Risk assessment is a decision-making technique that first came into use during the presidency of Jimmy Carter, who was trained as a nuclear engineer. At its best, risk assessment is an honest attempt to find a rational basis for decisions, by analyzing the available scientific evidence. In theory it is still an attractive ideal -- to make rational decisions based on scientific evidence -- because in principle it should allow diverse parties to agree on what needs to be done. However, 20 years of actual practice have badly tarnished the ideal of risk assessment and have sullied the reputation of many a risk assessor.

History of Risk Assessment

During the late 1960s it slowly became clear that many modern technologies had far surpassed human understanding, giving rise to byproducts that were dangerous, long-lived, and completely unanticipated. A book-length report issued by the White House in 1965 began with a letter signed by President Lyndon Johnson, who said, "Ours is a nation of affluence. But the technology that has permitted our affluence spews out vast quantities of wastes and spent products that pollute our air, poison our waters, and even impair our ability to feed ourselves."[1] The 1965 White House report identified numerous major sources of environmental contamination: municipal and industrial sewage, animal wastes, municipal solid wastes, mining wastes, and "unintentional releases," which included automobile exhausts, smoke stack emissions, pesticidal mists, and agricultural chemicals draining into waterways, among others. The main report contained "subpanel reports" on soil contamination, the potential for global warming by carbon dioxide, the effects of chlorinating wastes, the health effects of environmental pollution, and "the effects of pollutants on organisms other than man."

In 1969, the U.S. Secretary of Health, Education and Welfare issued another book-length report on "Pesticides and Their Relationship to Environmental Health." The report said, "Recent evidence indicates our need to be concerned about the unintentional effects of pesticides on various life forms within the environment and on human health. It is becoming increasingly apparent that the benefits of using pesticides must be considered in the context of the present and potential risks of pesticide usage. Sound judgments must be made."[2]

Therefore by the mid-1970s it was obvious even to journalists and politicians that industrial technology had a massive dark side. Technical mastery of natural forces was leading not to safety and well being but to a careless and accelerating dispersal of dangerous poisons into the biosphere with consequences impossible to predict.

During the 1970s, in response to a decade of disturbing reports and revelations, a vast "environmental movement" developed, made up of citizens concerned about one place or another -- their dinner table, the playground in their neighborhood, the river running through their town (often the source of their drinking water). They demanded reforms. Congress reacted by writing laws the size of a telephone book and by creating new agencies and departments to issue enforceable regulations.

As all the early official reports make clear, in those days environmental contamination was viewed through the twin lenses of engineering and traditional toxicology. Traditional toxicology maintains that "the dose makes the poison" -- meaning that everything is poisonous at a high enough dose, and you can prevent poisoning by giving a low enough dose. The engineer seeks to fine tune the nation's industrial apparatus to deliver just that dose and no more. At least that was the theory.

Unfortunately, there was one key element missing from this prescription: pollution pays handsomely. In the short run, corporations that dump their toxic wastes into a river, or bury them in the ground, make much more money than corporations that sequester and detoxify their wastes at great expense. Therefore, a political struggle of enormous proportions ensued. On one side, the petrochemical giants (such as Dow, DuPont, and Monsanto) were by then producing an array of profitable new products -- polymers, plastics, pesticides. On the other side, an alarmed citizenry demanded safety. This got translated into "safe doses."

In response to the new laws and regulations, governments at all levels geared up to make "sound judgments" inside this political pressure cooker. Under these circumstances, "risk assessment" seemed like a way to rationalize government decision-making, instead of allowing bureaucrats to make arbitrary choices: gather the necessary data, ask a group of impartial experts to interpret it, and render a sound judgment. What could be more reasonable?

Unfortunately, it did not work out. In the first place, as we shall see, the necessary data are not available, even today. In the second place, the traditional toxicological assumptions did not hold up under scrutiny. For many poisons, there is no safe dose. And finally, impartial experts are almost never impartial. Someone is paying their hefty fee and that someone often gets the benefit of the doubt when it comes time to interpret whatever data is available. Experts can be bought, it turns out.

In 1995, after risk assessment had been refined for 20 years, three well-known and well-respected risk assessors working for the California Department of Environmental Protection -- Anna Fan, Robert Howd, and Brian Davis -- published a detailed summary of the status of risk assessment.[3] In it, they pointed out:

** There is no agreement on which tests to use to determine whether someone's immune system has been damaged;

** There is no agreement on which tests should be used to assess damage to the nervous system;

** There is no agreement on ways to test for genetic damage.

Without agreement on test methods, people cannot agree on which data to include in a risk assessment. Under these circumstances, different risk assessors will select the data that they believe is relevant and they will usually reach different conclusions -- often VASTLY different conclusions.

Some kinds of toxicants present special problems because there is no threshold for damage -- in other words, there is no dose below which no effects occur. For these toxicants, any exposure may cause some damage. For such toxicants, the only "safe" dose is zero, if we define "safe" the way it is defined in a dictionary: secure from threat or danger.

** Some genetic damage may be a nonthreshold event because "direct chemical interactions with genes represent nonthreshold phenomena," Fan, Howd and Davis say. [Thus, only zero is safe, if safety is defined the way a dictionary defines it. --P.M.]

** If genetic damage occurs in a germ cell, it may be inherited by successive generations. Thus, some genetic damage is classified as damage to the reproductive system and/or the developmental systems. These kinds of damage may have lifelong effects: "a child may lead a less healthy life, may be more susceptible to disease, or have shortened productivity and life span," Fan, Howd, and Davis say. [For these kinds of damage, the only safe exposure is zero. --P.M.]
**Cancer is a considered nontreshold event under U.S. regulatory law. Any exposure to certain carcinogens may initiate a sequence that results in cancer. [Thus the only safe exposure is zero.--P.M.]

Fan, Howd, and Davis do not say so, but there are other problems with risk assessments:

** Science has no way to analyze the effects of multiple exposures, and almost all modern humans are routinely subjected to multiple exposures: pesticides; automobile exhaust; dioxins in meat, fish and dairy products; prescription drugs; tobacco smoke; food additives; ultraviolet sunlight passing through the earth's damaged ozone shield; and so on. Determining the cumulative effect of these insults is a scientific impossibility, so most risk assessors simply exclude these inconvenient realities. But the resulting risk assessment is bogus.

** According to the U.S. National Academy of Sciences (NAS), which in 1983 published the official formula for conducting a risk assessment,[4] risk assessments are supposed to take into account the special characteristics of the population at risk: Are they obese? Is their diet adequate? Do they suffer from chronic disorders like asthma, diabetes, or arthritis? Are they very young or very old? Are they pregnant? Do they eat unusual quantities of contaminated foods, such as cheese or fish? Most risk assessors simply ignore this NAS requirement for examining the characteristics of a population.

** Risk assessment, it is now clear, promises what it cannot deliver, and so is misleading at best and fraudulent at worst. It pretends to provide a rational assessment of “risk” or “safety” but it can do no such thing because the required data are simply not available, nor are standardized methods of interpretation. Science, as a way of knowing, has strict limits and risk assessment encompasses a set of problems too complex for science to solve. As Fan, Howd and Davis acknowledge, risk assessment is not a science, it is an art, combining data gathered by scientific methods with a large dose of judgment. Judgment is not reproducible from laboratory to laboratory so different risk assessors reach different conclusions, often based on who's paying.

** Risk assessment is inherently an undemocratic process because most people cannot understand the data, the calculations, or the basis for the risk assessor's judgment.

Now after 20 years, the public is catching on, that risk assessment has been a failure and in many cases a scam. Rather than allowing citizens to reach agreement on what's best, it has provided a patina of "scientific objectivity" that powerful corporations have used to justify continued contamination of the environment. With a few rare exceptions (sulfur dioxide emissions, for example) dangerous discharges have increased geometrically during the period when risk assessment has been the dominant mode of decision-making. It is now obvious to most people that risk assessment is a key part of the problem, not an important part of any solution.

In place of risk assessment, a new paradigm is ripening: the principle of precautionary action. The precautionary principle acknowledges that we are ignorant about many important aspects of the environment and human health. It acknowledges scientific uncertainty and guides our actions in response to it. The precautionary principle says,

"When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically. In this context the proponent of an activity, rather than the public, should bear the burden of proof. [See REHW #586.]

"The process of applying the Precautionary Principle must be open, informed and democratic and must include potentially affected parties. It must also involve an examination of the full range of alternatives, including no action."

The basic idea? Make decisions based on familiar maxims: An ounce of prevention is worth a pound of cure. Look before you leap. Better safe than sorry. Do unto others as you would have others do unto you.

This is not rocket science. Definitely not rocket science.

--Peter Montague (National Writers Union, UAW Local 1981/AFL-CIO)


Descriptor terms: history of risk assessment; precautionary principle;