;
- Production pressures;
- No reappraisal of design assumptions.

This list does not claim to be either definitive or exhaustive. Nevertheless the scope of safety is more or less covered through the seven POFs.

We will describe features of the POFs and how they can be detected thanks to “markers” (collected on field). Then we will discuss about metric (more qualitative rather than quantitative) to be used for their measurement.
Finally we will argue about the interest of taking POFs as key safety indicators are similar to those proposed for Human and Organisational key indicatorsby EDF (Dien, Duval 2010), in the iNTeg-Risk project, i.e. the design of KPis is based on a clinical approach. For technical risks side, design of KPis could also takes account of hazards defined at the time of the functional analysis.

Symposium S10. The reality of precaution - Comparing risk regulation in the United States and Europe

The *Reality of Precaution* research project (and its book by the same name, forthcoming from RFF Press/Earthscan) goes beyond the rhetoric of precaution as an abstract principle and tests the *reality* of precaution in practice. Challenging the conventional wisdom that Europe has become “more precautionary” than the US in recent years, the research project examines a broad array of risks and finds that since the 1970s there has been little transatlantic difference in the overall level of precaution, but that instead there have been variations in precaution aimed at particular individual risks within each polity. For example, the project finds that, while Europe has been more precautionary regarding genetically modified foods, beef hormones, toxic chemicals, and climate change, the U.S. has been more precautionary regarding mad cow disease, air pollution, ozone depletion, and terrorism. Moreover, both the US and Europe have now moved to evaluate and conduct precautionary regulation within a larger system of regulatory oversight using benefit-cost analysis and related accountability mechanisms. The project combines a dozen detailed case studies, a quantitative analysis of almost 3,000 risks, and cross-cutting analysis of politics, law, and risk perceptions, generating the conclusion that the relationship between U.S. and European regulatory approaches is best understood not as conflict or competition, nor as divergence or reversal, but rather as a process of highly selective application of precaution to particular risks, and a continuing transatlantic exchange of ideas yielding mutual cooperation and hybridisation. This symposium will highlight the project’s findings and their implications for risk, governance and accountability.

Chair: **Michael Rogers**

Wiener J (Duke University USA)

The pattern of precaution

This presentation details our forthcoming book, The Reality of Precaution: Comparing Risk Regulation in the US and Europe (Wiener, Rogers, Hammitt & Sand, eds.) (RFF Press/Earthscan, 2010). We test the real pattern of precaution in practice, through twelve case studies, a large quantitative analysis, and chapters on law, politics, and perceptions. Challenging conventional wisdom, we find that from 1970 - present there has been overall parity in transatlantic precaution, with selective precautions against particular risks. For example, Europe has been more precautionary regarding genetically modified foods, beef hormones, chemicals, and climate change, while the U.S. has been more precautionary regarding mad cow disease, air pollution, ozone depletion, smoking, and terrorism. Now the U.S. and Europe have both adopted regulatory oversight through impact assessment. Rather than divergence in cultures or legal styles, we see a continuing exchange of ideas, toward optimal precaution that accounts fully for risks, costs, and ancillary impacts.

Rogers M (ICAAS Turvuren Belgium)

Different approaches to precaution – GM and BSE

The regulation of health and environmental risks has generated transatlantic controversy concerning precaution and the precautionary principle (PP) in a number of fields. This controversy has been particularly marked in the case of genetically modified organisms where the EU appears to be more precautionary than the US and mad cow disease where the US appears to be more precautionary than the EU. This presentation explores these two cases and suggests possible explanations for the differences in precaution between the EU and the US.

Alemanno A (HEC Paris France)

Precaution and better regulation

Bergkamp L (Hunton & Williams, Brussels Belgium)

Legal and administrative systems: Implications For Precautionary Regulation

This presentation deals with the "cross-cutting" issue of whether the US and EU legal and administrative systems have implications, in and of themselves and independent of the substantive area of regulation involved, for the degree of precaution in risk regulation that results. The term "degree of precaution" encompasses both the timing and stringency of preventive regulation against future risk, and is used as an entirely descriptive phrase and implies no value judgment as to the appropriateness or adequacy of such regulation. We illustrate our conclusions by reference to both *ex ante* and *ex post* regulation, in the context of the legal and administrative systems of the United States and the EU.

Lofstedt R (King's College London UK)

Closing comments

Oral presentations

Parallel P10: Risk perception and behaviour

Chair**: Ian Hall**

Ayton P (City University UK); Murray S; Hampton J

Terrorism, dread risk and bicycle accidents

Gigerenzer (2004; 2006) claimed that, following the attacks of September 11, 2001, many Americans, dreading a repeat of these events, drove instead of flying; this resulted in additional car accidents, increasing the number of fatalities (indirectly) caused by the attacks by over 1,500. Apparently, people may unwittingly choose to take larger risks than necessary because they dread, and are especially averse to, situations where many may be harmed or killed at one point in time, compared to situations in which a similar or even greater number may be harmed or killed, but distributed over a longer period.

However, Su et al (2009) claim, contrary to Gigerenzer, that car travel did not increase following the 9/11 attacks; moreover fatal traffic accidents only increased in the North East of the USA along with alcohol- or drug-related citations issued in connection with these accidents. Consequently these authors argue that involuntary stress, not volitional decisions mediated by dread risk, explains the increased traffic fata - Rousseau (2005) failed to find a dread risk effect after the Madrid train bombings of 2004; no subsequent increase in car travel or fatal traffic accidents was detectable.

We investigated the effects of the 2005 London tube bombings: underground travel decreased, simultaneously bicycle travel and bicycle accidents increased. We attribute this to dread risk; apparently some Londoners switched from underground travel to less-safe bicycles. Our findings corroborate calls for vigilance to detect - and educational interventions to reduce - pernicious psychologically mediated secondary reactions to dread risks.

Elmieh N (University of British Columbia Canada); Dowlatabadi H; Teschke K; Copes R; MacDougall L; Fraser M; Henry B

The role of risk perceptions in creating messages for emerging infectious diseases: the case of West Nile virus

Emerging infectious diseases provide a challenge to public health in that the frequency, location, and duration of outbreak are not always readily identifiable. In the absence of such information, the need for effective and appropriate risk communication of preventative measures becomes even more critical. The purpose of this study was to use West Nile virus, as an example, to examine the role of risk perceptions and health beliefs that drive health behaviors recommended to reduce the risk of West Nile virus infection. A 32-item telephone questionnaire examining risk perceptions was developed and implemented across a random sample of the population across three provinces in Canada with varying levels of West Nile virus activity. Twenty four percent (Np9) agreed to participate in the survey. Results showed that health beliefs and behavioral activities changed depending on both perceived risk and the disease context. Respondents were more lik! ely to engage in recommended health behaviors if they received timely information, understood the benefits of a particular health behavior, and had experience with the disease. Respondents were also willing to engage in actions that brought them comfort (from mosquito bites) despite perceived risks and potential adverse effects. By understanding what leads individuals to engage in actions and which misconceptions prevent recommended health behaviors we can develop more effective public health messages and risk communications. The findings of this study have implications not only for West Nile virus planning but also for public health risk communication campaigns of other emerging infectious diseases such as H1N1.

Hall I (Lloyds Banking Group)

A Canadian, an American and a Brit were walking down a street..... Can mental models derived from scenario analysis accurately predict risk taking behaviour of actors in a risky situation?

This paper looks at whether the use of scenario analysis to generate mental models of risks can be effective in recreating the mental models of risk takers, and if so how this can be used in the education of individuals exposed to risk within their daily working lives.

Through the use of a qualitative methodology, the research captures the mental models of 'actors' in range of risky scenarios, and compares these to mental models generated through a classroom re-creation of each scenario. In each situation, the author explores the similarities and differences between the mental models of each group.
This study was undertaken following attendance at SRA 2009, where the author, an American and a Canadian were involved in a potential risky situation one evening. An analysis of the situation led to the creation of individual mental models, which revealed both a number of similarities, and a number of differences based on personal experiences. This led to the question as to whether others who had not been involved in the situation, could through qualitative study derive a mental model which predicted the reactions of the actors in the situation, and thus could be used to educate others in how to manage risk.

Two studies are being undertaken – the first examining personal risks to safety and the second examining risk taking within a Financial Services organisation. In both studies, a number of factors will be manipulated to explore the extent to which mental models are affected by the environment in which the risk is encountered.

The fieldwork is expected to complete during February 2010 with the conclusions from the work due in April 2010.

Parallel P11: Pharmaceutical risk regulation

Chair**: Sweta Chakrabory**

Boon W (Utrecht University Netherlands); Moors E; Meijer A

Balancing drug innovation and safety: governing drug risk surveillance

The need for fast drug innovation and the public demand for risk-free drugs create a dilemma for regulatory authorities: rapid market access conflicts with uncertainty about benefit/risk profiles of new drugs. Legal frameworks for post-marketing drug risk surveillance, or pharmacovigilance, have been developed, but resulting practices are not in line with the intentions underlying these forms of regulation. There is a governance problem: these present arrangements fall short in maintaining the delicate balance between innovation speed and safety.

Therefore, the aim of this paper is to increase the understanding of pharmacovigilance governance arrangements, in order to contribute to more responsible pharmaceutical innovation.

This project borrows its theoretical background from two strands of thinking about regulation and innovation. Firstly, the conceptualisation of post-marketing surveillance and risk assessment as a crucial element in the process of innovation is based upon theories in the field of innovation studies that stress the involvement of multiple stakeholders. Secondly, ideas about new forms of regulation are adapted from the growing field of governance studies.

Adequate post-marketing surveillance is imminent in cases of 'conditional approvals', medicines intended to be used for a disease for which no treatment is readily available, and which are granted early market access.

The empirical emphasis of this study is on the governance of pharmacovigilance in conditionally-approved medicines. Results from two completed case studies are presented that come from the qualitative analysis of the governance of pharmacovigilance, based on interviews and extensive desk research, complemented with the results of expert workshops.

Grantham S (University of Hartford); Connolly-Ahern C; Ahern L

Communicating the Risk of HPV and Cervical Cancer through Social Amplification: Merck's Strategic Marketing of Gardasil

While cervical cancer is the leading cause of death among females in developing countries, it trails other health issues, and other forms of cancer as a health issue, in developed countries. The use of condoms and pap smears performed during gynecological exams in developed countries has reduced cervical cancer deaths.

In 2006, Merck gained FDA approval for a vaccine to prevent four forms of HPV commonly linked to cervical cancer. In the developed regions of the world, where cases of cervical cancer are already reduced, Merck launched a campaign targeting expert prescribers (government agencies with oversight/physicians), media news channels, and direct advertising to consumers about the benefits of the vaccines. In the United States, where consumer buy-in was most desirable, Merck's One

Less campaign targeted young women and their parents to make them aware of the vaccines.

Within the social amplification of risk framework, the purpose of this study was to discover how young women learned about Gardasil, how effectively the campaign dealt with various dimensions of risk from HPV and cervical cancer, and if the One Less campaign influenced patient's decision to undergo/forego the Gardasil vaccines. Through survey analysis, results indicated that, overwhelmingly, the participants learned about Gardasil from television advertising. Participants felt that the campaign effectively addressed the control and empowerment dimensions of the risk associated with HPV and cervical cancer. While the campaign effectively raised awareness about these issues, physicians remained the primary sources of influence when the young women chose to undergo the vaccine series.

Hess R (ETH Zurich Switzerland); Visschers V (ETH Zurich); Siegrist M (ETH Zurich)

Understanding medical risks depicted in arrays of pictographs: The role of numeracy and reference risk information

Medical decisions often require laypeople to process numerical risk information. Many people, however, especially people with low numeracy skills, have problems understanding such information. Graphic depictions of probabilities, especially arrays of pictographs with reference information, are thought of having the potential to overcome this difficulty because they seem to be more intuitively understandable than numbers alone. Therefore, we conducted an experiment to investigate: 1) whether arrays of pictographs help persons with lower numeracy to understand probability information within a medical context, and 2) whether the addition of reference probability information simplifies this probability information. We applied a 2 (probability level high/low) x 2 (reference information present/not present) between-subjects design to a questionnaire that 533 randomly chosen persons from the general population completed. These respondents read a short sce! nario that contained graphically depicted test results for colon cancer, and then provided their probability estimate. We found that arrays of pictographs were useful for helping only persons with higher numeracy to differentiate between a high and low probability, and that the addition of reference information did not improve the respondents' understanding of risk, irrespective of their numeracy. Additionally, we analysed eye-tracking data from persons looking at an array of pictographs to understand why the arrays of pictographs did not help respondents with lower numeracy. Our study implies that reference information's role in communicating risk merits investigation, and that arrays of pictographs are not necessarily the best choice to communicate medical risks to persons with low numeracy.

Chakraborty S (King's College London UK)

Public Perceptions of Ex-Post Regulation Towards Pharma Sustainability

It is widely recognized that Europe, since the mid 1980s, has become increasingly stringent in terms of risk regulation as compared to the United States (Vogal, 2003). One exception is in the realm of medicines regulation, where policy measures appear to have converged (Vogal, 2010). One notable trend is towards the strengthening of pharmacovigilance systems for medicines or ex-post regulation (Hodges, 2005). For the pharmaceutical industry, the implications for economic sustainability are evident. Particularly, the potential for switching from costly pre-market testing of prescription drugs towards complete lifetime product monitoring wield considerable savings. Emphasizing pharmacovigilance could allow medicines to be approved earlier in the market lifecycle, which would dramatically cut research and development costs (Hodges, 2008). While the benefits of this change for the industry may be apparent, several technical and ethical challenges a! re simultaneously realized. Particularly, this presentation will examine the lay value-based implications associated with earlier drug approvals. It will hypothesize the social contract desired by patients in regards to the logistics of increased pharmacovigilance, primarily in regards to whom or what would be held accountable for any related adverse outcomes. This will be accomplished by drawing upon existing empirical evidence from similar past case studies in the field of risk perception (Slovic, 1993; Lofstedt, 2005). It will also refer to current research being undertaken by the author on public risk perception and the role of trust in chronic prescription drug-taking for an evidence-based perspective on public reception towards earlier approvals (Chakraborty, 2010).

Parallel P12: Risk perception

Chair: Michael Siegrist

Kusev P (City University UK); Johansson P; van Schaik P; Tsaneva-Atanasova K

Relative Theory of Choice: Preference Change for Risky Choices

In three experiments we studied the extent to which theories of decision-making and memory can predict people's preferences. Studding risky decisions, we aimed to answer questions about human preferences, prompted by similarities between the leading economic theory Expected Utility Theory (EUT) and the leading psychological theory of human choice under risk - Prospect Theory (PT). People's behaviour in the face of risk

implies that they judge and weight the probability of risky events in characteristic ways that deviate from EUT. Nonetheless, both EUT and PT frameworks share a common assumption: people's risk preferences and decisions under risk and uncertainty are independent of task. Accordingly, we studied (i) the lability of human preferences and their relation to choice justifications given in risky decision-making scenarios, (ii) the dynamics of preference formation for choice with monetary gambles and (iii) the limits of existing theoretical! accounts (e.g., UT and PT) by contrasting them with a new theory of risky choice based on the impact of context, complexity and prior choices. The results of all three experiments are not anticipated by EUT, PT or experience-based decision research (Hertwig, Barron, Weber, & Erev, 2004).We found evidence that people do not have underlying preferences for risk; instead, context, complexity and prior choices determine preferences even when the utilities (risk and reward) of alternative options are known.

Kewell B (York University)

Narrative and Risk: A Theoretical Exploration

Sources – and objects- of jeopardy, hazard and endangerment are largely identified in classical forms of risk analysis via processual epistemologies involving sequential logic, mathematical rubrics, probability analysis, decision-trees and statistical (i.e. stochastic or Bayesian) forecasting apparatuses. Narrative and story-telling are important, if unsung, contributors to the traditional positivistic forms of risk assessment that continue to undergird the contemporary risk discipline. In this paper, an exploration is undertaken of narrative theory first and foremost. It considers specifically how this area of literary studies may help expand our understanding of 'what makes the risk paradigm tick'. In doing so, the analysis draws upon Rosa's (1998) meta-theorisation of disciplinary positions within the risk field, considering how narrative is deployed within each of them – from positivistic statistical reporting through to the kinds of phenomeno! logical risk encounters and existentialist motifs adopted by philosopher constructionists (see for example: Fox 1999). The risks posed by the advent of Tissue Engineering and Regenerative Medicine offer an apposite vignette for exploring these connections. On the one hand, these sectors encompass traditional science stories and concomitant risk narratives and identification processes. On the other, they have raised ancient promethean spectres (Gardner 2007) that have in turn incubated significant risk reflexive sensitivities concerning the uncertainties such novel sciences anticipate (see industry digests by: Mason and Dunhill 2008a and b; Martin et al. 2009, Lysaght et al. 2008). It is argued by way of conclusion, that narrative is an embedded linguistic institution prevalent to many types and articulations of risk theory.

Evans D (University College Cork Republic of Ireland); Jakobus B

Risk intelligence: what is it, and how can we measure it?

Evidence from a variety of sources suggests that there is a special kind of intelligence for thinking about risk and uncertainty, and that this is not part of general intelligence. For example, expertise in betting on horse races has zero correlation with IQ. Calibration testing is a well established assessment technique which might serve as a simple way of measuring such "risk intelligence". We have set up a website for conducting calibration tests online, and have now collected test results from over a thousand participants. In this talk we will present our initial analysis of these data.

Connor M (ETH Zurich Switzerland); Siegrist M (ETH Zurich)

Consumers' cognitive map of biotechnology: MDS results of sorting data applied to different biotechnology applications

People responding to questionnaires may construct preferences using various sources of information available to them. This could even result in respondents using the questions within the questionnaire to form their preferences. Asking people about possible risks of biotechnology applications could imply that there may be risks involved, otherwise the question would not have been asked. The present research aims to examine which criteria lay people use spontaneously to evaluate biotechnology applications. The goal of the study was to examine how lay people categorise various biotechnology applications covering medical, agricultural, nutritional, and industrial applications. For the present study 632 'Face to Face' interviews were conducted in a Swiss community where near by field trials with genetically modified plants were carried out. People's perceptions were investigated without specifying any criteria for participants to consider using a card-s! orting technique. Results were analysed using multi-dimensional-scaling (MDS) and were represented in a 2-dimensional cognitive map. Furthermore, the criteria people use to classify various biotechnology applications were examined in an experimental approach where people were given different instructions to sort the cards. Results of the present research suggest that people's perception of biotechnology applications varies between 'medical' and 'non-medical' applications and is also greatly influenced by the type of organism involved. Furthermore, analysis of the experimental approach results in relatively stable perception of the biotechnology applications. People sorted the biotechnology applications according to the benefits they perceived despite being given different sorting instructions.

Parallel P13: Risk governance – historical perspectives

Chair**: Adam Burgess**

Agnew J (Royal Free Hospital London UK)

Education, child labour and legislation for factories and mines in the mid-nineteenth century: parliamentary arguments about risks and benefits

What should be the proper scope of legislation for control over industrial work? When can such legislation be effective? What hazards and perceptions are most relevant? In the mid-nineteenth century, the UK Parliament devoted major attention to these questions. From parliamentary records now readily accessible, this study seeks to categorise arguments and language deployed - as well as evidence utilised and evidence ignored. An 1850 Factories Bill debate noted confusion and unintended consequences from earlier legislation yet also data showing worker satisfaction and compliance. Two years later however, a report to a Select Committee dramatically emphasised great loss of life in mining due to 'ignorance and lack of education of the miners' and to the 'employment of very young children'. 1860 debates advocated the case for child workers to have - or be allowed to gain - at least basic literacy. Opponents of 'legislative interference' pointed! continually to the impossibility of legislating comprehensively and fairly across widely differing employment areas and the dangers to commercial progress from any extension of legislation. Debating stances and language show minimal explicit reference to 'risk' but much that can be taken as implicit weighing up of contrasting risks. Massive industrial development of the time was accompanied by severe anxiety over social change - and parliamentary discourse was often dominated by appeal to the emotions. Some shrewd parliamentarians however were successfully able to couple emotional appeal with clear analyses of the implications - the 'risks' - of alternative strategies for tackling major industrial, educational and social problems.

Fintz M (AFSSET France)

Lessons Learned, Lessons to Be Forgotten or the Ambiguous Role of Historical Information in Risk Governance

The report Late Lessons from Early Warnings (2002) by the European Environment Agency has drawn the attention to the long-term history of risks. Its scope addresses present-day risks often resulting from past uses of substances that have been since phased out. It also highlights the fact that the emergence of risks doesn't follow a linear trajectory but rather is entrenched into iterative processes of amplification, migration and oblivion that point out the need to rely on historical information to understand both current exposure pathways and the risks trade-off that have governed policy choices. The purpose of this communication is to highlight how the purported objective of accountability can potentially collide with liability and strategies undertaken by corporate and/or state representatives to pre-empt litigation risk. This work relies on a comparative research on chlordecone, an organochlorine insecticide, between United States and France through archival work, media reporting and interviews. Produced in the United States until its ban in 1978 in the aftermath of environmental and occupational contamination, chlordecone has been widely used in banana cultivation in the French West Indies until 1993. While the history of chlordecone in the United States ended with lawsuits against its manufacturer, scientific and legal uncertainties are still prevailing in state discourse in France entailing some reluctance to promote historical research despite pledges of transparency. While pre-empting litigation risk, the unintentional and intentional practices to deter historical research are susceptible to undermine risk evaluation, risk communication, and subsequently damage public trust.

Delvenne P (Université de Liège — SPIRAL Belgium)

Democratic Accountability in Governance of Science and Technology: on Reflexivity in European Parliamentary Technology Assessment Offices

Nowadays more than ever, dealing with risky scientific and technological issues requires careful attention and sustained policy-making support. In Western Europe, since the 1980s onwards, science and technology (S&T) issues are addressed in the institutional arena of Parliamentary Technology Assessment (PTA) offices. The main function of those PTAs is to increase the democratic accountability of S&T governance by providing the policy-makers and some stakeholders with intelligence on technological innovations and/or by enhancing social debate.

Being based on literature research, participatory observation, official document analysis and qualitative data collection (through semi-structured interviews with academics and TA practitioners), we claim that the emergence and development of Parliamentary Technology Assessment offices (PTAs), leading/supposed to lead to an increased democratic accountability, embody a relevant indication of S&T governance becoming more reflexive. We offer case studies of several European PTAs and we are particularly interested in how much reflexivity is visible. After formulating two main dimensions of (reflexive) governance of S&T, openness to plurality and blurring of boundaries, we map the paths of these institutions over time along those two dimensions. Then, we argue than there appears to be a reflexivity

pathway, on which some PTAs have moved farther than others. The empirical evidence for such a pathway to exist reveals the multiple features of democratic accountability fostered by o! ne PTA setting or another, which may range from a managerial outcome (decision-makers are accountable) to a public outcome (citizens are accountable) and a professional outcome (scientists are accountable).

Burgess A (University of Kent)

From moral to risk-based policy discussion

This paper will do 3 things. Firstly, suggest that it is useful to consider that there has been a shift in regulatory policy discussion from a more moral, to more risk-based framing. This will be done using examples of policy making around controversial social issues: illegal drugs, alcohol consumption, 'video violence' and teenage pregnancy. It will be considered whether these controversial areas are representative of a wider shift or more exceptional in their character. Secondly, the paper will reflect on the suggestion of cultural theorists that risk is only a modification in the historical form through which essentially moral boundaries are expressed – as opposed to the argument of Beck and Giddens that risk is fundamentally amoral. It will be argued that this approach tends to underplay the distinctive form and implications of choices being communicated through (expert) risk. Finally the paper will consider the consequences of this shift towar! ds risk-based framing, considering the argument that exclusively evidence-based, expert discourse is anti-democratic.

Parallel P14: Risk assessment in the workplace

Chair**: Michael Howard**

Trainor M (Health & Safety Laboratory UK Government)

Risks to health and safety from workplace activities: new and ongoing challenges

The risks to the health and safety of workers and the public arising from workplace activities continue to evolve as new technologies and working practices emerge and the demographics of the working population changes. And ill-health and accident statistics demonstrate the scale of the ongoing challenge. This presentation will illustrate, though examples of recent work at the Health and Safety Laboratory, how new research is improving the understanding and prevention of both emerging and ongoing challenges to health and safety. Examples will include:

Carbon Sequestration and Storage. The transport and storage of carbon dioxide above its supercritical pressure presents Major Accident Hazards that cannot be adequately estimated assuming the 'normal' state. Novel work, including experimental tests, identified key issues for risk estimation.

The Hydrogen Economy. Although spontaneous ignition was regarded by many as a myth, the phenomenon has been experimentally demonstrated, and ways to prevent it identified.

Respiratory ill-health in bakeries. A study in British bakeries identified that health surveillance and exposure control has been insufficient to prevent worker sensitization. New work includes reducing dustiness through modifying ingredients. Additionally, accurate prompt diagnosis is essential to reduce occupational asthma across a wide range of industries: to facilitate this, new guidance has been developed for healthcare workers.

Horizon scanning. New challenges include: changing demographics including increasing obesity and ageing; changing working patterns driven by IT developments and globalisation, and emerging technologies such as new generation robotics.

Healey N (Health & Safety Laboratory UK Government); Stacey N (Health & Safety Laboratory UK Government); Gauthier F; Chinniah Y

Theoretical Evaluation of Methods for the Qualitative Estimation of Risk

Qualitative risk estimation methods are extensively used across different industrial sectors to aid decision making for a wide range of purposes, often to satisfy health and safety legislation. The international standard ISO 14121: Safety of machinery - Risk assessment, for example, cites five types of method for the estimation of risk and states, in general terms, the parameters to be used. However, in addition to 'severity of harm', any combination of the other parameters cited may be used in the risk assessment process. In addition, each of the parameters can have from two, upwards of ten qualitative terms/values associated with them, all using different language and terminology. This has led to a wide diversity of methods/tools giving rise to uncertainty and confusion.

This paper describes a study that attempts to verify and explain the differences in performance of thirty-one qualitative estimation tools in terms of the influence of the types of parameters and construction of the tool.
The tools were compared, first by using a database to observe the difference in risk output when 'equivalent' inputs are used for each tool. They were then compared when estimating the risk level of twenty carefully chosen different 'real-world' hazardous situations taken from the machinery safety field. The study found there to be a significant difference between the tools when evaluating the same situation. Drawing upon the

observations of the behaviour of the different tools, the authors propose a series of construction rules in order to alleviate most of the problems.

Grotan TO (SINTEF Technology & Society Norway)

Risk Governance of Complexity in Integrated Operations

The concept of Integrated Operations (IO) is central to the ongoing development of the Norwegian offshore petroleum industry. Relocation of functions and personnel from offshore to onshore and increasingly extensive ICT-based collaboration are some of the key aspect of IO.

The RIO project aims to address the new, possibly systemic risks that emerge from the IO evolvement and effort. How can new aspects of risk be addressed? What methods are (not) adequate?

One specific RIO search path for answers is taking into account the contextual complexity that arise, e.g., from a nearly ubiquitous presence of remote operators and contributors, independent of time and space, in conjunction with the re-presentational capabilities of Information and Communication Technology (ICT).

In order to address the implications for risk assessment and governance, the International Risk Governance Council (IRGC) framework is used in order to identify which differences risk assessment should elaborate, that is, differences that make a difference in terms of risk management.

The options of risk management approach proposed by Ortwin Renn will be background for a discussion whether there is a need to make a difference between dynamics (from complicatedness) and dynamism (from complexity) of a system. The possible implications for risk management will incorporate the contemporary Resilience Engineering approach. Different notions of uncertainty will be discussed in order to make necessary distinctions.

Finally, the epistemological situation of the risk assessor in an IRGC/IO context will be included in the discussion, employing the ancient distinctions of knowledge as episteme, techne, phronesis and metis.

Albrechtsen E (SINTEF Technology & Society, Norway)

New technology and changed work processes – new approaches to interdisciplinary risk assessment

The purpose of the paper is to present preliminary results for the research project Interdisciplinary Risk Assessment of Integrated Operations addressing Human and Organizational Factors. The project aims at developing knowledge and models as a basis for risk assessment in relation to petroleum production in an integrated operations (IO) environment, and to provide guidance on the practical use of these results to relevant practitioners in the petroleum industry. The project period is 2008-11.

IO can be understood as use of information technology to change work processes in the petroleum industry at the Norwegian continental shelf to achieve improved decisions, remote control of processes and equipment, and to relocate functions and personnel to onshore facilities. This transition generates new challenges and opportunities for risk assessment and management, e.g.: new types of decision-making by use of real-time data and available experts; close collaboration across organisational and geographical borders; continuous change processes.

Based on interdisciplinary research approaches, preliminary results include: how different analytical perspectives on risk can be used to understand risk related to IO in different ways; how risk management in IO can be improved by utilizing IO technology and work processes; position the usability of different methods for safety ad risk assessment related to various IO concepts; how risk can be assessed in different system characteristics of IO

To bring the results together, a framework for interdisciplinary risk management of IO is developed, which has been inspired by the IRGC (International Risk Governance Council) risk governance framework

Session 4, Tuesday 1.30pm

Symposia

Symposium S11. Risk, place and power: local community attitudes to new low carbon energy developments in the UK and the rest of Europe

Major changes in electricity generation across Britain and Europe are required to meet **CO_2** reduction targets. Such changes will involve siting and building new, low-carbon energy developments. This includes the possible introduction of new technologies such as carbon capture and storage (CCS), and expanding wind energy and nuclear power. Public support will be important for these technologies to be implemented without causing social disruption. This requires understanding public discourses of support and objection, in hosting communities. This symposium considers public attitudes amongst communities hosting low carbon energy developments in the UK and Europe.

First, Nick Pidgeon considers perceptions of place and new nuclear build in a study conducted at communities situated close to two established nuclear power stations, Oldbury and Hinkley Point, UK. Next, Christopher R. Jones discusses 'wind-prospecting' in the UK, and an increased likelihood of developers proposing new projects close to existing and/or planned developments. This refers to a study in the Humberhead Levels (HHL) near Doncaster, UK a region recently subject to nine unique wind farm proposals. J. Richard Eiser then presents data from a study examining attitudes to wind generation in Poland, a country which is highly dependent on fossil fuels for electricity generation. Finally, Barry J. Orr discusses public attitudes towards CCS, a technology which would facilitate the continued use of fossil fuels, through storing carbon dioxide emissions. This references two studies: one in the aforementioned HHL region, UK; and one in Blekinge, south Sweden.

Chair: **J.Richard Eiser**

Pidgeon N (Cardiff University) UK; Venables D; Parkhill K (Cardiff University); Henwood K; Simmons P

Living with nuclear power: sense of place, perceived risk, proximity, and attitudes to new build in existing host communities

Previous research notes that public risk perceptions appear to decrease, and sense of place appears to increase in communities situated in close proximity to established hazardous or stigmatised sites. Furthermore, previous qualitative literature suggests that sense of place may act to mediate public experiences of risk in such localities. This major household survey (n=1326) draws on literature pointing to the importance of understanding public perceptions of nearby hazards in the context of local physical and social geographies. It investigates the relationships between sense of place, perceived risk, and proximity in communities situated close to two established nuclear power stations, Oldbury and Hinkley Point, both in the UK. Two scales were developed. First, sense of place was measured using items adapted from previous research. Second, perceptions of the nearby nuclear power station in relation to sense of place were measured, using an adapted version of Breakwell's four-process model of place identity. The role of these concepts in relation to proximity, perceived risk, and attitudes to new nuclear build is discussed. Furthermore, the capacity of sense of place to act as a statistical mediator of public risk perceptions is examined. These results have implications for existing theory and also for current policy regarding the building and siting of new nuclear power stations in the UK.

Eiser JR (Sheffield University UK); Aluchna K; Jones CR (Sheffield University)

Local wind or Russian gas? Contextual influences on Polish attitudes to wind energy developments.

A survey was completed by 200 residents of two localities (100 each) in Northern Poland, a target community affected by proposals for nearby wind farms, and an unaffected control community. Compared with controls, targets were, on average, less favourable towards wind energy development, both locally and elsewhere in Poland, were less convinced it would mitigate climate change, and expected more negative impacts. Targets also expressed less concern about energy dependence and political relationships with Russia. These mean differences disguised a bimodal distribution within the target group only, with most being neutral or against wind development, but a minority clearly in favour. We interpret these findings as supporting a 'construction of preference' perspective – that broad affective reactions and situational factors drive the adoption of more specific beliefs – in that many participants appeared to endorse environmental and political arguments as justifications for preferences constructed in response to contextual influences.

Jones CR (Sheffield University UK); Orr, BJ (Sheffield University); Eiser JR (Sheffield University)

How many wind farms are acceptable? Identifying predictors of perceived regional capacity for wind development in the UK.

Within the UK electricity generation accounts for approximately one-third of greenhouse gas emissions; hence 'decarbonising' this sector is seen as a priority in the battle against climate change. Key to achieving this aim will be the rapid expansion of renewable generating capacity, with much of the required expansion expected to come from investment in on- and off-shore wind-power projects (e.g., BWEA, 2009).

The extent of the 'wind-prospecting' now occurring in the UK is increasing the likelihood that developers will propose new projects in the vicinity of other existing and/or planned developments; raising concern over possible cumulative impacts. In this presentation I discuss the findings of analyses performed upon survey-response data obtained from the Humberhead Levels (HHL) region – an area near Doncaster simultaneously subject to nine large-scale wind farm proposals – in order to identify variables important in predicting respondents' estimates of the perceived acceptable regional capacity (PARC) for wind-power development.

Orr BJ ; Jones, CR ; Eiser JR

Environmental attitudes and community attachment, and the local acceptance of carbon capture technology in the UK and Sweden.

Carbon capture and storage technology (CCS) is proposed as an important part of the solution to the problem of climate change (DECC, 2009). CCS would allow continued use of fossil fuels, while storing carbon dioxide emissions. This makes it an attractive technology to certain governments, policy makers and private companies worldwide. One major proposed use for CCS is in fossil fuel electricity generation. Coal generation is emerging as a major focus, with biomass, oil and natural gas generation also of interest.

This presentation discusses (a) the relationship between attitudes towards local CCS deployment, and attitudes towards coal, climate change, ecology and community attachment. This is within a sample living adjacent to a planned CCS coal-fired power station development in Doncaster, UK. (b) The role of community attachment and ecology attitudes in influencing favourability towards an existing adjacent carbon capture oil-fired power station. This is in a sample in Blekinge, south Sweden. In the UK sample, community attachment and ecology attitudes appear significant in predicting positive attitude to CCS development, but attitudes towards traditional coal generation appear of much greater significance. These traditional coal attitudes appear to be distinct from community and ecological attitudes. In the Swedish sample, preliminary data indicates community attachment and ecology as non significant in influencing carbon capture attitudes. These findings are discussed with reference to (a) the identity and role of coal psychologically and socially in UK communities, linking with community and ecology, and (b) the community and ecology attitude contrasts between Swedish and UK samples.

Symposium S12. Uncertainty in human and environmental risk assessment: Part 1 Methodology

Chair: **Marko Tainio**

Estimates of risks caused by environmental stressors involve uncertainties. These uncertainties have significant impact on risk assessment results, and consequently to the decision making based on the assessment. Therefore, recognition and quantification of uncertainties is an essential part of the risk assessment process. In recent years, several methods and approaches to recognize, quantify and address the uncertainties have been developed and applied in assessment studies.

In this symposium, we will present both recent methodological developments (Part 1) and practical case studies (Part 2) on identifying and quantifying uncertainties. The individual presentations under the theme have been divided into two parts: Part 1 - Methodology and Part 2 – Case studies (full abstract details are at the end of this abstract).

This symposium is partly based on work presented in a joint Winter School on Uncertainties that was held in January 2010. This Winter School was a training course on integrating uncertainty with environmental health impact assessment, in order to promote the use of a harmonized methodology. The Winter School was organized by four EU-funded projects studying and applying risk assessment methods:

HEIMTSA - Health and Environment Integrated Methodology and Toolbox for Scenario Assessment;
INTARESE - Integrated Assessment of Health Risks of Environmental Stressors in Europe;
2-FUN - Full-chain and Uncertainty Approaches for Assessing Health Risks in Future Environmental Scenarios;
NoMiracle - Novel Methods for Integrated Risk Assessment of Cumulative Stressors in Europe.

Pohjola MV (National Institute for Health and Welfare Kuopio Finland); Tuomisto JT; Tainio M (National Institute for Health and Welfare Kuopio Finland)

The properties of good assessments: The factors that contribute to assessment performance

This abstract is a part of the Risk and uncertainty mini-symposium. Environmental health assessments are endeavours of producing science-based support to societal decision making upon issues related to environment and health. They produce information for specific needs thus making the information objects produced in assessments intentional artifacts; means to ends. There are two common views to assessment performance. The uncertainty approach focuses on the intrinsic properties of the information produced in assessment. The quality assurance/quality control approach focuses on the process of producing that information. However, in order to capture all factors that contribute to the overall assessment performance, it is necessary to consider not only both the production process and the information produced, but also the process of using that information. The properties of good assessment consider assessment performance as a function of (i) the quali! ty of information content (ii) applicability of information, and (iii) the efficiency of the assessment process. These property categories are further broken down into eight individual properties that jointly contribute to overall assessment performance: informativeness, calibration, relevance, availability, usability, acceptability, intra-assessment efficiency, and inter-assessment efficiency. As such, the properties of good assessment simultaneously address features of: (a) production of information, (b) the information content, (c) the information product, (d) information in use, and (e) characteristics of use context. The properties of good assessment can be used in ex-post evaluation of assessments, but it is most useful in ex ante evaluation during the design and execution phases of assessments.

Boriani E (Pharmacological Research Institute Mario Negri Italy); Fernandez A; Benfenati, E

Uncertainty in risk characterization of chemicals for REACH, integration of data from different sources

REACH aims to reduce the impact of chemicals on human health and the environment, and to promote risk assessment analysis for the evaluation of the health status of the environment. Due to the present lack of data on chemicals in Europe and to the limitations of assays, REACH supports a full use of all type of data (in vivo, in vitro, in silico). It now becomes necessary to assess how these heterogeneous data can be integrated into a unified approach suitable for the risk characterization of chemicals and taking into account different sources of uncertainty. A framework for the consensus process is presented where the identification, characterization and integration of uncertain sources of evidence is a crucial point in the design of the decision support system.

The degrees of uncertainty relative to the alternative methods (in vitro and in silico) are combined for the specific degree of uncertainty to the in vivo method. The relevance of using a method for the final risk characterization may be expressed in terms of its uncertainty. The advantage of this approach is that different methods can be easily combined and a clear consensus procedure is defined which can be applied unambiguously. The scientific basis of this approach relies on fundamental criteria for scientific measurements which have been incorporated into official guidelines for the evaluation of alternative methods, both for in vitro and in silico methods, reducing the need of expert judgments.

Ciffroy P (EDF France); Tanaka T; Stenberg K

Methods for deriving Probability Density Functions for parameters involved in multimedia modelling

The importance of probabilistic approaches to environmental risk assessment for chemicals have been well recognized. There is a general acceptance that the parameterization accounting for the uncertainty can be more realistic than giving only a best estimate value. Because of the high variability in most parameters required for multimedia modeling (e.g. transfer factors to organisms, etc), it can be a useful approach to introduce the concept of Probability Density Function (PDF) for representing its parametric variability and uncertainty. Indeed, such PDFs give information on the most probable value of the parameter, and also all the range of potential values, with an indication of their probability of occurrence.

However, how to derive PDFs remains an open question and highly depends on case-by-case contexts. This presentation aims at illustrating different methodologies that can be used for deriving PDFs, i.e.

· Bayesian updating of models providing prior information on the range of potential values. This will be illustrated by the derivation of PDFs for parameters involved in sedimentological models in rivers (e.g. settling velocity of particles);
· Bayesian updating of regression models; as an example, the derivation of fish Bioconcentration Factors as a function of contamination level will be shown ;
· Hierarchical Bayesian approach for deriving contamination levels at local scale from global prior

information; the case of PAHs contamination in Silesia (Poland) will be shown as an example;
· Frequentist approach involving weighted bootstrap to study the robustness of PDFs according to the dataset structure.

Knol A (RIVM Netherlands); Slottje P; Jeroen P. van der Sluijs JP; Lebret E

Using expert elicitation to deal with uncertainty in impact assessment

Environmental health impact assessments often have to deal with substantial uncertainties. Typically, the knowledge-base is limited with incomplete, or inconsistent evidence and missing or ambiguous data. Formal expert elicitation is a structured approach to systematically consult experts on such uncertain issues. It is most often used to quantify ranges for poorly known parameters, but may also be useful to further develop qualitative issues such as definitions, assumptions or conceptual (causal) models. A thorough preparation and systematic design and execution of an expert elicitation process may increase the validity of its outcomes and transparency and trustworthiness of its conclusions. Various expert elicitation protocols and methods exist. However, these are often not universally applicable, and need customization to suite the needs of environmental health impact assessment. We present a practical yet flexible seven step procedure towards organizing expert elicitatio! n in the context of environmental health impact assessment, based on existing protocols. Customization for specific applications is always necessary. In particular, three issues affect the choice of methods for a particular application: the types of uncertainties considered, the intended use of the elicited information, and the available resources. We outline how these three considerations guide choices regarding the design and execution of expert elicitation. We conclude that, despite some known criticism on its validity, formal expert elicitation can support environmental health research in various ways. Its main purpose is to provide a temporary summary of the limited available knowledge, which can serve as a provisional basis for policy until further research has been carried out.

Symposium S13. Risk, governance and accountability in the National Health Service

This seminar will examine the prospects and perils of the identification and management of risk in the British NHS. It will consider the increasing importance of the concept of risk in health care, exemplified in the introduction of more stringent regulatory requirements, high expectations for incident reporting systems, and an increasing awareness of the threat of litigation. Such developments come within the context of amplified demands from the public, press and politicians for safer care, and calls for health care professionals to become more accountable. This panel is uniquely possessed of the ability to assess such developments, being composed of both health care professionals (practitioners and management) and academics who have worked in this area.

The panel includes the following speakers: **Prof Mary Dixon-Woods** (Professor of Medical Sociology at the Department of Health Sciences, University of Leicester); **Ms Lesley Jack** (Risk Manager at King's College Hospital and former secondee at the King's NIHR Patient Safety and Service Quality Research Centre); **Dr Michael Holland** (Consultant Psychiatrist at the South London and Maudsley NHS Foundation Trust, and Fellow at the NHS Institute for Innovation and Improvement) and **Prof Amanda Howe** (Professor of Primary Care at the University of East Anglia and Honorary Secretary of the Royal College of General Practitioners). The seminar will be chaired by **Dr Anneliese Dodds**. Dr Dodds is the Director of the Risk Programme, and Acting Director, of the King's NIHR Patient Safety and Service Quality Research Centre.

Chair: **Anneliese Dodds**

Dixon-Woods M (Leicester University UK); Yeung K (Kings College London UK)

Accountability and design-based regulation in patient safety

The optimal choice of regulatory approach for securing patient safety is an important problem. Design-based regulation is increasingly emphasised as a means of correcting for the fallibilities of human agents in managing clinical risks. Action-forcing design operates through technical constraints that are self-executing. Yet the enthusiasm for design-based solutions has subdued critical commentary. We argue that technology, by concretising rules about proper behaviour and conduct, not only functions as a regulatory instrument, but may also encode particular values and versions of rationality. These are not trivial issues given that patient safety is often a site of struggle over the what constitutes an error, and who owns the definition of an error, and that excluding professional discretion is far from unproblematic. As debates in the broader area of "code" or "design"-based regulation have highlighted, design-based approaches may have significant social, political and ethical implications, including threats to accountability and stakeholder participation. Design-based regulation involves challenges to professional agency and authority, and engages with wider debates about the regulation of the medical profession. We argue that i is vital that the introduction of patient safety technology is sensitive to the values and motives that get encoded in design.

Jack, L (National Health Service (UK))

Communities of practice in patient safety

The presentation will discuss whether commuities of practice could act as an informal mechanism to enhance organizational learning in relation to patient safety issues. It will describe how communities of practice could encourage front line staff to engage in the learning and improvement process, highlight some of the challenges inherent in this approach and give suggestions for how the approach might be taken forward.

Holland M (National Health Service (UK))

Improvement in Patient Safety in Mental Health: Getting to Zero – A description of the methodologies used by Henry Ford System to reach zero suicides

Since 2001 the Behavioural health services division of the Henry Ford Health system has been running an improvement programme called “Perfect Depression Care”. One of the aims of this project was to eliminate suicides for any patient in the care of the Health system and they have reached this target of zero suicides for the last ten quarters. The project was first conceived following the publication of “Crossing the Quality Chasm” by the Institute of Medicine which was an indictment of the quality of care received by patients in the US healthcare system and they were part of the Pursuing Perfection programme by the Robert Wood Johnson Foundation and IHI.

The programme used frameworks from the Crossing the Quality Chasm report, LEAN and Model for Improvement methodologies were also used as well as the use of the Chronic Care model. The combined use of these service design methodologies have allowed them to improve care to a level never previously expected or seen.

Howe A (University of East Anglia UK)

How to develop adequate accountability to the self and peers against professional criteria to avoid risk to patients

How to develop adequate accountability to the self and peers against professional criteria to avoid risk to patients
The theme of this talk is the development of professional accountability. Developmental psychology suggests that children develop responsibility through a variety of socially conditioned repsonses, which need to be paralleled in professional development. However, working with adults for professional learning is different for several reasons:
• the ‘adult’ persona is already substantively formed, so is less plastic
• motivations are more abstract – aspiration to being a doctor, understanding of that role
• authority relations are different – institutional not parental, less emotional investment, though still moving the individual towards autonomy
• one’s judgements affect lives of others as well as the self.
Evidence from educational research into professional development in medicine shows a need for clear guidance and principles on how to do this– but in medical schools this can be challenging, as there are conflicting cultures, and some have an institutional belief that this aspect of a doctor is ‘born not made’. The author will discuss these aspects and make recommendations for engaging learners in effective learning environments that develop professional accountability and risk judgement.

Oral presentations

Parallel P15: Risk and organizations

Chair**: Asa Boholm**

Kinder KE (University of Lancaster UK); Boos D (ETZ Zurich Switzerland); Busby JS ; Grote G

Pervasive technologies, risk and accountability

Pervasive technologies, such as ‘ubiquitous computing’, ‘smart devices’ and sensor networks, are an important theme in the new ‘risk society’ (Busby & Kinder, 2009). The risks created by accountability provide both a reason why pervasive technologies are introduced and a challenge once they are implemented. Pervasive technologies introduce to organizations the ability to capture data in previously inaccessible domains and offer the prospect of unprecedented accuracy in recording organizational events, for example detailing the history of a product through the supply chain, or the hazardous exposures of an individual worker. Such a microscopic view of everyday occurrences promises much more detailed and less-error prone management of resources, assets and processes (Fleisch & Mattern 2005). However, the collected data also changes the way in which people and organizations can be held accountable for their actions (c.f. Yakel 2001, Suchman 2006). Pre! viously unnoticed or tacitly accepted discrepancies, gaps and work-arounds now become visible and identifiable with specific actors. Agreements to go along with such work-arounds may become impossible once they are a matter of record. New data measuring new things may inadvertently reorder the priorities of those being measured. This creates a need to understand the accountability challenges brought about by pervasive technologies, and the risks that motivate actors – both individuals and organizations – in welcoming or resisting them. We propose a concept of

accountability based on the three dimensions of answerability, responsibility and liability. We present findings on the relation between accountability, risk and pervasive technology from several case studies of technologies under development. We describe the accountability risks connected to various pervasive technologies, and discuss how these accountability challenges could be addressed.

Bodsberg L (SINTEF Technology and Society Norway); Herrera I; Hobrekke S; Krokenes T

The use of risk influencing factors for risk assessment of offshore helicopter transport

The paper presents the model established by SINTEF in a risk assessment study (2008-2010) of offshore helicopter transport on the Norwegian Continental Shelf. The study was funded by OLF The Norwegian Oil Industry Association.

SINTEF has identified major technical, human and organizational factors influencing helicopter transport risk (risk influencing factors - RIF) and established two generic risk influence diagrams; one for the frequency of helicopter accidents and one for the consequence of accidents.

The RIFs are arranged hierarchically in three levels and presented graphically in a risk influence diagram, where main interdependencies are indicated by arrows. At the operational level we have 14 RIFs (e.g. Operators maintenance and Air traffic/navigation service), at the organisational level we have 5 RIFs (e.g. Helicopter manufacturer and Helicopter operator), and at the authority/company level we have 3 RIFs (e.g. International aviation authority). We have identified 8 accident categories, and for each accident, we use accident/incident statistics and expert judgements to assess the state and the importance/weight of the various RIFs in the generic risk influence model.

The total risk to passengers and crew is estimated by summarizing the risk contribution from the 8 helicopter accident categories and quantified in terms of fatal accident rate per 100 million person flight hours.

The risk influence diagrams and risk influence model and have been very successful in communicating the overall risk picture to various stake holders involved in helicopter safety. Thus, this approach may represent an important supplement to traditional quantitative risk analysis

Hede, S (Swedish National Defence College)

Perceptions of societal risks, preparedness and management capability at government agency level. An interview study

Within the Swedish emergency management system government agencies have a central role in analysing risks, developing policy and implementing decisions relating to societal preparedness and crisis management capability. In addition to planning within their own area of responsibility the key agencies are organized in six cross-sectoral coordinating areas. These correspond to areas of joint responsibility such as transport, technical infrastructure, etc. Decision-makers in these key functions play a significant role in developing and coordinating analyses of risk and societal preparedness within and between central public authorities. Legislation forms a framework for these tasks, but there is also evidence that other influencing factors include previous experiences, media framing and perceived public expectations. This paper will focus on the decisions makers' own experiences, perceptions of risks and view of their own role in relation to these demands.
Fifteen strategically selected persons from eleven key organisations were interviewed and the data analysed according to grounded theory. Particular difficulties were perceived in relation to managing certain types of risks/crises, including natural disasters, antagonistic threats and "creeping crises". These difficulties related both to the nature of the events and to anticipated societal reactions. Perceived limitations for managing these risks included i) non-customized and contradicting laws governing actions, ii) unclear responsibility leading to possible conflicts (departmentalization) and iii) critical leadership issues relating to accountability and command. Based on these results some challenges for the emergency management system will be discussed.

Schiller F (Cranfield University); Rocks S; Pollard S

Risk maturity models as blueprints for better risk management – issues for a government department

Organisational maturity models are a management tool that can be used to facilitate organisational change aimed at better risk management by allowing the assessment of process capability rather than of the process's outcomes (Hillson 1997; Strutt et al. 2006; IACCM 2003). In this respect they are seen as enabling precautionary risk management since the maturity levels of the model are not static but define process standards for each level of improvement thus increasing the grip of risk management implementation at each level.
The model has been used by government as part of its Risk Programme to improve the operation of its

departments (Treasury 2004; OGC 2007). Our conceptual presentation will review the existing literature, which reveals deeper questions concerning the theoretical and empirical underpinning of the model (Bach 1994). The model is for instance still open for improvement regarding the integration of existing risk management processes and cultures in organisations (Fuller and Vassie 2002; Dowlen 1995; Osborn and Petts 2003), which is particularly crucial for a department and its network. There are also fundamental issues concerning differences between political and business organisations, e.g. lack of insurance-mechanism for government, which need to be addressed. Accordingly the work of the Risk Centre at Cranfield University for Defra so far has focused on a bottom-up perspective on improved organisational risk performance including problems of comparing different risks, the organisational culture behind the management of these risks and organisational learning. The authors would like to acknowledge Defra, EPSRC, ESRC and NERC for their support.

Parallel P16: Media and risk communication

Chair**: Gabriella Rundblad**

Revuelta G (Universitat Pompeu Fabra Spain); Cugat G; Gosalbez P (Catalan Food Safety Agency Spain); Santamaria M; Escurriol V (OCC-UPF Barcelona Spain)

Food safety and food security issues in the Catalan press: The SAM report

The SAM REPORT belongs to a main action plan (SAM PLATFORM) which objective is to improve the information that Catalan society receives about food safety and food security issues (FS).

The particular objective of the SAM Report is to reach a better understanding of the information given by mass media about FS issues and its underlying process. To reach this goal, seven general newspapers – representing the different profiles of audiences in Catalan society – were monitored during the year 2008 and studied by means of content analysis method.

Main results: 1) FS was a common issue among the monitored newspapers (1911 texts); 2) industry was the first source of information (33%), followed by politicians (26%), civil society (18%, mainly consumer and health organisations), scientists (15%), and administration (8%); 3) the journalistic treatment of topics that had a constant presence during the year (i.e.: “food prices” and “world food crisis”) was different from those corresponding with topics that were at the *public arena* just for days or weeks (i.e.; “sunflower oil with hydrocarbons” and “milk with melamine”); 4) one out of every four texts on FS talked explicitly of risk, and one in ten mentioned the term health warning; 5) among of the texts that addressed the “risk” of a particular food or technology, there was often no final conclusion, leading to an ambivalent message (with the pros and cons); 6) one out of every five texts on FS included recommendations for the reader, showing that not only does the press have an informative role, but it also clearly searches a sort of citizens' education.
In Catalan language, SAM comes from “Seguretat Alimentaria i Mitjans” (Food Safety and Media)

Hurrell C (University of British Columbia); Nicol AM (University of British Columbia); Hodgins K

Asbestos exposure in the news: a historical content analysis of French- and English-language newspapers

This study examines print media coverage of health risks of asbestos exposure and compares the coverage to a timeline of health research findings and government regulations on asbestos during the same period. This study also explores how the news coverage, and particularly the health effects content, varied by geographical region (comparing coverage from Canada, the United States, and the Canadian province of Quebec).

A content analysis of a random sample of articles was conducted for five newspapers during the period 1975-1985. Articles were coded for prominence, type of article, health effects reported, news trigger, and key message(s). Frame analysis was used to examine how the various newspapers portrayed asbestos exposure as a public policy issue.

The news stories were compared to a timeline of asbestos-related scientific and regulatory issues to examine how risk communication about asbestos exposure unfolded in the press versus how it emerged in scientific and regulatory realms.

The analysis showed that coverage differed between the regional papers based in Quebec (where asbestos mining was occurring) and the Canadian and US national papers. The regional newspapers were less likely to report on international events or scientific research. Regional papers also presented asbestos in a more positive frame than the national papers. This may reflect a “reassurance” function, whereby local media avoid intensifying risk perception and potential negative impacts on the local economy. Sovereignty issues between Quebec and the rest of Canada may also have contributed to the disparity in coverage.

Jönsson AM (Sodertorns University Sweden)

Risk communication and the European Public Sphere

During the 2000s we have seen an increased academic interest for issues concerning how Europe and the European Union are represented in news media, and several researchers have pointed out the importance of acknowledging a possible emerging European Public Sphere. Since the area of risk governance to a large extent is characterized by a need for transnational discussions and decisions, it makes the issue of a European Public Sphere especially interesting in this context.

Environmental risks transcend traditional boundaries and raise a need for new governing and communication strategies, involving different actors at different levels.

A public sphere can be defined as a communicative space for discourse on public matters. News media shape public discourse in terms of participation and representation in that they influence who has access to the arena, who can participate in the discourse, and the subjects that can be discussed. So far analyses of European Public Sphere(s) seem to conclude that this sphere mainly consists of national media reporting on European issues and institutions, but that there so far are no influential transnational European common media with a role in political communication.

Against this backdrop, this paper discusses how the concept of the public sphere can be understood in relation to risk governance and risk communication in the European arena with focus on environmental risks and marine governance. Also the roles of different media are problematized: What is the role of the traditional news media and what other media are available for a European public discourse?

Rundblad G (King's College London); Knapton O (King's College London)

Media communication during a natural disaster

Background:
In 2007, Gloucestershire was hit by the UK's worst ever floods, and both local and national media coverage was intense. In addition to the floods, 340,000 people lost their drinking water for up to 17 days. Once the water was restored, consumers were first told not to drink the water and then to boil it before drinking. A recent postal questionnaire study revealed a high degree of non-compliance to official advice.

Aims:
Dramatic and frequent media reporting of low probability/high consequence events has been linked to greater perceived risk. However, while media affects public risk perception, their ability to impact individual's health choices is still debatable. This study aimed to disclose whether consumers' perception of water safety and their behaviour during the Gloucestershire incident could be traced to media communication.

Methods:
Written media reports on the incident were compiled into a corpus, which was sub-divided into local versus national news. Corpus linguistic analysis and manual cognitive discourse analysis was employed. Analysis was supported by questionnaire results, interviews and focus groups.

Results:
Local media was more tuned-in to public needs and consequently more utilised by consumers. While national coverage rapidly decreased as the floods became manageable, local coverage was more consistent, including reporting when the drinking water was safe. Although the choice of information source used did not directly impact consumer behaviour, we did find that a simultaneous change in local and national media towards more authoritative language corresponded temporally with a decrease in non-compliance.

Parallel P17: Resilience and adaptation

Chair**: Judith Petts**

Harries T (King's College London)

Individual adaptation to climate change in conditions of uncertainty

Most individuals fail to make material adaptations to protect the security of their homes against the adverse impacts of climate change and natural hazards. This paper summarises an investigation into this issue conducted over the last five years with people living in flood risk areas of the UK. Looking beyond the reasons that people themselves give for their lack of adaptive behaviour, it asks what rhetorical aims they are trying to achieve when they construct these arguments, and why. The paper concludes that in circumstances of uncertainty over event probability, event impact and the reliability of adaptation measures, people tend to prioritise the protection of their social and emotional security over the more dubious benefits of taking steps to reduce material disruption and loss. Such behaviour is predicted by a number of factors, including the degree of experience of the hazard event, low perceived self-efficacy in choosing and implementing ! adaptation measures and the association of adaptation measures with social stigma. The evidence presented will be taken from analyses of survey datasets, semi-structured interviews and focus groups – work that was conducted as part of an Economic and Social Research Council (ESRC) Placement Fellowship at

the Department for Environment and an ESRC CASE Studentship at the Flood Hazard

Therrien MC (Ecole nationale d'administration publique Canada)

Building intra and inter-organizational resiliency: adaptive fit for better crisis management

The driving premise of this paper is that, in order to face the uncertainty brought on by the crisis, organizations need to build resiliency to face environmental turbulence. Organizations having to face crisis management frequently deal with environmental uncertainty. However, these organizations have not usually adapted their organizational routines enough to be very responsive to the organizational complexity the crisis brings. Moreover, organizations usually build routines in order to deal with or avoid uncertainty and complexity. Building a resilient capacity can be seen as developing micro-strategies through out the organization instead of building routines. Similar to a hologram, each part of the organizational structure should have a complete image of the whole organization. Organizations have a tendency to absorb complexity by building routines and processes that evolve and transform themselves as the organization analyses its capabil! ities, estimates the number of resources and the pressures from its environment (Lengnick-Hall and Beck, 2005).

How can this resiliency be built in a public organization such as a city where it has the responsibility to respond to the crisis and also prepare itself in terms of recovery planning for its own activities. The objective is to create a strategic framework for organizations managing essential infrastructures in the Montreal metropolitan area by identifying organizational strategies best adapted to increase the resilient quality of organizations (interface between protection of essential infrastructures and prevention management) and interorganizational coordination. More particularly, this paper will initially identify organizational strategies already used by organizations and estimate their quality. Finally, we will identify also which organizations have gaps in their resilient strategies.

Tanguay GA (Université du Québec à Montréal Canada); Normandin JM ; Therrien MC (Ecole nationale d'administration publique Canada)

City Strengths in Times of Turbulence: Strategic Resilience Indicators

Fragility and interdependence have rendered large socio-technical systems, such as cities, vulnerable not only to terrorism but also to natural and technological disasters. Although there have been great innovations in terms of risk analysis and disaster prevention, large events are increasing in size and number throughout the world. These increases are due mostly to an increase in population density in high risk urban zones and to an increase in interdependence of technical and social systems. In order to understand these growing problems, we turn to resilience strategies for the development and governance of cities.

In this paper we identify strategic resilience indicators for cities. Very few authors have developed the concept of urban resilience and none to our knowledge in the specific case to disasters. First, as identified by the Resilience Alliance (2007), we analyze four vectors which are distinct and interdependent: urban metabolism, social dynamics, the environment and network governance. Second, we compare this analysis with the criteria which are used for sustainable development, commonly called sustainable development indexes. We argue that sustainable development criteria are important to consider because although a city might have developed a high response capacity to disasters it should look into sustainable development factors in order to decrease its vulnerability.

Petts J (Birmingham University UK)

Building Climate Change Adaptive Capacity: Institutional Challenges

This paper will discuss the findings of the Royal Commission on Environmental Pollution's new report on Adaptation to Climate Change (published March 2010). Presented by a member of the Commission the paper will also include reflections on the implications for the research agenda.

Human societies have always adapted to a changing climate – usually reactively building on experience of extreme events but often sub optimally. In the UK we can deal with most weather conditions reasonably well, but extreme weather can cause severe disruption. Predicted climate change will present challenges of a different order: extreme events will occur more often, will potentially be more extreme and more widespread. The country's vulnerability will increase and institutions need to address this proactively and systematically. Mitigation (in the form of greenhouse gas emission reduction) will be insufficient, so institutions must build adaptive capacity. IPCC defines adaptation as having three possible objectives: to reduce exposure to the risk of damage; to develop the capacity to cope with unavoidable damages and to take advantage of new opportunities.

Institutions will face challenges that are not unique to climate change adaptation but certainly stress the need to embed responses as part of routine business. These are the challenges of uncertainty, complexity, path dependency and equity. The paper will discuss the Commission's findings in relation to these and its recommendations – including in relation to policy requirements, resourcing and communication. It will reflect on the outstanding

research questions and imperatives raised by the report.

Parallel P18: Risk assessment and standards

Chair: Michael Rogers

Simoncini M (University of Pisa Italy)

Regulating catastrophic risks by standards

This paper analyses the role played by standards of protection in the regulation of catastrophic risks.It examines how to protect people against the occurrence of catastrophic events, considering that the related risk is highly uncertain and difficult to predict through rational methodologies.

In this perspective, the paper focuses on environmental risks and terrorist threat, which affect common goods - respectively the environment and the security - whose damage is susceptible to produce ruinous effects and huge casualties: both natural and man-made disasters are able to alter the ordinary legal relations that States must institutionally assure to citizens.

Therefore, the severity of the consequences of catastrophic events cannot be ignored, despite the low probability of their occurrence. However, in the absence of emergencies, adopting exceptional measures means to alter the legal framework, and thus the enjoyment of fundamental freedoms and the priorities in the allocation of public resources. Every precautionary approach cannot escape from rational reflections about the opportunity-cost of any action, the cost-benefit analysis of countermeasures and the proportionality of every regulatory decision.In order to understand how to face those “low probability – high cost” risks, the paper considers a specific method of regulating risks, by resorting to standards of protection. By using thresholds of alarm, public administrations can settle fitting countermeasures in correspondence to specific risk characterizations. To this end, the paper analyses the administrative process of formulation of standards and how they allow to manage uncertain risks, promoting the development of a sound and accountable administration.

El Yamani M (AFSSET France); Brunet D

Setting Occupational exposure limits: between risk assessment and risk management

Recommending Occupational Exposure Limits (OELs) based solely on scientific data is a relatively new task assigned by French government to French Agency for Environmental and Occupational Health Safety (Afsset).

Afsset created and entrusted Occupational Expert Limit Committee (OEL) to guide this mission.

Afsset OEL committee considered that effects of chemicals which are both genotoxic and carcinogenic must be regarded as being with no-threshold. For those substances, OEL Committee assumes that there is some probability of harm to human health at any level of exposure, and consequently it is not appropriate to calculate a dose below which adverse effects are not expected to occur.

OEL Committee considers inappropriate to specify a concentration or dose associated with a negligible or acceptable level of risk because this would involve inclusion of risk management considerations which is not its mission.

Therefore, the OEL committee methodology for non threshold carcinogen considers three values of occupational risk levels (10-4, 10-5, and 10-6) associated with a concentration or dose to specify risks in terms of predicted incidence or numbers of excess cancer deaths per unit of workers population.

However, to help risk managers to decide at what level occupational exposure limits should be set for these carcinogenic substances, the Agency’s opinions give some information (i.e number of exposed workers, lowest OEL in EU, limits and uncertainties of the proposed risk assessment, etc) and sometimes confirm or indicate threshold limit values with corresponding residual excess risk of cancer. Examples will be given to illustrate some cases.

Illing P (PICS Ltd UK)

Issues in toxicological risk analysis for chemicals

The risk analysis framework for health and environmental risk assessment and management of chemicals (however defined) has been developing since 1983. In 2003/4 a terminology was agreed internationally. Normally risk has to be associated with benefit.

The framework for toxicological risk analysis involves risk assessment (hazard identification, hazard assessment, exposure assessment and risk characterisation/estimation) and risk management (risk evaluation, emission and exposure control, risk monitoring). Regulatory risk management often involves an initial risk evaluation based on structure-activity relationships, physical chemistry and animal testing, and further assessments using additional testing and data from humans, including risk monitoring data. One assessment process involves the use of no-observed-adverse-effect levels (or equivalents) and assessment factors to develop standards. Recent publications (Illing, 2006; Illing 2009; Illing and Marrs, 2009) summarise the current situation.There are societal issues affecting regulatory risk assessment and management. These include:

• How to communicate complex issues multidirectionally and to frame the questions and the conclusions adequately.
• What constitutes acceptable (or, at least tolerable) risk (and hence to what extent should a population be protected)?
• Uncertainty and the application of the 'precautionary principle'.
• The conflicts between knowledge, animal welfare and human experimentation and the need for a new paradigm for initial hazard assessment if we are to move away from the current dependency on animal studies.
• The conflict between further information and timely decisions, with particular reference to incident management in the face of somatogenic disease.
As point 3 will be examined separately by David Taylor, I will examine and exemplify several of the other points.

Rogers M (ICAAS Turvuren Belgium) ; Smriga M

Risk Governance of Food Supplements – The Case of Amino Acids

Following recent major food safety management issues, such as BSE in cattle and dioxin contamination, food RM has become increasingly precautionary, moving from "modern" RM to "post-modern" RM.

The EU General Food Law of 2002 has been followed by regulations on ingredients, novel ingredients, additives and supplements and horizontal regulations on consumer information and health claims.

Thus recent regulatory initiatives aim at controlling health-benefit claims for supplements and fortified foods, and setting upper supplement intake limits. However, it is found that the major risk to the consumer arises from inadequate quality controls rather that potential overdose or misinformation.

Specific amino acids have been used to improve sport performance, to enhance the quality of protein, improve immune functions, reduce stress, etc.

The International Council on Amino Acid Science (ICAAS) was set up to address problems such as upper limits and quality standards and to contribute to the risk governance process. ICAAS sponsored research has indicated that the major amino acids have a high margin of safety and that upper limits cannot be established using conventional risk assessment methods. The reason for this arises from a well-controlled homeostasis of amino acids in the human body, since they are not only elements of a normal diet but also make up a substantial part of human tissue. ICAAS is currently devoting attention to establishing globally applicable specification standards on amino acids used in the human food supply. The research results should contribute to the evolving risk governance in this field.

Parallel P19: Institutional dimensions of risk governance: Climate change and flooding

Chair**: Kristian Krieger**

Correlje A (Delft University, Netherlands); Broekhans B

Flood protection in the Netherlands: The institutionalization of residual risk

In deltas like the Netherlands, governments always face flooding risks. For centuries, risk management was primarily based on dike enhancement, taming the seas and rivers between ever higher dikes. Confronted with the high water events in the nineties, the effects of climate change and resistance of stakeholders because of the harmful effects of dike enhancement on cultural and landscape values, water policy makers re-opened critical debates about the level of security and new solutions to deal with flooding risks. One of the 'new' solutions is to make others responsible for the residual risk (restrisico).

Dilemma: policy has to be accountable (cost recovery, differentiation, dealing with uncertainties etc.) at the one hand, and at the other hand the public task to guarantee every ones safety (prevention at all costs, and reduction of probability).

The Ministry of Transport and Water management recently decided to examine the implications of this new approach for the institutions and the political and governmental power relations in water management and flood prevention. New institutional arrangements should re-balance and re-arrange the preventive protection of particular areas, dealing with potential floods and rampenbeheersing. This paper unravels how the new policy and the ministry deal with the dilemma, and considers the potential of this solution.

Baldet B (University of Toulouse France)

Renewal of public policies for flood risk management. Between globalized approach and localized stakes : Is there still a place for threat ?

The incertainties due to climate changes are often evoqued in order to explain the increase of natural threats. This study aims to explore the dynamics that are at work within the systems of actors dealing with state policies for flood risk management. We will be addressing the case of the "Touch" river located at the outskirts of Toulouse (France). For a few years now, the state policy for flood risk management is changing and is acknowledging the

irreducibility of the threat. This view is accompanied by procedural changes that encourage cooperation. It involves the emergence of single stakes and new actors engaged in decision-making. We therefore hope to propose an analysis to describe the institutional mechanisms as well as the set of technical and social mediations encountered by flood risk within the framework of state action. We will be studying how public policies for flooding risk management are based on a global approach of the river and the environement surrounding it (local agriculture, urbanisation, landscape...). This approach allows to take in consideration the different strategies used by various organisations whose local interests are at stake. We are therefore putting forward the idea that flood risk is created and is formed in the heart of a set of games that guide and control the actors.

Ellison D (Institute for World Economics Hungary); Keskitalo C

On the Institutional Governance of Mitigation and Adaptation to Climate Change

Global warming and climate change – imbued as they are with the qualities of risk and uncertainty – represent perhaps the greatest challenge to governance of this century. How national, regional, local and EU-level decision-making come to terms with this challenge may well define whether the planet and humanity survive into the next century.

Our analysis investigates the role of institutions and their structure in determining the capacity of governments to define meaningful strategies for climate change mitigation and adaptation. We investigate whether the structure of EU and national-level institutions aids or impedes the development of coherent and well-integrated responses to climate change. Inspired by observations from two recent studies (Ellison and Keskitalo, 2009; Ellison forthcoming) and an upcoming theoretical paper, we employ a series of interviews at the national and EU level to assess the role of institutional structure in fragmenting and weakening strategies for addressing climate change mitigation and adaptation. We measure whether the division of policy competence across multiple institutions is an important indicator of the likely fragmentation of policy coherence. Preliminary findings from the above cited literature suggest that the division of policy competence across multiple institutions and! even levels of governance are the likely cause of diluted and potentially failed policy outcomes. This in turn is presumably explained by the role of institutionally embedded interests. These findings provide a foundation for arguing that increased policy coherence and coordination would be greatly facilitated by the creation of a Climate Change Commission mandated to address both mitigation and adaptation.

Krieger K (King's College London UK)

Rational adaptation to increasing flood risk? Institutional barriers to and drivers of risk-based flood management in Germany and Britain

Climate change is expected to increase flood risk across Western Europe substantially over the next decades. Adapting to this increased risk has therefore become a major challenge to actors involved in dealing with flooding. A series of floods across Europe in the 1990s and 2000s has led to the emergence of ideas of ‘risk-based' flood management, replacing the previously dominant engineered security approach. At its simplest, ‘risk-based’ management implies the use of instruments (flood models/maps) that calculate probability and extent of future flood events and a subsequent tailoring of a wide range of flood management interventions (investments, access to compensation, regulation, and information) in accordance to varying risk levels.

As a ‘rational’ response to the increasing need to anticipate future disasters, it is reasonable to expect a universal adoption of ‘risk-based’ management in advanced industrialised countries where risk instruments have become increasingly available in the last two decades. This paper, however, argues that the extent to which risk instruments are selected by actors involved in flood management depends on the institutional context. Using Britain and Germany as comparative case studies, this paper shows that Britain’s unique regulatory state, with its emphasis on standardisation and centralisation, provides a more conducive environment than Germany’s fragmented state with its emphasis on citizen welfare and safety, as well as on rule of law/codification – even though policy-makers in both countries have stressed the importance of risk information for flood management, and experts have developed advanced risk instruments.

This paper therefore makes a contribution to the discussion under which institutional conditions adaptation to extreme weather events can be 'rationalised' through anticipatory risk instruments. This analysis seems highly relevant because of an expected rise in the number of such events as a result of climate change, policy initiatives such as the recent EU Flooding Directive that stress the importance of risk instruments, and the suggested universal appeal of functionally rational instruments associated with risk calculations that highlight the importance of critical, comparative research.

Session 5, Tuesday 3.30pm

Symposia

Symposium S14. Global governance of risks: WTO, Codex Alimentarius and Private Standards

This Symposium focuses on key organizations and institutions that directly or indirectly are governing risks related to food and veterinary products: the World Trade Organization (WTO), the Codex Alimentarius Commission (Codex) and the set of private actors playing an influential role in the design of food safety standards at the global level. The operation and cooperation of these institutions can be seen as the central part of an emerging system of global governance of risks.

The role of the WTO in this area originates in the linkage trade-environment/trade-health. The influence of the WTO, though indirect is substantial, mainly because of its strong capacity to enforce law vis-à-vis other international organizations. The wide-range of safety standards set by Codex, which are in principle non-binding, are in fact gaining quasi-binding status because of the way they are endorsed by the WTO. This regime is complemented by the growing importance of private standards applied to food products across the board. This emerging regime of international regulation of risks at different (though interrelated) levels is being criticized for not being sufficiently transparent, overriding democratic values and for its lack of legitimacy. The Symposium will discuss different aspects of this complex system drawing attention on new evolutions and on possible solutions to the existing legitimacy problems.

Chair: **Alessandra Arcuri**

Gruszczynski L (Polish Academy of Sciences)

A Standard of review in international SPS Trade disputes: Some new developments

The paper addresses the problem of a standard of review (i.e. the level of scrutiny that the reviewing body exerts over the decision or regulation being reviewed), which is applied by WTO panels in sanitary and phytosanitary (SPS) disputes when assessing scientific justification provided by WTO Members. In particular, it argues that important changes are currently taking place in the practice of the Appellate Body (AB) with more deferential approach replacing *de novo* type of review. This analysis is supplemented with a brief discussion on the relevance of those changes for the current dispute between Australia and New Zealand over importation of apples.

The Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) is one of the central legal instruments in the area of international SPS safety. As a general rule, it requires scientific justification in the form of risk assessment for all national SPS measures that affect international trade. The early SPS case law tended to adopt rather intrusive standard of review, which allowed WTO panels to assess quality, persuasive force and correctness of the national scientific determinations and substitute them with their own. This approach had an obvious impact on the allocation of power between the WTO and its Member States, favoring international over national level of governance. The recent decision of the AB in *EC – Hormones II* constitutes an important shift in the WTO jurisprudence. The AB opted for more deferential standard of review that gives an additional margin of direction to national governments when regulating SPS risks. The panel report in *Australia – Apples* is the first one to elaborate on the AB's findings and apply them to the specific circumstances of the case. The report is of particular importance as it will shed a light on the future direction of the SPS case law and clarify the relationship between prerogatives retained by the Member States and supervisory powers of the WTO.

Herwig A

The contribution of global administrative law to the legitimacy of the Codex Alimentarius Commission

After a brief introduction to the work of the Codex, the presentation analyses the status of Codex standards under the SPS and TBT Agreement. In the next section, it discusses the legitimacy deficits detected in the literature on the Codex. The final section inquiries whether concepts derived from administrative law scholarship help to address the legitimacy deficits of the Codex. It thereby analyses whether global administrative law proposed by some scholars a basis for the legitimacy of global regulation actually fulfills this purpose. The conclusion is that administrative law concepts do not remedy the crucial legitimacy deficits of the Codex because the scholarship fails to address the crucial underlying issues of 1) who is to be included in decision-making and 2) whether justice requires giving special weight to the interests of developing countries.

Arcuri A (Erasmus School of Law Netherlands)

Rethinking the risk paradigm at the WTO

The World Trade Organization plays an influential role in the global governance of risks related to food and veterinary products. It is argued that after the supremacy of a science-based approach to risk during its first decade of operation, the WTO has undergone a major shift in approach, and public values and risks perceptions have been welcomed to enter the WTO kingdom from the main door. The Appellate Body Report in *Canada-US Continued Suspension* is the main document evidencing this shift.

The paper examines 1) the reasons for this shift and 2) its implications for the global regulation of food safety. In relation to the reasons, it is argued that one of the driving forces behind this shift is related to the growing influence of behavioral and sociological approaches to the study of legal and economic phenomena. With regards to the implications for the policy making, it is contended that, once public values are considered legitimate factors for the determination of safety standards, it becomes necessary to develop an analytical framework to give more guidance on *how* these values can be assessed in practice. It is further proposed the construction of a taxonomy of risk and values that can guide the international judiciary organs to screen protectionism in safety measures adopted on the basis of public values.

Alemanno A (HEC Paris France)

Private sector food-safety standards between European and WTO level

The definition and implementation of food safety standards is no longer defined by national, EU and international legislation, but is increasingly set by private regimes of companies and determined by their cross-border supply-chains. This process is reinforced through the process of concentration on the food markets, especially of large supermarket chains operating globally, and interdependence along the same or sometimes different supply-chains in the same sector. As a result, food private regulation complements public regulation at the transnational level in relation to: standard-setting; monitoring and enforcement. Due to the non-participatory and untransparent nature of the standard-setting process, not only the legitimacy of some private standards is increasingly questioned today but also their effectiveness and enforceability. This paper will analyse both the EU and WTO approach towards private standards.

Symposium S15. Uncertainty in human and environmental risk assessment: Part 2 - Case Studies

For a description of the Symposium, see above under Uncertainty in human and environmental risk assessment: Part 2 – Case Studies

Chair: **Alexander Zenié**

Tainio M (National Institute for Health and Welfare Kuopio Finland); Karvosenoja N; Kupainen K; Kukkonen J; Pekkanen J; Tuomisto JT

The uncertainties of risk assessment for fine particulate matter: Implications of a European and Finnish case study?

Estimation of adverse health effects caused by environmental stressors involves uncertainties. The fine particulate matter air pollution (PM2.5) has been associated to the loss of life all over the world and several assessment studies have been performed to quantify the adverse health effects caused by PM2.5 in different geographical setting. In this study, we quantified uncertainties related to the PM2.5 risk assessment model and tested the sensitivity of the model to these uncertainties. The primary PM2.5 emissions in the whole of Europe and in more detail in Finland, and the emission-exposure relationships to different primary PM2.5 emission source categories were evaluated and incorporated into the model. The primary PM2.5 exposure-response functions and toxicity differences for the pollution originating from different source categories were estimated in an expert elicitation study performed by six European experts on air pollution health effects. Uncertainties were eval! uated for each phase of the model and uncertainty was propagated through the model with Monte Carlo simulation. Exposure-response function uncertainty was noticed to contribute most of the uncertainty in the model. Variation in toxicity was the second most important for those emission sources categories to which we assumed higher or lower toxicity in comparison to average PM2.5 mass. Emission strength and dispersion uncertainties contributed in average equally much to model uncertainty. We conclude that the variations of emission-exposure relationship and toxicity between various source categories had significant impacts on the assessment on premature deaths caused by primary PM2.5.

Kunseler EM ; Hage M (Netherlands Environmental Assessment Agency); Dassen TGM

An analytic-deliberative approach to urban sustainability appraisal

The Dutch policy ambition of creating sustainable cities needs to be supported with goal formation

and strategic pathway specification. Creating future images and perspectives for action is permeated with uncertainty as a result of a high degree of complexity and considerable dissent. A future-oriented study of the Netherlands Environmental Assessment Agency is designed in a participative way and makes use of foresight methods to capture the plurality of future images and perspectives for action to create healthy, liveable and energy-neutral city environments. Participative backcasting is used as method to develop visions on future sustainable urban environments and road maps with (policy) measures for their realization. A broad selection of scientists, policy makers and representatives of non-governmental organizations, interest groups and private parties is involved. Scenario analysis is used to explore and assess the variety of possible perspectives and understanding of t! he future with an integrated urban systems model. Societal change and new technologies here play an important role but also bring in additional uncertainty. The perspectives for action are appraised in a participatory, multi-criteria, option appraisal process addressing their sustainability potential, synergies and trade-offs, distributional effects over social economic groups, societal, technical and institutional complexity and political urgency. This analytic-deliberative approach stresses not only technical information but also the explicit input of values, insights and tradeoffs. This study poses a methodological challenge and serves as innovative case example of how to deal with uncertainty in future-oriented studies.

Ragas A (Radboud University Netherlands)

Dealing with uncertainty in ecological risk assessment

Environmental risk assessment is typically uncertain due to our limited knowledge about the physical, chemical and biological processes underlying the risk. Uncertainty may have a profound impact on the management decision, e.g. when stakes are high the probability at which an accident will be considered “acceptable by society” will be much smaller than when stakes are relatively low. Nevertheless, uncertainty is not always explicitly addressed in risk assessment and management. This may result in inconsistent or suboptimal management decisions. The possible benefits of addressing uncertainty will be illustrated in three case studies that focus on assessing ecological risks. In the first case study, uncertainty will be used as a tool to quantify the financial benefits of gathering additional information (value-of-information). In the second case study, it will be illustrated that the deterministic assessment factors currently used in ecological risk assessment result in high! ly variable levels of conservativeness and should be replaced by probabilistic factors. Finally, it will be shown that uncertainty in the No-Observed-Effect-Concentration (NOEC) can result in erroneous assessments. The take home message of this presentation is that uncertainty can and should be addressed in order to optimize environmental risk management.

Dimosthenis, S ; Kuhn, A; Denby, B; Gerharz, L; Sabel, C; Shaddick, G; Zenié, A (Joint Research Centre of the European Commission Ispra Italy)

Uncertainty analysis of the Heimtsa/Intarese case study on health impacts of climate change mitigation measures

Both Heimtsa and Intarese projects adopted a common case study in order to demonstrate the applicability of their methods and tools. The common case study consists of analysing the EU-wide environmental health impacts of climate change mitigation policies.

In parallel, the Heimtsa work package 1.2 on uncertainty analysis, together with the adequate work packages of Intarese, 2-Fun, and more recently, NoMiracle projects, proposed a tier-based harmonised methodology for analysing uncertainties within integrated environmental health impact assessment. Furthermore, a three days hands-on training was given in early 2010 to all members of the involved projects in order to disseminate the harmonised methodology and the associated IT tools.

This presentation focuses on the selected methods for the case study. It involves several models, and consequently several organisations, starting from emissions towards health impacts throughout exposure assessment and hazard assessment. A common denominator qualitative method for uncertainty analysis has been adopted in harmony with the U.S. EPA method for uncertainty analysis within risk and exposure assessment of SO2 and PM in ambient air. This method has been extracted from the 2008 WHO IPCS guidance document and then expanded and tailored.

The Heimtsa and Intarese projects adopted a prototype to ease the use of the selected qualitative uncertainty assessment method and to streamline the harmonisation of both the evaluation and the terminology between users. This prototype is under development towards its full integration, together with the basic NUSAP terminology, within the overall Heimtsa/Intarese Toolbox.

Finally, the degree of integration of the uncertainty analysis within the environmental health impact assessment will be analysed on the basis of at least three basic criteria:
- differentiation between online versus offline analysis of uncertainties with the risk assessment;
- separation between dynamic versus static integration of uncertainties in parameters;
- distinction between internal versus external consideration of uncertainties in models.

Oral presentations

Parallel P20: Risk perception

Chair**: Ellen Townsend**

Siegrist M (ETH Zurich Switzerland); Connor M

The influence of social trust, confidence and fairness on the acceptance of GMO field experiments in Switzerland

Because Swiss citizens endorsed a moratorium on gene technology, the commercial cultivation of genetically modified crops is prohibited there until 2010. In 2008, GMO field experiments were conducted, and we examined the factors that influenced public acceptance of them (N™9). We have proposed the TCC model, which postulates that both trust (related to value similarity) and confidence (related to past performance) influence acceptance of environmental hazards. In the present study, trust and confidence items were analyzed by a PCA. The analysis 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. We also included measures for outcome fairness and procedural fairness in our model. ! The impact of fairness may be moderated by issue importance, however. That is, fairness could be significant for people for whom GMO is a morally important issue, but not for others. A second regression analysis showed that, in addition to the trust and confidence factors, moral importance, outcome fairness and procedural fairness were significant predictors. The interaction between moral importance and outcome fairness was also significant. This latter result suggests that the decision to conduct the field experiment in the vicinity of participants was perceived as particularly unfair when the issue was morally important. The proposed model explained acceptance of the GMO field experiments very well (67% of the variance explained).

Assmuth T (Finnish Environment Institute Finland)

Bias in risk and uncertainty assessment: Cultural clashes and evolution of epistemologies and eschatologies

Risks as cultural constructs (Douglas and Wildavsky, 1982) are socially amplified (Kasperson et al., 1988) and attenuated. It is also well known, e.g. from Tversky and Kahneman (1974), that people state more narrow confidence intervals than justified by their knowledge about assessed qualities and entities, due to reliance on judgmental heuristics and psychological anchoring. However, this overestimation of certainty is counter-acted e.g. by 'manufactured uncertainty' in charged risk issues, by related structural societal factors and by increased ambiguity about risks. Also the traits and implications of risk over- and underestimation have changed in a post-Beckian 'risk society' obsessed with but also oblivious to fear and security. Against this background, I examine socio-psychological aspects of bias in risk and uncertainty assessment, with particular reference to the generation and use of evidence and to the relations of facts and values in con! stituting bias and accountability. I emphasize framing of issues, psychodynamics of risk and uncertainty aversion, and risks and risk management as eschatological ideas. The work is based partly on cultural notions of risk perception such as the grid/group model, but revises these by considering approaches to uncertainty and precaution. The models are explored by empirical data e.g. on expert and stakeholder surveys and interviews on integrated assessment of multi-stressor risks in the EU's NoMiracle project. I extend the findings to climate change risk perception and communication as a partly unique case of controversy and conflict over consensus of risks. I conclude with methodological and philosophical remarks on risk and uncertainty assessment.

Kuttschreuter M (University of Twente Netherlands)

Determinants of food safety practices at home

The incidence of foodborne disease is rather high. The source often lies in the manner in which individuals prepare their meals and store the necessary ingredients. Some people carry out more of the recommended food safety practices than others. Knowledge of the determinants of the individual’s level of food safety practices may help to reduce the number of incidences of foodborne disease originating in the home.
To study food safety practices at home and their determinants, a survey has been carried out among residents in the Netherlands. Based on the Protection Motivation Theory and the Theory of Planned Behaviour, subjects were questioned regarding the execution of recommended food safety practices, self-efficacy and outcome expectations related to these behaviours, food risk perception, affective response, risk sensitivity, social norms, perceived barriers, trust and experiences with foodborne disease. All variables were measured reliably.

Preliminary results showed that subjects considered the recommended behaviours effective in preventing foodborne disease, and considered themselves capable of adequately executing them. A considerable number of respondents, however, indicated that they did not actually adhere to all of the recommended behaviours. Correlational analysis showed food safety practices to be highly

significantly correlated with self-efficacy and outcome expectations, and to a lesser but still significant degree to risk perception, affective response, perceived barriers and social norms. Structural equation modelling will be applied to test a model, describing the relationships between the variables, using AMOS. Results will be presented and consequences for risk communication will be discussed.

Townsend E (University of Nottingham UK) Spence A (Cardiff University) Knowles S

Investigating the processes that underpin the affect heuristic

Affect is of central importance in risk perception and risky decision making. The affect heuristic is one of the most important constructs to have been developed in relation to this. However, research into the precise processes underlying this concept is lacking. We examined whether this heuristic operates at an associative or a deliberative level of processing. We compared performance on the task designed to examine the affective heuristic - the Time Pressured Affect Heuristic (TPAH) with performance on Go No-Go Association tasks (GNATs) which are commonly utilised in order to measure context free associative processes. Participants (n 1) completed explicit attitude measures online and then completed explicit measures of risks and benefits and several experimental tasks, (three Go-No Go Association Tasks, two affective priming tasks and the time pressured affect heuristic tasks) in a laboratory. There was a small but significant correlation betw! een responses on the climate change GNAT task and the climate TPAH task, but GNAT task performance did not significantly predict TPAH performance. Performance on the nuclear power TPAH was not associated with, or predicted by GNAT performance. However, TPAH performance for both risk issues was strongly associated with and significantly predicted by explicit attitude measures suggesting that the affect heuristic may primarily reflect more deliberative, rather than associative, processing as has previously been suggested. However, our results also support the notion that the affect heuristic is indeed operating as a heuristic because there was a significant, though not predictive, relationship between climate change TPAH/GNAT performance

Parallel P21: Risk governance: International perspectives

Chair**: David Levi-Faur**

Orru K (King's College London UK)

Europeanisation of risk regulation: drinking water safety case in Estonia and Lithuania

This paper focuses on the change of risk governance in the EU accession states. The realignment with the European regulatory systems offers accession countries political incentives as well as financial opportunities for improving the safety of the citizens. The research addresses the determinants of successful implementation of the EU Drinking Water Directive in the transitional contexts of Estonia and Lithuania. Using the risk regulation regime perspective (Hood et al, 2001), the study assesses the extent to which the deep-rooted dominating pressures, administrative and expertise capacities, and regulatory actors in the state affect the safety provision.

With the adoption of the EU requirements, previously state-dominated and publicly backgrounded drinking water safety issue has been brought to the daily public and political agendas of new Member States. The adoption of European ways of risk governance has reinforced the decentralisation and liberalisation tendencies in environmental health regulation. This has created lucrative business opportunities for experienced European engineering companies for water system upgrading. However, due to the legacies of technocratic elite-centred safety management, problems with the limited scope of the set safety standards and poor fit of monitoring requirements have been overlooked. Among the significant cross-national variations in risk regulation, Estonian radical decentralisation reforms in the beginning of re-independence have left the municipalities with small dysfunctional water supplies. Lithuanian centralised safety provision is however weakened due to the unresponsive municipal! management.

Van Oost B (Maastricht University Netherlands)

Uncertainty as a trigger for precautionary action? The controversy on drilling for gas on the Dutch Wadden Sea

The spirit of the precautionary principle can be captured by a triple negation: no scientific certainty is no reason for not regulating. On the basis of a detailed case study (application of the precautionary principle by the Dutch Cabinet in December 1999), this paper emphasizes that uncertainty should be no reason for precautionary actions either.

After a heated risk controversy, the Dutch Cabinet decided to ban further exploitation of the gas

encapsulated under the Wadden Sea. Using discourse analysis, the notions of 'uncertainty' in the scientific, political and public discourse are studied. It is shown that the various actors strongly disagreed on the uncertainties involved. There was consensus on one thing only: science can never give full certainty. This admittance was enough for the Dutch Cabinet to impose precautionary measures, leaving scientists, the oil company and politicians frustrated.

This case study on the one hand exemplifies the prevalent 'uncertainty paradox' (Van Asselt & Vos, 2006). On the other hand, it suggests a tendency of political decision-makers to portray uncertainty as a 'trigger' for precautionary measures. It is argued that such reasoning paralyzes the precautionary principle (it would always apply), leaving an open question: how to account for precautionary measures in an age of uncertainty? A tentative answer is that the demands of 'accountability' have to change.

Empirically, this paper draws upon the three risk assessments and seven expert-opinions that were presented to the Dutch government during 1998-1999 (scientific discourse), minutes of the parliamentary meetings and party statements (political discourse) and letters, campaign-strategies, opinion-polls and informal communication found in the archive of the Dutch Wadden Association, the main NGO in the studied controversy (public discourse).

Van Asselt, M.B.A. & E. Vos (2006). The precautionary principle and the uncertainty paradox. Journal of Risk Research, 9, 4, 313-336.

Hendrickx K (University of Liège Belgium) ; Fallon C; Joris G

The Good, the Bad and the Ugly. Integrating multiple frames in Flanders and Wallonia air policies by using the Delphi method.

A new European frame has developed stepwise to manage the health effect of air pollution from particulate matter (PM 10 and PM 2,5), backed by an international body of scientific knowledge and OMS reports. The European Union CAFE Directive (2008) leaves the Member States with an important margin to translate the air quality objectives into action plans. In Belgium this policy is entirely left to the regions and each of them developed different frames and decisional spaces. Belgium is a pollution 'hot spot' because of the variety of pollution sources it is faced with (traffic density, industrial density, transboundary pollution). As such, it provides an interesting ground for comparative research.

Our analysis of the policy networks in the two largest Belgian regions identified two decisional spaces that differ on political, administrative and technical levels. Earlier research on risk management has pointed out that transversality, openness, and interdisciplinarity positively affect the quality of decision making under uncertainty (Fallon et al, SRA 2008). In that perspective, we argue that specific tools can help build these dimensions into regional air policies. In our research project, funded by the Belgian Federal Science Policy, a web-based tool using the Delphi method has been tested in the two regions. This allowed to put forward some hypotheses concerning the specific potential for transversality, interdisciplinary and openness of each of the structures and decisional spaces. The results of the experiment and its potential for generalization will be discussed at length.

Justo-Hanani R (Tel-Aviv University Israel); Levi-Faur D; Dayan T

The limits of international harmonization in nanotechnology risk regulation

The aim of this paper is to clarify and analyze the concept of international harmonization in risk regulation and to place it within a broader understanding of the various mechanism of global governance. Drawing upon the literature on risk regulation and regulatory harmonization regimes, we argue that the case of nanotechnologies offers an interesting point of view and reference on the current technical understanding of international harmonization in risk regulation. This leads us to discuss the problems and challenges of regulatory legitimacy and accountability as a challenge for institutional design. Our argument also informs a discussion about whether the concept of regulatory harmonization, as a new instrument of regulatory governance, can contribute to the development of more inclusive approach to decision-making structures in regard to nanotechnologies and risk regulation regimes at large.

Parallel P22: Graphical risk communication

Chair**: Peter Wiedemann tbc**

Spangenberg C (Research Centre Jülich GmbH Germany); Krug HF ; Fleischer T; Kastenholz H; Hocke-Bergler P; Quendt C

Summarising and communicating evidence in the assessment of data uncertainties: practical application of evidence maps in the field of inflammation by engineered nanoparticles

Each instance of risk evaluation builds upon the establishment of scientific evidence of the (potential) hazard. However, it becomes considerably difficult to render an evaluation where such evidence builds upon sparse analytical grounds, or is based on controversial data. Based on the development of a novel tool dealing with such uncertainties when evaluating the health impact of electromagnetic fields, the "Nano-Health"

project (01.04.2006-30.09.2009) aimed at dealing via the novel “evidence map” approach with the biological impact of nanoparticles. When fully implemented, this approach would enable to handle the limited or contradictory scientific data associated with certain hazards. Such noxious matter includes most nano-scale materials and their possible biological effects.

The evidence maps strives for providing a better tool for risk assessment. Moreover, this approach aims at establishing a specific communication network whereby contradictory findings and scientific views can all be exchanged amongst stakeholders in this field. The evidence map method was adopted as a potent evidence assessment tool comprising a transparent and unambiguous graphical presentation. This is based on the following elements of this evidence weighing process: the database (number of relevant scientific studies); the debated possible relationship between exposure to a specific (potential) hazard and the associated biological effect; the conclusions based on such debate; and the remaining uncertainties.

We have implemented this tool to generate evidence maps for various nanomaterials and different biological reactions (endpoints). Our presentation includes the results from the assessment of the endpoint “inflammation” by seven nano-scale materials. The outcome of this approach, and the associated evidence maps, were discussed in several working groups with scientific experts (nanotoxicologists from Germany and Switzerland), stakeholders and the general public. Together with the unalloyed positive experience we gathered in communication between scientific experts, we present some weak points of the model appeared in applying evidence maps in communication about uncertain hazards particularly with laypeople. Therefore, we also present our suggestions for improvement of the evidence map as a means of risk communication with laypeople.

Keller C (ETH Zurich Switzerland)

Using a familiar risk comparison to overcome low numeracy: A study of visual attention

Utilizing an eye tracker that captures the visual attention efficiency and level of information processing of a familiar risk comparison within a risk ladder was examined in terms of numeracy. In a random sample from the general population (N h), objective numeracy was found to be negatively correlated with overall visual attention on the risk ladder (r_s =28, p =1) and positively correlated with efficiency of processing relevant frequency (r_s =4, $p < .001$) and relevant textual information (r_s =4, $p < .001$), but not with processing relevant familiar comparative information and numerical information. A significant negative correlation between numeracy and level of information processing of relevant familiar comparative risk information was found (r_s =21, $p < .01$). It can be concluded that, as familiar comparative risk information within a risk ladder is efficiently and deeply processed by low-numerates, this helps low-numerates to i! ncrease risk comprehension. Furthermore, the eye tracker method is a promising method for studying information processing and improving risk communication formats.

Boerner F (Research Center Jülich Germany); Schuetz H; Wiedemann P (ITAS, Research Centre Juelich GmbH Germany)

Evidence maps as a risk communication tool – An empirical evaluation

Summarizing complex scientific evidence about a (potential) hazard is a fundamental task in risk assessment. Here, various formats are used, ranging from quantitative to narrative summaries. A particular problem arises when the evidence consists of a multitude of inconsistent or even contradictory results of scientific studies. Communicating such results to an audience of different stakeholders with unequal expertise is a difficult task. We propose “evidence maps” as a tool to summarize scientific evidence in an easily accessible form. Evidence maps depict the underlying “logic” which leads experts to come to their conclusions about a (potential) hazard. To this end, the three core elements of risk assessment are presented in a graphical manner: (1) the evidence basis (i.e. the number and the quality of available scientific studies), (2) the pro- and con-arguments with their respective “supporting” and “attenuating” arguments, and (3) the conclusio! ns about the existence of a hazard with the remaining uncertainties.

The problem of summarizing evidence from toxicogenomics studies on effects of radio frequency electromagnetic fields exposure for human health risk assessment to a lay audience is used as an example to evaluate the usefulness of the evidence maps as a risk communication tool. In an experimental study evidence maps were compared to both a structured text summary and a narrative summary, which is the format typically used in scientific reviews of research results. After reading an introductory text, the first subject group received a summary of research findings on effects of radio frequency electromagnetic fields exposure on gene expression in the structured text format, the second group received the narrative summary, while the third group received the summary in terms of an evidence map. Then all subjects answered a number of rating scales on the comprehensibility and inferability of the presented information. Results show differences in the evaluation of the different pres! entation formats. These will be discussed with regard to implications for using and improving evidence maps as a risk communication tool.

Parallel P23: Public perceptions of risk: an international perspective

Chair: Tom Horlick-Jones

Cooper E (University of Manitoba Canada)

"Never Say Die": Differing Perceptions of Risk in Aklavik, NWT, Canada

Aklavik, NWT, Canada is situated in the Mackenzie Delta. Established as a mission station, trading station and government post in the early twentieth century the community is comprised of Gwitch'in, Inuvaluit and non-indigenous people. In 1959 after analyzing a series of government reports about the economic and geographic stability of the region, plans to build a new community to replace Aklavik were implemented. Social services and community amenities in Akiavlik were closed as the Government attempted to move the community 113 km east to Inuvik. Despite ongoing initiatives to encourage people to move from Aklavik, fifty years later people continue to call Aklavik home and the relevancy of this issue remains relevant.

Through a series of interviews with community members, as well as analysis of government documents and archival materials, it is apparent that Aklavik's community motto "Never Say Die" is still an accurate description of the feelings of community members. It is imperative that government and community work together to assess risks before making any decisions that will significantly affect people.

The governments perception of risks verses the indigenous communities perception of risks differ greatly. As community members worry about risks associated with changes that will inevitably occur (i.e. changes to traditional land-use, changes to subsistence hunting, and the impacts of complying with government decisions made without community consultation) if they move to Inuvik, the federal governments identified risks associated with flooding, economic growth and the limited ability to expand mining operations in Aklavik seem marginal in comparison.

Litmanen T (ITAS, Research Centre Juelich GmbH Germany)

The utmost ends of the nuclear fuel cycle How Finns perceive the risks of uranium mining and nuclear waste management

The aim of the paper is to analyze how Finns perceive the risks of uranium mining and nuclear waste management. In social science quite much research has been done on the issue of how people perceive the risks of nuclear waste and nuclear waste management, but not much has been done in analyzing the similarities and differences of risk perception (and ethical considerations) of the utmost ends of nuclear fuel cycle. There have been some changes in Finnish nuclear policy during ongoing decade, which make this type of study interesting: decision on the fifth nuclear power plant was done in 2002, the site for spent nuclear fuel has been chosen in 2001 and in 2010 the Parliament will decide which of three competitors will get the permission to construct the sixth nuclear power plant. This national nuclear renaissance was accompanied with the uranium boom, which started in 2005. New international interest in nuclear power had raised the price of uranium! . International mining companies started uranium explorations because Finnish bedrock is the oldest in Europe, and it is similar with and also of the same age as is that of the great uranium producers, Canada and Australia. The analysis of risk perceptions between uranium questions and spent nuclear fuel is based on the national survey data (N 80) gathered in 2007. The earlier version of the paper is already presented in December 2009 in Gothenburg at the Managing Radioactive Waste. Problems and Challenges in a Globalizing World conference. The paper will be further elaboration of the earlier one.

Horlick-Jones T (Cardiff University); Prades A (CIEMAT/CISOT Barcelona Spain)

Some conceptual and methodological considerations about interpretation and context in cross-cultural risk studies

This paper draws upon our practical experience of conducting collaborative Spanish-UK cross-cultural risk-related research over an extended period. Specifically, it attempts to get to grips with questions concerning: analytic postures and procedures; the role of language competence; and the extent to which micro-level interaction provides evidence of, or can be said to reflect, wider cultural similarities and differences, and other contextual features. In presenting and discussing these issues we will consider ideas from a range of conceptual positions, including ethnomethodology and conversational analysis, the sociology of knowledge, ethnography, social history and cultural anthropology. We will illustrate our discussion with data drawn from two distinct projects: a ten-year old study of risk perceptions in communities geographically close to potentially hazardous industrial sites; and a recent project which has investigated lay reasoning process! es associated with nuclear fusion as an energy technology.

Parallel P24: Risk and decision making

Chair: Frederic Bouder

Fox J (University of Oxford UK); South M

Arguing about risk: the role of logic

The standard mathematical treatment of risk combines quantitative measures of uncertainty (usually probability) and threat. There are significant

practical and theoretical problems with this interpretation. Estimation of required parameters is frequently difficult, particularly when dealing with one-off threats such as political, economic or environmental hazards. Intuitive ideas about risk, based on human motivations, market forces, scientific models (etc) at least require extensions to the standard treatment.

An intuitive approach to reasoning is now available in which arguments for and against some "claim" can be constructed by applying general logical schemas (about motivations, markets, models …) to descriptions of specific circumstances. Logic programming offers a computational tool for automatically constructing collections of such arguments. Quantitative estimates of risk can be generated from argument collections, while the logical form can be used to present, explain and judge the credibility of the evidence.

This approach has been shown to model risky judgment in a number of domains, including clinical medicine and toxicology. Mature software tools are now commercially available (e.g. www.infermed.com; www.lhasa.com). Argumentation frameworks are now being used to support open discussion and debate of important issues including ones entailing risks (e.g. see debate on environmental risks at www.debategraph.org).

There is now a strong case for saying that logical argumentation techniques offer a new strategy for constructing, analyzing, explaining and debating risks. Our paper will provide an overview of current theory, explain the key distinction between "evidential" and "dialectical" argumentation, and discuss the application of these methods to risk assessment, management and communication.

Duffey RB(CIEMAT/CISOT Barcelona Spain); Saull JW

The principles, practice and prediction of risk governance: enabling strategic resource allocation

We address the common principles for the practical management of risk in today's modern technological society. These encompass not only the widely-held governance qualities of being informed, transparent, prospective and adaptive, but also must provide a practical method for managing risk. Such a method must also apply to diverse areas: risk regulation for known or routine events and hazards: to the handling of systemic stability and emergency response; plus the mitigation measures and anticipation for unknown unknowns and rare events. Thus we are addressing diverse threats that may range from almost mundane events like accidents, derailments and financial crises, to the fears and paranoia of new nano-materials, unknown terrorist attacks and possible pandemics.

Problems with "relative" and "tolerable" risk require turning qualitative perceptions into the quantitative measures required for the governance decisions in effective risk management and prioritized response.

Our new approach utilises a method for robust risk prediction that is completely general, namely the learning curve. The underlying factors include human error, the learning process, and statistical predictions that importantly include the influence of complexity and uncertainty on governance and decision making. The methodological foundation includes successful correlation of known data from multiple risks and hazards, yielding a framework that provides quantitative risk prediction.

The applicability and power of the method is illustrated by actual and diverse risk examples as space system failures, financial market collapse, emergency response timing, and high reliability equipment failure. The benefits include optimizing strategic resource allocation, providing effective risk management, and supporting transparent communication.

Prpich G (Cranfield University); Rocks S (Cranfield University); Pollard S

Strategic Environmental Risk Assessment for Informing Decision Making Processes

Strategic level assessment of risk is an invaluable tool for informing high level decision-making processes. In particular, strategic risk assessment (SRA) can provide a systematic approach for comparison of otherwise incommensurate risks, thus providing a defensible and transparent framework which may be used to prioritize risks and in turn inform strategic decisions1. Developing a framework capable of capturing the disparate nature of different risks is challenging and nowhere is this more typified than in the comparison of environmental risks, which are intrinsically complex, comprised of environmental, social and economic characteristics2.

This work outlines the development and implementation of an SRA framework that cross-compares different environmental risks. Comparison metrics and ranking methodology for the SRA were developed and were populated with information gathered during interviews, a Delphi workshop and from technical literature. The cross-comparison exercise enabled the determination of a prioritisation list, which may be used in rational decision making processes regarding, among other things, changes to corporate priorities or resource allocation. The presentation will highlight the progress made in the development of the SRA tool as well as touch upon key barriers to successful implementation within an organisation.

The authors would like to acknowledge Cranfield University, DEFRA, EPSRC, ESRC and NERC for their support.
References:

1Pollard et al., Science of the Total Environment 400:20-31; 2008
2Pollard et al., Risk Analysis 24:1551-1560; 2004

Bostrom M (Sodertorn University Sweden); Borjeson N (Swedish National Defence College); Jonsson AM; Gilek M; Karlsson M

Responsible procurement and complex product chains

Responsibility is one of the grand catchwords of contemporary global politics and organizational life. Social movements and journalists report and protest about the misdeeds of powerful organizations and call for 'greater responsibility'. Companies face credibility risks and need to show that they have considered environmental risks and the health and well-beings of the workers and local communities. Responsible procurement is one key tool in this regard. However, there are great difficulties (in terms of resources, knowledge gap, communication, and policy instruments) involved in such risk management, which relate to high complexity in product chains. This paper draws attention to the implication of complex product chains for the development responsible procurement. How can buyers gain useful knowledge about social, environmental, and economic risks along all steps in these chains as well as design relevant governance arrangements and instruments? We focus on the practical and communicative challenges that private and public organizations face regarding the management of such risks. Empirically, we focus on chemical risks in textiles, and the analysis is based on qualitative interviews with staff responsible for environment, procurement, and CSR in Swedish public and private organizations. We synthesize our findings by analysing key dilemmas, strategies, and driving forces behind the development of responsible procurement in this focussed area.

Session 6, Wednesday 11am

Symposia

Symposium S16. Public engagement with climate change mitigation strategies

Human induced climate change is now acknowledged as being a risk of intergenerational and global significance, with climate change mitigation increasingly representing a key policy agenda in developed and developing nations alike. Whilst there is a broad consensus within the scientific community of the threat anthropogenic climate change represents to society, popular opinion seems less certain, often with fragmentary and contradictory claims being made as to the importance and/or salience of climate change. The public is often branded as being disengaged, disenfranchised and antipathetic in relation to environmental issues, yet, researchers and policy-makers alike recognise the importance of the publics' willingness to embrace change, if the most severe scenarios of climate change are to be avoided. Indeed, the public are argued to be key stakeholders capable of (at least in part) constraining or inducing strategies of climate change mitigation, including, however not limited, to their own (necessary) behaviour changes.

Climate change mitigation strategies increasingly straddle the spheres of behaviour change, and, technological and scientific innovation, and are realised at multiple spatial scales, with geoengineering being the latest in development. In adjacent research arenas, the importance of lay knowledges as well as upstream engagement with the public in relation to novel technologies and issues of socio-technical risk has been emphasised, notwithstanding the significant difficulties of early public engagement. The purpose of this symposium is to discuss and disseminate research findings relating to how the public engages with climate change and climate change mitigation strategies; from behaviour change to the technologically driven (and often emergent) scientific developments encapsulated under the umbrella term of "geoengineering".

The symposium will begin with an examination of how the public(s) engage with climate change. Stemming from research carried out in 2003 and 2008, Lorraine Whitmarsh explores the dimensions and prevalence of public uncertainty and scepticism of climate change. In addition Lorraine will highlight the links between dimensionality of public uncertainty and perceived lack of responsibility for climate change back to behaviour, before discussing what such research reveals in terms of how to cultivate more meaningful and productive public engagement in relation to climate change.

Alexa Spence will then outline the results from a national (UK) survey conducted in 2010 relating to public perceptions of climate change and key mitigation strategies, which will include a comparison to earlier trends. The linkages between public perceptions of climate change, including concern, perceived responsibility and control (amongst others) will also be explored, before relating such perceptions to the support expressed for different methods of climate change mitigation. These strategies will include voluntary behaviour change, support expressed for policy interventions, and, technological approaches such as geoengineering and low carbon sources of energy production.

In the third presentation, Adam Corner will explore the social, legal and ethical implications of proposals to geoengineer the earth's climate. Adam will outline the challenges of eliciting public opinion towards the complex social and ethical questions raised by geoengineering, and draw parallels with similar challenges faced in upstream engagement on nanotechnology. Ultimately, Adam will argue that a process of legitimate upstream engagement with the public must be pursued *before* technical geoengineering research programmes are commissioned.

In the final part of this symposium, Karen Parkhill presents findings from pilot research which explored public perceptions of geoengineering as part of a comprehensive investigation into how the public engage with and construct technologies of climate change mitigation including low (e.g. nuclear power and renewable energies) and high carbon (i.e. coal fire power stations with CCS) forms of energy production in two case sites (Aberthaw, South Wales; Hinkley Point, South-west England) which are host to existing and proposed energy developments. This paper argues that despite geoengineering being an emergent approach, the public are often able to reflect upon and critically evaluate the ethics and complexities of such novel means of mitigating climate change.

Professor Nick Pidgeon – a leading academic in environmental and socio-technical risk perception research – will be the discussant and chair of the session.

Chair: **Nick Pidgeon**

Whitmarsh L (Cardiff University UK)

Public uncertainty and scepticism about climate change

While there has emerged a scientific consensus about the reality of human-caused climate change, the media often emphasises disagreement and debate surrounding the issue due, for example, to journalistic norms (to present a balanced view). As a risk issue, climate change also poses many challenges to communicators due to its complexity, intangibility, and the implicit threat it poses to modern, energy-intensive lifestyles. These unique characteristics may - at least in part - explain why we see low levels of public engagement with, and perceived responsibility for, climate change. A particular barrier to public engagement appears to be uncertainty and scepticism. This talk will present the latest findings from mixed-method research on public perceptions of climate change in the UK, and will describe how and why scepticism is more prevent amongst different groups (e.g., age groups, political and environmental values), and why – despite the growing scientific consensus about anthropogenic climate change – scepticism actually appears to be increasing amongst UK and US publics. Findings from semi-structured interviews (N=24) and from two major UK surveys conducted in 2003 (N=589) and 2008 (N=551) expose the prevalence and dimensions of uncertainty and scepticism about climate change, identify what influences these attitudes, and highlight the links between uncertainty/scepticism and behaviour. The presentation will also discuss what research in this field can tell us about how to foster public engagement with this complex and uncertain risk issue.

Spence A (Cardiff University UK)

Perceptions and support for climate change mitigation strategies

Climate change is an increasingly salient and pressing issue worldwide. Governments are recognising this with the UK aiming to reduce greenhouse gas emissions by 80% by 2050 and the US recently outlining plans for an 83% reduction by 2050. Radical changes in both individual behaviour and society as a whole are required in order to meet these targets. We will present data from a national survey conducted in the UK in early 2010 which examines public perceptions of climate change and key related methods of mitigation. In particular we will outline current levels of perceived concern about climate change in the UK, how these changed since previous evaluations and how these relate to other key perceptions, e.g. responsibility and control. Perceptions relating to climate change will also be related to support expressed for different methods of climate change mitigation. We will compare levels of support for different mitigation strategies, in particular considering support for behaviour change (including both voluntary changes and policy development) and support for technological approaches (including geoengineering and the use of low carbon energy sources). A fuller understanding of public perceptions of climate change and related mitigation strategies will help to facilitate the identification and development of appropriate policy and public engagement in this field. Interpretation will consider historical data as well as key global and national events and recent policy developments.

Corner A (University of Cardiff UK); Pidgeon N (Cardiff University)

Geoengineering: The social and ethical implications

Geoengineering refers to the large scale intentional manipulation of the earth's climate to counteract anthropogenic climate change or its warming effects. Some geoengineering proposals may yet turn out to be little more than imaginative science fiction—for now, geoengineering is at a pre-research and development phase, with no major research initiatives yet undertaken. But geoengineering is beginning to be taken seriously by scientists around the world because the window for effectively mitigating against a 'dangerous' rise in global temperatures is extremely narrow. The considerable uncertainty surrounding geoengineering is not confined to questions of risk and technical feasibility, however – the prospect of coordinated and large-scale attempts to engineer the climate raises a host of challenging legal, ethical, and social questions. In this paper we outline some of the social and ethical questions that geoengineering proposals may raise. We then identify some methods by which public responses to these questions might be elicited. Finally, we argue that beginning a process of legitimate and participative public engagement *prior* to the commencement of a technical research programme is essential for policymakers who are considering proposals for geoengineering the climate.

Parkhill K (Cardiff University UK); Butler C; Pidgeon N (Cardiff University)

Weird Science? An Exploration of Public Perceptions of (Geo)Engineering the Climate

Anthropogenic climate change is widely perceived as being one of the most significant threats to society. As there is increasing doubt over the ability of nations to make the necessary cuts in greenhouse gas emissions to avoid significant temperature increases, other means of mitigating climate change are becoming increasingly prominent in policy and scientific debates. Indeed scientists are now beginning to hypothesise and develop more radical strategies for addressing climate change under the broad heading of geoengineering. Whilst at an early stage of

development, lessons from previous innovative technologies (including genetically modified organisms, nanotechnologies and hydrogen technologies) emphasise the importance of engaging with the public sooner rather than later. Other research suggests that due to the ethical and social questions evolving from geoengineering, it is imperative that policy makers engage with the public on this issue as early as possible. Yet to date, despite the commissioning of research into the technical feasibility and risks of (various) techniques of geoengineering, very little research has examined public perceptions. This paper aims to begin filling this research gap. It explores the ways in which the public in two case sites, perceive, discuss and reflect upon the possible development and implementation of geoengineering, including the uncertainties, benefits and risks. This paper argues that despite the embryonic status of geoengineering techniques, the public are often able to reflect upon and critically evaluate the ethics and complexities of such novel means of mitigating climate change.

Oral presentations

Parallel P25: Risk perception in an international context

Chair**: Frederic Bouder**

Pietrantoni L (University of Bologna Italy); Prati G (University of Bologna Italy); Picheca A (University of Bologna Italy); Zani B

Perception of environmental and health hazards and the influence of general trust and ecological worldview in a sample of Italian adults

By comparison with other psychological paradigms such as the expected utility, the psychometric paradigm assumes risk is subjectively defined by individuals who may be influenced by a wide array of psychological, social, institutional and cultural factors. Psychometric research identified a few and broad domain of characteristics such as dread risk which elicits visceral feelings of terror, and unknown risk which is new and unknown to science. This paradigm produced a "cognitive map" of hazards which are located along the dimensions. However the psychometric paradigm has been criticized because it does not consider individual differences in the cognitive representation of hazards. Individual differencesin the cognitive representation of hazards are correlated with external variables such as trust and ecological values. The present paper aims to study adults' risk perceptions of a series of environmental and health hazards which were examined in accordance with the psychometric paradigm and which examine the role of general trust and ecological values in risk perception. We conducted a survey including 20 health hazards (e.g., climate change, flood, nuclear plants), 4 risk attributes, and 2 risk constructs. Moreover, we administered the New Ecological Paradigm Scale and individual's level of trust in media, science, government agencies, environmentalist groups and multinational. The study surveyed a sample of 300 Italian students. According to the psychometric paradigm, there were few primary dimensions of risk perceptions concerning environmental and health hazards. Moreover, these primary dimensions of risk and the risk constructs were influenced by ecological values and general trust.

Chauvin B

Risk perception and personality facets

This work is in line with the field of risk perception studies conducted on lay people (e.g. Slovic, Fischhoff & Lichtenstein, 1985). It addresses the following question: "Why do some individuals perceive some hazards as riskier than other individuals"? The research strategy chosen to answer this question was to focus on personality. More precisely, the present study examined the relationship between risk perception and personality facets. To collect data about risk perception, the psychometric paradigm was applied (Slovic, Fischhoff & Lichtenstein, 1980). To collect data about personality, the Big Five model was used (Goldberg, 1990). A sample of 795 participants was asked to fill out (a) a risk perception questionnaire composed of 24 hazards covering various domains like Energy production, Pollutants, or Medical care and (b) five different personality questionnaires each corresponding to one of the five factors of personality: Extraversion, Agree! ableness, Conscientiousness, Emotional stability/Neuroticism, and Openness/Intellect. Results identified key personality facets that proved to be most predictive of risk perception compared to (or in association with) age, gender, educational level, and personality factors. They were Moderation and Tranquility (associated with Energy production or Pollutants), Rationality and Efficiency (associated with Pollutants, Sex, deviance and addictions, or Weapons), Creativity, Imagination, and Reflection (associated with Energy production, Pollutants, or Common individual hazards), Self-disclosure (associated with Outdoor activities), and Nurturance and Tenderness (associated with Sex, deviance and addictions, or Medical Care). These facets may be recommended for use in future studies on risk perception.

Van Poll R (RIVM Bilthoven Netherlands);Devilee J (RIVM Netherlands)

Environmental-Health risk characterisation by British residents

The natural sciences traditionally characterise risk by probability of their occurrence and severity of possible effects. They rarely take into account

peoples' perceptions. The main aim of this research is to quantify residents' risk perception of several environmental and health risks. Moreover, other factors that may influence the risk perception of the residents are studied: the way of coping with environmental and health risks, the behaviour of the respondents and their attitude towards risk policy and policymakers.

As part of a European study 1.000 British residents were asked to participate. Residents' risk perceptions on nine different risks were assessed: air pollution, sea level rise, corrosive cleaning agents, tanning, dampness, polluted tap water, nuclear waste, alcohol consumption, and pesticides in food. By means of an internet questionnaire residents provided information about these risks: extent of concern, policy priority, specific risk aspects (e.g.: involuntariness, equity, dread, trust), relevant risk-related behaviour (e.g.: car use, washing vegetables before use, only drinking bottled water) and coping options.

British respondents are most concerned about air pollution (42%), pesticides in food (36%), and tap water quality (30%). They are, relatively, little concerned about alcohol consumption (13%) and tanning (11%). In general it appears that 'number of people affected by the risk' and 'extent of effects' are relevant risk characteristics to residents, too. However, for different risks (e.g. air pollution or dampness) different risk profiles, in terms of risk characteristics (e.g. equity, trust, dread), are applicable.

Kurzenhaeuser S (Federal Institute for Risk Assesment (BfR) Berlin Germany); EppA; Bol GF

Food risk perception before and after reading scientific risk assessments

Background: Making scientific risk assessments available to the public is an important part of federal risk communication in consumer health protection. However, few studies have evaluated how such risk assessments affect consumers' risk perceptions.

Method: The present questionnaire study analysed risk perception, worry and subjective knowledge of German consumers (n 0) with regard to four selected food risks before and after reading original risk assessments. The familiarity of the food risks was pretested and varied within participants. Each participant read two of four risk assessments (length: 3-8 pages, familiar topics: pesticide residues in wine, trans-fatty acids in food; less familiar topics: nicotine in eggs, soy-food and allergies).

Results: Prior to reading the risk assessments, risk perception profiles were relatively similar for the four risk topics, with low levels of worry and subjective knowledge (lower for less familiar topics). These risk perceptions reflected general attitudes towards food risks and nutrition, but not socio-demographic differences. Reading the risk assessments had two major effects: Subjective knowledge increased for all topics (more for unfamiliar topics), and judgements of the severity of the risk differentiated strongly into the direction implied by the respective assessment. Worry, as well as individual and comparative probability ratings, were moderately affected, mainly for the less familiar risk topics.

Conclusions: Consumers' food risk perceptions are indeed sensitive to information provided by written risk assessments, in this case particularly perceptions about risk severity. These risk communication effects are influenced by the familiarity of the risk topic.

Parallel P26: Risk and communities

Chair: Tim Harries

Nicol AM (University of British Columbia); Murphy D; Corbett K

Communicating risk in a multimedia, multicultural context: pesticide safety and farm families

The aim of this project was to develop a risk communication intervention to inform farm family members about pesticide safety. The intervention needed to be culturally appropriate and accessible for the target audience, many of whom are recent immigrants to Canada. A series of in-home interviews and community based focus groups was conducted with members of the target population to explore cultural and linguistic preferences and to understand current perceptions and practices around pesticide risks. From this work, it was determined that a series of video interventions would be most appropriate for communicating pesticide safety information, in part due to literacy issues. The interventions would begin by focusing on the topic of indoor contamination from workclothes (paraoccupational pesticide exposure), as very few of the respondents were aware of this particular route of exposure. Content for the videos was developed in conjunction with government agencies and then the video content was filmed with local talent from the target community using a "bollywood style" approach, reflecting the preferences of the predominantly south asian farming community. Three final video versions were edited, varying in length from 30 seconds to 5 minutes and are being aired on local television, at community events and through websites. This research illustrated many of the difficulties associated with communicating health and safety risk information across cultures, particularly when literacy and language issues occur. Using a series of video formats as vehicles for health and safety promotion may be one approach for managing these issues. Community involvement in the

creation of these types of communication products is a key ingredient to making interesting and relevant programming.

Moura Arroz A (University of Azores Portugal); Sao Marcos R (University of Azores Portugal); Gabriel R; Borges PV

"United we stand, divided we fall" – empowerment and commitment in the local action. A risk communication program on the governance of an urban termite plague in the Azores

The termite Cryptotermes brevis, is a well-established and serious plague of structural wood currently affecting the Azores, Portugal. As a consequence there has been an increase in the study of the termite ecology and strategies of risk mitigation, as well as on the dissemination of research results. However, this investment has not had any impact in the control of the plague by the local authorities or the population. To reverse this situation, two social science research projects – Citizen Participation in the Control of Termite Infestation in the Azores (TERMIPAR) 2007-2009, and ◦frica Annes 2008-2011– studied the representations of citizens, researchers, politicians and businessmen about the problem and how to manage it, and their socio-cultural determinants. This presentation shows the design and foundations of a strategic communication program – informed by risk assessment, risk perception, and public trust representations – that aim to infl! uence the public and private management of the termites plague at the collective and individual action levels. Research to guide the program design, test the model, and evaluate impacts encompasses this program. Its financial support has been negotiated with the regional government and the municipal authorities from the more affected cities.

The following key issues in communicational planning will be addressed: How to promote the parts' adherence to the communicational purposes in order to have them participating in intervention planning? How to negotiate in order to insure that all parts get actually involved in the decision-making process? What regulation mechanisms should be put forward to monitor the implemented processes and their impact on the groups and systems, as well as on risk mitigation?

Especially, the usefulness of creating a logic model for program design, monitor and evaluation and its process of development will be discussed and illustrated.

Di Mauro C (RGS S.r.l. - Risk Governance Solutions Italy); Bouchon S; Chinaglia V; Zaccone A

Industrial risk perception and risk communication: the case of the Lombardy region (Italy)

Lombardy is one of the most densely populated and industrialized regions in Europe. It is interested by nearly 280 Seveso sites. The Seveso Directive requires specific measures on risk communication to the population. Nevertheless, the Lombardy Region Authorities consider that the implementation of such provisions is too weak. Therefore an exploratory research has been launched, in order to estimate the gaps in risk communication and to improve the participation of the population in the emergency preparedness activities. The project is supported by a multidisciplinary research group which investigates the following aspects.

- The regional situation regarding the risk communication at local level. A questionnaire was sent to each municipality where a Seveso sites located;
- The analysis of the gaps and ways of improvement related to an effective strategy of communication between industry, population and emergency services. A forum involving all the institutional stakeholders was set to discuss this issue. ;
- The analysis of the gaps and ways of improvement related to the public's perception of risks. Three case studies have been investigated, simulating; potential industrial accident at local level. Public meetings were organized to evaluate the public's perception of risk and the related knowledge of emergency behaviour.

The project aims to stimulate an institutional learning process involving governmental bodies (local, regional, and national), industrial organizations and the population. The oral presentation will report the main results of the research and will illustrate the future strategy of Region Lombardy to improve the risk communication and the population preparedness.

Zwarterook I; Le Blanc A (Universite du Littoral France); Hellequin AP; Calvo-Mendieta I

An Assessment of Risk Information and Participatory Processes in the Industrial Area of Dunkirk, France

As an always larger audience requires public information on activities considered as dangerous, and local populations demand that industrial and political stakeholders account for their decisions, risk information and participatory processes are settled, with much discussed forms and results. To analyze this trend, we carried out a large survey in

Dunkirk, a 200,000 inhabitants urban area which hosts 13 Seveso classified industrial settlements and a large nuclear plant. The results show three distinct levels of information processes. The first level, that of official information to a large audience, is widely considered as insufficient: thanks to an accurate assessment of the population's reactions and expectations about industrial risks information, the survey shows that a large majority of people do not remember having received information and want to be better and more frequently informed. On a second level, it seems that participatory structure! s have acquired legitimacy and efficiency, as many years of existence have led to a certain confidence, increased by deepened personal relationships. However, participatory structures remain much criticized, not so much for the quantity of information as for its quality. The third level is that of unofficial information: informal conversations occur between various categories of actors, mostly outside the framework of participatory reunions. Our survey shows how this type of information circulates, thanks to personal acquaintances and networks. Hence, despite strong criticism addressed to these information systems – partiality, technicality... – it seems that companies and authorities respond to a growing demand from a population that is increasingly aware of industrial risks.

Parallel P27: Public perception of food risks

Chair**: Ragnar Lofstedt**

Turcanu.C (Belgian Nuclear Research Center SCK-CEN) Perko T; Carlé B

Attitude towards radiocontamination in food products: what should we bear in mind before taking decisions?

This study investigates public attitude towards radiocontamination in food. The data originate from a large-scale public opinion survey carried out in Belgium in 2009 by computer assisted personal interviews. Two population samples are studied. The first one is representative for the Belgian population, which has none or very little experience with this issue; the other sample was taken from an area directly affected by a radiological incident in 2008, where protective actions for food have been implemented.

Management of contaminated food production systems is one of the key issues after a radiological event with subsequent contamination of the environment. The main challenges are to mitigate the health effects to the population and to bring social reassurance, while limiting the economic loss and restoring normal life.

Consumer's risk perception and attitude towards food products containing residual radioactivity are studied both in terms of intention to consume such products after a hypothetical nuclear accident, and as acceptance of protective actions taken after a real radiological incident. The products under discussion are assumed to satisfy the legal norms on maximal allowable levels of radioactive substances in food and therefore they can be freely marketed.
Alongside with the above, we take a close look to acceptance of food legal norms in general and to a number of risk characteristics such as tempering with nature, dread and unknown in the context of food radiocontamination.
The results are interpreted in the context of practical implications for emergency management and for the decision making process.

Sabry,S (University of Hawaii USA)

Attitudes of Hawaii Producers Toward Genetically Modified Products

The topic of Genetically Modified Organisms is a very sensitive issue in today's agriculture market. The objective of this research is to examine the attitudes of Hawaii farmers towards GMO taro and coffee. Farmers are the growers, harvesters and distributers of the agriculture products. Having a better understanding on the way they feel of GMOs may help to clear misconceptions of GM products. In general, many of the farmers lack the knowledge when it came to GM products benefits, limitations and exportation. This lack of knowledge may restrict farmers from growing and selling GM products. Knowing what the attitudes of the farmers are will allow policy makers to proceed for in finding a solution between GM products and the agriculture market.

Dijkstra A (University of Twente Netherlands); Gudde L ; Pin R; Gutteling J

Public acceptance of implementation of nutrigenomics application according to the experts

Public acceptance is important in making a technological innovation develop successfully. However, who relevant stakeholder groups are in the innovation process and what experts think about related social processes is unclear. In this paper, we analysed relevant stakeholder groups and studied their visions on public acceptance of implementation of nutrigenomics applications. From literature, we discerned three essential elements that contribute to acceptation of innovations: risk perception, communication, and public participation.

First, a stakeholder's analysis with 19 semi-structured interviews identified five groups of stakeholders as being most involved in nutrigenomics. Three of these groups – scientists, food industries, and government – already have a say in nutrigenomics developments, two other groups of stakeholders – patient/consumer

organizations, the public – should be more involved in the future implementation process.

Thereupon, three focus group discussions revealed expert's visions on issues regarding public perception, communication and public participation in the context of nutrigenomics applications. First of all, results indicate that feeling involved seems to be an important condition for public acceptance of nutrigenomics. To make people feel involved, it can be useful to involve representative opinion leaders or other relevant parties first. Second, communication seems to play a central role, since it creates awareness and a sense of commitment. Additionally, information should be complete, founded, transparent and easy to understand. Third, experts prefer consultation activities as a first step to public participation. According to the experts, public knowledge, interest and motivation are not sufficient (yet) to let people make decisions with regard to nutrigenomics applications.

Lores Garcia M (Universitat Rovira i Virgili Spain); Coma JF; Lozano Monterrubio N (Universitat Rovira i Virgili Spain)

The Catalan Food Safety Governance in the Spanish and European Context

Risk communication has experienced a great change in the food safety field since the turn of the 21st century. This study will focus on how the communication has changed its strategical position. The dependence of risk communication which is integrated into the risk assessment opens new ways of evaluation, such as some of the potential deficits of governance. The recent creation of EFSA has encouraged the state members to organise their own structures into a harmonised format. The paper will focus on Spanish and Catalan case.

The first aim is to analyse in what extent the European food law is accurately applied by Spanish agencies. In Spain there are distributed competences between the state and the different regions (known as Autonomous Communities) of the country. Due to Catalonia is one of the most advanced regions in Spain in terms of food research, it is particularly interesting to study this area. Therefore, the second objective is to conduct an intensive research in the Catalan case by analysing the differences in comparison with the remaining regions and the Spanish state.

In order to identify the level of recognition, the reputation and the influence of ACSA (Catalan Agency of Food Safety) the following instutional actors are in-depth interviewed: agencies' executive managers, distributors' organisations, farmers' organisations, governamental actors, technological and innovative research centers, trade unions and consumer organisations. The results will conclude how Catalan agency is self-perceived and perceived by the others.

Parallel P28: Deconstructing risk and risk expertise

Chair**: Ana Prades**

Giorgi L (ICCR Vienna Austria)

Putting Risk Governance to the Test or Why the Separation of Risk Assessment from Risk Management did not Improve Accountability

The separation of risk assessment from risk management in the field of EU food safety regulation – institutionally and procedurally – was meant to improve evidence-based policy-making thus increasing accountability in the food sector. This separation is not new to the food safety field but underlies regulatory and adjudication approaches in several fields governed by uncertainty. From the STS theoretical perspective as well as that of policy evaluation, this approach is based on the linear model of decision-making, even if it purports to allow for more interaction and communication, especially with stakeholders and civil society. The separation between science and policy is nevertheless maintained, partly as a safeguard to the autonomy of science (and its protection from 'dirty' political interests). In practice, however, the way scientific advice has been used in risk regulation entails the danger of undermining the authority of scientific knowled! ge and its rationalizing potential within the public sphere. It also can lead attention away from perfectly tangible and solvable problems within the realm of risk management. The paper will illustrate the above points with two case studies from the food safety sector, namely, dioxin contamination and aflatoxin contamination.

November V (Ecole Polytechnique Federale of Lausanne (EPFL) Switzerland)

Recalcitrance of risks: a management failure?

This paper aims at showing that recalcitrance is characteristic of risks and is often seen as a failure of risk management. It questions wether the recalcitrance of risks is due to the nature of risks or to the visions of risks enshrined in the dominating risk management approaches, which procedes by removal and containment. It first argues that an Actor-Network Theory (ANT) approach can contribute to formulate a new vision of risks, identifying it as an actor in a complexe assemblage of human and non-human actants (Latour 2005; Callon 2001) and focus on its performative action (Healy 2004; November 2004). As risks always have a location in space or, at least, a spatial dimension, the paper then argues that an ANT approach of risks modifies the perception of the role of space in the assemblages configured by risks, which is particularly relevant for urban spaces. Thus ANT approaches make it possible to develop risk management strategies that incorp! orate the

recalcitrance of risks. Three empirical studies (qualitative data) in the field of electrical failure (technological risk), fire (urban risk) and flood (natural risk) will help to foster the argument.

Todt O (University of the Balearic Islands Spain); Lujan JL (University of Balearic Islands Spain)

Risk assessment and methodological learning

This paper analyzes the relation between epistemic and non-epistemic values in regulatory science, and the implications of the recognition of such values for methodological learning. The objective is to understand the possibilities and limitations of the recent changes in the regulatory environment.

The adoption of non-standard scientific methodologies (like the Weight-Of-Evidence Approach or Short-Term Tests) in regulatory practice, as part of a growing "precautionary science", implies a change in the criteria for scientific rationality. The move from methodologies based on "academic values" like accuracy to new ones guided by the aim of efficient decision making provides an example of axiological change, as pictured by Laudan's reticulated model of justification. Our analysis suggests an alternative view: there is a direct link between, on the one hand, non-epistemic as well as purely epistemic aims and, on the other hand, methodological change. A corollary of this new value structure is that instead of maximizing one single epistemic value, risk assessment now aims at building equilibriums among a diversity of values.

We argue that these changes in risk assessment are constitutive of a significant methodological learning process. However, non-standard scientific methodologies are unlikely to provide a closure to the ongoing debates about the role of uncertainty in regulation, as shown by the phenomenon of "manufactured uncertainty". Furthermore, not taking into account explicitly the context and ultimate aims of regulatory science limits the possibility of methodological learning, increasing the chances of regulation being contested by different social actors.

Horlick-Jones T (Cardiff University UK); Prades A (CIEMAT/CISOT Barcelona Spain)

Beyond the critique of the deficit model; risk, lay expertise and practical reasoning

In recent years the relative status of lay and expert knowledge about health, risk, and related issues has become a matter of scholarly controversy. An extended debate has been taking place about the nature of what kind of expertise is conferred by what has been described as 'the privilege of experience'. Advocates at one end of a spectrum of views identify such 'lay epidemiology' as a substantive form of expertise, offering a challenge to conventional science-based professional expertise. Those at the other end of the spectrum are highly critical of this position, and see the term 'lay expertise' as no more than an oxymoron. This debate has recently been significantly enriched by the robust intervention by Harry Collins and Rob Evans. Drawing upon detailed empirical investigations of lay practical reasoning about technologies (genetically modified crops and food, and nuclear fusion as an energy source) and their associated risks, this paper will s! crutinise critically the 'folk wisdom', 'risk literacy' and 'interactional expertise' models of public understanding of risk.

Parallel P29: Managing disease risks

Chair**: Ann Enander**

Hanninen & Knol et al (RIVM Netherlands)

Environmental burden of disease in European countries: Quantification, comparison and ranking of environmental stressors within and between participating countries – the EBoDE project

Development of policies for the protection of public health needs quantitative estimates of the significance of various hazards. The Multinational European EBoDE project was started in 2009 to assess the impacts of a set of environmental stressors on a variety of health endpoints in a comparable way across six countries. The selection of environmental stressors was based on their public health relevance, potential of high individual risks, public concern and/or large economical impacts. The final set of stressors selected included (in alphabetical order): benzene, dioxins (including furans and dioxin like PCBs), environmental tobacco smoke (ETS), formaldehyde, lead, noise, ozone, particulate matter and radon.

In the EBoDE-project, these risks were ranked using disability adjusted life years (DALYs), which were estimated using country-specific exposure data and WHO burden of disease data. Results suggest that roughly 3-6 % of the total burden of disease, measured as standard discounted dalys, in the participating countries may be associated with the selected environmental stressors. Particulate matter is the leading factor associated with 6-9 mDALY (milliDALY; i.e. DALY per thousand people) followed by noise, radon and environmental tobacco smoke.

Several controversies and uncertainties were identified in the assessment, for example: lead has been the success story in environmental policies, but the follow up in exposure data in general populations is poor; formaldehyde is associated with a large discrepancy in widely used models due to the impossibility to establish a a safe threshold for cancer effects. The latter may also be the case for dioxins.

Rush-Sirkski A (University of Manitoba Canada); Driedger SM (University of Manitoba Canada); Cooper E

The role and importance of risk communication in pandemic planning

There is a global appreciation that the risk of a devastating pandemic influenza exists. This is fostered by the interconnectedness of the world and the relative speed and breadth at which illnesses can spread. When dealing with real-time events where the pattern and spread is highly uncertain, mathematical and Geographic Information Systems models can help health officials make decisions to protect public health. However, these models are only as good as their utility to decision-makers.

Developing strong communication channels and relationship building between modelers and decision-makers is important: modelers need to understand what results would be useful and what planning assumptions public health officials need to work within, and public health officials need to recognize the potential and limitations of modelling. Public health measures incorporated to minimize spread of a pandemic, given all the uncertainties, will almost certainly be controversial regardless of the decision made.

This presentation will focus on reflections from different public health representatives and mathematical modelers about the importance of establishing dialogue for communicating risk amongst different audiences. Emphasis will be placed on the utility of graphical representation and the potential contribution of maps. Data stem from key informant interviews conducted over the lifespan following the first wave, prior to and including the second wave of pandemic H1N1.

Marcu A (University of Surrey UK); Barnett J; Uzzell D

Information sufficiency and the timing of precautions: the case of Lyme disease

Using the model of risk information seeking and processing (Griffin, Dunwoody, & Neuwirth, 1999), the present survey investigated the information needs and the motivations for precautionary behaviour from the perspective of those who have been affected by Lyme disease, an infectious disease caused by ticks infected with the bacterium Borrelia burgdorferi. Of the 130 Lyme disease patients (M age S.15) recruited via the Lyme disease unit at the HPA, 74.80% had heard of Lyme disease before contracting the disease, and of these, 59% were aware of precautions against tick bites. The patients' information sufficiency was predicted by their knowledge of Lyme disease, but this relationship was mediated by the belief that the risks of tick bites are well-known and controllable (Aroian's z =99, $p < .05$). Intentions for precautionary behaviour loaded on two factors, representing precautions before and after the visit to the countryside (e.g. covering sk! in vs. checking skin for ticks). Intentions for pre-precautions were related to worry and to the perceived severity of tick bites, as well as to information sufficiency: the less the patients felt they knew about their health condition, the more motivated they were to take precautions. The patients' preference for post visit precautions (Ms =10 vs. 3.34, t (1, 104) =82, $p < .001$) suggests that previous experience of risk can diminish perceptions of risk or, equally, that restorative environments such as the countryside can inhibit precautionary behaviour. The implications for risk communication will be discussed.

Parallel P30: Risk and different sectors of society

Chair: **Jonathan Weiner**

Dahlgren J (University of Gothenburg Sweden)

Making sense of gender in risk policy and crisis management

During the 80's and 90's gender mainstreaming in civil politics and public policy became popular within different areas of Swedish government. Questions of female representation – or misrepresentation – were widely discussed during this period of time, affecting local governments to act on the belief that women needed to be included in all of the political areas. On the one hand women seemed to be of value because of the qualitative difference they would make, on the other hand the idea of gender neutrality were held high. In this lies – of course – an ontological conflict, where one of the main issues concerns women's statuses as citizens.

In crisis management and risk policy making in general, women are often seen as victims in relation to disasters and crisis, and a lot of studies have been done in this area. What has been neglected is the question of how gender operates within a crisis management system, and how gender and crisis are related to each other on a discursive level.

In this paper I am undertaking a case study of a crisis rehearsal based on local risk policy in a Swedish municipal, in order to analyse how gender makes sense when addressing issues that concern risk policy in the making. The case study is part of a project funded by The Swedish Rescue Agency which addresses gender and crisis management.

Filipsson M (Linnaeus University Sweden); Samuelsson L; Oberg T

Variability between individuals when reviewing environmental risk assessments at a public authority

The process leading to remediation of contaminated land is not exclusively a scientific process, but includes also judgements. Many risk assessment are made by private companies and are reviewed by public authorities. A questionnaire was used to investigate how in-depth risk assessments are reviewed by employees at the Swedish County Administrative Boards and how new knowledge generated in the Swedish EPA's research programme Sustainable Remediation is applied.

Two multivariate methods, principal component analysis and partial least squares regression, were used to analyse the results with respect to gender, age, working district, length of employment at the County Administrative Board, length of the total working experience in the environmental section, and working post. It was also considered if the projects were financed by the government or by a legally responsible operator.

The most significant relationship between background variables and the respondents' answers was related to gender, even though differences depending on age and experience were also seen. For example, female assessors generally answered a low rating for knowledge about the research programme and time for reviewing risk assessments by consultants and confidence in these.

Differences depending on the source of financing were also found. More respondents agreed that risk assessments with the government as the funding source are of higher quality, carry greater weight in decisions and that there are a greater extent of cooperation, compared to assessments funded by a responsible operator. These differences affect the review process and can thereby also affect the outcome of a contaminated land project.

Von Watzdorf S (ETH Zürich Switzerland); Skorna A (University of St. Gallen Switzerland)

The role of preventive services in the insurance purchasing decision

Maintaining and advancing competitiveness through additional services is an accepted strategy in today's insurance business. Despite the plethora of supplementary offerings the significance of preventive products or services deserves special attention. Safety trainings and emergency equipment do not only allow delivering additional value to the customer but provide a mean to select risk aware customers and reduce claims. The relevance of this strategy becomes apparent with the insurance industry striving for new ideas in order to escape the price war and eroding premiums in many European countries. Despite the number of contribution in this area and products on the market it remains unclear how the provision of preventive services affects the customer's decision during the insurance purchasing process.

To close this research gap we conducted a conjoint analysis based on a motor insurance product in 2009. In addition to traditional product attributes such as the price, the franchise or the no-claims bonus a driver's safety training was included in the offer.

Based on the results we show that the provision of the driver's safety training has a significant influence on the preference structure of the customer and hence on the purchasing decision. In a consecutive cluster analysis based on the individual preference values, customer segments were found which revealed the differing influence of the driver's safety training on the purchasing decision. The findings of this contribution show the influence of preventive services on the purchasing decision and provide practitioners with guidelines on how to target customer segments demanding such services.

Skorna A (University of St. Gallen Switzerland); vonWatzdorf; Weiss M

My home is my castle - claims prevention within the home insurance sector

The current economic crisis has speeded up the concentration process within the European home insurance sector, especially in the UK. However, nowadays customers are more price sensitive, which increases pressure for the whole industry and in consequence leads to further premium erosions. Thus, some insurers are looking for new ways to differentiate their portfolio by offering innovative insurance products combined with prevention activities to compete with a high value-added service strategy. Based on a profound analysis of more than 220.000 insurance claims of one leading European home insurer between 2004 and 2008, we generated different risk and customer profiles to identify the most suitable prevention strategy for each customer group. The prevention activities are focused on fire, theft, and water damage protection as these represent the core businesses of the examined insurance company.

The following research discusses the whole project lifecycle for water damage protection as an example - from target group and risk identification, choosing appropriate prevention actions down to building the corresponding business case. The presented prevention system centres on a comprehensive water detection system, which is based on intelligent water leak detectors, automatic valves, conventional and resistive detectors and control panels. We show from an insurance business perspective how these advances in sensing can

contribute to a better risk assessment as well as to significantly reduce the extent of damages. Likewise, we illustrate for insurance clients how damage protection comes together with voguish water saving to make the case even more customer rewarding.

Sparf J (Mid Sweden University)

Ability and vulnerability – everyday life dilemmas for people with disabilities

All of us, you and I, have individual abilities and debilities in a physical and mental as well as a social and economic sense. In a crisis situation these abilities and debilities do matter, and indeed, presumably define our individual level of vulnerability. However, in social research, vulnerability is often applied in a wider sense on a structural level as a categorization of specific groups of people. The organization of, and methods used for public risk and crisis management are mainly guided by the maxim - equal treatment of every citizen. In order to offer adequate support and help, local organizations ought to have a comprehensive knowledge of the various preconditions and needs among their clients. To gain deeper knowledge in this area and, in a wider sense, contribute to the development of a more dynamic and adapted local risk and crisis management, this paper will discuss the term vulnerability and give an account for an empirical study of a group that is constantly referred to as vulnerable, namely people with disabilities. The aim of the study is to examine how risk and vulnerability is manifested in the everyday life of people with disabilities and how this group tackles various risks and crisis situations.

The concept of *vulnerability* can, firstly, help us understand in what ways social stratification and large scale social processes can make people variously exposed to, and more or less defenceless against, conditions in natural and social systems. Secondly, vulnerability is a way of understanding and working with the multi-dimensionality of politics, poverty, economy, and nature. Thirdly, in disaster mitigation it is necessary to understand the social root causes, the dynamic pressures of class, gender and nation state. Fourthly, vulnerability is a way of conceptualizing risk and security in multi-faceted everyday life, with regard to issues of community planning, support, and the resilience of human beings. In the first three cases, research is solid. In the last case however, a lack of knowledge is evident.

Method
The study consisted of five group interviews with a total of 27 immobilized persons aged 18 to 85. The interviews concerned two areas of investigation: (1) what the interviewees acknowledge as risks and how these are manifested or affect them in their everyday life, and (2) what experiences the interviewees have, in terms of capacity and behaviour, of a specific crisis (scenario: a heavy snowstorm).

The analysis was made on full transcriptions of the interviews (ca 25 000 transcribed words), and in the end three analytic themes had emerged, identifying three main foci of experienced risk situations:
1) Causes
2) Emotions
3) Loci

For each theme a number of examples of experiences are presented with quotations, plus a risk adaptive dilemma emerging in each theme. The dilemmas point out areas of strategic vulnerability interest including decision making with conflicting demands.

Results
The two central conclusions from the study are: (1) vulnerability is a complex and multifaceted phenomenon in everyday life impinging upon strategically considerations and decision-makings, and (2) disability does not necessarily equals to vulnerability in all situations.

Risk is experienced in a tangible way, and is talked about in terms of oneself and one's close family and friends. Vulnerability is found in three central themes, with concomitant areas of dilemma: Causes (information), Emotions (avoidance), and Loci (marking).

The analysis has shown that on the micro level of everyday life vulnerability is a complex phenomenon, manifested in a multi-faceted way, including a number of dilemmas and making of decisions for the individual. Also, that vulnerability is not a consistent axiom that can be used to label a group that happens to bear a common condition. Instead of applying the common assessments in structural factors to certain population groups I would argue for a more elaborated approach towards vulnerability by examining and accepting the abilities and debilities of each and every one of us. In that way managing risks is very much about humane decisions considering every individual's state and circumstances. In regard of that, Iain Wilkinson (2008) proposes the term 'sociodicy' – alluding to a secular form of theodicy – in discussing actual social decision, the benevolence of social action, and the moral rectitude in social interventions intended to reduce social injustice. These instances of social action are crucial when it comes to vulnerability in that they set the limits for the individual and organizational space of action. A consciously humane attitude focused on salient moralities could hence support communities overcoming problems with discursive sociodicy and practical vulnerability.

Session 7, Wednesday 1.30pm

Symposia

Symposium S17. The changing nature of risks and benefits in the medical area: towards a two-way proactive model?

The changing nature of risks and benefits in the medical area: towards a two-way proactive model? A high level of uncertainty about the risks and benefits characterises the environment in which most health decisions are taken. At the time of its first marketing, knowledge of the properties of a given medicine remains incomplete (Silcock and Pritchard, 2002). Then, despite extensive trials drugs and vaccines retain some degree of uncertainty (Freeman, 1991; Graham and Hu, 2007). Regulators have addressed these issues with requests to collect extensive information on Adverse Drug Reactions (ADRs) throughout the lifecycle of drugs, from pre-marketing (trials) to post-marketing stages (pharmacovigilance). Increasingly, regulators feel that they need to share this information with the general public. The medical field has witnessed a global convergence towards more transparency. Examples include for example WHO initiatives on risk communication and the Erice declaration of 1997 (Hugman, 2006) that called for 'independent expertise to ensure that safety information on all available medicines is adequately collected, impartially evaluated, and made accessible to all'. The result is that critical data are becoming easily accessible, mainly through the internet. What will be the consequences of increased levels of transparency? Does more transparency comfort or challenge the nature of interactions between patients, regulators and industry? Modern risk communication has evolved as a way to 'help companies, governments and institutions minimise disputes, resolve issues and anticipate problems before they result in an irreversible breakdown in communications' (Löfstedt 2005). To better resolve issues and anticipate problems, many organisations have evolved from a top-down model centred on the development of technical expertise to control the risks, towards a model where actors become partners in the risk communication debate (Fischhoff 1995). Is this happening in the medical field? And what are the consequences in a post-MMR (Fitzpatrick, 2004; Horton, 2004) and post-Vioxx (Lofstedt 2007) environment?

The discussion will be informed by the results of a three-case review of benefit/risk communication carried by the University of Maastricht and King's College London in 2009 and 2010. This research project, funded by the European Medicines Agency (EMEA) is a step towards using approaches from the risk communication discipline to improve the communication of benefits and risks in complex multi-stakeholder environments. The project has analysed influential stakeholders' expectations and attitudes in the following cases:- The contamination by a genotoxic impurity of the anti-HIV drug Viracept- Safety scares in relation to the anti-cervical cancer vaccine Gardasil- Withdrawal of the anti-obesity drug AcompliaThese research outcomes will be introduced by Dr. Frederic BouderMaastricht University, who will also chair the discussion. Three discussants will be invited to reflect on the changing nature of risk communication towards more transparency and the possible implications for medical risk communication:

Dr. June Raine, Director of Vigilance and Risk Management of Medicines, Medicines and Healthcare products Regulatory Agency (MHRA), UK; Chair of the Pharmacovigilance Working Party, EMEA
Dr. Herve Le Louet, Head of the Regional Centre of Pharmacovigilance, P-HP Hôpital Henri Mondor, Paris
Dr. Deborah Szafir, Head of Risk Management Strategy, Hoffmann-La Roche Ltd

Chair: **Frederic Bouder**

Bouder F (Maastricht University Netherlands)

Balancing benefit and risks: a three case review of EMA's risk communication

Historically, the medical research community has concentrated its efforts on patients and consumers' attitudes to risk (Bellaby, 2003; Godolphin, 2003; Sedgwick and Hall, 2003; Smith, 2003) and has focused on doctor-to-patient communication (Alaszewski and Horlick-Jones, 2003). Unlike other areas, the use of cognitive science research remains limited (Slovic et al., 1989; Slovic et al,. 1991; Bostrom, 1999; Slovic et al. 2007). Although scandals like MMR and Vioxx question traditional medical communication, decision makers have not taken full advantage of research developments, especially useful research on communication in post-trust environments (Lofstedt 2005). This paper presents the results of a three-case review of benefit/risk communication at the European Medicines Agency (EMEA) designed to address this gap. It answers the following questions: What are the views and expectations of influential stakeholders? Do current communication channel! s build or undermine trust? How could the communication process maximise the opportunities for consensus on benefits and risks? The paper analyses influential stakeholders' expectations and attitudes with respect to:

- The contamination by a genotoxic impurity of the anti-HIV drug Viracept
- Safety scares in relation to the anti-cervical cancer vaccine Gardasil
- Withdrawal of the anti-obesity drug Acomplia

The research draws on behavioural and social psychology theories successfully applied in a variety of contexts (nuclear technology, chemicals, food, etc.). Data have been generated from extensive review of archival documents and media sources; 102 in-depth face-to-face interviews; 77 additional interviews.

Raine J

TBA

Le Louet H (P-HP Hopital Henri Mondor Paris France)

A clinical perspective on benefit/risk management and communication

Risk management activities in the medical field follow a thorough and formalised process, from pre-approval to post-marketing pharmacovigilance. Yet, the thresholds to determine the level of acceptable risk - which conditions approval and influences withdrawal--, are changing. Over the years the level of acceptable risk for a distinct subset of patients has increased. This is only acceptable if a strong risk management program is implemented and designed very early during the drug development. Consequently, the quality of risk communication becomes a critical factor of success or failure of pharmaceutical risk management. This presentation will provide a clinical perspective on recommendations for improving benefit/risk communication in the medical field. In particular, it will look into the importance of risk communication for the well-functioning of current risk minimization mechanisms. This presentation will discuss the need for specific mechanisms such as a risk communication advisory board and a better flow of information between the European and national levels as well as between the regulator and clinical settings.

Szafir D (Roche,France)

Risk communication or comparative benefit/risk communication?

For a long time Pharmaceutical benefit/risk communication has been based on a top-down expert-based system, historically built on the following assumptions: public risk perceptions are influenced by systematic cognitive biases, which produce erroneous assessment of probability and lead to incorrect weightings of relative risks and benefits, requiring corrections through appropriate expert advice. This model implies that experts are consistent in their judgment. Is this model still valid in the age of internet communication and Transparency? 21st century pharmaceutical communication relies on the successful interaction of core and needed actors, namely regulators, pharmaceutical companies, prescribers and patients. Increasingly “satellite” actors also have their say: citizens, the media, lawyers and financial analysts. Manufacturers need to face up to the key challenge of improving the effective communication of benefits and risks in a more complex communication environment characterized by multiple interactions. This presentation will offer an Industry perspective on specific recommendations for improving benefit/risk communication. In particular, how could an independent board to the EMA look like? How could Transparency and co-ordination be better managed? How could we learn from our past mistakes to improve the effectiveness of future communication?

Oral presentations

Parallel P31: Risk assessment and health

Chair**: Rick Reiss**

Di Bartolo C (ISMETT Italy); Triolo F ; Lopez F; PiazzaT; Gerlach JC; Gridelli B

A Quality Risk Management Model Approach for Cell Therapy Manufacturing

International regulatory authorities view risk management as an essential production need for the development of innovative, somatic cell-based therapies in regenerative medicine. The available risk management guidelines, however, provide little guidance on specific risk analysis approaches and procedures applicable in clinical cell therapy manufacturing. This raises a number of problems. Cell manufacturing is a poorly automated process, prone to operator-introduced variations, and affected by heterogeneity of the processed organs/tissues and lot-dependent variability of reagent (e.g., collagenase) efficiency. In this study, the principal challenges faced in a cell-based product manufacturing context (i.e., high dependence on human intervention and absence of reference standards for acceptable risk levels) are identified and addressed, and a risk management model approach applicable to manufacturing of cells for clinical use is described for the fi! rst time. The use of the heuristic and pseudo-quantitative Failure Mode and Effect Analysis/Failure Mode and Critical Effect Analysis (FMEA/FMECA) risk analysis technique associated with direct estimation of severity, occurrence and detection is, in this specific context, as effective as, but more efficient than, the Analytic Hierarchy Process (AHP). Moreover, a severity/occurrence matrix and Pareto analysis can be successfully adopted to identify priority failure modes on which to act in order to mitigate risks. The application of this approach to clinical cell therapy manufacturing in regenerative medicine is also discussed.

Ferri M (Veterinary service-Local Health Unit of Pescara- Ministry of Health Italy)

Microbiological risk assessment and the decision-making process in Italy. A proposed road map

The assessment, management and communication of food safety risk are interrelated steps of risk analysis, a methodology used for assessing the probability and severity of hazard to human and animal health, selecting and implementing control measure and exchanging information about risk among interested parties. In the new EU legal framework, risk analysis represents a scientific component necessary for developing food safety policy and a valuable tool for risk managers and policy-makers. The aim of this paper is to guide scientists and regulators to identify the main steps for conducting and coordinating microbiological risk assessment activities in Italy and most importantly to help them to recognize the advantages stemming from the integration of scientific research with the decision-making process. Based on this requirement a road-map with detailed objectives and necessary activities is proposed. The objectives identified are: risk assessment! complying with established criteria; research useful to risk assessment; risk-based priority setting for the use of decision-makers; integration of research and new scientific knowledge with decision making-process; selection and application of different risk assessment approaches based on nature and timeframe of decisions; development of risk assessment models; integration of risk assessment with economic and epidemiology and other relevant factors relevant to the decision-making process; active dialogue between risk manager, risk assessor and other stakeholders. To achieve the objectives the essential activities are: restructuring of the National Food Safety Agency; coordination of current and future risk assessment activities; development of Quantitative risk assessment methodology; development of infrastructure and education; renewal of risk communication strategy.

Giannopoulos G (European Commission, Joint Research Centre Italy); Arvanitis A; Zenie A (Joint Research Centre of the European Commission Ispra Italy); Kotzias D; Kephalopoulos S

Assessing consumer exposure using GExFRAME

In 2003 European Commission initiated the development of a European and global infrastructure of models and tools for consumer exposure assessment. This has been dictated by the requirements of the General Product Safety Directive (GPSD, 2001/95/EC) and the REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals) legislation in EU (REACH, 2006/121/EC). To follow this objective seven state-of-the-art workshops have been organized and sponsored by the European Commission's Joint Research Centre in 2004, 2005 and 2009 with the participation of experts, model developers and end-users in the field of consumer exposure modelling and assessment from EU, US, Japan and Canada (Global Consumer Exposure Modelling Network). Based on the recommendations of these workshops, the EC's Joint Research Centre setup a framework for consumer exposure modelling at global scale including databases, models and scenarios used world-wide.

GExFRAME was developed as a state-of-the-art, user-friendly and transparent scientific/technical tool for conducting both low tier screening level assessments as well as high tier probabilistic Monte Carlo assessments. The results of the assessments can be summarized in reports compatible with the requirements of REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals). GExFRAME can be used to work with exposure related databases as well as models. The current version has three branches in its Explorer-type tree, i.e., Data, Models, and Scenarios. Exposure related databases are continually being added to GExFRAME and are those contained in EXPOFACTS (EU), CONSEXPO (EU) and CARES (US). GExFRAME includes exposure assessment methods from currently existing models such as CONSEXPO, CARES (contains US EPA's Residential SOPs algorithms), MCCEM (a US EPA multiple zone indoor air dispersion model). The exposure routes addressed in GExFRAME are dermal, ingestion (! including children's hand-to-mouth), and inhalation.

Users can estimate exposures to chemicals of interest from the use of consumer products by 1) single routes, 2) multiple routes within a scenario, or 3) multiple scenarios. Scenarios (pre-built or custom) can be selected by a user, and one or more exposure algorithms per scenario during a model run. The framework in GExFRAME is being constructed to be compatible with data and tools developed as part of the European Union's regulatory framework for the Registration, Evaluation and Authorisation of Chemicals (REACH) and the General Product Safety Directive (GPSD, 2001/95/EC). However, GExFRAME is under constant development and it is intended to include REACH scenarios as well as take on board requirements for sectorial assessment needs such as the ones proposed by the Biocides community.

Zenié A (Joint Research Centre of the European Commission Ispra Italy); Jantunen M; Torfs R; Reina V; Kotzias D

The European Exposure Factors (ExpoFacts) Sourcebook - Supporting risk and exposure assessment of European populations

The ExpoFacts database, freely accessible on http://expofacts.jrc.ec.europa.eu/, is a unique European tool for exposure assessors and risk

managers involved in health and environmental issues, particularly in the areas of indoor air quality, dietary exposures and safety of consumer products and articles.

Housing conditions, non-dietary ingestion, consumption of food and beverages, anthropometrical, socio-economic, demographic and time use in different microenvironments are examples of exposure factors extracted from ExpoFacts.

The database contains information on exposure factors and population data covering 30 European countries with extensive links and references. European exposure factor data have been retrieved from national and international institutes and from scientific articles and reports. The data have now been compiled into this searchable database, in which it is easy to query, sort and retrieve the required information.

ExpoFacts has been financed by CEFIC while it was developed between 2002-2006 by THL (KTL) and JRC, with a steering group composed of key EU academic and regulatory experts as well as opinion-makers (e.g. Commission and WHO). The database was placed on the JRC web server on January 2007. Since then, the ExpoFacts project is continuously collecting, maintaining and providing reference data on exposure factors specific to European populations.

A recent example of its extended use will be presented.

Parallel P32: Risk, experts and the public

Chair: **Herve Corvellec**

Carrere G (LEREPS Toulouse 1 Capitole University France)

Road safety experts and the subjectivation of public action

In *The Risk Society: Towards a New Modernity* (1986), Ulrich Beck is interested in setting out a sociology of knowledge for the understanding of the risk society in its political dimensions. Anthony Giddens seems to answer Ulrich Becks' studies when he underlines, in *The Consequences of Modernity* (1991), the importance of expert systems in reflexive modernity. In this way, risk and expertise appear like coextensive notions in the risk society. This paper aims at presenting a work in progress of a study of experts, carried out in the Quebec Ministry of Transport. Also, we aim to go beyond the simplistic division between experts and the lay-public. Three methodological tools were used for this study: observation in an ethnographic approach, none-directive and semi-directive interviews. The expert population studied is composed of civil engineers who construct road infrastructures in order to reduce the number of accidents. During this empirical study we highlighted a subjectivation process in road safety expertise. We define the subjectivation process, on the one hand, as the ambition to control drivers' behaviours by the infrastructures and on the other hand, as the interactional use of experience and knowledge which arise from expert and lay-public rationalities. In their interaction, experience and knowledge lead also to hybrid behaviours like the expert-driver figure. In this way, this paper first of all explains how the subjectivation process takes shape in road safety expertise. Then, it examines its origins in the crisis of the profession and the various criticisms of modernist urban planning.

Sao-Marcos RS (University of Azores Portugal); Arroz AM.; Gabriel R; Neves I C; Rego I E; Palos A C

Child Obesity: Blessings for the family table, in the children´s name we say. Family enrolment in risk communication - a local tryout in the Azorean islands

World Health Organization has come to recognize, since 1998, that obesity is one of the major public health problems, that will, most likely be, one of the great epidemics of the twentieth century, in the developing countries. The Azorean context is no exception. Specialists in the field have come to the conclusion that no risk communication strategy addressing this issue should alienate the families; therefore, in order to involve them in the construction of a wider social consciousness of children obesity as problematic health risk, (and consequently educating for health by adopting healthier food habits and lifestyles) a participating intervention strategy was conceived. Trying to recover and reconfigure Mediterranean and Azorean meal liturgy. By conducting a tryout action where voluntary families enroll themselves to the intervention study, a communicational device will be created characterized by an intergerational participation in the construction of a table cloth incorporating each family's identity.

The making of the table cloth, the choice of what and how to be represented and the whole process of creation are a privileged common ground for the exchange of ancient knowledge, habits, and stories, narratives, contributing for a more reflecting practice of the meal as a richer and meaningful ritual.

By involving the targeted groups under analysis in the design of the message itself, this communication risk project aims to test cooperative ways of building communication devices, and to evaluate the process impacts, outputs, and the potential outcomes pointed out.

During the process they will be followed up by the research team on a succession of key moments to discuss and visually represent their own habits of

mind and thoughts – individually and as a whole - on food, food habits, food choices, body image, etc., with the common goal of producing a tablecloth: a material testimony of their own reflection.

Arroz AM (University of Azores Portugal); Estrela Rego I Caldeira SZ

What if 'it' happened now? How do families communicate and prepare for seismic hazards in the Azores?

Research and daily life situations have shown us how difficult it is for people to openly communicate about frightening issues, even though they might represent situations of permanent and/or serious risk for individuals and communities. Such difficulty may persist, or even increase, in situations where children are involved. Incapacity to talk about potential harmful events may, in turn, prevent or affect the way people anticipate and prepare for those situations.
This presentation describes a study in progress, part of a wider research project on Risk Communication in the Azores (Africa Annes), devoted to address the process of construction of a 'seismic risk emergency plan' by families. In addition to the description of the method employed (i.e. (1) sampling of families and its rationale; (2) the procedures followed by both the team and the participants throughout the process of developing the emergency plan; and (3) the analytical dispositive containing the conceptual dimensions under observation – knowledge, beliefs, affect, trust, actions/routines), a preliminary analysis of data, focusing on the communicational process and the content of the emergency plans developed, is also provided.

Corvellec H (Lund University, Sweden)

Narrative structure of Risk Accounts

This paper is a study of the narrative dimension of risk accounts. It presents an analysis of the generic narrative structure of these accounts. It also analyses the consequences of this structure for risk theory and discusses how this structure affects the political dimension of risk accounts and risk decision making.

Parallel P33: Environmental risk communication

Chair**: Anne Katrin Schlag**

Devilee J (RIVM Netherlands); de Vos M; van Poll R(RIVM Bilthoven Netherlands)

Risk communication on soil pollution and clean-up in The Netherlands

Although from an environmental health point of view soil pollution is a little disputed subject, the results of surveys repeatedly showed that Dutch citizens are relatively concerned about soil pollution. As in the current soil clean-up policy lists are being made, in which the most contaminated sites are prioritized, policy makers feared that as a unmeant side effect the societal concern about soil pollution would increase. This would be a very unwanted development as the Dutch Ministry for Housing, Spatial Planning and the Environment wants to shift its soil policy towards the monitoring of polluted sites instead of very expensive clean-ups. Therefore, it was decided to ask the Dutch National Institute for Public Health and the Environment to investigate whether residents near contamined sites are as concerned as the respondents in the surveys and in what way the responsible authorities communicate about the subject.

This study started with the stock-taking of the current risk communication practices in 23 provinces and municipalities in The Netherlands. This includes approximately 40 percent of the responsible administrative bodies. For in total 10 of these provinces and municipalities a specific case of soil contamination was studied in detail. The cases differed in the phase of the clean-up operation (planning, cleaned or will be monitored).

The results show that there are some important aspects on which local risk communication can be improved and that in general the concern at the local level is low. Despite of this low concern, very careful risk communication is needed as the risk of soil pollution appears to be susceptible to social amplification.

Bründl M (WSL-Institute for Snow and Avalanche Research SLF Switzerland); Rheinberger C

Perception of Natural Hazard Risks Related to Climate Change in the Alps

Mountain ranges belong to those regions that are most sensitive to global climate change. In the Alps, the effects of increased anthropogenic greenhouse gas emissions into the atmosphere become already visible. While the average temperature in Europe increased by about 1°C throughout the past century, the heating up in the Alps amounted to temperature increases of more than 1.5°C. This has

resulted in rapid ablation of glaciers, acceleration of erosion processes and frequent rockfalls and landslides. In this paper, we report on a representative sample of Swiss people, who were surveyed about their perception of risks associated with the effects of global climate change. More in particular, respondents were asked how they perceived the risks of rockfalls and snow avalanches on Alpine roads in comparison to ordinary traffic accidents. Results of ordered probit analyses show that the perceived risk of rockfall and avalanche accidents was significantly! related to personal believes about climate change consequences—if respondents believed that climate change would increase the frquency of rockfalls and avalanches affecting roads, they also perceived these hazards as particularly threatening. A number of personal characteristics including the age of respondents and their residency status also affected the perceived risk. Specifically, older people and residents of the Alpine region of Davos perceived natural hazards to roads significantly worse than people from the city of Zurich. In conclusion, our results suggest that people in Switzerland become increasingly aware of the consequences of climate change and this awareness in turn affects their risk perception.

Gonzalo Iglesia J(Universitat Rovira i Virgili Spain) ; Farré J(Universitat Rovira i Virgili Spain); Espluga J (Universitat Autonoma de Barcelona Spain); Prades A (CIEMAT/CISOT Barcelona Spain)

Communicative strategy of risk construction in the European Union: climate change case study

The need to increase the legitimacy of political decisions about risk has imposed the concept of “governance” over other approaches of risk communication. Communication adopts in governance a predominant role with concepts like transparency and participation.

The European Union, throughout the European Commission, is a clear example of the use of the governance as an internal and external political strategy. The analysis of the original application of risk communication in the chemical and nuclear cases, and the comparison with the developed communicative strategies around the climate change allow us to understand the contraindications and the multiple applications developed in risk governance.

Climate change breaks the restricted governance system. It is used as an example of the widest governance system to construct European identity and to modify the definition and management of the other risks.

Risk communication has turned, throughout governance, into an institutional tool of EU where communication plays a strategic and variable role at political interest’s disposal and the management of its identity. Furthermore, the strategies adopted over determined risks, in this case the climate change, redefine and replace the rest. This arises cases of attenuation (nuclear energy) or amplification (petrochemical sector).

To analyses the structures and strategies developed for the European Union, allow us to understand how risk is converted into a political action factor defined throughout communicative actions and the discourses’ circulation.

Smith N (University College London UK); Joffe H

Common sense understanding of global warming: A social representations investigation

Global warming is presented in the world’s media as a pressing societal issue. It is therefore important for research to ascertain how members of the public engage with and understand the associated risks. A considerable quantity of research has investigated public perceptions of global warming attitudes and beliefs using structured questionnaires and other quantitative techniques. Findings from these studies identify that global warming is perceived as a serious threat, but a threat that affects other people and happens ‘out there’. This presentation will report findings from a more in-depth and qualitative investigation that used social representations theory to explore common sense conceptualisations of global warming risk. Fifty-six members of a British, London-based public were initially asked to draw or write four spontaneous ‘first thoughts or feelings’ about global warming. These thoughts were then explored using an open-ended, exploratory! interview technique. First thoughts, either drawn or written, were often image-based mirroring, in part, the depiction of global warming in the British press. An in-depth exploration of interview data revealed a more nuanced understanding. In particular, respondents anchored global warming to a ‘contravention of the natural’. Respondents also brought symbols, metaphors and complex emotions such as guilt and nostalgia to play in their conceptualisations of global warming. The paper elaborates on these, showing that they give credence to the value of qualitative approaches in establishing naturalistic conceptualisations of pressing risk issues in a way that eludes questionnaire studies.

Parallel P34: Industrial risk management

Chair**: Jean-Pierre Galland**

McKenna SA (Strathclyde University UK); Alkaner S; Das PK

Modelling Risk in the Ship Dismantling Industry

This research presents a model which can be used to analyse the influence of technology and their processes have on health, safety and environmental (HSE) risk within the ship breaking industry. Traditionally, ship breaking over the last thirty years has taken place in the Indian sub-continent in HSE conditions that are no longer socially or environmentally acceptable. One of the main problems within the ship breaking industry is there is not one standard or endorsed method that can be applied in part or whole throughout the entire industry. Factors such as geographical location, characteristics of vessel type and amount, hazardous material onboard, climate, training of workforce and availability of technology all play significant roles in deciding the best practices used. Through research this study presents a generic model which highlights the association of risk and technology and the parts they play in determining critical factors affecting acc! idents and incidents. Identified in this study is a comprehensive risk framework of the HSE hazards associated with ship breaking, the typical accidents encountered and finally a risk register developed in a framework that defines total integrated risk and economic impacts.

Bozek F (University of Defence Brno Czech Republic); Bumbova A(University of Defence Brno Czech Republic); Dvorak J

Risk Management at Landfills

The paper deals with the proposal and application of methodical procedure for risk management at landfills. The land-filling of wastes is still the most common way of waste disposal in the Czech Republic and is associated with the risks of harming health and contaminating environmental elements in comparison to other methods of waste disposal. There is not an integrated procedure of adequate risk management on a national level either.

First an authentic comprehensive methodical procedure of risk directing at landfills was developed. Then its applicability in practice was verified in the form of four case studies in a region of the Czech Republic. The procedure is divided into six basic steps in a logical sequence. The methods of security audit, checklist of questions and a semiquantitative assessment of acquired data were used in the process of risk analysis. The aim of it was to assess the probability and impact of a particular undesirable event and to determine the risk. Thus the risk priorities were determined at selected landfills and counter-measures were proposed to cope with critical risks. The most frequent threats identified at the operating landfills include the following: leak of seepage water, escape of landfill gas, fire, explosion, fly dust, odour and dust, birds and insects at landfills, vandalism, failure of sealing system and violation of landfill stability.

The proposed methodical procedure is suitable for landfill operators as well as for the mutual comparison of risks between assessed landfills.

Stacey N (Health & Safety Laboratory UK Government)

Integrating Risk Concepts into an Undergraduate Engineering Degree

Experience may be the best teacher but when it comes to industrial accidents the price can simply be too high to pay. The challenge therefore is for professionals and managers to learn through their own mistakes and those of others without endangering their health and safety or that of others. This presentation will describe a joint project conducted by HSL and the University of Liverpool, with funding from HSE, to integrate health and safety risk concepts into their engineering undergraduate courses. It will explain how risk education learning outcomes were defined and implemented by merging new teaching materials (involving real accident case studies) into core engineering modules. The challenges involved and how there were overcome to ensure longevity of the use of the materials will also be discussed. Its contents, including any opinions and/or conclusions expressed, are those of the presenter alone and do not necessarily reflect HSE policy.

Louzis K (National Technical University of Athens Greece); Koimtzoglou A (National Technical University of Athens Greece); Ventikos NP (National Technical University of Athens Greece)

Ship Wreckage in Greece: A Fairytale Or A Nightmare To Be?

This paper deals with the development and application of a risk analysis approach regarding the importance and fate of shipwrecks in Greece. In general, in the past few decades there has been an increasing interest in environmental issues; moreover due to the large number of shipwrecks in Greece, the question of their environmental impact has arisen. Up to 2007 there was no internationally recognized set of regulations regarding the removal of wrecks and its implications; however in 2007 IMO held the International Convention of the Removal of Wrecks, which paved the way for the identification of wrecks as sources of danger through the use of specific criteria, with regards to the safety of navigation, and the protection of the environment.

The methodology drafted in this paper comprises the following items: the compilation of a dedicated database of shipwrecks in Greek waters, the assessment of risk per region following selected criteria, and the v! isualization of the results in both quantitative and geographical terms. This effort also involves the integration of new risk metrics to address in a complete manner the danger emerging from shipwrecks in Greece. Furthermore, the potential effects of a future application of the Wreck Removal Convention will be examined for Greek territorial waters. The paper is concluded with interesting insights and conclusions from the above tasks.

Galland JP (Laboratoire Techniques Territoires Sociétés France)

France/UK : two regimes of regulating industrial risks

France and the UK are confronted with about the same panel of industrial risks and dependent on the same Seveso Directives. But both countries differ on their national regulations and on the ways their respective public sectors are involved in this problem.

Since 1999 in the UK, the Health and Safety Executive (and the other Competent Authorities) has charged the operators for a part of the work their inspectors carry out under the Control of Major Accident Hazards Regulations. In this respect and with regards of top-tier establishments, HSE inspectors' main duty is to examine the safety reports and to advise or enforce operators in order they comply with regulations. Although HSE also gives (free) advice on the land use planning process, national inspectors are not accountable for this side of the problem of industrial risks, which is local authorities' situation.

Since 2003 in France (and Toulouse major accident 2001), the public sector and namely, the French Inspecteurs des Installations Classées pour la Protection de l'Environnement, have been more and more involved in both sides (on-site and off-site) of the industrial risks problem. The challenge is to balance costs and benefits between diverse solutions, from lowering in-site risks to moving away inhabitants who would be exposed to possible accidents, and to find the best solutions with the concerned stakeholders.

In this respect, and to be schematic, the industrial risks problem is becoming a public problem in France, and a private one (the operators' one) in the UK.

Posters

Bareno, J (Atos Origin Spain)

Cost Analysis in Compliance Management Models with MASTER

Business processes that are subject to compliance are often scattered across multiple business units in a variety of unorganized and unmanaged systems, so design and implementation of internal control processes is not an easy task. In multi-stakeholder scenarios such as outsourcing, where some business processes or parts of them are relying on IT systems of contracted service provider, the complexity of compliance management and control processes is increasing. In addition, distribution of software functions, storage or computing resources, such as in service oriented software systems and architectures, is further increasing this complexity.

In this paper we consider Integrated Compliance Management (ICM) which consists of many tasks roughly grouped around three main phases:
• Compliance engineering: Compliance engineering consist in the translation of non-trivial regulatory compliance requirements, business goals or organizational policy aspects, that are often expressed in natural language, into technical controls that can be deployed in operational infrastructure and can provide data which enables compliance assessment and eventual auditing. Set of operation policies is used as an interface to operational compliance infrastructure.
• Operational compliance infrastructure: indicators that are tailored to measure levels of compliance are used in combination with software components and different types of controls that enable evidence collection as well as some kind of corrective/compensation actions. Parts of this infrastructure include signalling, monitoring and enforcement components.
• Assessment of Compliance: In ideal situation, companies should have ability to continuously assess compliance levels not only for processes running on ICT systems at their premises, but also for those processes that run on external IT systems. Evidence aggregation, correlation, analysis, control refinement, risk assessment etc are some of tasks related to this phase of compliance management. Internal audits, sometimes called first party audits, are conducted by, or on behalf of, the organization itself for internal purposes. The internal or external auditors assess whether the controls are properly designed, implemented and working effectively, and make recommendations on how to improve internal control.

Bayramov A (Azerbaijan National Academy of Sciences)

About Nuclear Threat Risk Assessment

The mean of a nuclear security threat assessment is to better understand the existence and nature of the possible dangers presented by insiders, internal groups, and external groups that may seek unauthorized access to nuclear materials from sources inside the nation or that may try to use the nation's transportation systems or geography as part of a illicit transport system to move contraband nuclear materials from one point to another. The IAEA recommends six general nuclear security objectives: 1) performance of a risk based threat assessment, 2) establishment of appropriate legal and regulatory measures that promote nuclear security, 3) prevention, 4) detection, 5) response, and 6) the development of human resources. The aim of our investigations is not to predict terroristic events in Azerbaijan but only to indicate which scenario has the higher utility from the point of view of a terroristic organization in terms of balance between factors fa! voring and discoursing the attack, respectively.

Blust SA (University of Ottawa Canada); Lemyre L; Markon MPL; Lee JEC; Krewski D; Lemus C

Perceived CBRN Terrorism Threats and Public's Intent to Cooperate with Authorities: The Role of Uncertainty

Public's cooperation is extremely important during a terrorism threat, it helps responders and authorities gain control over the situation as well as prevent possible disastrous circumstances if people do not follow safety instructions. However, gaining public cooperation is not guaranteed. What affects the public's willingness to cooperate with the government during a terrorism threat? A National Public Survey of Perceived CBRN Terrorism Threat and Preparedness involving a representative sample of 1502 participants from the adult population from the ten Canadian provinces, was performed to clarify this question. Differences in intent were analyzed by sociodemographics and by appraisal of threats. Using linear regression, analyses indicated that perceived uncertainty about CBRN risks predicted intent to cooperate with the government during a terrorism threat. These findings suggest implications for risk communication and for both individual decision making and institutional planning.

Boulanger G (Afsset France); Solal C

General population and workers exposed to formaldehyde: a different approach to assess the health risks

Exposure to formaldehyde, classified as carcinogenic to humans by the IARC in 2004, occurs in a wide variety of occupations and industries; and through a large number of consumer products and building materials for the general population in indoor air.

The French agency for occupational and environmental health safety has set up a multidisciplinary working group to conduct a quantitative risk assessment for general population and workers exposed to formaldehyde. The appraisal was carried out separately between general population and workers following the classic four steps defined by the American NRC.

The hazard characterization was based on numerous reviews providing data on the critical effects and the dose-effect relationships in human and animals. Different toxicological reference values were selected specifically for each type of populations taking into account the inter individual variability between general population and workers.

Then different exposure scenarios were elaborated for the general population based mainly on the French Indoor Air quality Survey and time budget data. For workers, occupational exposures were estimated from concentrations measured at the french working places and exposure prevalence data.

Finally, an health risks characterization was performed for both populations and the risk of nasopharyngeal cancer was specifically considered.

The communication will outline the necessity of discussion and harmonization to justify similarities and differences between the risk assessment approach for general population and workers.

Brown LE (University of Strathclyde UK); Dinan W

Governance, Planning and Risk: an analysis of industrial and community change in Grangemouth

Based on original empirical research, this paper examines the effects of community liaison and governance on perceptions of environmental risk. The paper assesses the impact of commercial and political changes on perceptions of risk and regimes of accountability. This paper takes the town of Grangemouth in central Scotland as a case study in risk communication and risk management. Dominated by the presence of a major petrochemicals complex, the town is a suitable site for a micro-level study into the dynamics of planning governance and community liaison. The complex is now owned by INEOS and accommodates eight further 'top tier' hazard sites. These transnational corporations run various community liaison groups and are active participants in partnership activities with local authority Falkirk Council.

Employing semi-structured interviews, documentary analysis and some observational work, the research with local governance actors investigated the efficacy of risk communication strategies in mediating community concerns and considered how local decision-makers perceive community concerns regarding risk and hazard. The change in ownership of the main refinery was found to have had some impact on governance actors' perceptions of the complex; however, the withdrawal of BP and the different approach of INEOS have resulted in a changed relationship between industry and community in Grangemouth. The growing insecurity about the future of the refinery has resulted in the community being less keen to challenge the refinery owners, though local politicians and officials are not similarly immune from criticism and calls for accountability. In terms of partnerships, corporate involvement in local initiatives is regarded as having 'triggered' development, although the extent to whi! ch this benefits Grangemouth itself is unclear.

Carvalho H (Unidade de Arqueologia da Universidade do Minho, Portugal); Martins M; Loureiro E

Anthropic risk analysis and archeological data in the area around Braga (North of Portugal)

Archaeological research in Braga and surrounding countryside allows us to present a synthesis about the anthropic risks in the preservation, sustainability and management of arcaheological data around this city in the north of Portugal.

The area selected for this research is located in the interfluve of the Este and Cávado rivers and is mainly characterized by an increasing urbanization in the last 20 years that threatens not only the archaeological sites but also all the traditional forms of agricultural landscape and communities that work and explore these agricultural landscapes. The city and the intense urban development plans are consuming the traditional agrarian space and archaeological heritage is just one of the historic memories at risk.

The aim of this study is to characterize the risk factors in this area, highlighting the risk of historic memory and archaeological heritage.

Dagonneau J (Cranfield University UK); Prpich G; Rocks S; Pollard S

Technical Development of a Strategic Environmental Risk Appraisal Tool

The prioritisation of resources (economic as well as effort) has increased the necessity for organisations to consider the strategic prioritisation of risks in order to more effectively manage them. Previous research has attempted to appraise environmental risks at a strategic level. However, the results were difficult to interpret, understand and/or communicate. Therefore, in order to prioritize strategic environmental risks, it is crucial to develop a tool capable of effectively informing decision-makers.

This work describes the technical development of a strategic risk appraisal tool to evaluate the environmental, economic and social impacts of environmental risks specific to Department of Environment, Food and Rural Affairs (Defra). These risks include flooding, chemicals, and hazardous waste. The tool has been developed from the identification of models of best practice, existing comparative risk appraisal models and the selective identification of usable comparative attributes to create a prototype. The tool scores risks against a number of comparison attributes including those describing physical, economic and social harm as well as risk management performance and damage due to secondary risks. The attribute scores are used to rank and prioritise the different risks.

The strategic risk appraisal tool will provide a workable framework that can be used to prioritise environmental risks as well as a serve as an entry point for accessing the relevant information used to arrive at such conclusions.

deNazelle A (Centre for Research in Environmental Epidemiology Barcelona); Rojas D; Nieuwenhuijsen M; on behalf of the Transportation, Air Pollution and Physical Activities (TAPAS) workshop participants

Results of an international workshop on integrated health assessments of active transportation policies

Many cities are developing new policies to encourage walking and cycling as a means to increase physical activity and reduce vehicle use. It has thus become particularly important to understand how such strategies may overall affect health.

Methods
To inform the development of an integrated assessment of active travel policies, an international workshop was held in November 2009 gathering 45 international experts from 29 institutes/research groups in fields of social and policy sciences, behavioural psychology, epidemiology, transportation and urban planning, environmental sciences, public health. The objective was to review the state of the art knowledge in relevant fields, discussing strengths and limitations of evidence of different linkages between urban and transportation policies, exposures and public health, to determine the relevance and appropriateness of exposures, outcomes, and exposure-response functions to be included in a quantitative assessment.

Results
Participants agreed on the importance of a comprehensive assessment of active travel policies and underlined its complexity. The choice of policy scenarios, exposures and outcomes to be integrated, and assessment methods, were debated. Greatest benefits may be expected from increased physical activity, and most robust quantitative relationships from health benefits of physical activity and reductions in certain air pollutant. Linking policies to behaviours and exposures is more uncertain. Traffic injuries could be an important health driver, with many factors influencing risks. Many other impacts (e.g. noise, UV, diet, social interaction, crime) may not be sufficiently researched to allow quantification. Most appropriate methods depend on audience and outcomes chosen.

Farre J; Horlick-Jones T (Cardiff University UK)

The communicative turn in risk communication: towards a new research agenda

In recent years a technical discourse of risk has assumed the status of a universal basis for governance and administrative practice in both private and public sector organisations within Europe, the United States and elsewhere. This re-framing of pre-existing organisational concerns in terms of risk categories reflects an underlying bureaucratic concern with the accountable, controllable and cost-effective management of contingency. During this period, the use of risk communication as a regulatory and policy tool has become increasingly important as a part of institutional attempts to inform and influence the behaviour of target audiences. Research into formal risk communication has now developed from a concern with the top-down provision of factual materials to a focus on a range of more diverse activities, with a trend toward various sorts of stakeholder engagement. Proceeding by analogy with the celebrated linguistic (or hermeneutic) ‘turn’ in ! the social sciences, in which language use came to be seen as at least in part constitutive of the objects of their concern, in this paper we explore the communicative turn by which risk objects, categories and practices have come to be

shaped by the theory and discourse that informs risk communication.

Fleming P (University of East Anglia UK)

HPV vaccination perceptions in the UK and the USA

The HPV vaccine offers substantial health benefits to women. However, as a vaccination against a sexually transmitted disease it has been the subject of negative media speculation and might be assumed to be especially sensitive to social norms. The media presentation in the USA has been different to that in the UK as has the response, therefore the norms within the two countries are expected to be different. Pre-existing cross-cultural differences may further separate stakeholder perceptions in the two countries although the objective risks and benefits to American and British women are identical. Young adults who are of particular interest as they are close to the age of vaccination and the issues of social norms and sexual health are highly relevant. A survey of 100 student participants in the UK and USA compared knowledge, risk perceptions, and social norms concerning the HPV vaccine. The results will examine the social and cultural influences that differentiate UK and Am! erican perceptions. Preliminary data suggest significant disparities in social and cultural predictors of risk perceptions between the two countries. The importance of knowledge, people and organisations of influence and social norms will be considered in terms of targeting risk communications.

Gibson S (University of Ottawa Canada); Lemyre L

Social environment and emergency preparedness: Who we are, where we live, and what we do

This study examines how various individual and contextual characteristics in the social environment play a role in individual disaster preparedness and response. Previous research in health risk demonstrates that a positive social environment is related to increased protective health behaviours. Thus, it is hypothesized that emergency preparedness behaviours are also linked to protective elements in one's social environment. A representative sample of residents in Ottawa, Canada (N €4) were asked to rate their ability to respond effectively in the event of a major disaster, based on a series of scenarios that require some pre-event preparedness (ex. Knowing where to meet family members; being self-sufficient for 72 hours; having a system to check on those in one's social circle; and knowing where to get information.) Preliminary results indicate that individuals in each scenario are significantly better equipped to respond when they benefit from! protective factors in their social environment. Group differences for each scenario involved different types of socio-environmental factors, which were related to the required type of preparedness. For instance, rural residents are significantly more likely to know where to meet family members in an emergency, while retirees are more likely to have a system in place to check on others. Collectively, these results demonstrate that while achieving effective disaster response in the public is a complex task, risk managers can benefit from implicating social-environmental factors in their planning strategies to maximize assets in community sub-groups, and improve resource allocation in the event of a disaster.

Hartley A (Met Office UK); Hemming D

The impacts of climate change on a UK fire and rescue service: a risk-based approach

Fire and rescue services in the UK are becoming increasingly aware that they must integrate projected climatic changes into their long term planning structures. Changes in climate have the potential to drastically increase the demand for their services, especially with regard to flooding and vegetation fire incidents. This poster will present a pilot study of the current and future weather and climate related risk of the West Midlands Fire Service. We firstly quantify the current risk in the system by analysing the key hazards and vulnerabilities of the population of the West Midlands. Then, using the latest probabilistic climate change pojections for the UK, we quantify how this risk may change at different future time steps, and given different greenhouse gas emissions scenarios. The risk assessment process is completed by communicating the results back to the fire service, and assissting them in deciding on the most appropriate options for adaptation to climate change.

Hanninen O (Department of Environmental Health, Finland); Knol A; Lim TA; Conrad A; Carrer P; Kim R; Pruss-Ustun A; Kollanus V; Leino O. Jantunen M

Environmental burden of disease in European countries: Quantification, comparison and ranking of environmental stressors within and between participating countries – the EBoDE project

Formaldehyde is a high-production volume chemical widely used in building materials, industrial processes and wide range of products. Volatility of the compound leads to release into air and high levels in indoor spaces. Formaldehyde was identified as a probable human carcinogen based on limited evidence in humans and sufficient evidence in laboratory animals in the US (NTP 2005). International Agency for Research on

Cancer concluded recently that there is sufficient evidence for the carcinogenicity of formaldehyde in humans (IARC 2006) and consequently also in US formaldehyde was set under a re-review (ROC, 2010).

Traditionally linear no-threshold model has been applied for risk assessment of carcinogens and this approach has been widely used for formaldehyde, too (IRIS, 1991). Using exposure data from Finland, risk estimate calculated in the EBoDE-study (35 cases per year in 2005) would correspond to the total number of sinonasal cancers in the country. WHO working group for the air quality guidelines (WHO, 2000) and recent update for the indoor air quality guidelines (WHO, 2010, unpublished) conclude, however, that a threshold model would be more appropriate for formaldehyde due to the cytotoxic mechanism. When using the proposed thresholds (0.1 and 1 mg m-3) in the cancer risk model, the impact in general population (i.e. without occupational exposures) is significantly reduced or approaches zero.

Conclusions: Risk estimates for formaldehyde depends strongly on the possible safe threshold level and even though identified as a known human carcinogen, it is possible that the effects are negligible in real populations in Europe. Exposure data currently available is insufficient for estimating reliably the fraction of the population exceeding the threshold levels. Epidemiological methods should be applied to confirm the threshold in human populations.

Kang S (Ajou University South Korea); Song S; Kim S

The Survey Experiment about Perceived Risk/Benefit from MCD(Mad-Cow Disease) and the Possibility of Attitude Change

This study finds out the structural cause of the perceived risk/benefit and the possibility of attitude changes around MCD(Mad-Cow Disease).
In the Korea, 2008, there are severe social conflicts around the imported beef from USA. The Korean government believed that the beef would be welcomed by people because they will be getting the consumer benefit from imported beef supplied at cheaper price. However, government faced the resistances from people who expressed the fear about MCD. Even if government tried to persuade the people by mobilizing the various policy tools, focusing on the decreasing the perceived risk from MCD, there had been still increasing social conflicts.

What factorsbring out those social conflicts? Our paper will dissect the perceived risk/benefit structures and their possibility of attitude changes around MCD

Our studies will be divided into three parts as follows: First, based on survey data (n 60), we analyze the perceived risk/benefit structures and their determinants—i.e., ideology, knowledge, trust and stigma—around MCD. Second, to know the possibility of attitude change, in the survey experiment, we provide, to the respondents, the various persuasive stimuli—e.g., mitigating the perceived risk, increasing the benefit, building up the trust, providing the knowledge and attenuating the negative stigma, all of which are related with MCD. We compare the original risk/benefit structure with them which are measured after giving those stimuli. Third, we analyze the cause of attitude change—acceptance reactance—and non-change, responding to the intended stimuli.

Kim HJ (Ajou University South Korea); Kim Y

A maze in risk: Analysis of Government's Dilemma in Managing the Real-estate-Bubble Crisis in Korea

The goal of this paper is to propose a risk management model by analyzing Government's Dilemma in managing the real-estate bubble crisis in Korea.

Today, many countries are expected to undergo the real-estate bubble crisis. The collapse of bubble will causes financial crisis and deflation. For this reason, what is important for government is risk management about real estate bubble crisis. Government has to settle down the bubble economy by using risk management. It is impossible for government to risk management of real estate bubble without stabilization of real estate price. But in doing that work, government has dilemma in stabilizing the real estate price. For example, if the Government were to strongly regulate the mortgage loan to stabilize the real estate price, the real demand of housing will be reduce and economy will be depressed. Also, if the government were to increase of housing supply, it causes boom in development area.

In this paper, we will show such dilemma what government faces in the case of Korea government from 2003 to 2006. Based on a qualitative method of interviewing to government officers who may be concerned, we show that (1) How government manages such dilemma; (2) what is the result from government's dilemma and, (3) what is the factor influence the management of dilemma. In conclusion, our study is revealed the model as a means of risk management by government.

Kim S (Ajou University South Korea); Seo HJ; Pak SB

Does Value Matter?: The Difference and its Effect on Risk-Benefit Perception among Expert and Public

Our research analyzes the role of values in judging risk-benefit perception about technologies. There are a lot of researches over the differences between expert and public or lay persons. Those have tried to accept or deny the differences in risk judgment between expert and public. However, they have shortcomings as follows: First, as a lot of studies tried to reveal the result side corresponding to the degree of the expertise, they disregard the cause side of expertise. Second, as stressing too much on not distal variables, but proximal variables, e.g., the risk characteristics, they have dismissed the more fundamental variables to determine the risk perception, such as value, belief, ethics and religiosity.

Our researches will show the value's role in risk perception toward technologies by analyzing the survey data which include experts (n'9) and lay persons (n=000). The values as testing variable include Religiosity, Cultural Biases (Hierarchy, Individualism, and Egalitarianism), Materialism/Post-materialism, Environmentalism, Ideology, and Science Skepticism.

We will find out, first, the value's effect on perceived risk-benefit toward five general technologies and eleven specific applied technologies, highlighting the difference between experts and the public. Second, specify the difference among experts those are generally regarded as value-free social groups. Third, analyze how 'the different values' influence the risk judgments. In short, our study will show the significant roles of value in risk judgment toward technologies.

Kim T (Ajou University South Korea); Kim H

The Empirical Survey about the Effect of Personal Risk Characteristics on Credit Information Management

This paper empirically analyzes the people's credit information management behavior, which especially related to their risk sensitivity to the future's uncertain accidents like financial distress or personal bankruptcy. The management of one's own credit information allows consumers to lead the better economic stability by preventing the future financial distress and reducing the personal bankruptcy risk.

Traditional economics' model, generally, assumes that people make the decision about whether or not they use the private credit information services, for the sake of managing their credit information, after considering its expected benefits and costs. This model also expects that consumers—i.e., the bad consumers, who have higher risk of the financial distress or personal bankruptcy—have more incentives to take the credit information services because they will gain a larger extents of economic benefits from managing it. However, we argue that there are other structural risk characteristics—i.e., the risk sensitivity about the future's financial distress or personal bankruptcy, the degree of moral hazard, and cognitive dissonance behavior—influence the consumer behavior patterns differently to manage the credit information.

We will test those propositions by analyzing the survey data (n 0). After dividing the respondents into good-credit and bad-credit groups, we show each group's tendency to managing the credit information. In particular, analyze how the risk characteristics relate to consumers' credit and influence the credit management behavior. Based on these results, we will retest the traditional model and suggest the policy agenda for credit information management, especially for bad credit groups.

Kollanus V; Knol A; Tainio M; Kunseler E; Leino O; Tuomisto JT

The Impact Calculation Tool (ICT) – A Model for Quantifying Health Impacts of Environmental Exposures

Environmental health impact assessments require quantification of mortality and morbidity effects. Moreover, to evaluate and prioritise different exposures or policies aimed at mitigating these, health impacts need to be quantified in a comparable way. One method for this is disability adjusted life years (DALY). DALY combines mortality and morbidity effects into a single measure indicating the loss of healthy life years in a population. We developed a model, the Impact Calculation Tool (ICT), for quantification of environmental health impacts using the DALY indicator. In ICT, life table method is used for making population projections and quantification of life years lost due to premature mortality in alternative exposure scenarios. Life years lost due to morbidity are calculated based on the population projections, morbidity cases attributable to the exposure, and duration and severity of the outcome. ICT was developed with Analytica software, an! d it enables probabilistic impact assessment using Monte Carlo simulation. The model contains a user interface that allows the user to define assessment boundaries and input parameters and to estimate DALYs without advanced knowledge of the model technicalities. ICT will be released in the internet and made available to be used simply with a web browser.

Lee LK (Amiral Consulting USA); Lee KL

Risk Dynamics and Network Bottlenecks: Considerations in Enterprise Risk Management

Assessment of risk dynamics and organizational vulnerabilities, which can lead to surprises, broad-based failures, and missed strategic opportunities, is not explicit within the current ERM methodology. A qualitative examination of published surveys, industry case studies, and U.S. government audits, reveal opportunities to enhance the current framework and integration of ERM.

Rather than a check-list approach to ERM, we argue that an integrated systems approach must be emphasized to effectively guide synthesis of risk assessments and prioritization of actions to address both discrete event and systemic risks in large organizations. Non-linear risk consequences stemming from feedback loops, time delays, and resource and knowledge bottlenecks are sometimes ignored or underestimated due to lack of strategic clarity, too narrow a time window in risk characterization, linear approach to planning, and/or culture of reactive management.

An expanded ERM framework to address these synthesis challenges is proposed. Specific enhancements include the use of simplified network analyses and causal loop diagrams to assess relational dependencies and feedbacks which can help inform root causes, management options, and risk monitoring. In parallel, a system-level examination of bottlenecks in resource and knowledge flows can inform priorities in business process transformation and incentives coupling risk and knowledge management.

As the link between risk assessment and management is not trivial, we argue that effective ERM governance and accountability, as well as sustained benefits and integration, hinges in large part on the ability to drive a full contextual understanding of the portfolio of risks.

Leino O (National Institute for Health and Welfare Finland); Hanninen T; Priha E; Carrer P; Fanetti A; Jantunen M

Controversy in indoor air health risks: Formaldehyde and cancer – serious risk or a lot of concern for nothing?

Formaldehyde is a high-production volume chemical widely used in building materials, industrial processes and wide range of products. Volatility of the compound leads to release into air and high levels in indoor spaces. Formaldehyde was identified as a probable human carcinogen based on limited evidence in humans and sufficient evidence in laboratory animals in the US (NTP 2005). International Agency for Research on Cancer concluded recently that there is sufficient evidence for the carcinogenicity of formaldehyde in humans (IARC 2006) and consequently also in US formaldehyde was set under a re-review (ROC, 2010).

Traditionally linear no-threshold model has been applied for risk assessment of carcinogens and this approach has been widely used for formaldehyde, too (IRIS, 1991). Using exposure data from Finland, risk estimate calculated in the EBoDE-study (35 cases per year in 2005) would correspond to the total number of sinonasal cancers in the country. WHO working group for the air quality guidelines (WHO, 2000) and recent update for the indoor air quality guidelines (WHO, 2010, unpublished) conclude, however, that a threshold model would be more appropriate for formaldehyde due to the cytotoxic mechanism. When using the proposed thresholds (0.1 and 1 mg m-3) in the cancer risk model, the impact in general population (i.e. without occupational exposures) is significantly reduced or approaches zero.

Conclusions: Risk estimates for formaldehyde depends strongly on the possible safe threshold level and even though identified as a known human carcinogen, it is possible that the effects are negligible in real populations in Europe. Exposure data currently available is insufficient for estimating reliably the fraction of the population exceeding the threshold levels. Epidemiological methods should be applied to confirm the threshold in human populations.

Leino O (National Institute for Health and Welfare Finland); Pekkanen J; Hanninen T; Komulainen H; Kuusisto E; Priha E; Kauppinen T; Karjalainen A; Kurttio P; Hallikainen A

SETURI – a project for ranking environmental health risks in Finland

Exposures to hazardous agents in our environment pose diverse humans health risks. Estimating these risks individually is often a first step to understand the importance of a single agent. However, for an optimal decision-making process, policy makers need to be able to compare various risks quantitatively.

The national SETURI collaboration project with four Finnish research institutes aimed at ranking the most relevant chemical, physical, occupational and environmental exposures in Finland in terms of health impacts. More than forty stressors were included according to presumed public health relevance, possible high individual risk or due to public concern.

Depending on the type of available scientific data, three different calculation methods were applied: epidemiological (risk ratios), absolute risk (unit risk),

and registry data, where the cases have been directly identified. However, in some cases data available creates additional challenges and state of the art methods for the individual stressor calculation has to be utilized (e.g. noise, methylmercury and lead).

The number of annual excess cases of serious diseases (deaths, cancer and myocardial infarctions) ranged from zero to 1500 a-1 in Finland with fine particles, UV-radiation, occupational noise, radon, occupational dusts, ozone, environmental noise and second hand smoke forming the clearly distinctive top-stressor group with over 30 cases per year (listed in decreasing order of significance). The results were also calculated as excess lifetime risk of the exposed subjects. These two ways illustrate the effect on the public health and individual level.

Markon MPL (University of Ottawa Canada); Lemyre L

Governmental Risk Communication: An Experimental Investigation of Presenting Different Types of Uncertainty to the Public

There is much debate in the field of risk communication about the consequences of sharing with the public various sources of epistemic uncertainty about the existence of a risk, on the adherence to the message and the trust in the source. This experimental study tests the effects of communication of different kinds of uncertainty (1- divergence between experts; 2- contradictory data; 3- lack of scientific data; 4- no mention of uncertainty) in a governmental message communicating either the existence of a health risk and recommending taking actions to avoid the risk, or the non existence of a risk and recommending the status quo. Adults of the Canadian population (N B0) filled up an online questionnaire investigating their perception of a randomly assigned fictitious governmental message stating the existence (or not) of a risk associated to a substance supposedly found in the drinking water nation-wide. Messages varied across conditions in the ! degree and type of epistemic uncertainty. Analyses of variance contrasting public reactions revealed that mentioning the presence of uncertainty due to divergence between experts or in the data lowered the perception of risk, increased risk acceptability and decreased behavioural intentions to avoid the substance. In contrast, revealing uncertainty from the lack of data did not reduce adherence to the message. The implications of these findings for the presentation of epistemic uncertainty in risk communication are discussed.

Mauelshagen C (Cranfield University UK); Schiller F; Denyer D; Rocks S; Pollard S

Risk maturity models: accounting for organisational cultures

'Maturity models' are management tools used increasingly to control, benchmark and improve organisational capabilities in executing businesses processes, including corporate risk governance. Widely used to build confidence among Boards, insurance brokers and financiers and monitor progress towards better risk governance, a range of risk management maturity models have emerged in recent years. A research interest at Cranfield has been the extent to which such models reflect reality on the ground in organisations. Our previous work has developed the technical and explicit processes required for risk management [123].However we propose that the specific organisational context in which a process or framework is embedded, including intangible elements such as organisational culture, will determine its final efficacy [4]. Accordingly we are now looking beyond explicit processes, focussing on organisational culture and its effect on risk knowledge creation and use [567].To date, a! ttempts within these models to characterise and evaluate preventative risk management cultures within organisations have been empirically and theoretically incomplete, tending toward the 'auditing' of risk management infrastructure. Using qualitative analysis of semi-structured interviews followed by quantitative questionnaires we will identify socio-cultural attributes important to risk knowledge management in utility and government organisations. We explain the theoretical underpinning of this work and its relevance to risk governance.

Park C (Ajou University South Korea); Kim J; Kim S

The Specification of Affective Image's Role in Risk Judgement about Nanotechnology

This paper specifically analyzes the variant role of affect in the acceptance about nanotechnology which is one of emerging new technologies. Even though a lot of researches have focused on role of trust (Cobb & Macoubrie, 2004: Seigrist et al., 2007a), knowledge (Scheufele & Lewenstein, 2005: Kahn et al., 2008) and religiosity (Scheufele et al., 2008) in judging the perceived risks from nanotechnology, the affect or emotion—i.e., stigma or negative image—have been dismissed. In particular, very few studies (Seigrist et al., 2007b) have focused on affect's role in nanotechnology. However, affective image or feeling takes a role in directly or indirectly influencing the risk judgement (Slovic, 1999: Slovic et al., 2004: Peter et al., 2004).

We argue and demonstrate that affective image takes a significant role in determining the attitude toward nanotechnology. Based on survey data (n 60), our research topics will include the

followings, first, the role of affective image in determine the degree of perceived risk and benefits, in which we compare the relative explanation power of affective variables with traditional key variables in risk study, e.g., risk/benefit, knowledge and trust. Second, we specify the role of relationships between those affective images and other independent variables. In particular, affective image's moderating/mediating or interactive role between independent and dependent variables will be highlighted.

In short, we will find out the specific structural and variant role of affective image in risk judgement about nanotechnology.

Park SS (Ajou University South Korea); Cha HY

Risk and Politics: Conflicting Discourses on the Korean Candlelight Demonstration against the Import of the US beef

During the summer 2008, in Korea, there was a big-scale candlelight demonstration against BSE(Bovine Spongiform Encephalopathy), so called mad cow disease. The protest was the biggest one after Korea was democratized in 1987. It continued for 106 days from May 2nd until August 15th 2008, and millions of people took a part in the protest during the period. The catalyst of the demonstration was the Korea-US beef agreement.

The public wanted the Korean government to withdraw or revise the agreement because they thought that the agreement would expose people to BSE risk. However, the Korean government tried to persuade citizens that the agreement has a lot of benefit. One of the economic benefits is the increase of export toward the US in return for importing their beef. The government shifted the responsibility for the candlelight demonstration issue onto the public who distrusted their government. The rash report of the press and social mistrust of the government have aggravated people's image on BSE. Moreover, there are conflicting views among experts. According to some scientists, BSE might be caused by feed. Therefore, controlling the feed thoroughly, BSE rarely occurs. Other scientists stress that importing the US beef may dangerous because Koreans are genetically more vulnerable to BSE than Westerners.

Why did the public, scientists, and government have different standpoints? Why were the public so angry? What controversial scientific evidences were presented by Scientists? Why did bureaucrats strongly believe the safety of the US?

This research intends to examine the conflict discourses among government offices, scientists and general citizens. Each stakeholder has a particular mental frame to communicate the risk issue. The research tries to find structural factors in discourse—e.g., symbol, frame, language, image, and preference—, which have amplified people's fear of BSE.

Park S (Ajou University South Korea)

A Democratic Crisis: The Coexistence of a Low Turnout and a Vehement Demonstration

There are two mixed tendencies among the Korean electorate to participate in politics. The double movement of political participation shows both a low turnout in elections and an ardent support for demonstrations. In the 18th general election, held in April 2008, only 46.1% of the Korean electorate voted for their representatives. The record is lowest not only in Korean electoral history, but also in elections of the whole Asian countries in recent years. Contrary to the institutional political participation, unofficial one is active. The candlelight demonstration against the Korea-US beef agreement continued for 106 days from May 2nd until August 15th 2008, and millions of people took a part in the protest during the period.

Although, facing this phenomenon, it is hard to say that Koreans passive or active in political participation, it is easy to argue that the phenomenon is a signal of the crisis in Korean democracy. It seems that Korean people prefer violent ways of political participation to peaceful and institutional ways. Why does this happen? Many Korean scholars conducted their researches on this topic, and they agreed that there is something wrong with Korean democracy. Almost of those researches focused on institutional aspects, such as the electoral rule, the party system, and the structure of political power, or cultural dimension within which the electorate choose candidates on the basis their region or individual reputation.

This paper focuses on psychological factors which are the terms of political efficacy and party identification. People are reluctant to vote because of the distrust in Korean institutional politics and politicians. Instead, people believe that street protests are more effective in achieving their political needs than institutions. To explain why the electorate has and shows this kind of belief system and behavior, this paper will use the variables of "effective representation" and "government-citizen ideological distance" presented by G. Bingham Powell(2000), and "effective threshold" by Arend Lijphart(1994). Other variables, such as "support rates for ruling party" and "compulsory rule for voters to vote," will be also considered with the dependent variable of "turnout rate" by the regression analysis.

Redaelli, M (AFSSET France)

Impact of after-treatment technologies on nitrogen dioxide (NO2) emissions from diesel vehicles, and associated health issues

The use of diesel particulate filters (DPFs) is increasingly widespread. Various studies indicate that some technologies using an oxidation catalyst increase NO2 emissions without effects on NOx emissions. NO2 inhalation can increase bronchial hyperactivity in asthmatics and cause respiratory irritation and inflammation at high concentrations. This raises the issue of the impact in France of widespread use of DPFs on NO2 emissions and health.

Method:
- Assessing the impact of technologies and Euro standards on nitrogen oxides emissions, through the review of collected emission data, 300 for passenger cars (PC) and 70 for heavy duty vehicles, and a simulation of NO2 emissions from the French circulating car fleet from 2007 to 2014;
- Analysing nitrogen oxides concentrations in the ambient air;
- Comparing assessed NO2 exposure levels (current, prospective), for the general population and workers, with selected health reference values.
Main results:
- Oxidation catalysts have led to an increase in NO2 emissions from the car fleet. NO2 emissions are already an issue mainly due to Euro 2 to 4 catalysed diesel vehicles (without DPF). The prospect of reducing emissions over the coming years is extremely low;
- NO2 concentrations have tended to stagnate or increase near traffic since the mid nineties. The highest levels are recorded mainly within vehicle cabins;
- In the majority of the envisaged situations, NO2 levels to which PC users are exposed (general population, workers) exceed the reference values and can have toxic respiratory effects (especially in sensitive populations).
Recommendations have been developed for decision-makers.

Schaffner, D (Rutgers University USA)

Preliminary risk assessment Salmonella in formulated dry foods

This risk assessment was undertaken to assist food companies in managing the risks associated with formulated dry food products that do not support the growth of Salmonella. It has been specifically designed to contain components relevant to recent US Salmonella outbreaks and recalls, including the Peanut Butter Corporation of America outbreak, the Plainview non-fat dry milk recall, and the Basic Food Flavors hydrolyzed vegetable protein recall.

Specific model components include: serving size, weight of contaminated ingredient per serving, Salmonella cells per gram, the effect of negative test results on Salmonella prevalence, the effect of thermal processing on Salmonella in the dry state and the effect on storage time on Salmonella survival. A component of the model was also created to use the effect of environmental sampling test results to predict finished product risk. Estimated number of illnesses resulting from contaminated servings was calculated using the FAO/WHO beta-Poisson dose-response model for Salmonella. The risk model was developed using the Microsoft Excel add-in, @Risk (Palisade Corporation, Ithaca, NY).

Results show that even when foods are contaminated with very low levels of Salmonella, when millions of servings are simulated, hundreds or thousands of illnesses are predicted to result.

SendaY (Central Research Institute of Electric Power Industry Japan); Kosugi M; Tsuchiya T

Public Perception on Judgment with regard to Certainty of Health Information

When experts explain to the public about health effects of radiation, electromagnetic field, chemicals, etc., communicating uncertainty about health risk assessment is important. However, our previous research showed that the public hardly understands the scientific description about this uncertainty, although it does not include technical jargon. The purpose of this research is to clarify: the extent to which the public shares the experts' view about the judgment on certainty of health information; what judgment on certainty the public will make towards insufficient evidences for health effects. This clarification is a first step in investigating a method of communicating the uncertainty. We designed an internet survey for investigating: public perception on the experts' view derived from some literature; public judgment towards the research results which were evaluated as uncertain evidences for carcinogenicity by International Agency for Research on Cancer (IARC). We conducted the survey in February 2009, where 8,534 respondents, chosen from monitors of a survey company, answered. As for public perception, the survey results show that the public: 1) considers that the information from experts is more reliable than from ordinary people, and regards conference presentations just as reliable as peer-reviewed papers; 2) has little knowledge of research approaches (cell experiments, animal experiments, and epidemiological studies) for investigating health effects; 3) recognizes the possibility that the current research results might be reversed by a new one in the future. The survey results also indicate that public judgment towards uncertain evidences shows the relatively the same tendency of evaluation by IARC.

Skinner D (Cranfield University UK); Drew GH; Rocks SA; Pollard STJ

Addressing Uncertainty in a Weight of Evidence Framework

The frameworks used in the Environmental Risk Assessment (ERA) process (termed Weight of Evidence; WOE) aim to provide either a definitive course of action or information as to what additional research needs to be conducted for definitive conclusions to be reached (Chapman, 2007). Whilst the underlying mechanisms used throughout these systems vary greatly, they are all bound by the presence of uncertainties, such as bias and randomness (Ascough II et al., 2008). Better understanding of its influence on WOE frameworks enhances the reliability and clarity of the evidence base, allowing decisions to be made with a greater degree of confidence.

The presented work considers how policy and decisions were made in the specific case of Genetically Modified Organisms (GMOs) in food, both within the UK as well as Europe. The work assesses the performance of available techniques (e.g. Monte-Carlo simulation, fuzzy logic) used to deal with different types of uncertainties surrounding this area. Data submitted by organisations as part of the European Union (EU)-governed approval process is used to recreate the WOE ERAs with their inclusion. Further analysis is provided describing the success of existing EU legislation for risk management of GMOs, and highlights the areas for continued research to enable the inclusion of relevant uncertainty-coping techniques and processes in future legislation.

Song S (Ajou University South Korea); Kim J; Cha HY; Wang J

Knowledge or Feeling?: Its Effect on Risk Perception of Genetically Modified(GM) Foods in South Korea

The purpose of this study is to analyze the relative impact of knowledge and feeling on the public risk perception of GM foods. There are many researches about the role of knowledge in risk perception (House et al., 2004; Christoph, 2008; Knight, 2009). Recently, interest on effect of feeling in risk perception has been increased. But few studies have examined the role of feeling in risk perception (Townsend et al., 2004). In addition, no study has examined both knowledge and feeling's relative effect on risk perception.

Using the survey data (n=000), we perform the research as following; First, we measure the level of the public knowledge on biotechnology and GM foods. Second, we evaluate the public feelings such as dread and stress on risk of GM foods. Lastly, through the correlation and regression analysis, we analyze the relative impact of knowledge and feeling on risk perception of GM foods.

Through this study, we expect to find the structure of the public risk perception on GM foods. And through the analysis on the relative effect of knowledge and feeling, we can find definitely to the cause of agreement or disagreement of the mass on GM foods.

Ward S (University of Southampton UK)

Scoping risk analysis for best practice risk management

Analysis in common risk management practice is generally limited to identification and simplistic prioritisation of potential threat events. Analysis in best practice risk takes a wider, uncertainty management perspective and is properly integrated into a coherent and efficient risk management process.

First, a definition of risk as uncertainty about the attainment of objectives (as in the new international standard), has four important implications for analysis: setting objectives is part of risk management, performance and therefore risk are multi-dimensional, tradeoffs between different performance objectives should be addressed, and different stakeholders with differing objectives, will adopt different approaches to risk. Effective analysis must begin by addressing uncertainty in these areas in order to provide a sound basis for subsequent planning and option evaluation.

Second, effective management involves considering how to improve performance, not merely seeking to reduce or neutralise threats. This warrants attention to all significant sources of uncertainty about future performance without preconceptions about whether a source constitutes a threat or opportunity. These uncertainties may be related to relevant stakeholders, objectives, tradeoffs, 'risk appetites', particular events, knowledge, quality of estimates, or systemic effects. Understanding the implications of these uncertainties requires an appropriate combination of qualitative as well as quantitative analysis.

Third, effective management of uncertainty and risk also needs to be efficient, recognising the resources available for analysis and management, and recognising the limited quality of data. Thus analysis needs itself to be appropriately focused, and iterative, with progressively more detailed analysis employed only if it cost effective.

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