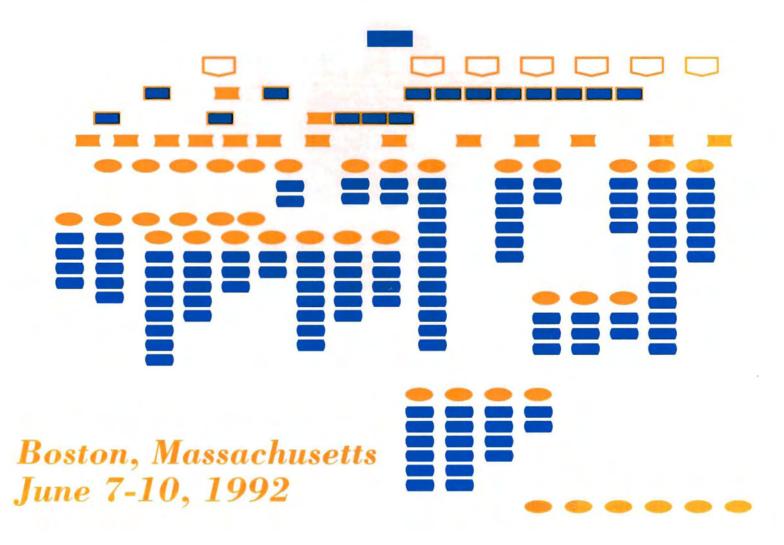
PROCEEDINGS

Topical Meeting on Risk Management— Expanding Horizons



Proceedings of the Risk Management— Expanding Horizons

Ronald A. Knief (Ogden EES) Editor

Sponsored by the American Nuclear Society's Power Division

Cosponsored by: American Nuclear Insurers American Institute of Chemical Engineers Electric Power Research Institute Harvard School of Public Health International Atomic Energy Agency Risk and Insurance Management Society, Inc. American Society of Mechanical Engineers Society of Risk Analysis



Published by the American Nuclear Society, Inc. La Grange Park, Illinois 60525 USA

MEETING ORGANIZERS

Organizing Committee

B. John Garrick (PLG, Inc.) Robert L. Long (GPU Nuclear, NJ) General Chairs

Technical Program Committee Ronald A. Knief (Ogden EES) Chair

David Carlson (SNL) G. William Hannaman (SAIC) Michael Weinstein (ANI) Deputy Chairs

Hatice Cullingford (NASA) Sharon Hudnall (Response Manage) Mark Paradies (System Improvements) Mike Weinstein (ANI) Douglas Iden (Erin Eng) Robert Bari (BNL) Ronald Bayer (Virginia Power) Lisa Bendixen (Arthur D. Little) Victoria Briant (GPU Nuclear) Tony Bridger (Bank of Montreal) Annick Carnino (EdF/IAEA) Vincent Covello (Columbia Univ) Joseph Cramer (Brown & Root/AEChE) Dirk Dahlgren (SNL) George Dooley (DCS Systems) Mark Hoover (Lovelace ITRI) Roger Humphries (AECL) Reed Johnson (Univ of Virginia) Felix Kloman (Tillinghast) Joel Kramer (NRC) Harold Kurstadt (Management Sys Lab) Fred Mogolesko (Boston Edison) Edward Quinn (MDM Eng) Nathan Siu (MIT) Ian Wall (Consult)

> ISBN: 0-89448-176-2 ANS Order No. 700180 Copyright © 1993 American Nuclear Society, Inc. 555 N. Kensington Ave. La Grange Park, IL 60525 USA

CONTENTS

RISK MANAGEMENT—EXPANDING HORIZONS

OPENING PLENARY AND TUTORIAL ON RISK MANAGEMENT

Organizer:	Ronald Knief (Ogden Environmental and
	Energy Services)
Co-Moderator:	Robert Long (GPU Nuclear Corporation)
Co-Moderator:	Jean van Dievoet (Belgonucléaire)

Rethinking Risk Management / H. Felix Kloman	
(Tillinghast)	

BROAD-CONTEXT RISK MANAGEMENT APPROACHES

Organizer and

Co-Moderator: Michael Weinstein (American Nuclear Insurers) Co-Moderator: Michael Cullingford (U.S. Nuclear Regulatory Commission)

Nuclear Quality Assurance Operating Philosophy— A Quality-Oriented Approach / William R. Corcoran (TENERA), James E. Geiger (Florida Power & Light Company), Richard E. Heibel (Baltimore Gas & Electric Company), John B. Cotton (Philadelphia Electric Company), Andrew R. Sabol (Pennyslvania Power & Light Company)52

Risk Management Programs in the Chemical Industry from Bhopal Onward / Joseph J. Cramer (Brown & Root, Houston), Harris R. Greenberg (Stone & Webster, NY)......60

RISK-BASED AND MATRIX APPROACHES TO MANAGEMENT

Organizer: Michael Weinstein (American Nuclear Insurers) Co-Moderator: Robert Bari (Brookhaven National Laboratory) Co-Moderator: Robert Shaw (Electric Power Research Institute)

Application of Risk-Based Methods for Inspection of Nuclear Power Plant Components / Kenneth R. Balkey (ASME Center for Research and Technology Development) 66

Prioritization Methods and Department of Energy Applications / Kenneth G. Murphy (U.S. Department of Energy), Michael G. Stamatelatos (SCIENTECH, San Diego)..73

RISK MANAGEMENT APPLICATIONS

Organizer: Michael Weinstein (American Nuclear Insurers) Co-Moderator: Dirk Dahlgren (Sandia National Laboratories) Co-Moderator: David Harvey (Atkins SETEC)

Risk Management Applications / Michael Weinstein (American Nuclear Insurers, West Hartford, CT), Dirk Dahlgren (Sandia National Laboratories, Albuquerque, NM)
Risk-Based Regulation / Herschel Specter (New York Power Authority, White Plains, NY)
Management Safety Assurance / Glen J. Briscoe (EG&G Idaho, Inc., Idaho National Engineering Laboratory, Idaho Falls, ID)111
The Engineer's Approach to the Management of Risk / Harold A. Kurstedt, Jr., Larry A. Mallak (Virginia Polytechnic Institute and State University, Blacksburg, VA)
Engineering Perceptions of Nuclear Insurance Risk / Larry A. Cross (American Nuclear Insurers, West Hartford, CT) 119
Integrated Risk Management for Business Survival / J. A. Piatt (Pacific Northwest Laboratory, Richland, WA) 128
Safety Analysis and Review System / E. J. Hallinan, E. B. Donner, J. M. Low, M. L. Cowen, K. W. Stephens, W. R. Waltz, K. S. Kim (Westinghouse Savannah River Company, Aiken, SC)
The Selection of Probabilistic Safety Assessment Techniques for Non-reactor Nuclear Facilities / James Vail (Westinghouse Idaho Nuclear Company, Idaho Falls, ID) 137

ORGANIZATION CULTURE

Organizer: Hatice Cullingford (NASA) Co-Moderator: Don Riley (U.S. Department of Energy) Co-Moderator: G. Bruce Varnado (Ogden Environmental and Energy Services)
Organization Culture ./ Hatice S. Cullingford (NASA Johnson Space Center, Houston, TX), Donald R. Riley (U.S. Department of Energy, Denver, CO)
Managing Culture Change in the Commercial Nuclear Industry and the DOE Weapons Complex / Anthony R. Buhl (TENERA, Knoxville, TN)
The Role of Organization and Culture in Risk Management / George A. Rodney (National Aeronautics and Space Administration, Washington, DC)
Framework for Assessing the Influence of Organization on Plant Safety / Mohammad Modarres, A. Mosleh (University of Maryland, College Park, MD), John Wreathall (Science Applications International Corporation, Dublin, OH)
Safety Culture in Bayesian and Legal Context or How Safe Is Safe Enough? / Harry E. P. Krug, Jr. (U.S. Department of Energy, Washington, DC)
Organizational Culture During the Accident Response Process / D. A. Shurberg, S. B. Haber (Brookhaven National Laboratory, Upton, NY)
The Addictive Organization / Diane Fassel (Wilson-Schaef Associates, Inc., Boulder, CO)
How Hype and Glory Gull / Marion K. Pinsdorf (Fordham University, New York, NY)
Controlling Risk in a Changing Environment / R. W. Keaten, A. H. Rone (GPU Nuclear Corporation, Parsippany, NJ) 167
RISK MANAGEMENT ACTIONS TO ENHANCE HUMAN RELIABILITY
Organizer and Co-Moderator: G. William Hannaman (SAIC/San Diego) Co-Moderator: Edward Frederick (GPU Nuclear Corporation)
Risk Management Actions to Enhance Human Reliability / G. William Hannaman (Science Applications International Corporation, San Diego, CA)

Enhancing Professionalism at GPU Nuclear /
Richard P. Coe (GPU Nuclear Corporation,
Parsippany, NJ)

FACTORS AFFECTING RELIABILITY OF HUMAN ACTIONS

	G. William Hannaman (SAIC/San Diego) George Dooley (DCS Systems) Annick Carnino (International Atomic Ene Agency)	ergy
Factors Affecting	Human Reliability / G. William Hannama	an
(Science Applicat	tions International Corporation,	
	1	195
An Evolutionary	Enhancement of the SLIM-MAUD	
	ating Human Error Rates / J. Zamanali	
(Baltimore Gas &	& Electric, Lusby, MD), F. R. Hubbard	
(FRH, Inc., Baltin	more, MD), A. Mosleh (University of	
Maryland, Colleg	e Park, MD)	196
Emergency Operation	ating Procedures for Severe Core Damage	
Mitigation / Sha	hin Seyedhosseini, Alexander Knoll,	
Fredrick W. Berg	g (Public Service Electric & Gas	
Company, Hanco	ocks Bridge, NJ)	207
Evidence of Circa	adian and Extended Shift Effects on Reacto	Г
Transient Freque	ncy / Stephen Maloney (Devonrue,	
Boston, MA)	•••••	211
	*	
Mental Models a	nd Learning from Experience in Nuclear	
Power Plants / J	I. S. Carroll (MIT Sloan School of	
Management, Ca	mbridge, MA)	213

INCIDENT INVESTIGATION AND FEEDBACK

Organizer: Mark Paradies (System Improvements) Co-Moderator: Edward Frederick (GPU Nuclear Corporation)

Incident Investigation and Feedback Session—Introduction / Mark Paradies (System Improvements, Inc., Knoxville, TN)....219

Investigation of Events Involving Human Performance / Richard J. Eckenrode, P. Clare Goodman, Garmon West, Jr. (U.S. Nuclear Regulatory Commission, Washington, DC)......234

RISK COMMUNICATION

-	Sharon Hudnall (Response Management) Charles Powers (Resources for Responsible
Co-Moderator:	Management) Douglas Bedell (GPU Nuclear Corporation)
(Response Mana	Communication / Sharon Hudnall gement, San Diego, CA), Douglas Bedell orporation, Middletown, PA)243
to Real Compreh Charles W. Powe	nunication to Risk Education: Plotting the Path ension and Active Choice in a Risky Society / ers (Resources for Responsible ston, MA)
U	of Communicating About Risk / Ann Fisher ate University, University Park, PA)248
Impossible? / C	Risk to the Public—Probabilistically harles O. Gallina (Illinois Department of Springfield, IL)253
Marie-Noele Sice	ew Goal in Risk Management / ard (Universite de Technologie de apiegne, France)256
Nuclear Fuel as a Bruce J. Minches (Idaho National	ility of the Use of Gamma Rays from Spent a Hazardous Waste Treatment Process / r, Richard P. Wells, Harry J. Reilly Engineering Laboratory, EG&G Idaho, Inc.,

Initial Crisis Risk Communication: A Success Story / Debra K. Traverso (Cleveland Electric Illuminating Company, Perry, OH), Steven B. Goldman (Technology and Management Planning Associates, Inc., Olney, MD)......271

APPLICATIONS OF QUANTITATIVE RISK ASSESSMENT TO NUCLEAR REACTOR SAFETY

Organizer: David Carlson (Sandia National Laboratories) Co-Moderator: Adolph Birkhofer (Gesellschaft für Reaktorsicherheit)

Perspectives on Quantitative Approaches to Risk Management / David D. Carlson (Sandia National Laboratories, Albuquerque, NM), Nathan Siu (EG&G Idaho, Inc., Idaho Falls, ID)
The Use of Probabilistic Safety Assessments Nuclear Safety in Europe / Adolf Birkhofer (Gesellschaft fur Reaktorsicherheit, Garching, Germany)
Risk Management Guidelines / Donald A. Dube (Northeast Utilities, Berlin, CT)
Connecticut Yankee Risk Reduction Initiative / E. A. Oswald, D. A. Dube, W. H. Becker, G. A. Flannery, S. J. Weyland (Northeast Utilities, Berlin, CT)
Cost Analysis and Financial Risk Profile for Severe Reactor Accidents at Waterford-3 / John D. Cutbush (ABZ, Inc., Chantilly, VA), William L. Carpenter, Jr., (Louisiana Power & Light Company, New Orleans, LA)
Value-Impact Assessment of Safety-Related Modifications / W. M. C. Knowles, K. S. Dinnie, C. W. Gordon (Ontario Hydro, Toronto, Ontario, Canada)
Trade-Off for the Savannah River Reactors Quantified with PRA Methods / S. V. Topp (Westinghouse Savannah River Technology Center, Aiken, SC)
Development of Insights from PRAs for Non-PRA People / Harry J. Reilly, Babette M. Meale (Idaho National Engineering Laboratory, EG&G Idaho, Inc., Idaho Falls, ID)
Estimating Management Impact on Core-Melt Frequency / Wei Ugo He, Norman C. Rasmussen (Massachusetts Institute of Technology, Cambridge, MA)

QUANTITATIVE APPROACHES TO MANAGING DIVERSE RISKS

Organizer:	David Carlson (Sandia National Laboratories)
Co-Moderator:	Nathan Siu (Massachusetts Institute of
	Technology
Co-Moderator:	Brian Wimpenny (Rolls-Royce & Associates)
A New Approach	n to Managing Nuclear Criticality Risk
	ervices, Inc., / Ron Green, Rik Droke,
	uclear Fuel Services, Inc., Erwin, TN)
Applications of F	PRA in Nuclear Criticality Safety /
Thomas P. McLa	ughlin (Los Alamos National Laboratory,
Los Alamos, NM)
Risk Managemer	t in Space / M. V. Aarset
(STATCON A/S,	Oslo, Norway)
Application of th	e Master Plant Logic Diagram in Risk-Based
Evaluations / M	Madaman (Il minamite of Mamiland

RISK MANAGEMENT GENERAL CHAIRS' CLOSING PLENARY

0-----

Organizer and Co-Moderator: B. John Garrick (PLG, Inc.)
Co-Moderator: Annick Carnino (International Atomic Energy Agency)
Risk Management General Chairs' Closing Plenary /
B. John Garrick (PLG, Inc., Newport Beach, CA), Annick
Carnino (International Atomic Energy Agency, Vienna, Austria)
· · · · · · · · · · · · · · · · · · ·
Reliability Implications on Manned Spaceflight via
Illustration of Shuttle Mission STS-43 /
Jim Adamson (National Aeronautics and Space Administration, Houston, TX)
To Best Manage Transportation Risk-Regulate or Deregulate? /
Vernon Leslie Grose (Omega Systems Group,
Arlington, VA)
Risk Management Practices at Unocal / Donald L. Hanley,
Narayanan Sankaran (Unocal, Los Angeles, CA)
How to Communicate Disk to Skanting, An Environmental
How to Communicate Risk to Skeptics: An Environmental Perspective / Lester B. Lave (Carnegie-Mellon
University, Pittsburgh, PA)
Evaluation of Risk Management Practices at Yankee Atomic*
Electric Company / S. P. Schultz (Yankee Atomic Electric Company, Bolton, MA)
Company, Douon, MA)
Risk-Based Radiation Protection Standards / Dade W. Moeller,
(Harvard School of Public Health, Boston, MA)