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2017 YEAR OF RISK

Sharing an Uncertain World: Lessons in Managing Risk

13-14 July 2017

The Geological Society, Burlington House, London

Abstract Book

Convenors

Lead Convenor - Glen Burridge (Glen Burridge & Associates)
Lead Convenor - Georgina Worrall (The Geological Society)
Co-Convenor - Sarah Gordon (The Geological Society/Satarla)

Conference sponsored by JLT

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15.20	**Workshop: How will climate risks change and how will you manage them effectively?** Chris Jones & Ian Sollom, Strategic Fit
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6.00	**Plenary session with session chairs**
16.45	**Conference Closes**

ABSTRACTS
(in programme order)

Why do natural disasters always take us by surprise? How science can help

Bill McGuire
University College London

Natural catastrophes, and in particular those at the most extreme end of the spectrum, still take us by surprise. This is a reflection of a number of factors including: an inadequate awareness of the hazard; poor understanding of the risk; a focus that is still skewed towards response; lack of political will, monetary support or technical expertise; ineffective engagement between the scientific community and other stakeholders; insufficient regard for scientific forecasts. Scientific expertise has a critical role to play in: identifying future potential disasters; reducing vulnerability; improving preparedness; diminishing the required response after disasters. These contributions are often compromised, however, by the fact that the importance of preparedness and the input of hazard and risk science remain insufficiently recognised by other stakeholders. As a consequence, expertise and information that can help reduce vulnerability, exposure, and the impacts of disasters, if and when they are realised, is not being accessed and/or utilised by many – if not most – 'disaster reduction organisations'.

Biography

Bill McGuire is an academic, broadcaster and popular science and fiction writer. He is currently Professor Emeritus of Geophysical and Climate Hazards at University College London. Bill was a member of the UK Government Natural Hazard Working Group established in January 2005, in the wake of the Indian Ocean tsunami, and in 2010 a member of the Science Advisory Group in Emergencies (SAGE) addressing the Icelandic volcanic ash problem. In 2011, he was one of the authors of the IPCC report on climate change and extreme events. His non-fiction books include *A Guide to the End of the World: Everything you Never Wanted to Know* and *Surviving Armageddon: Solutions for a Threatened Planet.* His current book is *Waking the Giant: How a Changing Climate Triggers Earthquakes, Tsunamis and Volcanoes;* ranked at number five in The Guardian's Top 10 'eco' books. Bill presented the BBC Radio 4 series, *Disasters in Waiting* and *Scientists Under Pressure* and the *End of the World Reports* on Channel 5 and Sky News. He has also contributed to countless other television and radio programmes and was consultant and main contributor for the lauded BBC *Horizon* films; *Supervolcanoes* and *Megatsunami - Wave of Destruction*, as well as for the BBC drama, *Supervolcano*. Bill writes for *The Guardian*, *The Times* and *The Observer,* and is a regular contributor to *New Scientist* and *Focus* magazines. He is currently co-presenting *Project Doomsday* with comedy duo, Robin & Partridge (various venues).

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Mega Trends and Emerging Risks: Forging Ahead in an Uncertain World

Dr Keith Smith
Lloyd's of London

Just as earthly forces act over time to change the geological landscape, so trends in society, politics and the fast pace of technological development drive changes in how we live. This address will present an approach taken to prepare for these changes by illustrating the work on emerging risks undertaken at Lloyd's; the World's specialist insurance market. The address will illustrate how Lloyd's adapts to these trends through work done in recent years, such as work undertaken around climate change and the pressure to shift away from a Carbon based economy. The address will also discuss some of the trends being addressed now, such as the rise in Cyber-crime and the growth in cities. To close, this address will highlight some of the new trends.

Biography

Keith original trained as an engineer back in the 80's and worked for the Plessey organisation in telecommunications for a number of years. With a keen interest in the management of risk, Keith has formally researched into the topic twice. Firstly for his MBA, looking at product liability and then later looking at the management of risk with close to real time information for his Doctorate. This later research leading to an approach to risk management he labels Risk Clockspeed. Now at Lloyd's, Keith is Manager of Emerging Risks and Research, which looks into emerging and poorly defined risks in support of the Lloyd's market. Keith is a Certified Fellow of the Institute of Risk Management (IRM) as well as being a former Director.

NOTES

Rolling the sky dice – how aviation deals with hazard and risk

Tim Atkinson
theiC limited

Drawing on three decades of experience in aviation, much of it at the cutting edge of accident and incident investigation, Tim Atkinson will explain:

- how aviation deals with hazard and risk
- the benefits and pitfalls of statistically-driven 'safety' in a data-rich environment
- the effects of individual, team, and organisational behaviour on risk management
- Heinrich and how he works against balanced decision-making
- what the compartmentalisation of safety means for your organisation, and how to guard against it
- the fight between technology and balanced risk-taking in high-reliability businesses
- the three things to do when you roll the dice and lose
- bad apples and fabulous apples - balancing blame and achievement

Biography

Tim Atkinson is a professional aviator, safety specialist, and accident investigator. His career has encompassed many years as an airline and business jet pilot and training captain, flying instructor and survey pilot, air traffic controller, and safety officer in one of Europe's largest airlines. In 2004 he joined the UK Air Accidents Investigation Branch, and during his twelve years in that role he investigated a wide range of accidents and serious incidents, working on several high-profile cases such as Air France 447 and Turkish 1951. A renowned lateral-thinker, he takes a particular interest in human and organisational factors and focuses on practical solutions to those problems which lie at the heart of catastrophe. His experience as Director of Flight Operations in a UK private jet company, and qualifications on a number of types of turbine-powered transport aircraft give him a broad and deep experience in civil aviation. Tim is still a current Boeing 737 and business jet captain, and consults on a wide range of aviation and safety topics.

NOTES

Understanding Weather and Climate Risk

Matthew Perry
Met Office

Weather events and hazards cause great impacts globally, affecting for example health and safety, agriculture, transport, water resources and energy systems.

Earth observation through data from satellites and station networks, combined with computional numerical modelling of the Earth system, are used to monitor the state of the atmosphere and forecast its evolution in time.

The climatological risk of impact varies spatially and seasonally, and understanding these patterns help society to manage risks through preparedness. For example, spatial mapping of the risk of operational hazards allows equipment and infrastructure to be designed and tested to operate safely in these conditions.

Short-term forecasting of hazardous weather events and the communication of these forecasts enables warnings to be provided. Projections of future changes in the climate can inform planning decisions, allowing society to adapt to the changes.

Biography
After gaining a BSc in Geology and Geography from Keele University and an MSc in Environmental Statistics and systems from Lancaster University, Matthew joined the Met Office in 2001 and was involved in developing climatological datasets for the UK. Since 2008, his focus has been on applying science to help customers understand and address the weather and climate risks which affect their business, and he has worked on projects across sectors such as energy, transport, mining and defence. He has recently returned from a 2 year secondment to CSIRO in Australia where he carried out research into meteorological aspects of solar energy.

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Panel Session: Communicating Geoscience Risk

Panellists (to be confirmed):
Laurance Donnelly, Arup
Glen Burridge, Glen Burridge & Associates
Ken Stewart, People Development Partnership

In the past, there have been good and poor examples of how geoscience information is communicated to end users throughout the world. This includes other geoscientists, civil and geotechncial engineers, mining engineers, investors, lawyers, insurers, police, members of the public, politicians and the media. Traditionally, geoscience information is communicated in the form of geological maps, memoirs, scientific paper and technical reports or verbally, with various levels of success. The failure to effectively communicate geoscience information may have serious consequences on a project or community. In extreme cases, loss of life and financial losses may result. Geoscientists are not conventionally trained in the skill of communication, it seems to be a capability that develops throughout a geoscientist's career. However, a basic understanding of the art and behavioural aspects of communication could significantly aid the ability of a geoscientists to communicate. Since communication is a skill it can be learned, and there is available geoscience and other scientific guidance on effective communication. Communication may often be compounded by for example; language, cultural, political and historical barriers. Other forms of communication, such as social media and digital techniques including Geographic Information Systems (GIS) can facilitate communication and help convey visualise the complexities of geology. However, in an attempt to be transparent and open, could the real time communication of geoscience data and information via social media and interactive web sites lead to misinterpretation? In the author's experiences, there is no substitute for 'face-to-face' meeting and direct, proactive, client or community engagement. In this situation, due consideration must be given to how to engage with an audience, communication channels available, format, venue and body language. The information may then be dispatched and transferred in a manner that is understandable, without the use of technical terms and jargon. When the public and stakeholders are empowered if they are informed about a geohazard and the levels of associated risk, they may become better placed to understand, manage and mitigate the risks. The recipient of geoscience information should be given the opportunity to provide feedback and ask questions. Future issues that are likely to require effective communication includes for example; geological hazards, climate change, flooding, energy sources, nuclear waste and shale gas exploration. Is there a requirement for more authoritative and professional guidance and protocols on communication in geoscience and who is responsible for producing these? The objective of this session is to explore and discuss communication in geoscience, and to promote debate.

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Panel session: Decision making under uncertainty in complex emergencies: what can volcanologists learn from other disciplines?

Panellists:
Major-General (ret.) Mungo Melvin, Royal United Services Institute and King's College London
Tim Atkinson, theIC Ltd

Chair:
Simon Day, University College London

Before, during and after volcanic eruptions, volcanologists commonly find themselves advising a variety of decision makers on the basis of the uncertain results obtained by instrumental and other monitoring of potentially precursory phenomena to potentially highly destructive events, interpreted in the light of hazard mapping and modeling whose applications to a developing emergency situation themselves introduce more uncertainties. Nevertheless, the potential for sudden and widespread destruction typical of many types of volcanic hazards means that mitigation of those hazards often requires anticipatory actions and therefore the making of key decisions on the basis of uncertain information and in time for the decisions to take effect before they are overtaken by rapidly evolving events. Since in most places volcanic eruptions are fortunately rare, institutional decision makers are unlikely to have faced such decisions before in their professional careers. In practice, a combination of rapid learning under the pressure of events and the application of training and experience in other types of emergency decision making often allows these decision makers to "muddle through" with a large degree of success: a pattern exemplified by events during the 1991 eruption of Mt. Pinatubo in the Philippines when many key decision makers had backgrounds in engineering, aviation and the military (and sometimes two or three of these).

Perhaps surprisingly, no systematic post-event studies have been carried out on how these and other decision makers coped with the unfamiliar situations in which they found themselves, and on how well their decision-making was supported by information from volcanologists. This panel discussion addresses this problem from the other direction by considering the nature of time-critical decision making under uncertainty in the fields of commercial aviation safety and military operations, and attempting to draw out some general lessons that can be applied to emergency management in volcanic eruptions and other complex geohazard events. Potential topics include the trade-offs between timeliness and certainty of decision making, the importance of the potential costs of anticipatory decisions in determining the levels of acceptable uncertainty in the information upon which the decisions are based, the influence of prior knowledge and experience upon decision-makers' interpretations of unfamiliar information, and the relationships between providers of information (such as volcanologists) and the decision-makers who use that information.

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Workshop: Rebranding our planet

Scott Leonard
The Champion Agency

We build brands for a living. But when it comes to emotional attachment, the one brand that gives us life – Earth – gets overlooked. This workshop takes a big-picture, interactive approach to rebranding our planet.

Geology might have started out as a sport, but it's now got a critical role to play in all our futures. Yet we still use unemotional words such as climate change to describe how humans have plundered the planet. Tomorrow's language has to be far more emotive. Every human needs to reconnect with brand Earth.

Who do we target first? How do we reach them? What do we say?

Biography
First design commission at 16. Big Issue art editor at 21. Mother's first creative hiring – co-created Creative Circle campaign of the year and Advertising Grand Prix of the Year. Headhunted to Amsterdam and co-created the world's first branded, global multi-platform game. Moved to Wieden+Kennedy Amsterdam to run the Nike creative team across the Mediterranean. Back to London to become the brand guardian for Wanadoo, then creative consultant at Momentum Films. Wrote the poster Make Tea Not War that is now part of the Victoria & Albert museum collection. Lead creative St Luke's, helped set up Albion London and then Creative Director at DNA. Joined Ogilvy & Mather as Associate Creative Partner, developed two documentaries at More 4 and created the first personalized, digital billboard in the UK. Global Creative Director for Berghaus and Brand Director for Pfizer UK. Resigned to become Brand Director at Streetcar; successfully transitioning it through to Zipcar. Mentor on the Google digital experts programme. Founded The Champion Agency in May 2012 – the UK's only creative agency and social enterprise championing young creative talent. Guest speaker at King's College London, On Purpose, Social Enterprise UK and School for Social Entrepreneurs. 02 Smarter 100 winners 2014 out of 4.9 million SMEs in the UK. 2015 invited to join the Royal Society of Arts fellowship for achievements championing young creative talent. 2016 Brand master class trainer at Virgin Start Up.

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Military Risks: The paradoxes of likelihood, proximity and deniability

Major General (ret'd) Mungo Melvin CB OBE MA
Senior Associate Fellow of the Royal United Services Institute;
Senior Visiting Research Fellow of the War Studies Department of King's College London

Before military decisions are taken at the tactical level it is normal practice to conduct an 'estimate of the situation' that includes both terrain and threat analyses. Hence questions such as '*what* the enemy could and might be expected to do' over a particular piece of ground figure prominently, typically generating 'most likely' and 'most dangerous' courses of action that address the '*how*, the *when* and the *where*?' Proximity of an enemy in time and space, however, may not drive necessarily the best overall decisions in any campaign. Moreover, at the operational level of war that nests between the tactical and strategic, the greatest risk to own forces, may often lie in more distant threats. Perversely, if such dangers appear too far away in perception, place or impact they risk being denied at the strategic level. Over time the attendant risks may well compound in an alarming manner but remain unaddressed – potentially being justified on the grounds of expediency.

Using a number of historical examples, including those drawn from his recently published study, *Sevastopol's Wars: Crimea from Potemkin to Putin* (Oxford: Osprey, 2017), Mungo Melvin will explore the complexity of military risk analysis within a geostrategic context. Furthermore, he will attempt to demonstrate that militaries often fail to learn from their mistakes, and remain highly vulnerable, as do their political masters, to their opponents' surprise and deception. Potentially most dangerous remains a policy of only taking seriously the risks that one can *afford* to address without changing priorities. In such circumstances, the conflict that has yet to commence may already have been lost.

Biography

Major General Mungo Melvin CB OBE MA retired from the British Army in December 2011 following a career of 37 years in the Royal Engineers and General Staff. He then served as a specialist adviser to the House of Commons Defence Committee until April 2017. From 2012 to 2017 he was President of the British Commission for Military History. He has recently been appointed as the Chairman of the Royal Engineers Historical Society and as Vice President of the Western Front Association. He is a Senior Associate Fellow of the Royal United Services Institute and a Senior Visiting Research Fellow of the War Studies Department of King's College London.

Mungo Melvin's biography, *Manstein: Hitler's Greatest General*, was published to critical acclaim in 2010, and was awarded as the best military biography of the year by the United States Society for Military History in 2012. As the British Army's senior advisor for the First World War centennial commemorations, he edited the Army's *Battlefield Guide to the*

Western Front of the First World War (2014). Mungo's next major work, *Sevastopol's Wars: Crimea from Potemkin to Putin* was published in April 2017.
Mungo Melvin plans and runs a wide range of battlefield studies for both civilian and military audiences. He takes a keen interest in the impact of terrain on the planning and conduct of land operations, and not least on the design of fortifications.

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The value of expecting the unexpected: hazard awareness and the mitigation of tsunamis and megatsunamis in the absence of scientific consensus

S. J Day
University College London

We are most vulnerable to those events and threats that we do not expect, precisely because we do not expect them and therefore do not prepare ourselves to resist them. This ancient principle of human conflict also applies to disasters triggered by natural hazards. Evidence from recent and historic tsunamis indicates that awareness of the potential for tsunamis to strike in a particular place has such a dominant effect on our vulnerability to them, that the lifetime probability of dying in a tsunami on a given coastline may actually increase with decreasing frequency of their occurrence on that coastline. This is the opposite of the relationship that we expect, as a result of our usual assumption that the risk equation is linear, but examination of the behavior of people in tsunami inundation zones provides an understanding of why it is so.

In traditional coastal communities in Papua New Guinea and other parts of the South Pacific and SE Asia where any one piece of coastline is typically struck by tsunamis at intervals of the order of a human lifespan (~ 50 years), awareness of the warning signs that a tsunami is about to strike is high, and traditions of self-warning and precautionary action ("constructive paranoia") are strong. As a result, tsunami self-warning and voluntary evacuations at community level are swift and generally highly effective in these communities.

Similar awareness and traditions of self-sufficient warning and action were tragically lacking in more recently arrived, migrant and transient communities that were struck by the 2004 Sumatra-Andaman tsunami and experienced high mortality rates. Photo and video evidence indicates that tourists and others caught up in the 2004 tsunami who had no prior expectation that such an event might occur and no capacity to recognize its warning signs, experienced disorganized and inefficient processes of observation, (dis)orientation, decision and action that can be analysed using a one-sided version of the Boyd loop theory of decision-making in human conflict. In many places, disorientation and consequent indecision seems to have increased mortality rates. Likewise, survivor interview surveys after the 2011 Tohoku tsunami indicate that misorientation, due to unfounded expectations of the effectiveness of coastal defences and vertical evacuation structures in the face of an unexpectedly large tsunami, was a significant factor in the actions and inactions that led to the deaths of many people in that disaster. Carefully designed awareness education, integrated with warning signs and systems, is needed to avoid repetition of such disorientation and misorientation in future tsunamis.

The critical importance and low capital cost of hazard awareness as a tsunami mitigation strategy has implications for the controversy around the hypothesis of transoceanic megatsunamis generated by giant lateral collapses at ocean island volcanoes. Although large epistemic uncertainties exist around this hypothesis, such that it is difficult to use it for

other mitigation strategies such as coastal land use restrictions, public awareness of the possibility of such events is a prerequisite for effective anticipatory mitigation of them in the future.

Biography

Simon Day is currently a research associate in the Institute of Risk and Disaster Reduction, Department of Earth Sciences, University College London. At UCL since 1997, he has also (2004-2006) been an associate researcher at the University of California at Santa Cruz. Prior to 1997, he held posts as research fellow, Cheltenham & Gloucester College of Higher Education (1994-1997); research assistant, University of Bristol (1993-4) and as Departmental Senior Demonstrator, University of Liverpool (1989-1992). He has over 20 years of research experience including field investigations on volcanoes in the Canary Islands, Cape Verde Islands, South Sandwich Islands and in Papua New Guinea, and of geological evidence for tsunamis in Papua New Guinea. Aims of this research work have included the mapping and characterization of volcanic hazards; investigation of physical processes of volcano deformation and collapse; the development and testing of tsunami models, focusing on the generation of tsunamis by volcano collapse landslides and also other types of landslide; and investigations of the roles of traditional knowledge and awareness education in shaping risk perceptions and choices of mitigation strategies for tsunami, volcanic and other hazards.

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Someone Has To Love Them

Colin Stevenson
Crocodiles of the World

Conservation sometimes bites back! In some parts of the world, crocodile numbers are increasing due to successful conservation programs. Now, people that live in such areas are questioning the wisdom of protecting these dangerous wild animals. Similarly, working with crocodiles and alligators in zoos seems not the most sensible career move to most people. These two areas are tied together in many ways, but there are most definitely measures that can mitigate against the risks associated with crocodiles. We'll investigate how we can work safely with crocodiles, and the use of technology in helping ensure that people can live with crocodiles.

Biography
Colin Stevenson is a crocodile biologist, and has worked with these incredible animals in Australia, India, and here in the UK. He is a member of the Crocodile Specialist Group within the IUCN Species Survival Commission, and a member of the IUCN Commission on Education and Communication. Colin is currently the Head of Education at Crocodiles of the World – the UKs only crocodile park.

NOTES

The Role of a National Geological Survey in understanding and modelling geology to better inform the design of the built environment?

Katherine Royse
British Geological Survey

What is the remit of a Geological Survey in collecting, analysing and disseminating geo-environmental information for the built environment? The ways that the British Geological Survey present and communicate this information to the user community has changed significantly in recent years due to an increasing awareness of the impact of natural hazards on society at large. Environmental hazards become disasters as a result of the risks and vulnerabilities that people are exposed to. They are typically compound processes that must be understood in context. Within the built environment there is a growing awareness that as well as understanding the distribution and severity of individual hazards in relation to key assets, it is crucial to understand the interaction between multiple hazards and how their combined effects can exacerbate those impacts. Understanding these interactions means asset owners can begin to identify assets under threat and prioritize areas where mitigation is most needed.

The core function of a national geological survey is to apply science to meet the needs of society. In this it is important to be flexible and innovative in the way that the Survey's data and information technology are exploited. Recent developments in this respect include the establishment of the National Hazard Partnership, a consortium of public bodies which exchange knowledge, ideas, expertise, intelligence and best practice with the intention of providing timely and consistent advice to government and emergency responders for civil contingencies and disaster response. Another example is the Survey's GeoSure insurance product, which provides information specifically for the insurance industry in relation to natural ground instability. The importance of communicating risk and uncertainties is becoming increasingly important but how should we display this information? Using words without numerical reference points can be misleading but care must be taken to use common language and recognise that information will inevitably be communicated by the media in sound bites.

Biography

Dr Katherine Royse is the Science Director for GeoAnalytics and Modelling at the British Geological Survey (BGS). The Directorate develops novel methods and techniques to gain added-value from BGS's data holdings; using a trans-disciplinary approach to produce models that explain, explore and predict the Earth's response to natural or human induced environmental change. Her research at BGS has focused around the development of 3D geological models for decision support and hazard mitigation in the urban environment. She is a trustee and council member of the Geological Society of London. She is also a member of NERCs Innovation Advisory board providing advice on how best to translate environmental knowledge and data into new value adding approaches, tools and solutions.

In 2010-2014 she held a NERC KE Fellowship for which, she has lead a team in the development of a linked Groundwater Catastrophe model which won an OpenMI association award in 2012. This year the directorate has been recognised by the Praxisunico/RCUK Impact awards for its novel approach to innovation and communication of geoscience information to the wider user community.

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How do geoscientists in the construction industry handle project hazard and risk?

D.T. Shilston
Atkins

The lecture will explain how hazards and risks are perceived in the construction industry and the skills, tools, technical resources and approaches that geoscientists bring to bear. The geoscientist's role in the identification of hazards and the management of risk will be described from regulatory and practical project perspectives.

One can, of course, learn from projects that had problems, and indeed from (thankfully) rare disasters; but useful lessons can also be learnt from projects that identified hazards and risks and handled them successfully. Using examples of where things have gone well and not so well, the lecture will explore and illustrate the keys to success in typical construction projects, large and small, from initial planning through to final construction: the project programme, the use of appropriate staff and how they work together, the acquisition of information and its timely assessment, the use of feed-back-loops, and so forth.

Looking to the future, the lecture will discuss current and imminent trends and changes that have the potential to alter how hazards and risks are handled in the construction industry, some being to the good and some being less so.

Biography
David Shilston more than 35 years' experience of civil engineering and geological projects in the UK and many countries overseas. David is an Atkins Fellow and Professional Head of Discipline for Engineering Geology at Atkins.

In addition to his general working knowledge of civil engineering, geotechnics, geology and geomorphology, David has specific expertise in the assessment and management of geohazards, including problems encountered during the construction and operation of projects, landslides & erosion, collapsing ground, and seismic hazards.

David is currently President of the Earth Science Teachers' Association and is a former President of the Geological Society.

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Enterprise Risk Management of Geo-Environmental Hazards on Rail Infrastructure: Theory & Practice from Network Rail's Western Route

Mike Gallop
Network Rail Director Route Asset Management: Western Route

The Western Route of Network Rail traverses the Thames Valley, West Country and South West Peninsula of the UK linking London (Paddington Station) and Penzance via Reading, Bristol, Exeter and Plymouth. The railway line was designed by IK Brunel and contains numerous iconic engineering structures. Linespeeds and intensity of train services are generally high with 125mph operation between London and Bristol and 110 mph between Bristol and Exeter.

The line is subject to a range of significant geo-environmental hazards including:

(i) Seacliff erosion and marine flooding between Exeter, Dawlish and Newton Abbot
(ii) Large scale cutting and embankment failures in cohesive soils
(iii) Rockfall and rockslope failures in cuttings
(iv) Major flooding risks associated with river catchments such as the Somerset Levels and the Thames
(v) Groundwater Flooding from Chalk Aquifers
(vi) Spontaneous combustion of embankments formed from coal waste
(vii)

Network Rail utilises Enterprise Risk Management tools to manage the complex suite of geo-environmental risks it faces on Western Route. Inputs to the Enterprise Risk tool include extensive site inspection (both visual and intrusive), remote condition monitoring and a significant capital investment programme of renewal and refurbishment of life expired or problematic geotechnical assets.

A hierarchy of risk management tools is used to manage Geotechnical and Drainage Assets against the corporate Network Rail appetite for risk – this being defined through a series of risk outcome scenarios. The hierarchy of risk has been developed against each asset and how each asset group is managed within the context of safety, operational criticality and operational performance.

The Paper will describe the Enterprise Risk Management tools utilised by Network Rail; the process by which risk is identified and placed in a hierarchy of risk; and real-time geo-environmental risk monitoring and management. A series of case studies from Western Route showing how Enterprise Risk Management theory and Risk Management Tools are applied to real life geo-environmental hazards will be described.

Biography

Mike is Director of Route Safety and Asset Management for Network Rail's Western Route. He leads a team of Asset Managers managing a diverse and extensive railway infrastructure which extends from Paddington to Penzance.

Within his portfolio Mike is accountable for the condition and performance of all asset types on the Western Route including drainage, flood defence and coastal assets.

By profession Mike is a Chartered Geologist and holds a PhD in the geotechnical behaviour of Quaternary soils. Prior to joining Network Rail in 2006 Mike worked in the Consulting Engineering and Utilities Sectors delivering a range of Infrastructure and Asset Management Projects.

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Innovating a New Kind of Modular Reactor Power Station Design

Paul Smith
Arup.

Our world is radically changing.

The way we do engineering must also change, mitigating and protecting against future emerging risks. Our challenge is to develop new kinds of nuclear reactors that are fit for the future and ultimately safe.

We have to mitigate and adapt to the impact of climate change, while supporting a growing population in denser localities, all being vulnerable to increasingly severe climate and weather extremes, with many coastal regions becoming defenseless against global and local sea rise. The area of useable land for habitation and supply infrastructure will diminish as the years continue into the future; this especially being a critical problem for low lying islands, but also for highly developed countries where there exists complex and tightly coupled infrastructure close to sea level. Accepting that nuclear power generation is important for our future, the reality of whether countries can afford the considerable capital cost of providing safe nuclear power is presently questionable.

The practice of design for new kinds of nuclear power should apply completely new and innovative thinking that enables lower capital cost, more efficient power generation and highly robust and ultimately resilient civil containment and support structures. Allied design considerations will be reducing the time for carrying out the build and construction process, reduced operating cost, improved through-life operability with less dose risk etc. Of major concern is new kinds of reactor that are efficient, but also robust and resilient in the face of climate change and sea rise.

Biography

Paul left school at 16 to follow a 6 year indentured mechanical engineering apprenticeship with SKF bearings in Luton. That was in 1972. In 1973 he nearly cut off his thumb when working on a large band-saw! Suffice to say that he survived, with SKF training him to become a “toolmaker”. But Paul wanted to strive to do better. After doing his ONC, HND and CEI examinations, Paul managed to get into (at that time) Cranfield Institute of Technology, to try and get a Masters in Materials Science. He eventually managed to scrape through, after five years gaining his Ph.D. in Fracture Mechanics and Failure Analysis. But in 1983 there was a very bad recession. There were very few jobs. Paul emigrated with his young family to South Africa, to work for ESKOM. It was while in South Africa that Paul realised how little he knew. Coal, hydro-electric, gas turbine and nuclear power station engineering was where Paul started to learn “his ropes”.

In 1987, for personal reasons, Paul and his family returned back to the UK, and started working for the National Nuclear Corporation at Booths Hall, Cheshire, carrying incredibility of failure analysis on the Sizewell Class of PWR. But, again, life tempted fate with only Sizewell B happening. Then by chance, with Paul's Cranfield knowledge, Nuclear Electric's independent inspection agency in Barnwood asked Paul to perform non-linear finite element analysis on the 1/10th scale model structural test of the Sizewell B secondary containment structure. Using his past knowledge of engineering, materials and failure analysis. Thereafter, Paul carried further research studies on various safety-critical structures forced to destruction, trying to better understand their ultimate behaviour and complex failure mechanisms.

In 1996, Paul went to the Devonport Royal Dockyard as one of their key independent peer review assessors, reviewing the nuclear related safety cases produced for the Royal Navy's nuclear submarine fleet. Paul's experience ranged from Swiftsure, Trafalgar and the Vanguard Classes of submarine. In 2002, Paul was mad nuclear facilities Chief Engineer, specifically for the D154 project to upgrade Devonport's old Dreadnought battleship docking facilities. Paul left Devonport in 2006, looking to diversify his career, possibly getting involved with the UK's nuclear new build programme. For three years Paul was seconded to EDF in Paris working on adaptation of the Areva EPR for the UK, based at EDF CEIDRE in Saint Denis. Paul's career was to suddenly change yet again, triggered by the Fukushima Daiichi accident in Japan and the ramifications for the nuclear industry and the world as a whole.

After the Fukushima Daiichi accident Paul joined Arup. And Climate Change became a concern around about the same time. At Arup, Paul found a more amenable reception to his ideas of how to look at risk in the modern world. For many years, Paul has presented new innovative approaches to model failure, disasters and accidents, looking at sever accidents, extreme hazard-shock events accounting for future climate change, and how to design for future risk reduction, robustness and socio-technical resilience. Now Paul is trying to forge new ways of looking at design and engineering into the future, accounting for complexity of this risky world and how to adapt it.

NOTES

Forensic Geology Front Line Operation Services for Police and Law Enforcement Investigations and the Evaluation of Associated Risks

Laurance Donnelly
Chair, International Union of Geological Sciences, Initiative on Forensic Geology (IUGS-IFG)
Arup

Forensic geologists provide services to the police and law enforcement by examining crimes scenes, collecting and analysing geological trace evidence to determine if there could be an association between different items or a suspect, and searching for graves or buried and concealed items related to homicide, organised crime and counter terrorism. Police and forensic geology investigations may be regarded as high risk, although the levels of risks will vary considerably depending on the dynamics of each crime scene or search area. In a police and forensic geology context, and for the purposes of this paper, risk may be regarded as; an emerging uncertain event or condition that if happens would impact on the individual or organisations. Threats are non-specific with no particular cause highlighted (modified after UK Police, 2016). The types of risks a forensic geologist may have to evaluate include; occupational health, safety and security and well-being of colleagues and the public, cross contamination of a crime scene or item under investigation, forensic recovery, interpretation of geological trace evidence, provision of a high assurance search stagey for a burial, dealing with uncertainty, effective communication, presentation of evidence in court, regulation and accreditation, commercial and contractual, financial accountability, press and media management, dealing with the public and victims' of crime family members, physical and mental consequences of trauma, hostile experiences, emotion, ethical dilemmas, short time frames and protection of reputational damage. Conventionally, geologists are not trained in forensic science and policing and this is an important risk that must also be managed. Some risk management standard operating procedures (SOP) have been written by the police services, however, these have been largely written by the police for the police. Risks can be effectively managed by a forensic geologists, working in collaboration with the senior investigating officer (SIO), police search adviser (PolSA) or crime scene manager (CSM) in the preliminary stages of an investigation before crime scene examination or a search takes place. The risk management process may be quantitative and qualitative, and this generally comprises four stages. Firstly, the risks must be identified to determine what they are, if and when they may occur, and could they prevent the objective or service from being achieved. Secondly, the risks are assessed to evaluate the level of risk using a risk assessment matrix and/or by stress testing, where appropriate. Thirdly, risks are managed in one of five potential ways; tolerate, treat, transfer, terminate or take an opportunity and exploit the risk presented. If a risk is treated or opportunity taken a risk mitigating plan is required that may be strategic (i.e. what is the plan) and tactical (i.e. actions, activities and resources required). Fourthly, the risks are monitored at a time interval and with resources deemed to be appropriate. This paper is based on the personal experiences of the author and do not necessarily represent the views of others or other organisations. This paper provides an overview of risk management in forensic geology, however, further research is required and professional guidance is

recommended to aid and assist forensic geologists who provide front line operational services to policing and law enforcement.

Biography

Dr Laurance Donnelly is a professional, chartered geologist, with a First Class Honours Degree (Applied Geology & Mineral Exploration) and a PhD (Geohazards). He has 28 years' experience throughout the UK and world-wide in; mineral exploration, geophysics, geomorphology, mining, engineering geology and geohazards. He works with Arup and previously worked with Worley Parsons (Chief Geologist), Wardell Armstrong International, Halcrow, International Mining Consultants and the British Geological Survey. For 23 years he has been involved with numerous high-profile cases, in the UK and internationally, advising the police and law enforcement as a forensic geologist. In 2002, he was invited to Westminster Palace, Houses of Parliament, to give a presentation on Forensic Geology and the Moors Murders. In 2006, he established the Forensic Geoscience Group (FGG), of the Geological Society of London and served as its first Chair. In 2010, the International Union of Geological Sciences invited him to establish an International Work Group on Forensic Geology, which has evolved into the IUGS Initiative on Forensic Geology (IUGS-IFG), where he serves as the Chair. His forensic geology investigations has included collaboration with the UK police and UK Police National Search Centre, 'The Body Farm' (Tennessee, USA) and federal police in Colombia, Italy, Sicily, Moscow, Japan, Australia, UAE, Northern Ireland and Brazil. Currently is registered as an Expert Adviser (Forensic Geologist) to the National Crime Agency (NCA). He has approximately 230 publications and one book. Globally, he has pioneered new strategies to search the ground for burials related to graves, homicide, counter terrorism and organised crime. He is the recipient of awards for outstanding contributions to applied geology and forensic geology from; the Institution of Mining & Metallurgy, Geological Society of London, Geological Society of America and Russian Federal Centre of Forensic Science at the Ministry of Justice of Russia, in Moscow.

NOTES

Researching uncertainty – the NERC Centre for Doctoral Training in 'Data, Risk and Environmental Analytical Methods', DREAM

S.H.Hallett
Cranfield University

The Natural Environment Research Council, NERC, support a number of Centres for Doctoral Training (CDTs), providing PhD studentships aimed at addressing specific research and skills gaps identified by NERC and its partners. One such Centre is that in 'Data, Risk and Environmental Analytical Methods'. DREAM is established between Cranfield University, Newcastle University, the University of Cambridge, and the University of Birmingham, commencing in February 2015, it will have some 37 doctoral researchers combining excellence in risk mitigation science with cutting-edge big data interpretation across the environmental sciences. This presentation by Centre Director Dr Hallett, provides a summary of the journey of DREAM to-date in establishing a student-focussed centre of excellence, outlining the diversity of the academic research currently underway and being planned, and providing an assessment of the scientific excellence employed in the use of Big Data principles to improve our understanding of environmental risks and mitigation options across the NERC thematic priorities, and the role of Big Data in improving decision making.

Biography
Dr. Stephen Hallett is Director of the NERC DREAM Centre for Doctoral Training in Big Data and Environmental Risk (www.dream-cdt.ac.uk). He is Principal Research Fellow in Environmental Informatics at Cranfield University, with particular interest in using soils information in environmental decision making. His research interests examine the role of soil in agri-infomatics; land resource management; geohazards and urban infrastructure; and environmental risk mitigation and soil-related impacts of climate change.

BSc (Hons) MSc PhD SFHEA FBSSS

NOTES

A view on AI and risk

Philip Lindan
Withers LLP

No-one can have failed to notice the clamour and speculation about what the future will look like under the advance of AI into every aspect of our lives. AI gives us general tools that are capable of learning from experience and making decisions. But if we let machines take decisions then sometimes they will get it wrong. I will offer some thoughts on "who gets the blame" for a bad machine decision, and that will involve more than just pointing the finger at an errant algorithm. I will consider how to judge a machine decision, and that will draw in considerations of design, software, training, control and autonomy of AI systems. I hope to give both technical and legal perspectives and to show where some of the critical points lie in AI applications. If time permits I will explain some ways in which the nature of work itself might change with AI uptake, and what that will mean for traditional industries.

Biography

Before qualifying as a lawyer, Phil Lindan was a scientist raised on a diet of statistical and quantum physics, applied mathematics and computer simulation of materials. Now he works within employment law, with a special interest in helping 'sage' professionals – individuals with cumulative careers where intellect is the capital. He has acted for academics including those in senior management, healthcare professionals, scientists and technology specialist, lawyers and more. He is able to understand what his clients actually do and therefore how best to protect their interests.

NOTES

Earthquake Risk in the Alpine-Himalayan Belt

Philip England
University of Oxford

A stark contrast exists between earthquake risks in the continental interiors and those at the boundaries between plates. Relative to their size, earthquakes at plate boundaries cause few deaths: Nature nudges each society every few decades with a large earthquake and, in consequence, the hazards are recognized and societies have generally built effective strategies for mitigation. In contrast, the time interval between successive earthquakes at the same location within the continents is measured not in decades but in centuries or millennia, so societies' memories fade. In such places, there is little effective response to seismic risk, and moderate earthquakes kill tens of thousands, whereas comparable earthquakes at the plate boundaries kill few to none. This contrast in risk maps onto, but does not correspond exactly with, the divide between the developed and developing worlds: in earthquakes, the rich pay, while the poor die. The distribution of earthquake risk in the developed world is quite well understood, and billions of dollars annually are invested in its mitigation. This talk will give a brief review of the scientific, societal, and political challenges of earthquake risk in the developing world, and will question the wisdom of trying to meet those challenges with solutions derived from the developed world.

Biography
Philip England is Professor of Geology in the Department of Earth Sciences, Oxford. He works on many aspects of tectonics, including continental deformation, metamorphism, and the thermal and mechanical structure of subduction zones. Much of his work has been directed towards the dynamics of continental deformation, including several studies of the links between surface faulting and the motions of the deeper lithosphere.

NOTES

Understanding and managing cascading disasters

David E. Alexander
University College London

In the future world, almost all disasters over a certain size will probably be cascading events. In these, the consequences occur in a chain or dendritic form, or as 'toppling-dominoes'. The direct impact of the hazard may not be the principal consequence of the disaster, as nodes in the chain of effects can act as escalation points. Cascading disasters often occur in conjunction with compound, interconnected and interacting phenomena, from which the cascade, *sensu stricto*, must be distinguished. This paper presents a model of cascading disasters, in which the escalation points are explained as vulnerability loops which interact at various scales of time and space. Examples demonstrate how physical and social vulnerability loops escalate the prevailing crisis and create panarchy in the evolution of the cascading event. In cascades, interactions occur between types of critical infrastructure, and between scales of operation. They can cause vulnerability loops to multiply and make the consequences of the crisis bigger and more complex. Multiple physical hazards may also be at work. In other cases, there are multiple sources of vulnerability. A scheme to interpret cascading disasters as complex interactions between cause and effect, impact and vulnerability is presented, An intensity scale maps their geographical extent and duration, and their impact upon critical infrastructure. In a predictive capacity, the scale can help develop detailed but flexible scenarios. Scenarios constructed with a systems framework can be applied to real events from the past and real problems in which disaster is a likely future outcome.

Biography

David Alexander is Professor of Risk and Disaster Reduction at University College London. His books include "Natural Disasters", "Confronting Catastrophe", "Principles of Emergency Planning and Management", "Recovery from Disaster" (with Ian Davis) and "How to Write an Emergency Plan". He is the founding Editor-in-Chief of the International Journal of Disaster Risk Reduction. His research and teaching interests include natural hazards, earthquake disasters, culture and disasters, and emergency planning and management. David Alexander is Vice-President of the Institute of Civil Protection and Emergency Management and a board member of one other learned society and 13 journals.

Natural Catastrophe (NAT CAT) Insurance assessment - Taking out the Cat

Companies build factories and facilities to make money. To achieve that, they need to continue to operate in rain or shine, in fair weather or foul.

Wherever you operate in the world, you have to deal with the natural environment in that area and region. If your customers or suppliers are there, then you need to be there too.

But whether you are operating an oil refinery or a factory, or looking to build or extend a site or facility, there is a risk of weather conditions or other natural events affecting the site or its operations. This has risk, but it is the risk we accept when we work there. This is particularly true if this is being carried out in an earthquake prone area, on the flood plain of a river, or in other similar areas of natural catastrophic events.

While no-one hopes that there is damage from a natural event, such as windstorm or freeze, it can happen. There are normally designs to protect against likely events, but in the event of damage, companies protect against risk how they can. One of the ways of transferring risk is by insurance.

This presentation and Q&A session will look at some of the ways how natural catastrophe exposures are identified, and used for insurance purposes.
Brokers and insurers use information available on the locations to be insured to identify potential causes of loss, and structure an insurance programme.

Some of the information can be based on the address or post/zip code. Some is based on the occupancy of the site or buildings, and their construction and age. However, some of the information is obtained by physical visits to the site. These are normally carried out by technical specialists.

As risk engineers, we are tasked with attending operational and construction sites around the globe and reporting on the natural catastrophe exposures which the site could face. We look at a wide variety of the issues that could cause loss and mitigations (If any that have been installed, or are available by business continuity planning etc.) that can affect the sites.

Such reporting can assist in the placing of insurance, where such insurance is available.
The presentation will look at a range of issues and examples, to put both the context of the work and the ways in which better information assists.
Catastrophe cannot always be avoided but sometimes it can be mitigated against.

Biography
Paul joined JLT from Aon in July 2013 as Head of Energy Risk Engineering. This is to support JLT clients worldwide in the presentation of information for insurance purposes and

to assist in the development and implementation of client risk management and improvement programmes.

As an experienced Chemical Engineer, Paul has worked in risk management in the insurance industry for over 23 years. In this time, his main involvement has been with the hydrocarbon processing, utilities, energy industries, from an operational and construction perspective, and he has led cross-discipline teams of engineers and specialists.

He has extensive experience of the hydrocarbon processing and chemical industries including oil refining, petrochemical plants, LNG and a wide variety of types of chemical, fertiliser and plastics plants. He also has experience of oil and gas exploration and development. Clients he has worked with in these areas include major oil and petrochemical companies from around the world.

NOTES

Workshop: Navigating geopolitical & country risk

Tom Bacon
Protection Group International

The session will give an overview of key geopolitical considerations for multinational companies, both pre-investment and during operations. Using supporting material and case studies, the session will evaluate important geopolitical factors including regulatory risk, international sanctions, political violence & terrorism, civil unrest & industrial action, cyber threats, medical & infrastructure considerations, among others.

Corporate Boards increasingly recognise that understanding and managing geopolitical risks can provide companies with long-term advantages and resilience. This session will highlight how an understanding of geopolitical and country risk is vital in not only securing people and assets, but navigating changing regulatory and political circumstances that can ensure long-term business growth.

Session attendees will be given access to the Risk Portal, an online geopolitical risk tool that provides daily information and analysis on global political and security threats.

Biography
Tom is currently Geopolitcal Director at Protection Group International having previously been at G4S Risk Management.

Tom graduated from Warwick University with a degree in Politics and International Studies.

NOTES

Panel Session: Coping with epistemic uncertainty in the design of engineered solutions to the mitigation of extreme events

Panellists:
Paul Smith, Arup
Paul Clarke, JLT Specialty Ltd

Chair: Simon Day, University College London

Construction of houses, bridges and a wide variety of other structures for resistance to the effects of natural hazards is a paradigmatic method for the mitigation of several important geohazards, most notably earthquake shaking but also tsunamis, as well as a variety of meteorological-geophysical hazards such as floods, storm waves and windstorms. Critical to this approach, however, is the setting of the design parameters that define the intensity of hazard that these engineered solutions to hazard mitigation are expected to resist with specified levels of material damage and loss of functionality. These parameters are usually determined in terms of specified performance in extreme at-site hazard intensities that are often associated with rare events. Since these rare events are normally poorly represented in historical records, engineered solutions to hazard mitigation are nowadays heavily dependent upon models of rare event occurrence that are used by the professional, national and international institutions responsible for setting and enforcing design standards. Other hazard mitigation decision makers, such as insurers, also make use of risk models that ultimately derive from methods developed for engineering purposes such as the Cornell method for engineering seismic risk analysis.

As pointed out by the social anthropologist Mary Douglas, institutions tend to enforce certainty, and therefore tend to be ill equipped to cope with epistemic uncertainty. The problem is exacerbated for long-lived structures by advances in knowledge of rare hazard events through the lifetime of these structures, especially in cases where paradigm shifts in the science underpinning hazard occurrence models generate periods of heightened epistemic uncertainty. The consequences have been highlighted by high-profile failures of engineered structures in recent natural hazard events that were not anticipated in the design of those structures, most notably in the 2011 Tohoku earthquake-generated tsunami. Cases in which more local design decisions used information not in the models to generate hazard intensity parameters above those derived from institutional models and led to survival of structures, such as the Onagawa NPP in the 2011 Tohoku tsunami, are less widely known.

This panel discussion will address the relationships between epistemic uncertainties in the geoscience behind hazard occurrence models for extreme events and problems faced in the use of those models for engineering, insurance and other risk mitigation methods. It will ask where the responsibility for critically assessing and allowing for uncertainties in the models lies, and consider when and how information that is hard to incorporate in the models should be incorporated in the decision-making process.

NOTES

Workshop: How will climate risks change and how will you manage them effectively?

Chris Jones & Ian Sollom
StrategicFit, London

There is a clear gap between what is required to meet the Paris climate agreement and projections of incoming regulation and energy mix changes. What happens in this gap and how the world moves between these two paradigms will have profound implications for the extractive industries. What would you do differently now if you knew how it would happen?

Many companies, industry bodies and international organisations use scenarios to think through the possibilities for the gap in a self-consistent way. We will review some examples and look back at scenarios from 10 years ago – what did they have to say about the world we live in today, and were they correct? Does it matter if they weren't? What are scenarios really for? Do scenarios help you identify the key risks and prepare for them, even if you can't predict them precisely?

We recently conducted a survey of technology and industry experts to gather views on what companies should be looking out for: what technologies could take off, how would that affect other competing technologies, how might their impact differ from conventional thinking, what are the signposts that could alert us to sudden change? We will share some of the key insights and explore the potential risks of either adopting a technology too early or missing an emerging disruptive technology.

We will explore the implications for the audience. What could the impact be on your industry, your job and your company? And what might make you wrong about all this?

Biographies

Chris Jones, Senior Consultant at StrategicFit
Chris has a wide range of experience across the energy sector including conventional oil and gas, renewable energy and fuel cell technology. He holds an MSci in Physics from Cambridge University.
Highlights:

- Supporting a multi-national oil and gas company to value future CO2 policy regulation when making project investment decisions.
- Helping a gas technology provider evaluate their business model against future energy scenarios and kick-off plans to adapt to changes
- Helping a newly established area forum in Norway, comprising multiple operating companies, to work together to understand and deliver an efficient area development. Working in a collaborative rather than competitive way. This type of forum was a first there and received praise from the Norwegian regulator.

- Evaluating the opportunities for a Waste to Energy plant operator. How they could leverage their expertise and what value that could bring.

Ian Sollom, Senior Consultant at StrategicFit

Ian has worked on a variety of analytically complex forecasting projects in the energy sector and supported organisations making investment decisions in challenging regulatory environments. He has a Physics PhD from Cambridge University and his research formed the basis of a new method determining the speed of the Earth in the universe used by the Planck satellite collaboration.

Highlights:

- Bringing joint venture partners together to create a shared asset strategy and approach to government negotiations regarding environmental concerns.
- Supporting a supermajor to model the forecast profile of a number of mature production streams, taking into account the hydrocarbon and water constraints existing within the aging evacuation system.
- Facilitating the alignment of mega-project shareholders taking high stakes, controversial decisions on operations, development and government relations.
- Developing a strategic roadmap to extend the life of an ageing North Sea infrastructure complex, quantifying the risks and opportunities of alternative routes to decommissioning.

NOTES

The Path to Failure

Sam Parkin
Evakin Consulting Ltd.

Sam Parkin has extensive international experience having worked for the past 15 years on projects in Europe, Africa, the Middle East, South America and Australasia within various sectors including highways, marine, energy, oil and gas, mining, waste and international insurance loss assessment.

Industry experience (and particularly the undertaking of engineering assessments for insurance claims) related to construction and property damage losses has provided a view through the looking-glass into the world of failure.

Despite great improvements in the understanding, management and implementation of risk management processes throughout all stages of the project life cycle, common themes and oversights consistently appear, which (either individually or combined) result in failures occurring. Unfortunately, these failures can be catastrophic in nature, resulting not only in large project delay costs but can also carry risk for loss of life.

This presentation sets out to discuss four common themes: '*The Flaw of Averages'; 'The Right Data in the Wrong Hands'; 'Ineffective Risk Management';* and *'Losing Sight of the Whole Picture'*. Each of these themes commonly result in failure.

These themes are then used to develop a further discussion on *"Population Growth - Challenges for the (Near) Future"* and the resulting need to develop ever increasingly marginal land, with its increased engineering challenges, risk and consequence driving the need to reduce the incidences of failures.

Several case studies will be presented to demonstrate and assist the development of discussion.

By continually evaluating and reflecting on the path to failure, we can identify and avoid these issues, paving the path to success.

Biography
Sam Parkin is currently the Director of Evakin Consultants Ltd (Evakin), a UK-based specialist consultancy firm providing independent expert and forensic engineering services for the international reinsurance and construction dispute markets.

Having spent over fifteen years working as an Engineering Geologist in the field of Geotechnical Engineering Sam has gained experience in working across various sectors

including: road and highways infrastructure; housing; shallow marine (ports and harbours); energy; onshore oil and gas; mining; waste; and international insurance loss assessment.

Sam's work has seen him take on various project assignments in the UK and abroad with substantial time spent working in Europe, Africa, the Middle East, South America and Australasia.

As an Engineering Geologist Sam has gained extensive experience of ground investigation, field surveying, ground model development, geotechnical instrumentation, and inputting to geotechnical design for slopes, earthworks, ground improvement, pipelines, roads, buildings, dredging, retaining structures and piling works etc. This work has been undertaken at all stages of the project lifecycle from early concept through construction to maintenance/operations and upgrades.

Beyond his technical experience Sam has held engineering consultancy management positions with responsibility for business management, project management and team management. With a proven track record of successful delivery on small and large-scale engineering projects Sam's experience includes: managing multidisciplinary engineering teams; operating profit and loss accounts; WIP and debt controls; financial forecasting and reporting; overseeing contract specification, procurement and execution; resource management; project programming and tracking; risk mitigation; claims dispute resolution; and client interfacing.

NOTES

Glen Burridge - Lead Convenor

When GSL put out a request for ideas for the Year of Risk, Glen jumped at the chance. Informed by his own experiences in aviation, a conference sharing ideas between Earth Scientists and different professions and sectors on how they approach and handle risk was an event he'd been wanting to put on for years.

Originally trained as a geophysicist, he now works as management consultant on technical and organisational topics in Upstream Oil & Gas and is based between London and Australia. He has 20 years of experience of the industry working in a broad range of roles from frontier explorationist to development geoscientist to shaping subsurface assurance workflows for operators, through to designing training programmes and evaluation criteria for technical software toolkits. He's worked on projects in the UK, France, Norway, South America, North Africa, the Arabian Peninsula, India and Australia.

His particular interests are in effective knowledge capture for technical assurance, the role of cultural risk, improving well planning workflows and raising the profile of geomechanics as a discipline.

He is passionate about bringing a holistic view of risk involving the Earth Sciences to the fore, one that includes all its constituent elements across technical, commercial and human spheres and hopes that this conference provides a wonderful opportunity for Earth Scientists and our very welcome guests to reach towards that goal while sharing lessons from their own fascinating experiences.

Glen is Program Chair and co-founder of the Society of Petroleum Engineers (SPE) Geomechanics Technical Section, Steering Committee member of the SPE/EAGE *Integrated Geomechanics* conference in Abu Dhabi in 2018, co-convenor of the GSL's *Managing Risk across the Mining and Oil & Gas Lifecycle* conference and has been an invited keynote speaker and contributor at a number of international management and subsurface technical conferences. He is also a contributor on cultural and risk topics to SPE Publications, the Intercultural Training Channel and Airsoc.com.

Georgina Worrall – Lead Convenor

Georgina has been Conference Manager at the Geological Society since March 2006, previously having worked at the Royal Society of Medicine.

Georgina is the Secretariat for the Society's Science Committee, who are responsible for the Society's scientific programme of events.

Georgina is a co-founder of the City of London Geoscience Forum whose aim is to share knowledge between geoscientists and professionals working within the finance and insurance sectors.

Georgina is particularly keen on bringing together professionals from outside geoscience to disseminate knowledge, so was very keen to be involved in this conference.

Sarah Gordon – Co-convenor

When Sarah first heard about Glen's idea for this conference, the opportunity to help pull together individuals from the worlds that she routinely works in (both risk and geosciences) was too good to miss.

Having completed her undergraduate in Earth Sciences at the University of Glasgow, Sarah then went on to work as a Geologist for Anglo American, completing her PhD at Imperial College along the way. She was lucky enough to live and work in Canada, Brazil, Southern Africa, and Europe, in a variety of functions from exploration through to sustainability, risk management and assurance. This grounding allowed her to explore different risk management techniques and uses, applying them to real situations.

Together with two other risk managers, Sarah founded Satarla in 2014. Now with 30 Associates based around the world, Satarla provides risk management consultancy, training and research to organisations from sectors such as healthcare, agriculture, charities, finance, together with petrochemicals and the extractives industries.

Sarah currently sits on the Council for the Geological Society and chairs the External Relations Committee. She is also an accredited trainer for the Institute of Risk Management, and an honorary lecturer at Imperial College London.

Geological Society
Fire Safety Information

If you hear the Alarm
Alarm Bells are situated throughout the building and will ring continuously for an evacuation.

Do not stop to collect your personal belongings.

Leave the building via the nearest and safest exit or the exit that you are advised to by the Fire Marshall on that floor.

Fire Exits from the Geological Society Conference Rooms
Lower Library:
Exit via main reception onto Piccadilly, or via staff entrance onto the courtyard.

Lecture Theatre
Exit at front of theatre (by screen) onto Courtyard or via side door out to Piccadilly entrance or via the doors that link to the Lower Library and to the staff entrance.

Main Piccadilly Entrance
Straight out door and walk around to the Courtyard.

Close the doors when leaving a room. **DO NOT SWITCH OFF THE LIGHTS**.

Assemble in the Courtyard in front of the Royal Academy, outside the Royal Astronomical Society.

Please do not re-enter the building except when you are advised that it is safe to do so by the Fire Brigade.

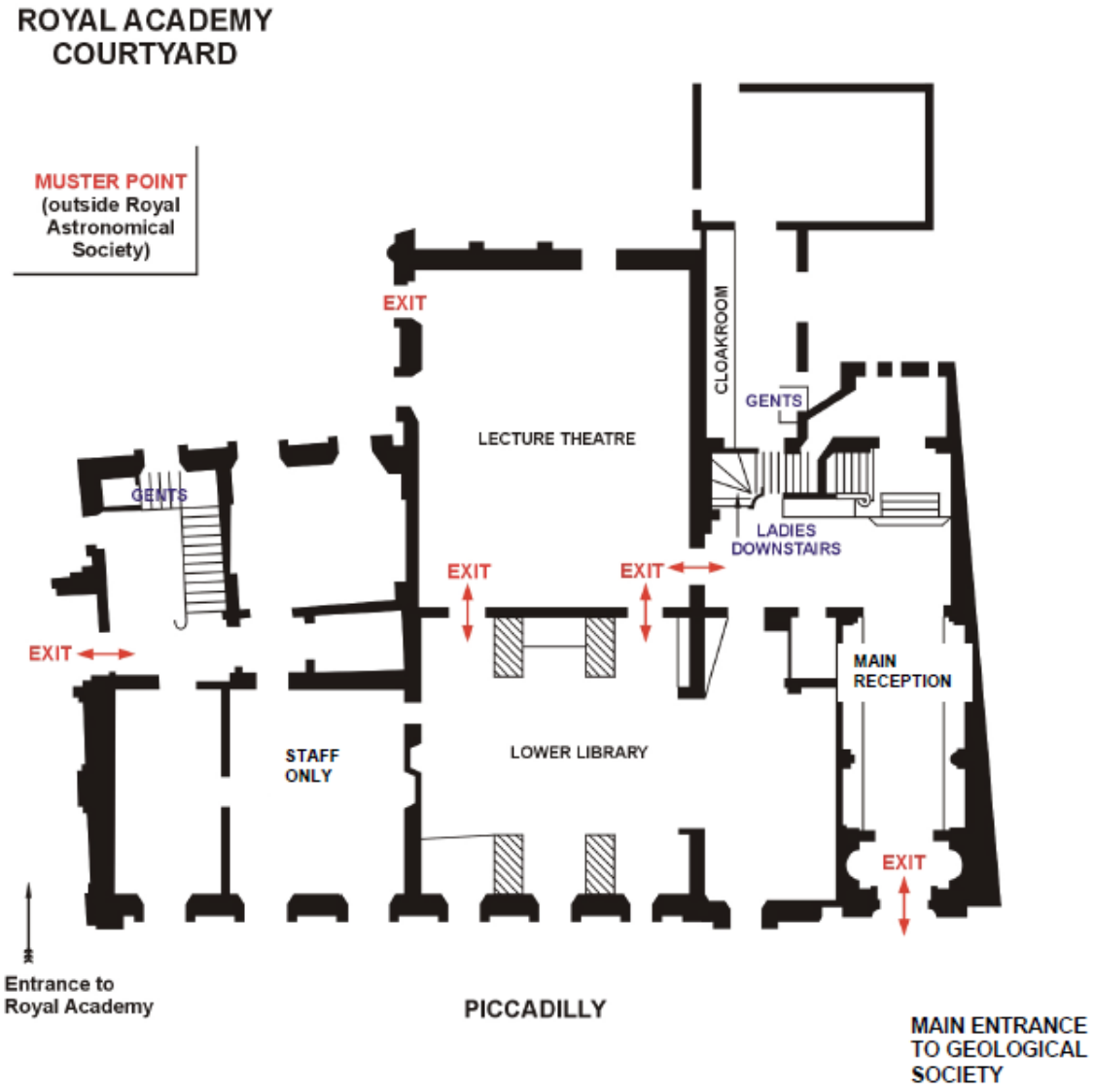
First Aid
All accidents should be reported to Reception and First Aid assistance will be provided if necessary.

Facilities
The ladies toilets are situated in the basement at the bottom of the staircase outside the Lecture Theatre.

The Gents toilets are situated on the ground floor in the corridor leading to the Arthur Holmes Room.

The cloakroom is located along the corridor to the Arthur Holmes Room.

Ground Floor Plan of The Geological Society



Working for comfort or discomfort? Handling uncertainty and risk in mature oil and gas field developments

Mark Bentley
AGR TRACS Training, Aberdeen, UK

Most oil and gas fields around the world are, by definition, 'mature'. Although the big, billion dollar capital investments are still typically associated with the development of new fields, the predominance of mature assets means the bulk of decisions in oil and gas are of a smaller, million dollar nature.

The handling of risk and uncertainty for new vs. mature fields differs markedly: whereas much effort is expended on quantifying upside and downside risks in the new fields, comparatively little attention is paid to uncertainty in mature fields, and decisions are often made on a simple 'best guess' basis.

The reasons for this can be discussed, but include:

1. A belief that the asset is 'known' and therefore uncertainties have been resolved
2. A desire not to get bogged down working through mature field data, which can involve a significant effort, more so than for new fields with little data
3. A simple wish to get on with things practically and quickly

In addition to the above there is a cognitive bias that encourages teams to work in support of decisions which have already been made – if modelling exercises are conduscted in the spirit of quantitative risk assessment this is often just '*modelling for comfort'*.

Here we have a choice, especilly when using quantitative modelling tools: we either use the tools to quantify the uncertainty and highlight the risks, or we use the same tools to determine an optimum, preferred path and hence give comfort to the decision maker. These paths are not the same, and it is argued here that while we may wish for the former in principle, the three reasons above (and other natural biases) lead us quickly to the latter – we end up 'modelling for comfort' and regressing to a best guess too easily and too frequently.

It is proposed that reservoir modelling and simulation tools should be employed to **make us uncomfortable**. This is not a call to a neurotic lifestyle, although from a business perspective some mild neurosis is preferable to an over-confident best guess.

The subtlety for technical professionals in oil and gas is how to choose a workflow for data-laden mature fields which keeps us on that path, avoiding the common biases which lead us to collapse on a preferred case too soon.

An example is shared from a mature field in which standard modelling workflows were replaced by a non-standard approach designed to expose risk, create discomfort and deliver a better decision.

Geological Society 2017 Conferences

Date	Title	Location
13-14 July	Sharing an Uncertain World: Lessons in Managing Risk	Burlington House
7-8 September	Building Resilience	Burlington House
14-15 September	The evolution of flooding and flood risk: past, present and future	Burlington House
25-27 September	Fermor Meeting 2017: Factory Earth	Burlington House
3-5 October	William Smith Meeting 2017: Plate Tectonics at 50	Burlington House
16 October	6th UK Deep Geothermal Symposium	Burlington House
26-27 October	Ground related Risk to Transportation Infrastructure	Burlington House
31 October – 2 November	PG: Fold and Thrust Belts: Structural style, evolution and exploration	Burlington House
6-7 November	Janet Watson 2017 Meeting: The Future of Contaminated Land Risk Assessment: stakeholder perspectives	Burlington House
08 November	GSL Nottingham Career and Industry Day	British Geological Survey, Keyworth
15-17 November	PG: Handling Fault Seals, Baffles, Barriers and Conduits	Burlington House
22 November	GSL Edinburgh Career and Industry Day	Our Dynamic Earth, Edinburgh
23 November	Bryan Lovell 2017 Meeting: Title TBC	Burlington House
27-28 November	PG: Cross-border Exploration between UK and Norway	Burlington House

https://www.geolsoc.org.uk/Events/Society