26 January 1979, Volume 203, Number 4378

SCIENCE

Risk: A Pragmatic De Minimis Approach

Society is becoming increasingly well informed and anxiety-prone about technology-associated risks, which leads to desire for their elimination. The logical and traditional approach is first to estimate the risk, a scientific task. Then comes the issue of risk acceptance, a most difficult step—moving from the world of facts to the world of values. Ideally, judgments involving risk acceptance should be made on society's behalf by a constitutionally appropriate body. But no such public decision-making process exists. We make do with disparate efforts of individuals, special-interest groups, self-appointed public interest groups, and legislative, judicial, and regulatory systems. However, if at least very large and very small risks were dealt with on the factual basis of effects, the individual and social value systems could be accommodated to some degree and much confusion avoided.

It is human nature to be concerned primarily with effects on our own person and family and secondarily with effects on the population at large. Unfortunately, although we can predict statistical effects on populations, there is no way to predict effects on individuals. This is why fortune-tellers never become as rich as insurance companies. We need then to define actuarially the existing state of well-being and calculate effects on it.

Each person has a probability of dying in any particular year, the value depending mainly on age. The existing probabilities are well known for the United States. For example, in 1975, 1.89 million died out of a population of 213 million, giving an overall probability of 1 in 113. For some specific age groups the values were: 1 to 4 years, 1 in 1425; 5 to 14 years, 1 in 2849; 25 to 34 years, 1 in 692; 55 to 64 years, 1 in 67. We can now answer the question, What does changing a risk do to a person's existing probability of dying? For instance, if a young child were exposed to an additional risk of 1 in 100,000 (0.014 in 1425) in 1975, his overall risk for that year would be 1 in 1425 plus 0.014 in 1425, or 1.014 in 1425.

For the purpose of discussion some guidelines, which may depend somewhat on age, can now be stated in terms of numerical risk:

1) Eliminate any risk that carries no benefit or is easily avoided.

2) Eliminate any large risk (about 1 in 10,000 per year or greater) that does not carry clearly overriding benefits.

3) Ignore for the time being any small risk (about 1 in 100,000 per year or less) that does not fall into category 1.

4) Actively study risks falling between these limits, with the view that the risk of taking any proposed action should be weighed against the risk of not taking that action.

Clearly, these suggested guidelines are a gross oversimplification. The unfortunate, overtaken by a one-in-a-million catastrophe, have a 100 percent chance of harm. The hard fact is that attempts to eliminate risks for the unfortunate few tend to markedly increase them for the rest of a large population. This idea is most difficult to defend politically, especially when the unfortunate few are known and the unfortunate many are nameless. In addition, it is necessary to take into account such matters as validity and uncertainty in risk estimates, nonlethal and esthetic effects, voluntary versus involuntary risks, societal abhorrences, and the strange versus the familiar.

Nevertheless, other than depriving the news media of a ready source of attention-grabbing items, the pragmatic de minimis approach should serve to promote understanding about how to deal with risk in the real world; encourage identifiers of risk to provide risk estimates; focus attention on actions that can effectively improve health and welfare and at the same time avoid squandering resources in attempts to reduce small risks while leaving larger ones unattended; and prevent anxiety, apathy, or derision as a response to the increasing recognition that we apparently live in a sea of carcinogens (the "today" risk).—CYRIL L. COMAR, *Professor Emeritus, Cornell University, and Director, Environmental Assessment Department, Electric Power Research Institute, Palo Alto, California 94303*