Northeastern

Department of Civil and Environmental Engineering Distinguished Seminar Series

Risk and Resilience: Current Developments and Trends

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458 Richards Hall

Abstract

Risk-based approaches have been used to predict global change and mitigate consequences associated with changing environment. Risk assessment requires quantifying the risk of each component of a system and its associated uncertainties. Quantification's goal is to identify each component's contribution to the overall risk to ascertain if one component poses substantially more risk than the others. If so, that component becomes the basis for developing a quantitative benchmark, which becomes the de facto risk-based standard. The rapid technological evolution, unprecedented nature, and extent of emerging threats defy us to enumerate the potential hazards, much less estimate reliable probabilities of occurrence and the magnitude of consequences. Thus, a comprehensive approach to protecting the nation's critical infrastructure, economy, and well-being must be risk based—not risk exclusive—and it must not end at risk assessment but rather provide a way for decision makers to make their organizational systems resilient to a range of threats within specific cost and time restraints. This points towards an emerging concept of resilience. In contrast to the definition of risk, resilience is focused on the ability to prepare and recover quickly from threats which may be known or unknown. Whereas risk involves the identification and assessment of threats acting on or within a system, resilience can be thought of as a property of the system itself. Managing for resilience requires ensuring a system's ability to plan and prepare for a hazard, and then absorb, recover, and adapt to the hazard. This, coupled with a systems view, in which systems are defined as containing components across physical, information, cognitive, and social environments in which the system exists, is the basis for resilience. Decision analytical tools and network science approaches can be used to quantify resilience. This presentation will review history of risk assessment and management and discuss emergence of resilience management and its role in Global Change research and critical infrastructure management. Case studies in the areas of coastal infrastructure, transportation, building resilience, cybersecurity, and disease epidemics management will be discussed. Specifically, summaries of the two recent workshops on Risk and Resilience (Aspen, 2015 and Azores 2016) will be presented and the International Risk Governance Council (IRGC) Guidebook on Resilience released in Davos in August 2016 will be introduced.

Biographical Sketch

Dr. Linkov leads the Risk and Decision Science Team and Focus Area at the US Army Engineer Research and Development Center, he is also Adjunct Professor of Engineering and Public Policy at Carnegie Mellon University. Dr. Linkov has managed multiple risk assessments and risk management projects in the areas of resilient infrastructure, cybersecurity, nanomaterials, environmental management, climate change, energy, and systems vulnerability. He is currently leading several projects implementing resilience management for cyber systems, critical infrastructure, energy and environment. He has published widely on environmental policy, environmental modeling, and risk analysis, including thirteen books and over 250 peer-reviewed papers and book chapters. Dr. Linkov has organized more than twenty national and international conferences and continuing education workshops, including workshops on Risk and Resilience in Berlin (2014), Aspen (2015) and Azores (2016) and 2015 World Congress on Risk in Singapore and 2018 World Congress on Risk in South Africa. He has served on many review and advisory panels for DOD, DHS, FDA, EPA, NSF, EU and other US and international agencies. The Governor of Massachusetts has appointed Dr. Linkov to serve as a Scientific Advisor to the Toxic Use Reduction Institute. He served as 2013 US Embassy Fellow in Berlin and will serve at the US Mission at OECD in 2017. He is recipient of two Army medals for outstanding civilian service. He is the recipient of the 2014 Society for Risk Analysis (SRA) Outstanding Practitioner Award, 2005 SRA Chauncey Starr Award for exceptional contribution to Risk Analysis, SRA Fellow award and was an elected SRA Councilor (2009-2013). He is elected fellow of the American Association for the Advancement of Science (AAAS). Dr. Linkov has a B.S. and M.Sc. in Physics and Mathematics (Polytechnic Institute) and a Ph.D. in Environmental, Occupational and Radiation Health (University of Pittsburgh). He completed his postdoctoral training in Risk Assessment at Harvard University.

Igor Linkov, PhD

Risk and Decision Science Focus Area Lead, US Army Engineer Research and Development Center

Adjunct Professor, Carnegie Mellon University

Education

- **Post-Doctoral training, Biostatistics and Toxicology, *Harvard University***
- **PhD, Environmental, Occupational & Radiation health, *University of Pittsburg***
- **MS, Physics and Mathematics, *Polytechnic Institute***
- **BS equivalent, Materials Science, *Polytechnic Institute***

Research Interests

- **Risk analysis & management**
- **Decision analysis**
- **Environment management and policy**
- **Infrastructure resilience**

Selected Service and Awards

- **Served on many review and advisory panels for DOD, DHS, FDA, EPA, NSF, EU and other US and international agencies.**
- **Scientific Advisor to the Toxic Use Reduction Institute**
- **Recipient of two Army medals for outstanding civilian service.**
- **Society for Risk Analysis (SRA) Outstanding Practitioner Award**