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The Need to Go Beyond Analysis in Making Risk-Based Decisions

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“... the assessment of risk has carried its own risk – namely, an undue reliance on logical quantitative techniques that fail to address the root causes of public concern and apprehension.” [1]

Background

To the technical world, risk analysis for many years has been based on $R(A) = P(A) \times C(A)$. When public attitudes toward technologies that carried the potential for catastrophe were studied, this standard formula was modified by some to incorporate an increase in risk above $P \times C$ by using an exponential factor, C^a (a suggestion by David Okrent) or a multiplier risk factor, RCF. [2] In both cases, the attempt still based the assessment on technology or natural science in calculating the probability of the event and the health consequences. (Ecological consequences were less considered.)

Paul Slovic and his colleagues, in papers stretching over two decades, substantially expanded the understanding of public perception of risk, although how the public reaches some perceptions may be disputed. [3] Most analysts are now familiar with the four quadrant diagram which has axes measuring familiar to unfamiliar, common to uncommon, voluntary to involuntary, and understandable to dread. The evolving concepts in risk analysis can be seen in risk studies published by the U.S. National Academy Press. In 1983, the Red Book came out, focused on Risk Management. This stressed the role of analysis. In 1989, *Improving Risk Communication* stressed the need for two-way true dialogue between government and public, but still relied on traditional risk analysis. In 1997, *Understanding Risk* gave very little space to traditional analysis, but concentrated on working with what the book calls interested and affected parties (getting away from the term stakeholder) to decide what should be examined, how it should be examined, and how any decision should be made.

Much of the risk literature, both technical and social science, addresses issues involving nuclear reactors or radioactive waste. Both topics are appropriate for this conference. The background description for this conference states “The controversy surrounding the long-term disposal of radioactive waste provides opportunity for discussing ... the factual issues and the value issues in the decision-making process... the ultimate goal will be to look at ways to develop more transparent decision processes in a democratic society.”

Any topic relating to radioactivity has problems which Slovic has identified as technological stigma. As we know, radioactivity (the radiation) is invisible, odorless, cannot be felt at the levels usually of concern, and has effects that may not show up for decades. Although most technical people will argue against the linkage, nuclear power – the sources of much of the radioactive waste – is associated by the general public with nuclear weapons. Thus, the stigma is large.

Attempts have been made to involve local publics in siting of radioactive waste facilities or nuclear power reactors. The results often bear out what the risk communication study found: The disputes often are not about facts, but about values. Jin Tan Liu and V. Kerry Smith studied an attempt by the Taiwan Nuclear Power Company to develop support for another reactor by holding an extensive educational campaign. [4] The campaign was not biased, attempted to be objective and informative, and ended up increasing public opposition. Armour describes a process taking ten years, with two years of public hearings, to site a facility for industrial hazardous wastes in Canada. The proposed site was rejected when the hearing board decided that the proponents, while showing the site met the pertinent environmental standards, had not shown the site was optimal.

In the United States, government agencies involved in risk work often are told to follow Thomas Jefferson’s advice that if the public is not informed, it is the duty of the government to inform them. A former administrator of the EPA would quote Jefferson and add, “Easy for him to say.”

Even today, some technical people believe that public opposition is irrational. Peter Sandman has written that such is irrational if you believe it is rational “to ignore equity, uncertainty, locus of control and the various other factors that affect, not ‘distort,’ our sense of what risks are acceptable and which are not.” [5]

“The principles that are supposed to be applied in a democratic society are that a potential decision should be announced well before the decision is to be made, with all the necessary data and analyses made available to any concerned citizen. After a reasonable length of time, meetings should be held between the concerned public and the government officials and their staffs to discuss the ramifications of the potential

decision, to discuss what new information is needed, and to discuss any other issues relating to the potential decision.” [6]

As both the *Risk Communication* and *Understanding Risk* books pointed out, one should not expect agreement merely because an open dialogue is held: Agreement should not be expected – hoped for, yes, but not expected. Then why engage in open dialogue, why make the system transparent?

Because a democracy is built on the consent of the governed. Consequently, substantial effort must be expended to provide information. And any public meeting must be one in which opponents or doubters are listened to respectfully and answers to their questions are provided. Perhaps the best that can be achieved is, in Sandman’s term, getting to maybe.

Radioactive Waste

The United States, as do other countries with nuclear power plants, has an accumulation of high-level waste, primarily spent fuel. (A few countries also have the high-level waste from the manufacture of nuclear weapons. While a problem in only a few countries, at least in the United States and Russia this waste is a much more serious problem than spent fuel.)

There are what I believe are myths concerning spent fuel. First, that resolution of what to do with it is essential for the future of nuclear power. At least in the United States, I believe nuclear power’s demise is mainly related to the extremely high cost of constructing nuclear power plants. Solving the spent fuel problem will do nothing to alleviate the construction cost problem. A second myth is that the spent fuel must be moved to a repository now for public health and safety reasons. I believe, as does the U.S. Nuclear Regulatory Commission, that the onsite storage, in pools or dry casks, is quite safe and will remain so for decades.

Finally, some opponents of the Yucca Mountain repository or of interim storage sites seem to be seeking a magic land solution. This is a land in which no one has ever lived nor will live in the future, in which there are no possible pathways for radioactive material to reach the biosphere, and to which there would be no possible danger in transporting spent fuel.

The waste exists. What should be done with it? A recent Congressional hearing on this issue showed the continued opposition of political leaders in the State of Nevada to any high-level waste storage facility in Nevada. The new Representative, acknowledging she was not raising any new issues, said everything has been said, but not everyone has said it. The U.S. Department of Energy recently completed a several year, multi-volume study of the viability of the Yucca Mountain repository. Although there remain some open issues, and recommendations have been made to reduce the

operating temperature of the storage areas, the Department of Energy concluded that there are no fundamental objections. But the Department of Energy is not believed by the Nevada opponents: Once credibility and trust are lost, it is nearly impossible to regain.

In the United States, we have been unable to site either new low-level waste facilities or to complete the high-level waste facility. The low-level waste sites that have been attempted have failed, typically after the host state has spent at least \$80 million. The Yucca Mountain effort has absorbed at least \$5 billion, but, unlike the low-level sites, some construction has occurred -- seven miles of tunnels have been dug.

At the end of March, after 25 years of studies, the Waste Isolation Pilot Plant (WIPP), in New Mexico, received the first shipment of transuranic waste (TRU). This may not end the controversy concerning WIPP, since opponents have gone to court to attempt not only to block any additional shipments, but also to require the Department of Energy to remove the first shipment.

Public Involvement

If a low-level waste facility cannot be sited, what hope is there for a high-level waste facility? The issues are somewhat different. The United States does have three operating low-level facilities, and the volume of low-level waste being generated has dropped dramatically with the introduction of improved waste segregation, compaction, and incineration. For high-level waste, however, all the effort in the U.S. for the past nearly 20 years has been on the Congressionally selected Yucca Mountain. However suitable the site may be, the process of selecting it violated the concepts of public participation developed over many years. The public in Nevada had almost no say in the selection process and, on the grounds of fairness, have justifiably opposed developing the site.

Unfortunately, fairness is not a legal requirement. The argument therefore is made on either geology or responsibilities to future generations. Regarding geology, the issues relate to predicting behavior over times longer than recorded history.

Regarding responsibilities to future generations, the International Atomic Energy Agency has said that "The objective of radioactive waste management is to deal with radioactive waste in a manner that protects human health and the environment now and in the future without imposing undue burdens on future generations." That does not resolve the issue, since people disagree on what is or is not a future burden.

The U.S. does have processes to involve the public in such major federal decisions. These are rule-making, under our Administrative Procedures Act, and the Environmental Impact Statement (EIS) process, under the National Environmental

Protection Act (NEPA). Both have been challenged as being inadequate by the environmental community. However, I believe the inadequacies are not in the processes, but in how some agencies administer them. They also have been challenged by some in the scientific community. The objections are several:

- (1) While accepting that these processes allow the public to participate in a significant way, the objection is that the public may be wrong. However, in a democracy, the public has a right to be wrong.
- (2) The public may not understand.
 - (a) One reason may be that the information provided may be deceptive, or may be framed in misleading ways. In the United States, courts have been the locale for correcting these errors.
 - (b) The proposal, either in rule-making or in the EIS, may be unclear. This can be challenged in comments to both.
 - (c) The subject is too complex in the draft rule. This also can be challenged until the complexity is broken down.

Summary

As a physicist, I prefer the $R = P \times C$, with the inclusion of a risk magnifier when appropriate. However, I also accept this is inadequate. For risk-based decisions to be acceptable in a democratic society, there must be widespread agreement on the criteria to be used, the process by which the decision is reached, and the linkage between the criteria and the decision. These demand a transparent process.

Armour wrote: "To date, efforts directed toward facility siting conflicts have focused almost exclusively on the 'public acceptance' factor [and neglected the legitimacy of the process] ... the sad reality is that these strategies have not been all that effective. Moreover, given that the underlying motivation is to 'gain public acceptance' such strategies have often worsened the facility siting problems when used by proponents who were unable, in appearance or in fact, to tread the fine line between manipulating public opinion and liberating it ... the issue of the legitimacy of the decision making process had tended to be taken for granted. Generally speaking, policy makers have failed to seriously question and have not responded well to others who have dared to question the established roles and principles of our conventional processes of decision making." [7]

Finally, acceptance also requires agreement that the issues to be decided are the appropriate issues. Often the decision-makers concentrate on issues that are not the ones the public views as the most important. Sometimes it is because the public wants other alternatives examined. Sometimes it is because the public does not accept the necessity to decide now. And sometimes it is because the public does not trust those who have assumed responsibility for making the decision.