

## 2<sup>ND</sup> NRC-RES/ EPRI FIRE PRA WORKSHOP

*MAY 24-26, 2006*

**U.S. NUCLEAR REGULATORY COMMISSION, AUDITORIUM  
11545 ROCKVILLE PIKE, ROCKVILLE, MD**

Start	End	Topic	Lecturer
<b><u>Wednesday May 24, 2006</u></b>			
<b>Session I: Introduction:</b> An overview of the Fire Risk Re-quantification project and the EPRI/NRC-RES Fire PRA methodology.			
8:00a	- 8:15a	Opening Remarks	TBD (EPRI) TBD (NRC-RES)
8:15a	- 8:45a	Fire Risk Re-quantification Project	R. P. Kassawara (EPRI) J. S. Hyslop (NRC-RES)
8:45a	- 9:30a	Overview of the Fire PRA Methodology	B. Najafi (SAIC) S. P. Nowlen (SNL)
9:30a	- 10:00a	BREAK	
<b>Session II: EPRI/NRC-RES Fire PRA Methodology:</b> Detailed presentation of the methodology, tools, data and technical bases.			
10:00a	- 10:30a	1: Plant Analysis Boundary and Partitioning 4: Qualitative Screening A: Walkdowns	S. P. Nowlen
10:30a	- 12:00p	2: Fire Critical Equipment Selection 5: Plant Fire-Induced Risk Model Development	A. M. Kolaczowski
12:00p	- 1:00p	LUNCH	
1:00p	- 3:00p	Fire PRA Circuit Analysis Overview 3: Cable Selection 9: Detailed Circuit Analysis B: Fire PRA Database	D. F. Funk F. Wyant
3:00p	- 3:30p	BREAK	
3:30p	- 5:00p	7: Quantitative Screening 12a: Post-Fire HRA (Screening)	A. M. Kolaczowski
5:00p		ADJOURN	
<b><u>Thursday May 25, 2006</u></b>			
8:00a	- 8:45a	6: Fire Ignition Frequency Development	M. Kazarians
8:45a	- 9:15a	Heat Release Rate	F. Joglar
9:15a	- 9:45a	Fire Severity	M. Kazarians
9:45a	- 10:15a	BREAK	
10:15a	- 10:45a	Damage Criteria	S. P. Nowlen
10:45a	- 11:15a	8: Scoping Fire Modeling	F. Joglar
11:15a	- 12:00p	11a: Fire Modeling – Single Compartment Fires	B. Najafi
12:00p	- 1:00p	LUNCH	
1:00p	- 2:00p	Special Models (1) Cable fires High energy arcing faults Cabinet-to-cabinet fire propagation Passive fire protection features	B. Najafi

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2:00p	3:00p	Special Models (2) Control Room Main Control Board Turbine Generator fires Hydrogen fires Smoke damage	S. P. Nowlen
3:00p	- 3:30p	BREAK	
3:30p	- 4:15p	Detection and Suppression	F. Joglar
4:15p	- 5:00p	11b: Fire Modeling - Multi-compartment Fires	M. Kazarians
5:00p		ADJOURN	
<b><i>Friday May 26, 2006</i></b>			
8:00a	- 8:45a	11c: Fire Modeling - Control Room Fires	F. Joglar
8:45a	- 9:45a	12b: Post-Fire HRA: Detailed HRA of fire scenarios	A. M. Kolaczowski
9:45a	- 10:15a	BREAK	
10:15a	- 11:45a	10: Circuit failure mode likelihood analysis	F. Wyant D. F. Funk
11:45a	- 12:45p	LUNCH	
12:45p	- 1:45p	13: Seismic-fire interactions	M. Kazarians
		14: Quantification of Fire Risk	A. M. Kolaczowski
		15: Uncertainty and Sensitivity Analysis	
		16: Fire PRA Documentation	M. Kazarians
<b>Session III: Closing Remarks:</b> A summary of the lessons learned, insights gained and path forward.			
1:45p	- 2:30p	Lessons learned and insights	B. Najafi S. P. Nowlen
		Perspective	R. P. Kassawara J. S. Hyslop
		Q&A	
2:30p		ADJOURN	

### **R. P. Kassawara**

**Education:** BSCE Polytechnic Institute of Brooklyn, Ph.D. Civil Engineering, University of Illinois

**Institution/Position:** EPRI, Fire Protection Program Manager

**Contact Information:** 650-855-2775, [rkassawa@epri.com](mailto:rkassawa@epri.com)

**Summary:** Dr. Kassawara is the Manager of Fire Protection Engineering at EPRI responsible for the technical, financial and administrative planning and management of EPRI's R&D for fire protection. He is responsible for EPRI's efforts in Risk Informed/ Performance Based Fire Protection, Fire Modeling, Fire Induced Circuit Failures, Fire Risk Re-quantification, and EPRI Fire Events Data Base. He was instrumental in the development of the Memorandum of Understanding on Fire Protection between EPRI and NRC Research that has enabled the two organizations to work jointly on a range of projects from circuit failure tests to fire risk re-quantification.

### **B. Najafi**

**Education:** BS Electrical Engineering, (76), MS Nuclear Engineering University of Washington (79)

**Institution/Position:** SAIC / Manager, Fire Protection Section

**Contact Information:** 650-960-5944, [bijan.najafi@saic.com](mailto:bijan.najafi@saic.com)

**Summary:** Mr. Najafi is the Manager of the EPRI Fire Technology Program at SAIC. He has been instrumental in development of methods, data and guidance for nuclear fire protection community for nearly 15 years that has produced "Fire PRA Implementation Guide", "Fire Modeling Guide", and "Fire Barrier Penetration Seal Handbook." Mr. Najafi is currently the EPRI Technical Project Manager of the Fire Risk Re-quantification Project, an EPRI/NRC-RES collaborative project, to develop state-of-the-art fire risk technology for risk-informed applications. He is a member of the NFPA Technical Committee for Nuclear Facilities, SFPE Performance-Based Fire Protection Design and Risk Task Groups and ANS writing committee for the Fire PRA Standard.

### **F. Joglar-Billoch**

**Education:** BS Industrial Eng., Univ. of Puerto Rico (97), MS Fire Protection Engineering (98) & Ph.D. Reliability Engineering (00), University of Md.

**Institution, Position:** SAIC, Fire & Risk Analyst

**Contact Information:** 703-318-4695, [francisco.j.joglar-billoch@saic.com](mailto:francisco.j.joglar-billoch@saic.com)

**Summary:** Since joining SAIC, Dr. Joglar research has been focused on the use of fire modeling tools in nuclear power plant applications, including fire risk analysis. In the area of fire modeling, Dr. Joglar is the principal author of EPRI's, Fire Modeling Guide for Nuclear Power Plant Applications, and is an instructor of EPRI's seminars on fire modeling. In the area of fire risk, Dr. Joglar is member of the writing committees for both the EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities, and the ANS Fire PRA Standard. Dr. Joglar is also a consultant to commercial nuclear utilities in the area of fire modeling and fire risk analysis. He is the co-author of the Reliability Chapter of the SFPE Handbook. Dr. Joglar is a Licensed Professional Engineer.

### **D. Funk**

**Education:** BS Electrical Engineering, (81)

**Institution/Position:** Edan Engineering, Principal Engineer

**Contact Information:** 360-750-4842, [dfunk@edanengineering.com](mailto:dfunk@edanengineering.com)

**Summary:** Mr. Funk is a co-founder and principal engineer of Edan Engineering Corporation. He has 23 years of engineering, testing, and management experience. Mr. Funk has held positions as engineering manager, principal engineer, engineering supervisor, and project manager. He has extensive experience with fire protection requirements for electrical systems at nuclear power and industrial facilities. He has participated in development of numerous industry documents and guides relating to fire-induced circuit failures. Mr. Funk participated in all facets of the recent nuclear industry fire tests and is currently the electrical lead for an EPRI/NRC-RES collaborative project to develop state-of-the-art fire risk technology for risk-informed applications. Mr. Funk is a registered professional engineer in electrical and control systems.

### **J.S. Hyslop**

**Education:** Ph.D. Physics, Virginia Tech (90), M.S. Physics, Virginia Tech (82), B.S Physics, Washington and Lee University (79)

**Institution/Position:** U.S. Nuclear Regulatory Commission, Office of Nuclear Regulatory Research (RES) / Senior Reliability and Risk Engineer

**Contact Information:** 301-415-6354, [jsh2@nrc.gov](mailto:jsh2@nrc.gov)

**Summary:** For the last 3 years, Dr. Hyslop has been the lead for fire PRA under RES's fire research program. He plans the fire PRA regulatory program from both a financial and technical perspective, leads its implementation, and participates in the development and review of its products. Examples of recent accomplishments in which RES has participated are the revision of the fire protection Significance Determination Process, and the development of the technical basis for RIS 2004-03 on safe-shutdown circuit inspection items. Dr. Hyslop is currently the RES project manager for the Fire Risk Requantification Study, under which this methodology was developed, and a reviewer of the ANS fire PRA Standard. Prior to coming to RES, he was the fire PRA lead in NRR for the analysis of the significance of fire protection inspection findings. He also participated in several of the comprehensive Fire Protection Functional Inspections carried out by NRC.

### **S.P. Nowlen**

**Education:** BS Mechanical Engineering (81); MS Mechanical Engineering (84), Michigan State University

**Institution/Position:** Sandia National Laboratories, Distinguished Member of Technical Staff, Risk and Reliability Analysis Dept.

**Contact Information:** 505-845-9850, [spnowle@sandia.gov](mailto:spnowle@sandia.gov)

**Summary:** Mr. Nowlen joined SNL in 1983. His early career focused on fire testing including, in particular, studies of the fire damageability of cables and other electrical components. Mr. Nowlen became the technical and programmatic lead for the NRC-sponsored fire protection studies at SNL in 1987. His more recent work focuses on the fire risk analysis methods and applications. He was a member of the NRC Senior Review Board for IPEEE fire analyses; led efforts to develop the new Fire Protection SDP process; is a member of the core writing team for the ANS Fire PRA Standard; and is the NRC Technical Program Manager for the Fire Risk Requantification Study. He has also played a prominent role in recent efforts to resolve the cable failure modes and effects circuit analysis issues, and has published extensively in the field of NPP fire protection.

### **M. Kazarians**

**Education:** Ph.D. Nuclear Engineering, UCLA

**Institution/Position:** Kazarians & Associates, Inc. / Principal

**Contact Information:** (818) 242-0401; [Mardy.Kazarians@Kazarians.com](mailto:Mardy.Kazarians@Kazarians.com)

**Summary:** Dr. Mardy Kazarians was one of the first few PRA practitioners and methodology developers for internal fires and floods risk analysis for nuclear power plants. He has extensive experience in applying those methods and has participated in several major projects for the Nuclear Regulatory Commission where he has reviewed IPEEEs, assessed risk significance of Appendix R (10CFR50) exemptions, studied risk related lessons of a number of major fire events at nuclear power plants, participated in phase 3 SDP evaluation projects. In addition to nuclear power plants, Dr. Kazarians has developed process safety and risk management plans for facilities handling highly hazardous chemicals and has managed several security vulnerability assessment projects for the water utilities and chemicals manufacturing facilities.

### **A.M. Kolaczowski**

**Education:** BS Electrical Eng., Worcester Polytechnic Institute (70), MS Nuclear Eng., Penn State Univ. (72)

**Institution/Position:** SAIC, VP/Nuclear Safety-Risk Analyst

**Contact Information:** 541-607-9304, [alan.m.kolaczowski@saic.com](mailto:alan.m.kolaczowski@saic.com)

**Summary:** Mr. Kolaczowski is the NRC Technical Area Lead for PRA/Risk Analysis and a co-leader for Post-Fire Human Reliability Analysis in the collaborative EPRI/NRC-RES Fire Risk Re-quantification Project. Additionally, he is a member of the writing committee for the ANS Fire PRA consensus standard effort. His most relevant experience includes: key contributor to fire PRA updates as part of a demonstration project for the EPRI-NRC fire procedures, key contributor to a SNL study of Fire Detection and Suppression systems performance in nuclear power plants, co-author of a "Human Reliability Analysis Good Practices" document to become part of Regulatory Guide 1.200, contributor to NRC's Regulatory Guide covering acceptable criteria for crediting post-fire local manual actions, and he has had numerous program manager, technical lead, and key reviewer assignments covering multiple IPE, IPEEE, and NRC-sponsored PRA studies; some involving fire risk.

### **F. Wyant**

**Education:** BS Engineering Science (79), MS Nuclear Engineering (80), Iowa State University

**Institution/Position:** Sandia National Laboratories, SMTS, Risk & Reliability Analysis Dept.

**Contact Information:** 505-844-5682, [fjwyant@sandia.gov](mailto:fjwyant@sandia.gov)

**Summary:** Mr. Wyant is an active participant in the US NRC Fire Risk Research Programs. He is the principal investigator for the Hemyc and M.T. Fire Barrier Performance Test Program. Mr. Wyant is also a key member of the Significance Determination Process, Phase-3 Analysis Team for the NRC Office of Reactor Regulation. In recent years, he has participated in a number of triennial fire-protection inspections along with NRC Region inspection staff. Mr. Wyant is the co-technical area lead for circuit analysis tasks in the EPRI/NRC-RES Fire Risk Re-quantification Project.