Risk assessment is one way of making decisions, but it is not the only way, and it is not the best way.[1] Furthermore, risk assessment as usually practiced is unethical. Risk assessment has been described by the National Academy of Sciences (NAS) as a four-step process.[2]

**STEP 1: HAZARD IDENTIFICATION.** This step is supposed to estimate chemical damage from acute (single dose), subchronic (a few doses), or chronic exposures for each possible toxic endpoint. Toxic "endpoints" include cancer, damage to organs (liver, kidney, heart, etc.), developmental disorders, damage to the immune system, central nervous system, reproductive system, and genes. Because organisms (whether hamsters or people) react differently at different stages of development, particularly while in the womb, dozens of "endpoints" must be considered. In actual practice, most endpoints are simply ignored.

**STEP 2: DOSE-RESPONSE ASSESSMENT.** Dose-response assessment means determining what damage, and to which bodily systems, will occur as the dose of a chemical increases. Most people are familiar with the concept of dose-response; think of the effects from drinking one, two, or three glasses of wine. In general, greater dose leads to greater effect. Usually assessing dose-response for a chemical requires estimating ("extrapolating") from data about laboratory animals, who have been given high doses, to effects in humans who typically receive low doses from environmental exposures. There are many different ways of "extrapolating" from high-dose animal data down to low-dose human estimates.

**STEP 3: EXPOSURE ASSESSMENT.** Exposure assessment tries, or should try, to determine how much of a chemical is absorbed from all sources. Example: if the chemical is a pesticide, exposures might occur through food, water, air, and perhaps even skin, through home and occupational uses. (In practice, many sources of exposure are usually ignored.)

**STEP 4: RISK CHARACTERIZATION.** Ideally, risk characterization takes information from hazard assessment, dose-response assessment, and exposure assessment, then adds information about the characteristics of the affected population --How old are they? Are they generally malnourished? Overweight?--and combines it all together to determine an estimate of hazard (called "risk"). (In practice, the characteristics of a particular population are usually ignored and averages are used instead.) Hazard (called "risk") is expressed as a probability of a particular kind of harm to a specified group of people during a stated period of time. For example, a typical estimate of "risk" might be expressed this way: a particular group of people is expected to endure one additional cancer for every 100,000 people, over and above the normal risk of cancer, as a result of chronic exposure to some toxic chemical in their drinking water during their lifetimes of 70 years.

Despite the NAS's idealistic description of risk assessment, the process is deeply flawed and subject to abuse.

**NO RISK IS ACCEPTABLE IF IT IS AVOIDABLE:** When people are examining a full range of alternatives, they have an opportunity to apply the principle that, "No risk is acceptable if it is avoidable." However, when people are merely doing a risk assessment, this principle cannot come into play. A risk assessment never reaches the conclusion that a risk is avoidable because risk assessment NEVER asks whether a particular risk can be avoided. That is simply not a question that risk assessment asks.

An example will show the difference between these two approaches (risk assessment vs. examining all the alternatives): In some communities, a decision has been made (often without any public input) to burn solid waste. This decision has then been justified by a risk assessment. A risk assessor is called in to show that the incinerator will "only" harm one in a million people living nearby. Because the harm is so "small," the incinerator is deemed "acceptable." This is a typical use of risk assessment, to justify a decision that was made by lawyers, financial analysts, bankers, corporate officials, and elected officials. Often, such a decision is announced after the fact, and then a risk assessment is completed to "prove" to the public that such a decision is "acceptable.

Another way of approaching an incinerator would be to step back and ask, "What is the problem we are trying to solve here?" One answer is "the problem of solid waste" or perhaps even "use and disposal of items that are not biodegradable." Then the question becomes, what are the different ways of solving such a problem? Here the public will have a great deal to say, and the search for an answer can be a model of democracy. For some portion of solid waste, recycling and reuse are obvious alternatives to incineration. Separating out the toxic materials, and landfills the remainder, is another alternative. Some communities have even banned certain kinds of consumer products because they are so difficult to get rid of without creating dangers. Batteries that contain mercury are one example; certain plastics are another example. Obviously there are many alternatives to examine, including some alternatives that involve asking people to consider changing their own behavior.

Once the various alternatives have been described, then risk assessment could be applied to each alternative, as one part of a decision-making process.

**A BETTER WAY OF MAKING DECISIONS IS AVAILABLE:** To assure that all viewpoints are brought to the table, we should not rely on risk assessment for decision-making. Instead, we could employ a decision-making technique that was described in the National Environmental Policy Act (NEPA) of 1969, a federal law. NEPA requires that, before certain decisions can be made, all reasonable alternatives must be examined. If this approach is taken, then the public can get involved in describing and discussing all reasonable alternatives. In such a process, all viewpoints can be aired. Cultural values, historical perspectives, and local concerns can all be brought into the decision, along with issues of technology, costs, and benefits. People can look at all the alternatives and can decide which one they prefer. The process of thinking about alternatives is healthy for a community -- it helps people visualize the future that they want for themselves and their children. Risk assessment suppresses such discussions.

**RELIANCE ON RISK ASSESSMENT HARM'S DEMOCRACY:** Because risk assessment is a mathematical technique, most people cannot understand, or participate in, risk assessments. Therefore, reliance on risk assessment for decision-making harms democracy because most people are excluded from the process.
make a choice, they want to balance the disadvantages AND the advantages, the costs AND the benefits. Risk assessment merely assesses the costs (the "risks") of one proposal and asks whether those costs are "acceptable" or not. But people in the real world don't just want to know whether the "costs" are acceptable -- they also want to know whether the "benefits" are sufficiently desirable. Assessing all the alternatives will allow people to discuss benefits as well as costs.

** RISK ASSESSMENT OF ONE OR A FEW CHOICES IS UNETHICAL: The environment is being harmed and needs to be protected. Therefore, ethical considerations require us to try to harm the environment as little as possible. Risk assessment does not ask the question, "What is the least harm we can do?" Instead, risk assessment asks, "Will the damage we are going to do be acceptable?" To provide an ethical framework for decision-making, we need to ask, "Which alternative will bring sufficient benefits AND minimize damage to the earth?" If a decision has not been made by examining all available alternatives and then selecting the least-damaging alternative, the decision is not an ethical one. Risk assessment as commonly practiced is unethical because it excludes discussion of reasonable alternatives, including least-damaging alternatives.

In sum, in the recent past, risk assessment has often been used to impose bad decisions on people-of-color communities, on indigenous people, and on communities that lack political power. Even when risk assessment is used for legitimate purposes, it falls short as a decision-making technique because it does not consider benefits or alternatives; it only evaluates "risks" and furthermore it only evaluates some of the "risks." Finally, it can never evaluate the hazards of multiple exposures.

The main decision-making tool that we should rely on is "looking at all the available alternatives" and having a full public discussion of the costs AND THE BENEFITS of those alternatives. This approach can engage the community in discussion of what is desirable and what is important, not merely what is an "acceptable risk." In an open, democratic decision-making process, risk assessment might play some role in helping people evaluate a full range of alternatives, but it should certainly never be the only decision-making technique, and it should never be applied to a single choice or to a narrow range of choices.

Unless we search for least-damaging alternatives, our decisions cannot be ethical ones. A decision made by examining the risks of a single alternative, or of a narrow range of alternatives, can never be an ethical decision. Protecting the environment requires us to examine all the alternatives in an open, democratic process, examine all the costs and all the benefits, and then choose the least-damaging alternative.

--Peter Montague

[1] Thanks to Tom Goldtooth of the Indigenous Environmental Network (IEN), and to Paul Connett of St. Lawrence University, who expanded our thinking about risk assessment. Credit for the main ideas in this discussion of decision-making belongs to Mary O'Brien, who nevertheless bears no responsibility for the way those ideas are presented here.
