

pesticide residues on foods—environmental hazards that are invisible or little understood and whose presence in our lives is largely outside our personal control. In contrast, people are readier to accept and ignore the risks of smoking cigarettes, overeating, and not exercising, which are voluntary activities statistically shown to pose far greater risks to health.

### Risk assessment analyzes risk quantitatively

The quantitative measurement of risk and the comparison of risks involved in different activities or substances together are termed **risk assessment**. Risk assessment is a way to identify and outline problems. In environmental health, it helps ascertain which substances and activities pose health threats to people or wildlife and which are largely safe.

Assessing risk for a chemical substance involves several steps. The first steps involve the scientific study of toxicity we examined above—determining whether a substance has toxic effects and, through dose-response analysis, measuring how effects vary with the degree of exposure. Subsequent steps involve assessing the individual's or population's likely extent of exposure to the substance, including the frequency of contact, the concentrations likely encountered, and the length of encounter.

### Risk management combines science and other social factors

Accurate risk assessment is a vital step toward effective **risk management**, which consists of decisions and strategies to minimize risk. In most nations, risk management is handled largely by federal agencies. In the United States, these include agencies such as the Food and Drug Administration (FDA), the EPA, and the CDC. In risk management, scientific assessments

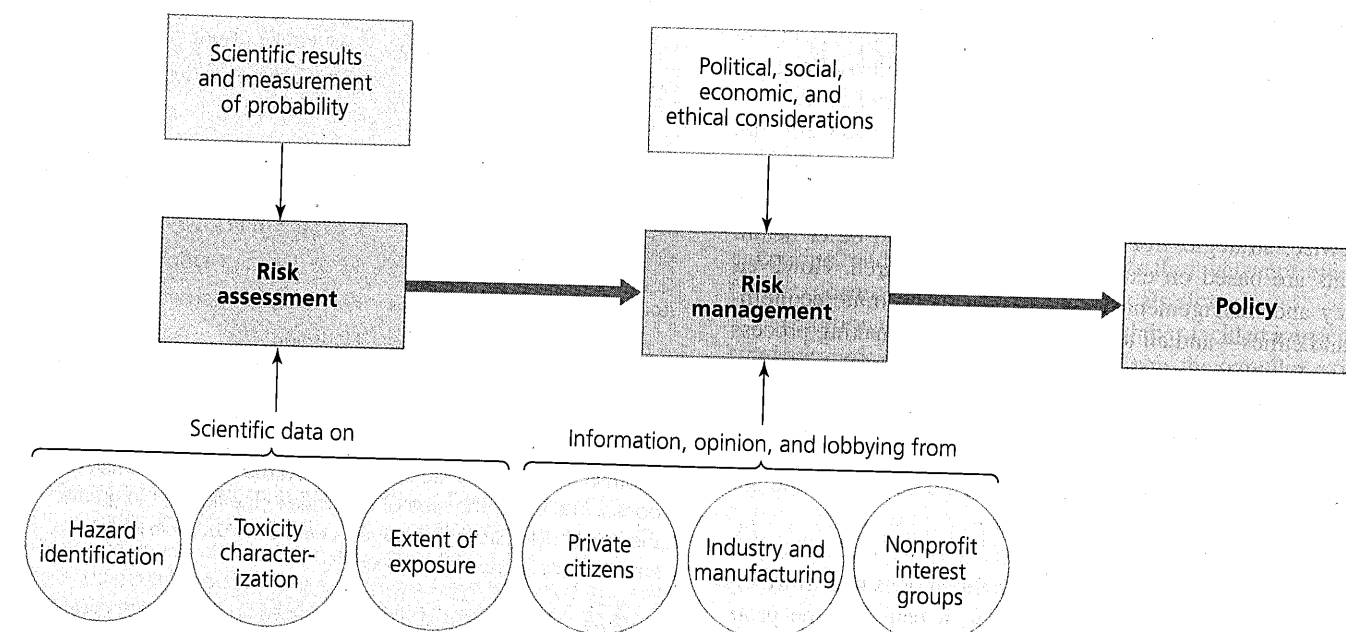
of risk are considered in light of economic, social, and political needs and values. Risk managers assess costs and benefits of addressing risk in various ways, with regard to both scientific and nonscientific concerns, before making decisions on whether and how to reduce or eliminate risk (FIGURE 10.11).

In environmental health and toxicology, comparing costs and benefits (p. 96) can be difficult because the benefits are often economic, whereas the costs often pertain to health. Moreover, economic benefits are generally known, easily quantified, and of a discrete and stable amount, whereas health risks are hard-to-measure probabilities, often involving a small percentage of people likely to suffer greatly and a large majority likely to experience little effect. Because of the lack of equivalence in the way costs and benefits are measured, risk management frequently tends to stir up debate.

In the case of BPA and phthalates, eliminating food packaging in the name of safety could do more harm than good. The plastic lining inside metal cans, for example, can release BPA into the food, but also helps prevent metal corrosion and the contamination of food by pathogens. Some alternative substances exist to those that expose users to BPA and phthalates, but replacing them with alternatives will entail economic costs to industry, and these costs get passed on to consumers in the prices of products. Such complex considerations can make risk management decisions difficult even if the science of risk assessment is fairly clear.

### Two approaches exist for testing the safety of new products

Because we cannot know a substance's toxicity until we measure and test it, and because so many untested chemicals and combinations exist, science will never eliminate the many uncertainties that accompany risk assessment. In such a world



**FIGURE 10.11** The first step in addressing risks from an environmental hazard is risk assessment. Once science identifies and measures risks, then risk management can proceed. In risk management, economic, political, social, and ethical issues are considered in light of the scientific data from risk assessment.