

Risk Analysis and Sustainability: Building the Yellow Brick Road

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In the *Wizard of Oz*, Dorothy and her companions follow the Yellow Brick Road through risky adventures ranging from an apple tree that does not want to be picked to an angry witch with lethal powers who is looking for revenge. After much trepidation, adventure and barely surviving, they arrive at the Emerald City, where they meet the almighty Wizard.

Today's Emerald City would be shaped around sustainable practices, and the Wizard would have a team of risk analysts in service. Sustainability is a goal grounded in the belief that we have the responsibility to think beyond the present: that is, we need to plan and implement in anticipation of possible impactful events, and our thinking and planning need to emphasize the reality that future generations require water, energy and other resources, and more generally that they must not inherit a compromised high-risk future.

Risk analysis is a process tool supported by many analytical methods that answers six questions. The first three are risk assessment:

1. What can go wrong?
2. What are the chances that something with serious consequences will go wrong?
3. What are the consequences if something does go wrong?

The second three are risk management:

4. How can consequences be prevented or reduced?
5. How can recovery be enhanced, if the scenario occurs?
6. How can key local officials, expert staff and the public be informed to reduce concern and increase trust and confidence?

The first objective of answering these six questions is to understand human health, ecological and economic implications of anthropogenic and natural hazard events, such as hurricanes, tornadoes, industrial activities, transportation modes, new drugs and treatments, products and many others. The second objective is to try to prevent the consequences or at least reduce the damage. Finally, if an event occurs, the goal is to return to normal – or a new normal – as soon as possible. All three of these objectives require our institutions to respond quickly and effectively.

Risk analysis can help us better understand the sustainability-related consequences of alternative actions. For example, should we continue to build and expand medical care facilities in the 100-year floodplain? Should we allow homes to be built in areas that have a history of mudslides? How do we protect a structure containing very hazardous materials from an earthquake that might occur only once during the next 1000 years? Thinking about sustainability in a risk analysis framework forces decision-makers to confront the consequences of events that might not occur in the immediate future but could be extraordinarily impactful when they do occur, unless, we hope, a sustainable design has been put in place.

Currently, the link between sustainability and risk analysis is most apparent in the management of nuclear waste. The long-lived nature of some nuclear elements requires solutions that will last for generations and are flexible enough to be modified should the need for recovering stored nuclear materials arise. I am not saying that the marriage of risk analysis and sustainability in nuclear waste management has been a perfect one. We know from highly publicized events that it is not. But we also know that these are taken seriously and efforts are made to prevent them from happening again. We badly need to see more applications of risk analysis in regard to planning for natural hazard events, managing long-lived non-nuclear chemical and physical agents and their wastes, and developing and marketing new products.

While I hope to see many more illustrations in the not-too-distant future, I know that building the Yellow Brick Road that leads us along a sustainability path will be a challenge because the effort and cost involved create angst among those who are firmly focused on the present and see sustainability as a waste of resources because they assume that the future will take care of itself. In particular, I am concerned about the propensity to cut government human and ecological health and safety budgets for research and enforcement, the retirement of many of the most experienced and technically competent members of the workforce, and the increasing pressure to turn inventions into marketable products immediately to increase profits and reduce the chances of theft of ideas. Some believe that technology drives the world economy, and whether you do or do not, the reality is that the benefits of new technologies and threats imposed by new technology necessitate that we invoke the process and methods of risk analysis in support of a sustainable future.

If you are curious to read more about this subject, I suggest consulting three websites:

- www.sra.org is the official website of the Society for Risk Analysis. It has been recently upgraded and contains numerous links. The editors of the society's journal have prepared several virtual books that summarize parts of the field, such as risk analysis and terrorism and the economics of risk analysis. You can access these online.
- www.epa.gov/riskassessment is the US Environmental Protection Agency's portal. It presents updates on guidance, new information and other places to search.
- www.riskworld.com is a web location that tries to track everything in the field, including articles, laws, books, news and other information.

In regard to journals, I recommend *Risk Analysis: An International Journal*, which offers a wide range of papers. I also recommend the *Journal of Risk Research*, which is produced by the European SRA. These two will give you a feel for topics that researchers are working on. For example, one of my recent papers in *Risk Analysis* presented mathematical models used to simulate how terrorists or natural hazards might disable a major passenger railroad system, how many people might be killed and injured, the property and other economic damages from such events, and how we might prevent those events or at least reduce their impacts. Another of my

papers examined public support in New Jersey for restrictive land use decisions following multiple massive hurricanes.

If you are interested in a truly exciting opportunity to work on critically important projects that will increasingly influence every person on Earth, then think about contributing to risk analysis in support of a sustainable future. Your mode of contribution is not prescribed. The entry points include, but are not limited to, lawyer, engineer, environmental scientist, mathematician, physicist, chemist, sociologist, and public health researcher. Together, we need to create the capability of a real Wizard to protect our collective future.