CorporateRiskAssociates
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UK's 2nd Probabilistic Safety Analysis / Human Factors Assessment Forum

8-9 September 2011
The Park Royal Hotel, Warrington, UK

SERVING THE NUCLEAR INDUSTRY

CRA's mission is to be the premier risk management consultancy of the 21st century and beyond.

CHAIRMANS FORWARD

On behalf of CRA, I would like to welcome you to the UK's 2nd PSA/HFA forum

The UK's Nuclear Industry (civil and defence) has a very broad base covering fuel design, manufacture and fabrication, power generation, waste storage, reprocessing, decommissioning, and now nuclear new build. PSA/HFA is performed throughout the UK's Nuclear Industry and is taking on a greater level of importance in the ALARP decision making process. Having studied Nuclear Engineering at Manchester University a year after the accident at Chernobyl, I have been working in the Nuclear Industry for over 20 years as a PSA/HFA expert. During this time I have seen much change in the industry due to the need to extend plant life and more recently, from the needs of the nuclear new build programme. With nuclear new build firmly established in the UK and being widely considered in other countries around the world, I feel that greater attention needs to be paid to ensuring that the nuclear industry is managing and reducing risks to achieve greater levels of safety than for previous generations of nuclear power plants. Sadly, the accident at Fukushima has highlighted this point.

The time is now right for the UK's Nuclear Industry to gain even more public awareness and be more vocal about the benefits of PSA/HFA. The UK's Nuclear PSA/HFA community has a wealth of knowledge and experience that could promote a brighter future for the nuclear industry. Therefore, my aims of the forum are as follows:

1. Establish the UK's Nuclear Industry's voice for PSA/HFA;
2. Set-up a fund for promoting focused PSA/HFA research and development;
3. Disseminate information on the latest techniques and developments in PSA/HFA;
4. Provide the necessary information to enable better education of the general public on Nuclear Risk Issues.

Looking ahead, I would like to see the forum grow and members continue to meet once a year. I am keen to ensure that the forum is not just another talking shop. It has to be a forum where researchers, practitioners, developers and creative thinkers come together to really push forward our knowledge and understanding on probabilistic and human factors issues which will lead to the greater good of the Nuclear Industry.

I hope you find the next two days both informative and enjoyable.

Jasbir Singh Sidhu

Jasbir Sidhu – Managing Director, CRA

THE PROGRAMME

DAY 1 8 September 2011

09.30 – Registration and Refreshments

10.00 – Welcome, Introductions and Aims – **Jasbir Sidhu**, Managing Director, CRA

10.15 – **Fukushima: Lessons to be Learned - Geoff Grint, HM Principal Inspector, Office for Nuclear Regulation, Health and Safety Executive**

This presentation will cover lessons learned from the accident at Fukushima and will draw on the interim report of the Office of Nuclear Regulation's Chief Inspector, the Japanese Government report to IAEA and the IAEA's mission to Japan. The session will also cover the nature and content of the European Council's "Stress Tests".

11.00 – Questions & Answers

11.15 – **Common Cause Failure Modelling in UK PSAs - Nadim Choudhary, Consultant and Dr Charles Shepherd, Chief Consultant, Corporate Risk Associates Ltd**

This presentation will cover the modelling of Common Cause Failure (CCF) in the PSAs for Nuclear Power Plants (NPPs) in the UK including: the way that CCF is currently modelled and the strengths and weaknesses in this approach; the other options for modelling CCF and their strengths and weaknesses; the current state of the art in the PSAs carried out in other countries; the availability of CCF data to support a detailed parametric model; and what issues will need to be addressed if the CCF modelling is going to be changed.

12.00 – Questions & Answers

12.15 – Lunch and Networking

13.15 – **Software Reliability, the Silent Danger and How to Assess it - Suzanne Flynn, Head of Software Safety & Reliability Assessment Group, Cygnet Solutions Ltd**

The presentation will explain the various causes of software errors and how to prevent them. It will then describe methods and techniques for assessing the quality and reliability of software along with the role of IEC 61508 "Functional Safety of … programmable electronic safety-related systems".

For practical purposes software reliability cannot be measured or estimated. The techniques used to assess software reliability are a mixture of qualitative assessment of the software development/ testing and measures of, for example, the complexity ("spaghetti-ness") of the code. These techniques will be explained and the strengths and weaknesses of each described. The presentation will finally clarify how an assessment arrives at a Safety Integrity Level for software.

14.00 – Questions & Answers

14.15 – **Incorporating Reliability Figures for Programmable Control and Instrumentation Systems into PSAs - John Delafield, Nuclear Safety Engineer, Safety & Regulation Division, Barnwood, EDF Energy**

This presentation will highlight issues that require consideration when incorporating reliability data for Programmable Control and Instrumentation Systems into PSAs, (i.e. systems containing software). The presentation will consider such issues as: 'level of confidence' in reliability data for software, safe/dangerous failures of software systems, treatment of Common Cause Failure (CCF), use of operational experience to support software reliability, use of 'per demand' / 'per annum' reliability figures and probability of software failing over time. The presentation will touch on the human reliability aspects when considering Programmable Control and Instrumentation Systems.

15.00 – Questions & Answers

15.15 – Refreshments

15.30 – **IAEA Insights for PSA Methodology from the Fukushima Accident – Dr Charles Shepherd, Chief Consultant, Corporate Risk Associates Ltd**

The presentation will consider the methodology for Probabilistic Safety Analysis (PSA) of NPPs which was created in the 1970s and has been developing for the last three decades. Nowadays there are many guidelines and standards for PSA methodology (IAEA Safety Guides and TECDOCs, ASME/ANS PRA Standard, etc.). The PSA technology was judged to be well matured. However, the accident at Fukushima NPP in Japan highlighted the fact that there are indeed several issues that need further development or adjustment. In addition, the application of PSA methodology requires a more rigorous control and independent review. This presentation will explain the work carried out by the IAEA's Safety Assessment Team to provide a summary of major assumptions/considerations in Level-1 and Level-2 PSAs that may require revisions based on lessons learned from the Fukushima accident.

16.15 – Panel Session – Open discussion on all topics covered during the day.

17.00 – Close

19.00 – Forum Dinner

DAY 2 9 September 2011

09.00 – **Strengthening EDF's MERMOS HRA Technique for EPR Application - Pierre Le Bot, Expert Research Engineer, EDF Research & Development, EDF**

This presentation will look at the reference method, MERMOS, used by EDF for Human Reliability Assessment (HRA) to assess the emergency operation of nuclear reactors during incidents and accidents for PSA. Pierre, as one of the leading researchers in this area will discuss the current improvements to the MERMOS method to assess the novelties in the EPR design (in the interface, the organisation and the procedures).

09.45 – Questions & Answers

10.00 – **Earthquakes and NPPs in Japan: Seismological Insights, Seismic Hazard and PSA Implications - Professor Willy Aspinall, Aspinall & Associates Ltd and Bristol University**

This presentation will consider the Kashiwazaki-Kariwa Nuclear Power Station, Japan (one of the world's largest NPPs, with seven reactors and a total capacity of 8.2MWe) and the effect of a magnitude 6.6 earthquake on 16 July 2007. While structural damage was almost non-existent and secondary damage trivial, some minor radiological releases did occur and the station was out of operation for two years. This raised fundamental issues for the Japanese and the worldwide nuclear industry.

However, before much progress could be made in changing the hazard estimation and risk assessment culture in Japan, the magnitude 9 Off-Tohoku earthquake occurred on 11 March 2011, producing a whole new set of concerns about safety of NPPs against natural hazards. Seismic effects can be a major factor for PSAs, and this talk will highlight some of the emerging issues and new challenges for seismic hazard estimation in the wake of the catastrophic events at the Fukushima Dai'ichi NPP.

10.45 – Questions & Answers

11.00 – Refreshments

11.30 – Panel Session – Questions, Feedback, Experiences and Topics for Research – All Speakers, Chair – **Jasbir Sidhu**

12.15 – Summary and Conclusions

12.30 – Lunch and Networking

14.00 – Close

The organisers retain the right to change the programme at short notice.

SPEAKER BIOGRAPHIES

Geoff Grint, HM Principal Inspector, Office for Nuclear Regulation, Health and Safety Excutive
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Geoff Grint is a Principal Inspector with the Office for Nuclear Regulation (formerly NII) and has been with the organisation for 22 years. Geoff's main area of interest is Probabilistic Safety Analysis (PSA) and he has been involved in the assessment of reactor PSAs for Magnox, Advanced Gas Reactors, the Prototype Fast Reactor and Pressurised Water Reactors (both in the UK and internationally) and led the PSA assessment of the UK EPR within the Generic Design Assessment (GDA) process.

In his time with the Office for Nuclear Regulation, Geoff has also coordinated the UK Nuclear safety research programme and spent time as a Site Inspector at Sellafield and at the Low Level Waste Repository at Drigg.

Geoff is currently part of the regulatory team supporting the production of Dr Mike Weightman's reports on Fukushima and coordinating of the European Stress Tests for UK Nuclear Installations.

Nadim Choudhary, MEng (Hons), CEng, MIMechE, Consultant, CRA
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Nadim is a Consultant with over 5 years experience in safety and risk consulting for the nuclear sector. Nadim joined Corporate Risk Associates in June 2006 as an MEng graduate in Aerospace Engineering (1st Class Honours) and became a Chartered Engineer with the IMechE in January 2010. He is currently a member of the Nuclear Institute Young Generation Network actively participating in events, conferences and annual dinners.

Nadim has been involved in the development of numerous PSA studies, covering all aspects from fault schedule development, data analysis, fault tree/event tree modelling, and quantification. Nadim was involved in the quantification of common cause failures using the Unified Partial Methodology (UPM) for Hartlepool and Heysham 1 Nuclear Power Stations.

More recently, Nadim has been involved in using the automatic modelling facility in Risk Spectrum PSA.NET to model common cause failures using the Multiple Greek Letter (MGL) and Alpha Factor methodologies. He also recently co-delivered a training workshop on the use of Risk Spectrum PSA.NET and its facilities.

Suzanne Flynn, BSc.(Eng), ACGI CEng, FIET, MCQI, CQP, FIES, MWES, FRSA
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Suzanne is a founder member of Cygnet Solutions Limited (www.cygnets.co.uk) which for 16 years has provided Safety, IT and Business Consultancy and the bespoke software development of business- and safety-critical systems. Suzanne began her engineering career as an engineering officer in the RAF and after a career break joined Marconi Defence Systems.

Suzanne is a chartered electrical engineer and has worked on software projects for 40 years. She is a registered software auditor. She has a special interest in software quality, dependability and reliability. Over the last 20 years, she has made a study of software testing practices including the use of special tools to aid the testing process.

Suzanne has assessed many software systems for quality and reliability using a number of techniques and methods. Many of the assessments are for the nuclear and defence sectors. There is much interest now in the assessment of SMART (i.e. devices containing software or firmware) process instruments. These require different approaches to assessment as often application-specific real time operating systems are employed. Suzanne's assessments are based on real 'hands-on' experience of why software fails or gives the wrong results.

Suzanne is an active member of the Institution of Engineering and Technology, where she has been involved in the introduction of the ICTTech professional registration for ICT technicians. She is an assessor for CEng, IEng and EngTech and for Fellows of the IET.

John Delafield, BEng (Hons), CEng, MIET Nuclear Safety Engineer, Safety and Regulation Division, Barnwood, EDF Energy
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John has worked for EDF Energy (formally British Energy) since leaving school at the age of 16. He has a degree in electronic and electrical engineering and has worked at the sharp end as a System Engineer at a Nuclear Power Station and in various roles within central engineering support functions in the field of Control and Instrumentation (C&I). John has also worked in the Fuel Route branch which has given him a good background in the wider aspects of Safety Cases, importantly including human reliability. Over the years John has been involved in C&I design and maintenance, as well as all aspects of the production of a variety of Safety Cases.

John currently works as a Nuclear Safety Engineer within the Safety and Regulation Division (SRD) of EDF Energy. [SRD is the 'internal' nuclear regulator within EDF Energy, ONR (formally NII) being the 'external' regulator.] Over the last 9 years John's main role has been carrying out Independent Nuclear Safety Assessments and hence approvals of Safety Cases, many of which cover the implementation of modern C&I systems within safety critical applications in the company's Nuclear Power Stations.

John is passionate about reducing the nuclear risk by the appropriate implementation of modern C&I systems within the company's power stations. Key to this is ensuring that an appropriate level of justification is completed to provide a sufficient level of confidence in the reliability of the new C&I systems to support the safety case.

Dr Charles Shepherd, BSc (Hons), MSc., Phd, Chief Consultant, CRA
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Charles Shepherd has over 35 years of experience as a regulator of nuclear facilities and as a consultant in carrying out fault studies and probabilistic safety analysis.

As a regulator, he was involved in the assessment of the safety cases for all types of nuclear facilities including nuclear power plants, nuclear fuel reprocessing facilities, research reactors and defence facilities. He was project manager for the licensing of the Pressurised Water Reactor at Sizewell B and worked on the periodic safety reviews of the operating Magnox reactors and Advanced Gas-cooled Reactors. He established the methodologies for the assessments of public and worker risk that were carried out for the upgrading of the UK defence facilities which included the refuelling of nuclear submarines at Devonport, and reviewed the analyses produced by the licensees.

As a consultant, he has provided services on probabilistic safety analysis, fault studies, human factors analysis and availability analysis to the nuclear industry and for a wide range of clients in the UK and overseas. Recently he has carried out work on the implementation of Risk Monitors at nuclear power plants and the development of the PSA for this application, the regulatory review of a fire PSA for a Candu reactor, and a peer review of a report on the nuclear education available in the European Community.

He has worked extensively as a consultant to the International Atomic Energy Agency in the updating of their Nuclear Safety Standards, Requirements and Guidance which has included the Requirements for Safety Assessment and Verification and the Specific Safety Guides on Level 1 and Level 2 PSA. Currently he is involved in the reviews of new designs of nuclear power plant against the IAEA safety standards, the development of guidance for Integrated Risk-Informed Decision Making and the development of an IAEA peer review service on the impact of extreme events on nuclear power plants following Fukushima.

He was the UK representative and vice-chairman on the OECD Working Group on Risk. He was the main author of the report on Risk Monitors, a number of Technical Opinion Papers on PSA and was involved in setting up the International Common Cause Failure Data Exchange (ICDE). Recently, he has been assisting the Office for Nuclear Regulation on the updating of the WGRisk report on the Use and Development of PSA in the Member Countries to be published later this year.

Pierre Le Bot, Ingénieur Chercheur Expert, EDF R&D, EDF
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Pierre Le Bot has extensive experience in nuclear power plant safety engineering in general and in accident prevention and mitigation in particular. He has been an expert researcher in Human Reliability Analysis for EDF's R&D since1993. First, he contributed to the human data collection from observations on simulators for HRA (Human Reliability Analysis) method development and application. Then he led the development of MERMOS (méthode d'evaluation de la réalisations des missions opérateur pour la sûreté), currently being implemented at EDF.

A former graduate in sociology from the Institute of Political Sciences (IEP, Institut d'Etudes Politiques), Pierre Le Bot is currently focusing his research on the impact of organizations on human reliability. Recently he has developed the Model of Resilience in Situation, which proposes a theoretical modeling of resilience for engineering of risky systems.

Professor Willy Aspinall, Aspinall & Associates and Bristol University
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Prof. Willy Aspinall is a consulting Chartered Scientist and Chartered Geologist, and Cabot Professor in Natural Hazards and Risk Science at Bristol University, with interests in volcanology and seismology, and the formalised use of expert judgement in decision-making in circumstances of scientific or engineering uncertainty. He specialises in probabilistic assessments of earthquake and volcanic hazards and risks. Aspinall is a Member of the Scientific Committee of the IAEA International Safety Centre, of the British Government Scientific Advisory Committees on Montserrat Volcanic Activity and the Government Chief Scientific Adviser's Blackett Group on high impact - low probability "Black Swan" events. He sat on the SAGE Scientific Advisory Group for Emergencies during the Icelandic volcanic ash emergency, and the UK CAA Blue Skies working group. Other involvements include the IAEA Specialist Group preparing the new Safety Guide on Volcanic Hazards in Site Evaluation of Nuclear Power Plants, and the IAEA Working Group on Probabilistic Seismic Hazard Assessment, and as a member of IAEA Missions to Kashiwazaki-Kariwa NPP, Japan, and Metsamor NPP, Armenia. He was a member of a Royal Society Working Group on detection and decontamination of biological and chemical terrorism attacks, and since 1983 has worked as a member of the UK nuclear industry Seismic Hazard Working Party.

Jasbir S. Sidhu, BEng (Hons), MBA, MIoD, Managing Director, CRA
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Jasbir is one of the founders of CRA and is currently the CEO. Jasbir is one of the UK's leading Engineering Risk Analysts, with over 18 years of experience as a NPP PSA/HFA specialist. He provides power generation clients with an understanding of their plant operational risks and suggests ways of managing risk profiles by means of plant re-design and/or modifications to plant operating procedures. He was the master architect of the first Periodic Safety Review (PSR1) PSAs/HFAs for most of the British Energy NPPs. He has been instrumental in the identification of the role of the operator in accident sequences by translating the complex structural and transient analysis information into specific timescales within which key operator actions have to be performed. He has developed a method for translating the complex PSA event trees into Simplified Event Trees where the deterministic and probabilistic lines of protection are clearly identified.

FORUM VENUE and COSTS

The Forum will be held in the Garden Suite of the Park Royal Hotel, near Warrington. The hotel is within easy reach of major motorways, and a short taxi ride from both Manchester and Liverpool airports and both Warrington Central and Warrington Bank Quay train stations.

Corporate Risk Associates will cover the venue, lunch and refreshments costs for both days including evening dinner. Each delegate is responsible for their own travel and accommodation costs and should therefore contact the Hotel directly to book rooms. A number of rooms at a preferential rate have been allocated by the Park Royal Hotel for this event. If you wish to book one of these rooms please quote Corporate Risk Associates Forum.

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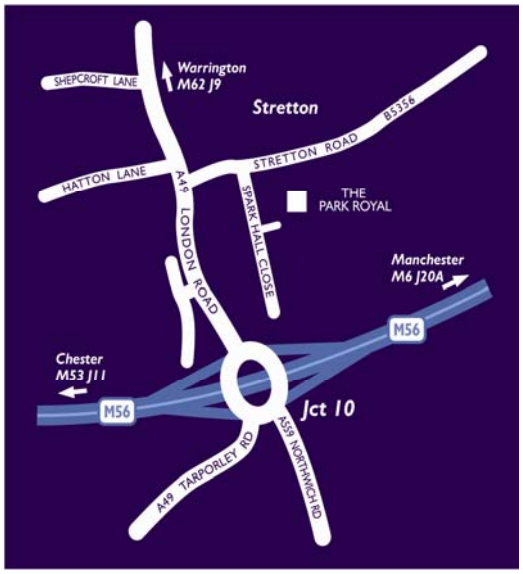

Directions to The Park Royal Hotel
By Road
From Junction 10 of the M56 motorway, take the A49 towards Warrington. At the first set of lights, turn right into Stretton Road. After 200 yards, turn right into Spark Hall Close. The hotel is 50 yards along on the left hand side.

By Rail
Warrington Bank Quay Station (West Coast Main line) is 4 miles away.
Warrington Central Station (Tran Pennine line) is 4 miles away.
Taxis are available outside both stations.

By Air
Manchester Airport is 12 miles away.
Liverpool Airport is 18 miles away.

Also see goggle map
http://maps.google.co.uk/maps?q=WA4+4NS&ll=53.272605,-2.580414&spn=0.639742,0.733337&oe=utf-8&client=firefox-a&gl=uk&z=10

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