Risk Assessors Taken to Task

The numbers are issued with startling precision: 90.3 deaths per million from exposure to, say, benzene. Partly based on these risk estimates, regulations are crafted and millions of dollars are spent. But the apparent precision in those numbers belies how fragile they really are, says Adam Finkel in a new report from Resources for the Future, *Confronting Uncertainty in Risk Management*. Finkel challenges federal regulatory agencies to change the way they assess chemical and other hazards.

Finkel is not calling for a wholesale revision of risk assessment practices. Rather, he is simply asking the Environmental Protection Agency and other agencies to admit how squishy the numbers are and, more important, to factor this uncertainty into their risk assessments.

What that would mean is that instead of providing a point estimate, the 90.3 deaths, risk analysts would provide a distribution of estimates, with some indication of the likelihood that each number is correct—for example, how confident the analyst is that the risk is greater than 20 deaths per year, and so on. Analysts typically address uncertainty now, says Finkel, by ginning up an elaborate number, which sometimes stretches out to several significant figures, and then saying, "but of course it could be zero"—an approach Finkel dismisses as "cowardly." He contends that analysts don't know enough to say the risk is precisely 90.3, but they should be able to provide more information than simply saying that the range is somewhere between 0 and 90.

"Right now risk assessors don't do a very good job with uncertainty," concedes Joseph Rodricks, who does risk assessments at the Environ Corp. in Arlington, Virginia. And one reason, he says, is that the kind of analysis Finkel is suggesting can be a lot of work. "To portray honestly what we know and don't know about risk is a bigger endeavor than the typical risk assessment."

What Finkel would have risk assessors do is factor in the uncertainty inherent in each step in their analyses. As he describes it, there are perhaps two dozen assumptions made in every risk assessment. For example, in calculating the health risk from the toxic air pollutant perchloroethylene (PCE), a solvent used in dry cleaning, the risk analyst must estimate how much PCE is emitted from the exhaust vents, how far it disperses, how much a hypothetical person 5 miles away breathes in, how much reaches the liver and lungs, and so on. And then there are the host of biological assumptions involved in evaluating PCE's toxicity in rats and then extrapolating that information to humans.

Now risk analysts typically pick a number for each assumption and then put all the numbers together to come up with a final point estimate. Finkel would instead provide a range of numbers for each assumption and then plug those ranges into a computer to generate the overall risk distribution using Monte Carlo techniques. The data would then be presented to a decision-maker, preferably with a graph showing the range of risk estimates with the associated probabilities.

Finkel admits that his scheme would jack up both the time and cost of doing a risk assessment but doesn't think that would be prohibitive, especially since it would put regulatory decisions on a more solid and defensible footing. Increasingly, regulators are relying on quantitative risk assessment, says Finkel, citing proposed Clean Air Act legislation that sets a "bright line" of acceptable risk at one cancer in 1 million people exposed to toxic chemicals in air.

But how feasible Finkel's scheme is remains to be seen. The key question, says J. Clarence Davies, assistant administrator for policy, planning, and evaluation at EPA, is whether "it can really be fitted into the analytic process in the agency in a way that makes sense—that doesn't overload the analyst or the decision-makers by giving them so much information that they can't use it."

Rodricks is skeptical, though he applauds Finkel for pushing the agency in the right direction. "The problem is getting anyone to use this kind of analysis. Risk managers want simplicity; they want point estimates. And they will continue to push risk assessors to come up with their best estimate and ignore the uncertainties."

Perhaps the best tack, suggests Rodricks, would be to try out this scheme selectively for those chemicals and exposures that warrant extra caution—"those for which the consequences of an error in the risk assessment are enormous."

At EPA, officials were already thinking about how to incorporate uncertainty into risk analysis and are now looking closely at the report, says Davies, who calls it "very useful." ■ **LESLIE ROBERTS**

Space Planners Brought Down to Earth

The National Research Council (NRC) last week dashed some cold water on President Bush's ambitious plans for space travel. The critique appeared in a newly issued report* on the President's "Human Exploration Initiative," which calls for building a base on the moon and advancing to Mars in the next decade.

Suggestions for how to do this have come from planners at the National Aeronautics and Space Administration (NASA) and from a more adventurous crew at the Livermore National Laboratory. The latter, led by Lowell Wood, put forward a concept they call "The Great Exploration." Its core concept consisted of space stations of inflatable material, an approach that looks wonderfully cheap. Livermore estimated that the United States could construct bases on the moon and Mars by the year 2000. NASA's more traditional scenario would put humans on Mars by 2011.

The NRC review of these ideas, chaired by former presidential science adviser H. Guyford Stever, praised the objectives but found some big problems:

■ Livermore's "Great Exploration" depends on the use of materials that have never been tested in space and were not designed for extraterrestrial wear and tear. The committee was "not convinced" that these items would work as assumed. It also found that Livermore "underestimates the many engineering and operational challenges involved in bringing its technical concepts to practical realization."

■ More attention must be given to transportation and energy needs, the committee said. Although the Administration is threatening to cut a rocket R&D project funded jointly by the Department of Defense and NASA called the Advanced Launch System, the NRC says that new propulsion systems of this kind are crucial. It also found it "essential" to develop a space nuclear power system.

■ "The nation has no strategy for research to determine the need for. . .artificial gravity," the NRC says, even though it may be essential for human survival on interplanetary trips. ■ **ELIOT MARSHALL**

*"Human Exploration of Space: A Review of NASA's 90-Day Study and Alternatives" (National Academy Press, Washington DC, 1990).