

# Risk Management REVIEW

Wharton

RISK MANAGEMENT  
AND DECISION  
PROCESSES CENTER  
SPRING 1998

## Managing Catastrophic Risks

The consequences of catastrophic risk from natural disasters are of major concern to private financial markets, the insurance community and the public sector. Combined insurance claims from Hurricane Andrew in Florida (\$15.5 billion) and the Northridge earthquake in California (\$12.5 billion) illustrate the magnitude of the losses associated with natural disasters.

A major research program begun within Wharton last year reflects this concern. This research project, "Managing Catastrophic Risk," is a joint activity of the Risk Management and Decision Processes Center and the Financial Institutions Center. The project is sponsored by a group of insurers, reinsurers, and financial institutions; it involves students and faculty from several departments at Wharton and the University of Pennsylvania.

Research will address one of the fundamental questions posed by natural disasters: how do structural and market dynamics influence future losses from natural disasters and the ability of the



*The consequences of catastrophic risk from natural disasters are a major concern to private financial markets, the insurance community and the public sector.*

insurance industry to provide coverage against such losses?

In the case of Hurricane Andrew and the Northridge earthquake, some insurer insolvencies occurred. The question of insurance industry capacity to pay for the "big one" is particularly significant when one considers the possibility of \$100 billion events in the future and the potential stress these disasters would place on insurance

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## Risk Center on the World Wide Web

Visit the Wharton Risk Management and Decision Processes Center's homepage on the World Wide Web at:

<http://opim.wharton.upenn.edu/risk/>

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The Wharton School  
University of Pennsylvania

New Challenges,  
New Opportunities

At its last Advisory Committee meeting, the Center explored two new initiatives that it will be pursuing over the coming year. One initiative is concerned with the development of organizational strategies for dealing with low-probability high-consequence events. This committee will be exploring a multi-disciplinary approach to modeling risk and the relationship that exists between costs, risks, and incentives. The outputs are expected to entail policy implications and possible legislative suggestions.

The second initiative concerns how small businesses make decisions regarding low-probability high-consequence events. This committee will explore how small firms assess and manage environmental risk and the relationship of this to their financial risk. The goal of this work is to suggest market mechanisms coupled with regulations better suited to the limited financial, legal, and human resources of the small firm.

Both of these initiatives signal the Center's expansion of activities while still maintaining its basic theme of characterizing and better managing low-probability high-consequence events. The proposed new projects are exciting on several fronts. They offer an opportunity of involving other faculty and students from different parts of Wharton and other parts of the University of Pennsylvania in Center activities. Secondly, they actively involve Center Advisory Committee members in helping to plan future activities of the Center and to provide critical input on ways to attract



Howard Kunreuther



Paul R. Kleindorfer

EH&S in Supply  
Chain Design

Fueled by the quality revolution in the early '80s, companies have come to see their business processes as the key source of cost, risk, and value. Business process improvement teams worked locally on their processes first and then on the quality of interconnecting links to

upstream and downstream processes. Quality management evolved into time-based competition, then into process reengineering, and finally into organizational transformation and the core competency movement. Process management became the central focus of organizational architecture and strategy.

Perhaps the most important consequence of the process management movement in the '90s has been the focus on the supply chain. Aided by new developments in Information Technology, companies have come to see supply chain excellence as a *sine qua non* for competitive success, with speed, quality, customer-focus, cost, and risk of the supply chain as basic value drivers. Increasingly, EH&S professionals have become essential members of company teams to assure effective supply chain performance.

Recent research at the Center (e.g., my work with Eli Snir in the Publications and Working Papers List on page 9 of this newsletter) has examined the role of EH&S in supply chain design and coordination. For industry leaders, what we find is a key role for EH&S in the identification and analysis of the environmental and ecological resources used in the extended supply chain. These "blueprinting" or

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funding, provide data for undertaking these studies, and suggest prescriptive recommendations.

Finally, the projects are designed to increase the interaction of Risk Center personnel with other Centers within Wharton. Groups like the Jones Center, the Huntsman Center, and the Manufacturing and Service Center offer possibilities for coordinated work. The Center is already engaged in this type of activity with the Financial Institutions Center on the "Managing Catastrophic Risk" project. A set of its activities are reported in this newsletter on page 1.

The challenges in reducing losses and better managing low-probability high-consequence events in the natural disaster realm and the area of technological hazards is attracting increasing attention. The Center wants to be at the forefront in designing programs that have chance of being implemented for dealing with the such disasters. The new initiatives, which will be spearheaded under the leadership of our new Advisory Committee chairperson, Robert P. Irvan, CFO of CIGNA, represents a challenge for all of us. We welcome a chance to learn from all of you on ways we can make these efforts successful.

— Howard C. Kunreuther  
Co-Director

## Environmental Justice: Its Time Has Come

Jerome Balter

Our media these days are filled with revelations about the wealthy buying access to influence members of the executive and legislative branches of government. Workers and low-income citizens don't have the resources to purchase such access—they can only appeal to public officials on the basis of the fundamental fairness of their position. Sometimes it even works.

Back in 1980, workers and community residents had no right to learn about toxic chemicals being used in the workplace or released into the community environment. And organizations such as the Chemical Manufacturers Association and the Chamber of Commerce used their lobbyists to try to keep it that way. But the fundamental unfairness of the prevailing law made it possible for workers and community residents to convince legislators to change the law. That is how Right-to-Know legislation came to be enacted in cities and states across the country and in the U.S. Congress.

Today, residents of low-income, poor-health, minority communities appeal for environmental justice to overcome their communities' increasing concentration of unwanted waste and toxic chemical facilities. The manifest injustice is made obvious by statistics such as the ones depicted below, which compare Delaware County, Pennsylvania, with the City of Chester, the largest municipality in Delaware County.

The Chester situation is not unique. So pervasive is the problem of environmental injustice that President Clinton issued an Executive Order in February 1994, imposing a responsibility on all government agencies to overcome environmental inequality. Though the federal agencies have been slow to



Jerome Balter with Zulene Mayfield, Chairperson, Chester (Pa.) Residents Concerned for Quality Living, discussing environmental justice.

respond to the Presidential order, in recent months there have been a number of decisions indicating that environmental justice may have played a key role in determining where not to site certain facilities.

In May 1997, the Nuclear Regulatory Commission refused to grant a license for building a uranium-enriched plant in the poor, all-black communities of Springs and Forrest Grove, Louisiana, and in September 1997, the EPA denied a permit for a polyvinyl chloride manufacturing facility proposed for Dentron, Louisiana, a poor black community that already has 12 chemical manufacturing facilities. And in October 1997, the Pennsylvania Department of Environmental Protection (DEP) denied a permit for a 300,000-ton-per-year soil remediation plant proposed for the City of Chester. Though the permit denial was officially based on inadequacies in the application, the fact that DEP has been charged in a federal lawsuit with violation of the EPA Civil Rights Regulation in respect to its issuance of waste facility permits in Chester may have had an

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	DELAWARE COUNTY <sup>(1)</sup>	CITY OF CHESTER	CITY OF CHESTER/DELAWARE COUNTY (%)
Population	508,000	42,000	8.3
% African-American	7.7	65	844
Median Family Income (\$)	37,500	21,000	56
Mortality Rate <sup>(2)</sup>	1,037	1,442	139
Cancer Mortality Rate <sup>(2)</sup>	260	358	138
Infant Mortality Rate <sup>(3)</sup>	8.9	17.6	198
Low Birth Weight Rate <sup>(4)</sup>	6.8	12.4	182
Waste Permits Issued (1987-1996)	2	5	250
Tons of Waste per Year (1987-1996)	1,400	2,000,000	142,857

<sup>(1)</sup> Excluding the City of Chester.

<sup>(3)</sup> Per 1000 births.

<sup>(2)</sup> Age adjusted rates per 100,000.

<sup>(4)</sup> Per 1000 live births

## Environmental Justice: Its Time Has Come

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effect on DEP's decision. In December 1997, the U. S. Court of Appeals ruled that the Chester residents had a right to enforce EPA's regulations without having to prove discriminatory intent on the part of the DEP.

Howard Kunreuther and his students have conducted considerable research into the role of the community in the siting of facilities that might adversely affect it. His work has included collaboration with researchers at MIT and Harvard. Despite their findings, existing systems for siting unwanted waste and chemical facilities have produced environmental injustice. These systems must be changed. Industry should not seek to locate unwanted waste or toxic chemical

facilities in low-income, poor-health, minority communities; government agencies should refuse to grant any permits for such facilities in such communities.

Experience teaches us that waste and chemical plants can be designed and operated without producing adverse community effects. And such facilities will be so designated and operated when they are no longer allowed in low-income, poor-health, minority communities. An end to environmental injustice will bring environmental justice for all.

One of the reasons the Center has an Advisory Committee is to suggest topics that are ripe for prescriptive research. The role of environmental

justice is one such area that needs additional research and the attention of all stakeholders.

*Jerome Balter is the Director of Environmental Projects for the Public Interest Law Center of Philadelphia. As a mechanical engineer and attorney he has been interested for many years in the adverse effects of technology on the community and has championed efforts to address inequities at the industry/government/community interface. In his pursuit of social justice he has represented clients in wide-ranging circumstances and before various legal jurisdictions. He is active in numerous legal and professional organizations and has been a member of the Center's Advisory Committee since 1990.*

## The Changing of the Guard

At the last meeting of the Risk Center Advisory Committee (AC), J. Robert Banks, who has chaired the committee for the last three years, retired as chairman (he will remain a member of the AC). Robert P. Irvan, who has been a member of the AC since 1993, accepted chairmanship of the current committee (see Advisory Committee, page 15). In a dinner and reception honoring Banks, Robert H. Campbell, CEO and Chairman of Sun Company, Inc., and Joan Bavaria, Co-Chair of the CERES Board and President of Franklin Research and Development Corporation, joined Irvan in a panel discussion of Risk Center activities. The group stressed the importance of pursuing relationships between industry, regulators, advocacy groups,



*Robert H. Campbell, CEO and Chairman of Sun Company, Inc., Joan Bavaria, Co-chair, CERES Board, and President, Franklin Research and Development Corporation, and Robert P. Irvan, Senior Vice President and Chief Financial Officer, CIGNA Property and Casualty, at Bob Bank's recognition dinner.*

academia, and other stakeholders and the need for understanding decision processes. They also stressed the need for developing risk management strategies for mitigating risks associated with low-probability high-consequence events.

The AC meeting the following day reviewed potential research projects for future Center interest. Bob Banks initiated the discussion by suggesting five key questions that should be asked in setting up any Center research project:

- *Who is the client/audience for the proposed research and who will use or benefit from the project?*
- *What is the time schedule for the research to be completed?*
- *Will the research be completed in time to be of use?*
- *What will be the impact of the research?*
- *Is the research unique to Wharton? Does it duplicate work done by others?*

To provide perspective for the day's discussions, Howard Kunreuther and Paul Kleindorfer reviewed the Center's recent research programs and the publications, roundtable meetings, and major conferences that have resulted from such work. For each project they indicated the effort made to link science with policy through the project's sponsors, research partners, and technical advisory committees. They used both successes and failures to illustrate these points. Howard Kunreuther continued the discussion, reviewing some of the Center's current research activities, and gave a detailed overview of the Managing Catastrophic Risk project. This joint project between the Risk Center and the Financial Institutions Center is aimed at exploring and examining the role of insurance, capital markets, and mitigation efforts in reducing losses from natural disasters. Howard concluded with a few key questions that indicate possible on-going research challenges:



*J. Robert Banks, Vice President, Health, Environment and Safety, Sun Company, Inc., wishing his successor Robert P. Irvan, Senior Vice President and Chief Financial Officer, CIGNA Property & Casualty, success as Chairman of the Advisory Committee.*



*Eric W. Orts, Associate Professor of Legal Studies, Wharton School, James A. Ament, Vice President Operations, State Farm Fire and Casualty Co., and James Makris, Director, Chemical Emergency Preparedness and Prevention Office, EPA at Bob Bank's recognition dinner.*

- *What role can mitigation play in reducing future losses from disasters?*
- *What impact does regulation have on the structure of insurance and reinsurance markets in protection against catastrophic risks?*
- *What are the challenges in developing financial instruments for providing coverage against catastrophic risk?*
- *What is the capacity on the insurance industry to respond to catastrophic events?*

Irv Rosenthal provided an overview of the Cooperative Agreement Project between the Chemical Emergency Preparedness and Prevention Office (CEPPO) of the U.S. Environmental Protection Agency and the Center. He summarized three areas of investigation that are currently active: investigations into chemical accident data; development of a risk assessment dictionary/thesaurus; and

the use of third parties as a mechanism for preventing major accidents. He concluded with a number of provocative questions and suggestions for future research.

Two potential themes developed from subsequent small group discussions: risk assessment and risk management in small entities with limited resources, i.e., in small businesses, governments, and communities; and a multi-disciplinary approach to modeling risk-sharing and the allocation of costs, risks, and incentives. Volunteers from the AC agreed to serve on the Risk Analysis and Small Businesses, and Risk Analysis and Strategies committees. Reports from these committees will be given at the next AC meeting on June 11.

*Questions concerning the Advisory Committee should be addressed to Howard Kunreuther (kunreuther@wharton.upenn.edu) or Paul Kleindorfer (kleindorfer@wharton.upenn.edu).*

## Low-Probability High-Consequence Events in the Chemical Industry

The Risk Center is interested in low-probability high-consequence events from both natural and anthropogenic origin. In recent years, the focus of its technological research has been on the chemical industry. Three avenues of research currently are being pursued.

### Use of ISO 14000 and Other Third-Party Mechanisms

The U.S. Environmental Protection Agency (EPA) estimates that 66,000 facilities, many small and not previously covered by process safety regulations, will be regulated under section 112(r) of the Clean Air Act Amendments, "Risk Management Programs for Chemical Accidental Release Prevention" ("the Rule"). At a time of decreasing federal and state budgets and a growing reluctance to enforce non-funded federal mandates, the cost-effective implementation of this new federal regulation requires movement away from command and control enforcement and the use of market-based approaches to compliance. The Risk Center and its Corporate Associates (page 14) have been conducting research with the Chemical Emergency Preparedness and Prevention Office (CEPPO) of the EPA to investigate the usefulness of independent third-party auditors. This research is being pursued in a series of roundtable meetings with a wide variety of stakeholders.

The ninth roundtable meeting in this series, held at Wharton on November 11, 1997, addressed issues such as the mechanisms and processes needed for the qualification and supervision of third-party auditors and the



*Irv Rosenthal, Wharton Risk Management and Decision Processes Center, chairing the Roundtable on the Use of 14000 and Other Third-Party Mechanisms*

definition of third parties' responsibilities and duties. The agenda also included the use of the ISO 14000 standard and third-party auditors qualified to audit under this standard. The ISO 14000 third-party model was considered as a means of dealing with businesses that are unique in their engineering and process design and whose technology and management systems are complex.

Previous roundtable meetings focused on the use of third-party auditors in industry segments, such as propane distributors, chlorine handling facilities, and anhydrous ammonia-based refrigeration systems, situations similar to the inspection of boilers and pressure vessels. These technologies are rather mature and well-developed, and are used by a large number of small businesses. EPA has already developed, or has committed to developing, model

Risk Management Plans (RMP) for these industry segments, which should promote the success of the third-party audit process.

During the Roundtable on November 11, CEPPO, EPA Region III, and the state of Delaware reported, based on the experience gathered during the course of EPA's Reinventing Government Initiatives and substantial (but not unanimous) comment from the previous eight Wharton roundtable meetings, that they are going forward with pilot programs to investigate the use of third parties as an option. They outlined the nature of the program and the incentives, responsibilities, and requirements for all parties involved in the program. A number of major points emerged from the discussion:

- Roundtable participants confirmed a third-party option as a desirable part of an overall approach to the implementation of the Rule. Many stakeholders expressed interest in participating in the process that would select, certify, and oversee third parties.
- Public legitimacy is essential for the success of a third-party option.
- The EPA needs to take the initiative in setting criteria for certifying third parties and the audit protocol, and determining whether the audit report should ensure compliance with the provisions of the Rule or certify a safe facility. The EPA should also define the mechanism and criteria by which groups would be qualified and selected to certify third parties and the means that the EPA would use for oversight.

- The first step in implementing a third-party option should be via the Boiler Model in one of the industries that have a model RMP in place, because large numbers of smaller, technically unsophisticated firms are likely to need assistance, and because qualifying third-party auditors and devising audit protocols for a narrow technology segment with a Model RMP in place will be easier.
- While the ISO 14000 third-party option holds great promise, its implementation should await experience with the Boiler Model, because presently there are relatively few regulated facilities that are registered under ISO 14000, and because it will be difficult to audit facilities that have unique technologies.
- Third-party auditors should be required to have significant levels of insurance (errors and omissions) in the performance of facility audits to assure local communities of their commitment.

### Improvements in Understanding Gained from the Investigation of Major Chemical Accidents

There are many examples of society's use of technology to obtain benefits and, by constantly modifying the social charter under which businesses operate, ensuring that its use will not adversely affect the common good. Nowhere is this better illustrated than in safety, health, and environmental regulations designed to prevent the occurrence of low-probability high-consequence accidents and discovering the underlying

ing root causes of accidents that do occur. Practical considerations, however, thwart both objectives.

Practitioners of major chemical accident risk have developed powerful methodologies for determining the underlying causes of accidents. These methodologies include techniques for gathering, classifying, and communicating accident information, through supply chains and to the general public. However, literature studies by the Risk Center have shown that root-cause accident investigations are not widely used in industry. If such studies are conducted, the findings generally are not made available because of the reasonably justified industry fear that root causes, often labeled as management system failures, will be unjustifiably used during subsequent civil liability proceedings.

Earlier Roundtable meetings on this topic reviewed the present balance between the prevention/punishment goals of accident investigation and whether that balance was appropriate in today's conditions. The consensus was that the balance was inappropriate and that much greater emphasis should be placed on knowledge gained from prevention methods.

The last Roundtable meeting reviewed accident investigation protocols that might lead to both increased knowledge and the dissemination of such knowledge. Candid and earnest discussions helped identify the obstacles that need to be overcome in achieving this goal. The objectives that seemed to warrant most attention are:

- Develop comprehensive accident investigation protocols that reflect

contributions from all stakeholders. These protocols should comply with and, if possible, transcend the existing standards and rules.

- Encourage a concerted effort by the EPA and OSHA with industry cooperation to adhere to a six-month time frame in which to complete compliance investigations, with the option of extending investigation beyond six months for the purpose of learning.
- Build increased trust in the accident investigation process among all stakeholders.
- Educate the public on potential hazards, risk prevention, and the probability that accidents can occur even with good practice.
- Provide positive incentives to firms and agencies that promote good accident investigations, as opposed to punishment of firms that seek to obscure learning in the accident investigation process.
- Reduce the limitations that the EPA and OSHA face in accident investigations.

### Chemical Accident Research Using RMP\* Info Database

Regulations under the Rule require manufacturing facilities to make public a risk management plan (RMP) prior to June 21, 1999, which must include a five-year record of chemical releases. An Electronic Submission Workgroup has been established within the EPA to create an electronic database (RMP\* Info database) for storing these data. This will be the first national database

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## Low-Probability High-Consequence Events in the Chemical Industry

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to contain the number of major chemical incidents occurring in a defined population of facilities, the size of the population of facilities in which these incidents occur, and extensive, updated demographic information on all of the facilities in the population.

The Risk Center has developed epidemiological methodology that it believes can be used together with the RMP\* Info database to determine the risk factors that lead to accidents. The Center has been holding a series of roundtable meetings with representatives of government, labor, industry,

technical societies, academic research groups, and the public. They seek to determine the types of questions that various stakeholders might need to answer, using an epidemiological approach to the RMP\* Info database. They also want to determine which database features RMP\* Info would need to make this type of research feasible.

At the last Roundtable meeting, representatives from public interest groups, industry, labor, government, and academe outlined questions and hypotheses of interest. There was a

consensus that this area of research holds great promise. To facilitate research in this area and promote cooperative efforts, Professors Kleindorfer and Lowe will develop and maintain a website devoted to the exchange of ideas in this area.

*Questions concerning any of the projects dealing with low-probability high-consequence events in the chemical industry should be addressed to Irv Rosenthal:*

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## Publications and Working Paper List

*Recent representative books, publications and working papers from the Risk Center's research faculty are listed below. The research faculty of the Risk Center includes senior Wharton and University of Pennsylvania faculty, as well as leading researchers from outside the University community. Center projects draw on faculty from economics, finance, health care systems, insurance, management, marketing, public policy and management, psychology, and decision sciences.*

### JONATHAN BARON

*Judgment Misguided: Intuition and Error in Public Decision Making.* New York: Oxford University Press, forthcoming.

"Biases in the Quantitative Measurement of Values for Public Decisions." *Psychological Bulletin*, 122:72-88 (1997).

"Confusion of Relative and Absolute Risk in Valuation." *Journal of Risk and Uncertainty*, 14:301-309 (1997).

- *with M. Spranca*  
"Protected Values." *Organizational Behavior and Human Decision Processes*, 70:1-16 (1997).

### EDWARD H. BOWMAN

- *with H. Kunreuther*  
"A Dynamic Model of Organizational Decision Making: Chemco Revisited Six Years After Bhopal." *Organizational Science*, 8(4):404-413 (July-August 1997).

### J. DAVID CUMMINS

- *with A.N. Berger and M.A. Weiss*  
"The Coexistence of Multiple Distribution Systems for Financial Services: The Case of Property-Liability Insurance." *The Journal of Business*, 70(4):515-546 (1997).

- *with C.M. Lewis and R.D. Phillips*  
"Pricing Catastrophic Loss Insurance: A Comparison of Engineering Simulation Analysis and Historical Loss Estimates." In *The Financing of Property/Casualty Risk*, K. Froot, editor. Chicago: University of Chicago Press, forthcoming.
- *with M.A. Weiss and H. Zi*  
"Organizational Form and Efficiency: An Analysis of Stock and Mutual Property-Liability Insurers." Working paper.

### PATRICIA M. DANZON

- *with S.E. Harrington*  
*Rate Regulations of Worker's Compensation Insurance: How Price Controls Increase Costs.* American Enterprise Institute Press, 1998.

#### NEIL A. DOHERTY

"Financial Innovation for Financing and Hedging Catastrophic Risk." In *Financial Risk Management for Natural Catastrophes*. N. R. Britton and J. Oliver, editors. Aon Group Australia Limited, 191-209, 1997.

#### JOHN C. HERSHEY

- *with M. Schweitzer and D.A. Asch*  
"Individual Choice in Health Care: Can We Rely on Patients to Choose Well?" *Medical Care*, 86:684-690 (1996).

#### ALBERT J. IGNATOWSKI

- *with I. Rosenthal and L.D. Helsing*  
"An Internet Thesaurus/Dictionary for Analyzing Risk Assessment Processes, Laws and Regulations." In *International Conference and Workshop on Risk Analysis and Process Safety*, American Institute of Chemical Engineers, 567-579, 1997.

#### PAUL R. KLEINDORFER

"Decision Sciences Foundations of Environmental Decision Making." In *Better Environmental Decision: Strategies for Governments, Businesses and Communities*, K. Sexton, editor. 1998.

"Market-Based Environmental Audits and Environmental Risk: Implementing ISO 14000." *The Geneva Papers on Risk Insurance*, 22(83):194-210 (April 1997).

- *with E.M. Snir*  
"Environmental Information in Supply Chain Design and Coordination." Presented at the Industrial Ecology Workshop, National Academy of Engineering, Woods Hole, Massachusetts, July 20-22, 1997.

#### HOWARD KUNREUTHER

"Managing Catastrophic Risks Through Insurance and Mitigation." In *Financial Risk Management for Natural Catastrophes*, N. R. Britton and J. Oliver, editors. Aon Group Australia Limited, 191-209 (1997).

- *with P. Freeman*  
*Managing Environmental Risk Through Insurance*. American Enterprise Institute and Kluwer Academic Press, 1997.
- *with P.R. Kleindorfer*  
"The Complimentary Roles of Insurance and Mitigation in Managing Catastrophic Risks." Presented at the Public Private Partnership 2000 Conference on "The Uncertainty of Managing Catastrophic Risk," Washington, D.C., December 11, 1997.

#### JACQUELINE R. MESZAROS

"The Cognition of Catastrophe: Preliminary Examination of an Industry in Transition." Center working paper, 1997.

#### PATRICK J. MCNULTY

- *with R.A. Barrish and R.C. Antoff*  
"Use of the OECD Dictionary/Thesaurus to Encode Delaware's Law for Process Safety." In *International Conference and Workshop on Risk Analysis and Process Safety*, American Institute of Chemical Engineers, 593-602, 1997.

#### ERIC W. ORTS

"Shirking and Sharking: A Legal Theory of the Firm." *Yale Law and Policy Review*, forthcoming.

- *with P.R. Kleindorfer*

"Informational Regulations of Environmental Risk." *Risk Analysis*, forthcoming.

#### MARK V. PAULY

*Health Benefits at Work*. University of Michigan Press, 1997.

"Environmental Liability Insurance as a Handmaiden to International Trade and Investment." *The Geneva Papers on Risk and Insurance*, 22(83) (April 1997).

- *with S.D. Ramsey*  
"Structural Incentives and Adoption of Medical Technologies in HMO and Fee-for-Service Health Insurance Plans." *Inquiry*, 34 (Fall 1997).

#### ISADORE (IRV) ROSENTHAL

- *with B.J.M. Ale and L.D. Helsing*  
"An Outline of the Approach Being Used In Developing the OECD Dictionary/Thesaurus of Risk Assessment Terminology." Presented at the International Conference Mapping Environmental Risks and Risk Comparisons, Amsterdam, The Netherlands, October 21-24, 1997.

#### ALEX FARRELL

- *with J.J. Winebrake*  
"The AFV Credit Program and Its Role in Future AFV Market Development." *Transportation Research*, 2(2):125-132 (1997).

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## Judgment Misguided: Intuition and Error in Public Decision Making

Jonathan Baron

*Judgment Misguided: Intuition and Error in Public Decision Making*, soon to be published by the Oxford University Press (New York), concerns certain intuitions, particularly moral intuitions, that work themselves through the system of law, government, and free enterprise. The intuitions in question are those that oppose the idea of doing the most good. Not surprisingly, I argue, these intuitions make public outcomes worse.

For example, major fisheries around the world are declining. Cod, flounder, and halibut are almost gone from the once-teeming Atlantic waters off New England and Canada. The same thing is happening off the Pacific Northwest coast. We cannot expect fishers to voluntarily cut back to avoid these catastrophes, but we might expect them not to lobby against effective regulation that is in their long-term interest.

Yet, fishers oppose regulations, often because they see them as unfair. Their perception of fairness is itself tailored to their own circumstances. Fishers in states with relatively small catches in the past, such as Connecticut, think it is unfair to base future catch limits on past catches; fishers elsewhere think it is unfair to do otherwise. Likewise, Maryland fishers want separate length limits for them on striped bass, because the fish are smaller off the Maryland coast. Fishers farther north think that the same length for everyone is the only fair rule. In such cases, regulations are tied up, and, when they are finally imposed, it is too late.

The same intuitions underlie the current debate about global warming. The developed countries want something close to the same regulations for

everyone. Developing countries think it unfair if they cannot burn fuels to grow, as the developed countries did before them.

Other intuitions work against agreement here: People want harms undone in kind, so that, if the problem was caused by burning fuel, the solution is to burn less fuel. Alternative solutions, such as sucking carbon out of the air by fertilizing marine phytoplankton with iron (the “Geritol solution”), conflict with intuitive opposition to “going against nature,” something that is, alas, too late to avoid. Still other solutions, such as making adaptation easier by reducing population growth, run against this intuition of naturalism, and against other intuitions, such as the belief in autonomy (non-interference with private decisions, however public their effects). These solutions may or may not be more cost-effective than burning less fuel, but they are not being examined thoroughly. To many, they seem intuitively wrong.

My book examines other such intuitions that affect risk regulation, birth control and abortion, international conflict, trade agreements, distribution of benefits and burdens, etc.

To reduce these problems, people should think more quantitatively about consequences. This does not mean converting everything to numbers. Rather, people must understand that good decisions consider the magnitudes and probabilities of their effects. Because of the efforts of schools and universities, the media, and even public officials, people now think this way more than in the past, but the change could happen faster still.

*Jonathan Baron is Professor of Psychology and Education.*

## Comings and Goings

**Jwee Ping Er** has completed his doctoral studies in insurance and risk management and is a lecturer at the National University of Singapore (NUS). Dr. Er is working with the Productivity and Quality Research Center, NUS, conducting research in credit risk management, credit unions and third party inspections. He will continue collaborative research with faculty members in the Wharton School.

**Alex Farrell** has completed his doctoral studies in energy management and environmental policy and is a Research Fellow in the Belfer Center for Science and International Affairs, Kennedy School of Government, Harvard University. Before joining the group in Cambridge, Dr. Farrell spent some time with the EPA in Washington, D.C., preparing a working paper on sustainability.

**Albert J. Ignatowski**, Principal, *HazCom* Consulting, has been named Senior Fellow in the Wharton Risk Management and Decision Processes Center. Before forming *HazCom*, Dr. Ignatowski spent 33 years with the Rohm and Haas Company where his last assignment was manager in charge of hazard communication for satisfying chemical regulatory requirements.

**Christian Schade** is a visiting scholar from Johann Wolfgang Goethe University, Frankfurt, Germany, at the Risk Center this spring. He will be conducting experiments on how bundling of insurance policies and warranties with the insured product influences the purchase decision. His research is supported by a grant from the German Research Foundation (DFG).

## Managing Catastrophic Risks

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markets. Furthermore, the influence of government regulations on the supply and purchase of coverage is broad and complex. Government financing of catastrophic risk through residual market mechanisms, special CAT funds, and other devices adds other elements of uncertainty to the ultimate capacity available.

The rise in natural disaster costs and the recognition of the insurance industry's overexposure has caused insurers to look for sources of capital different from premium revenue and reinsurance, the traditional sources. In particular, the possibility of using new types of financial instruments to secure backstop capital from the normal capital market has emerged as a major focus of activity in the United States and Japan. The Managing Catastrophic Risk project will be evaluating these prototype offerings, as well as the general question of the necessary preconditions for such financial

instruments to supplement traditional coverage for catastrophic risks.

The project is also concerned with the role of mitigation and its impact on future losses from natural disasters. To that end, the team is working with the three leading modeling organizations in the country—Applied Insurance Research, EQECAT, and Risk Management Solutions—to evaluate how specific loss reduction measures and policy tools affect three U.S. cities: Miami, Oakland, and Long Beach. A Technical Advisory Committee has been established to critique the modeling activity and to offer suggestions on the types of analyses that might be undertaken on the model cities.

During 1997, in two meetings held at Wharton, faculty members reported on the early stages of research addressing the types of mitigation measures that appear to be cost-effective, the financial ability of the insurance industry to respond to catastrophic risk, the impact



*How do structural and market dynamics impact future losses from natural disasters and the ability of the insurance industry to provide coverage?*



*The question of insurance industry capacity to pay for the "big one" is particularly significant when one considers the possibility of \$100 billion events in the future and the potential stress these disasters would place on insurance markets.*

of regulations on market capacity, and the relationship between catastrophic risk insurance and capital markets. In December, the Wharton School sponsored a workshop, "The Uncertainty of Managing Catastrophic Risks," one of a series of forums that are part of the Public Private Partnership 2000 (PPP 2000), a cooperative endeavor of 19 federal agencies, the Institute for Business and Home Safety, and a wide variety of private-sector organizations.

Progress on Wharton's multi-year research project will be reported in future issues of the newsletter.

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## OECD Dictionary/Thesaurus

Variations in language, legal jurisdiction, and technical discipline make it difficult to understand or compare different risk assessments. The Chemical Emergency Preparedness and Prevention Office (CEPPO) of the U.S. Environmental Protection Agency (EPA) is taking the leadership role within the Organization for Economic Cooperation and Development (OECD) in supporting research in the Risk Center to develop a Risk Assessment Dictionary/Thesaurus. CEPPO and the Risk Center are working cooperatively on this research effort with OECD countries, in particular the Netherlands, the UK, and France. The intent of the Risk Assessment Dictionary/Thesaurus is not to create a standardized risk assessment nomenclature or risk assessment practice, but rather to provide a means to better understand what various regulations and risk assessment practitioners actually mean.

The approach taken by the Center has been to create a comprehensive



*Gerald Spindler (Germany), Gerald C. M. Lommers (The Netherlands), Lyse D. Helsing (United States) and Jean LeGuen (United Kingdom).*

risk assessment hierarchy divided into four major sections and two supplemental sections. The major sections are referred to as *generic elements*. The four generic elements correspond roughly to the four major considerations that the literature generally includes in the

scheme for doing a risk assessment. Various technical subtleties modified the hierarchy. This hierarchical structure was converted into a questionnaire format designed to elicit information on the risk assessment item being entered in operational language.

During 1997, the Phase 1 version of the Dictionary/Thesaurus was installed on a Wharton web site. Task force members from participating OECD countries encoded regulations aimed at preventing major chemical releases. The results from Phase 1 of the project were discussed in a meeting at Wharton and provided the basis for Phase 2 research.

Phase 2 of the Dictionary/Thesaurus was undertaken to allow easier data entry, simpler query routines, comparative analysis of encoded data, and both the implicit and explicit meanings of definitions and regulations. Representatives from OECD member countries used Phase 2 version of the Dictionary/Thesaurus to encode risk



*Representatives from governmental agencies and private firms at Wharton discussing the OECD Dictionary/Thesaurus: Marel Chapron (France), Karel Bláha (Czech Republic), Amanda Lees (United Kingdom) and Gerry Phillips (Nova Chemicals Limited, Canada).*

assessments for the storage and/or processing of chlorine and propane. To provide further points of comparison, they also encoded the meaning of ten basic terms used in their country's risk assessment regulations. Reports on use of the Dictionary/Thesaurus were presented at October meetings in the United States and in Europe (see publications, page 9). In December 1997, a complete report was presented at the International Conference Mapping Environmental Risks and Risk Comparisons, at the OECD meeting in Paris.

Research to date has shown that variations in risk assessment processes, both the terms used and the practices required by various regulations, are far greater than anticipated. Use of the Dictionary/Thesaurus is allowing

practitioners to more objectively examine risk assessment methodology and to make the scope and the intent of regulations more readily understood.

As a result of the meetings held in October and December, Phase 3 research on the Dictionary/Thesaurus will take place during the first half of 1998. It will consist of modifying both hardware and software to facilitate easier data entry and support better query capability.

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*Bernard J. M. Ale (The Netherlands) and Michael S. Hogg (BP International Limited, United Kingdom).*

## **EH&S in Supply Chain Design**

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“metric” activities are then coupled with initiatives to eliminate risk, waste, and inefficiency in this eco-supply chain, just as economic waste has been eliminated in the traditional supply chain of business activities.

The tools for accomplishing this are not new. Green Design and Life-cycle Analysis as tools to understanding a product's complete impact on the environment have been used for some time. Product stewardship, as promoted by CMA's Responsible Care Code, emphasizes the need to encompass a product's entire span, from 'cradle to grave' and across the extended supply chain to assure environmental

responsibility. Reverse (or “Eco-”) Logistics is a related set of methods to reduce environmental impacts through recycling of packaging and products. And, of course, Risk Management methods are by now 'old hat' in EH&S-intensive industries.

What is new here is the integrated use of these traditional approaches in the context of improving the performance of the extended supply chain, not just in terms of cost, time, and inventory, but also in terms of eco-efficiency and risk. The objectives of this integration are enhanced corporate image and regulatory compliance, with reduced risks and liabilities

from pollution, biocides, and toxins in the extended supply chain. By coupling the integration of EH&S activities with new IT approaches to coordinate supply chain operations, EH&S strategies can achieve significant synergies with overall supply chain redesign approaches. In the words of Harald Einsmann, president of Procter & Gamble Europe, the result is “1 + 1 = 11,” a huge gain for both EH&S and traditional supply chain performance.

**— Paul R. Kleindorfer**  
*Co-Director*

## The Limits of Risk Reduction

David A. Asch and John C. Hershey

As managed care increases in the United States and, more generally, as more industrial models of health care delivery take hold, many have looked to clinical guidelines as a way to reduce cost, sustain quality, and measure performance. Many of these clinical guidelines are the products of quantitative policy analysis, like cost effectiveness analysis, decision analyses, and other techniques designed to help managers make decisions under conditions of uncertainty.

The promise of clinical guidelines is that they might standardize approaches to health care, when in the past physicians' practices have greatly varied. Clinical guidelines appeal to an emerging breed of medical managers who believe that guidelines force consideration of tradeoffs and priorities in health care delivery that so far haven't been made explicit.

Despite these promises, physicians do not uniformly embrace clinical practice guidelines. Some consider them emblematic of the more general erosion of individual physician's autonomy and authority. Others are concerned that guidelines may legitimate lower quality for everyone. We think this latter concern is valid.

The problem is not with the guidelines themselves, but the way they are created. In many cases, they derive from clinical results that are reported only in terms of averages and expectations for a group, not in terms of the distribution of outcomes actually available to individual patients. The result is that they can make medical decisions appear less risky than they really are.

Looking only from a group perspective is similar to looking at a diversified portfolio of financial investments. Because each security is unlikely to move in lock step with other securities, variations in investment

performance tend to offset each other. Investors who pool capital into a mutual fund share this reduced risk.

But these decisions of diversification rarely apply to decisions about health care. Diversification requires perspective and assumes that individual gains and losses can offset each other. This may work with individual securities, but it doesn't work with individual patients. When you invest in 100 securities you don't care about the return of each stock: you care about the average return. However, when you recommend a medical intervention to 100 patients, you ought to care about the outcome in each case.

Physicians, who are used to facing patients one-by-one, may reasonably conclude that guidelines based on average or group outcomes don't fit with their practice goals. Consider the recommendation not to order an extra test to detect a rare disease. Physicians may still favor the test because they recognize that each patient is unlikely to bear the average burden and receive the average benefit.

Managed care organizations have a responsibility to care about the distribution of clinical outcomes on individual patients when making recommendations for the group as a whole. They may be able to put their providers into a common financial risk pool, but they cannot put their patients in a common health risk pool. The health professionals have many lessons to learn from financial and industrial management models of thinking. But the power of diversification is not one of them.

*David A. Asch is Associate Professor of General Internal Medicine and John C. Hershey is Daniel H. Silberberg Professor and Professor of Operation and Information Management, Health Care Systems, and Psychology.*

## CORPORATE ASSOCIATES

The Corporate Associates program is a vital part of the Risk Center's operation. In addition to providing financial support, the Corporate Associates sit on the Center's Advisory Committee, participate in roundtable meetings and provide the Center with information and insight into the value, direction and timing of research projects.

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