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Introduction

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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.

—*Wingspread Statement on the Precautionary Principle, 1998*

Where threats of serious or irreversible damage to people or natural systems exist, lack of full scientific certainty relating to cause and effect shall not be viewed as sufficient reason for the City to postpone measures to prevent the degradation of the environment or protect the health of its citizens. . . . Where there are reasonable grounds for concern, the Precautionary Principle is meant to help reduce harm.

—*San Francisco Precautionary Principle Ordinance, June 2003*

Precautionary is an action taken in advance to protect people and a principle is a rule. The “precautionary principle” protects everybody against danger or injury. It’s better to be safe than sorry!

—*Alexandria Gracian, 12, Los Angeles*

Ed Soph is a jazz musician and professor at the University of North Texas in Denton, a growing town of about 100,000 just outside Dallas. In 1997, Ed and his wife, Carol, founded Citizens for Healthy Growth, a Denton group concerned about the environment and future of their town. Ed and his colleagues—the group now numbers about 400—are among the innovative pioneers who are implementing the precautionary principle in the United States.

Ed and Carol first came across the precautionary principle in 1998, in the early days of the group’s campaign to prevent a local copper wire manufacturer, United Copper Industries, from obtaining an air permit that would have allowed lead emissions. Ed remembers the discovery of the Wingspread Statement on the Precautionary Principle as “truly a life-changing experience.” Using the precautionary principle as a guide, the

citizens refused to be drawn into debates on what levels of lead, a known toxicant, might constitute a danger to people's health. Instead, they pointed out that a safer process was available, insisting the wise course was not to issue the permit. The citizens prevailed.

The principle helped again in 2001, when a citizen learned that 2,4-D, simazine, Dicamba, and MCPP were being sprayed in the city parks. "The question was, given the 'suspected' dangers of these chemicals, should the city regard those suspicions as a reassurance of the chemicals' safety or as a warning of their potential dangers?" Ed recalls. "Should the city act out of ignorance or out of common sense and precaution?"

Ed learned that the Greater Los Angeles School District had written the precautionary principle into its policy on pesticide use and had turned to Integrated Pest Management (IPM), a system aimed at controlling pests without using toxic chemicals. The Denton group decided to try the policy at home. They persuaded the city's park district to form a focus group of park users and organic gardening experts. The city stopped spraying the four problem chemicals and initiated a pilot IPM program.

The campaign brought an unexpected economic bonus to the city. In the course of their research, parks department staff discovered corn gluten was a good turf builder and natural broadleaf herbicide. But the nearest supplier of corn gluten was in the Midwest, and that meant high shipping costs for the city. Meanwhile, a corn processing facility in Denton was throwing away the corn gluten it produced as a byproduct. The parks department made the link, and everyone was pleased. The local corn company was happy to add a new product line; the city expanded local business while paying a lower price for a local product; and the environmental group chalked up another success.

The citizens of Denton, Texas, did not stop there. They began an effort to improve the community's air pollution standards. They removed arsenic-treated wood products from school playgrounds and parks, replacing them with nontoxic facilities. "The precautionary principle helped us define the problems and find the solutions," Ed says.

But, as he wrote in an editorial for the local paper, "The piecemeal approach is slow, costly, and often more concerned with mitigation than prevention." Taking a cue from precautionary-principle pioneers in San Francisco, they also began lobbying for a comprehensive new environmental code for the community, based on the precautionary principle.

In June 2003, San Francisco's board of supervisors became the first government in the United States to embrace the precautionary principle. A new environmental code drafted by the city's environment commission

made the precautionary principle Article One. Step 1 in implementing the code was a new set of guidelines for city purchasing, pointing the way toward “environmentally preferable” purchases through careful analysis and choice of the best alternatives. The White Paper accompanying the ordinance pointed out that most of the city’s progressive environmental policies were already in line with the precautionary principle, and the new code gave the policies unity and focus rather than radically new direction (SFCOE 2003a). That focus is important; too often, environmental matters seem like a long, miscellaneous, and confusing list of problems and solutions.

Likewise in Denton, the precautionary principle has not been a magic wand for transforming policy, but it has put backbone into efforts to enact truly protective and farsighted environmental policies. Ed Soph pointed out that, in his community as in others, special interests had often dictated growth in the name of economic development, and the environment got short shrift. “Environmental protection and pollution prevention in our city have been a matter, not of proactive policy, but of reaction to federal and state mandates, to the threat of citizens’ lawsuits, and to civic embarrassment. Little thought is given to future environmental impacts,” he told the city council when he argued for a new environmental code.

Ed added, “The toxic chemical pollution emitted by area industries has been ignored or accepted for all the ill-informed or selfish reasons that we are too familiar with. The precautionary principle dispels that ignorance and empowers concerned citizens with the means to ensure a healthier future.”

San Francisco and Denton are just two of the growing number of U.S. communities in which the precautionary principle is helping to strengthen and even transform environmental and public health policies. The principle is also stirring interest among government bodies and agencies at all levels throughout the country. Yet, despite the hopeful and logical responses the precautionary principle has evoked, and despite the simplicity of an idea that can be articulated by a schoolchild, the continuing question is, “But how *do* you implement the precautionary principle?”

The “just do it” responses in Denton and San Francisco—and in Los Angeles, where a parent group learned of the precautionary principle from the electronic newsletter *Rachel’s Environment and Health News* and used it to change the school district’s pest-management practices—are rare. The truth is, this simple idea has farreaching implications that are not so simple. The principle itself contains a conundrum about science that citizens have often sensed but policymakers have seldom confronted, and

it embodies a set of values that have been under constant siege in the past several decades. Add to this the difficulty of creating policies and practices for which few models have existed in recent years, and the challenge of “implementing the precautionary principle” can seem daunting.

The authors of this book believe the precautionary principle must become a firm basis for environmental policies at all levels in this country and around the world. We do not believe implementing this principle is easy, but neither are we daunted by the challenge. The purpose of this book is to show that implementing it is both necessary and possible. You can do this at home.

This book provides tools, instructions, and templates. That is not all that is required, however. The most important components are the imagination, wisdom, and determination of individuals and groups in all kinds of settings, from city playgrounds to rural coops; from state legislatures to academic training grounds for lawyers, scientists, and educators; from government agencies to the electoral process. Implementing the precautionary principle means changing the way we think as well as what we do. There are plenty of examples of how this can be done and has been done, many of which are included in this book. But we are only at the beginning of a rich time of innovation and experimentation.

Why Precaution Now?

The recent upsurge in interest in the precautionary principle stems from a 1998 conference, described later, that introduced the principle widely in the United States. However, the precautionary instinct was at the basis of some U.S. environmental and food and drug legislation enacted in the late 1960s and throughout the 1970s. (See *The Precautionary Principle in the United States*, pages 5–6.) These laws incorporated foresight, prevention, and care; many gave regulators considerable leeway to take action to prevent possible but unproven harm. Although “precaution” had never been defined as a discreet principle behind those laws, at the time they were enacted it almost went without saying that such laws should be based on sensible notions people incorporated in their daily lives: Look before you leap. First, do no harm. Better safe than sorry. Prevention is the best cure.

Nevertheless, a tremendous gap developed between this sensible and widely accepted idea and what took place in the real world. Rather than routinely practicing precaution, when it came to protecting the environment and human health, governments have routinely tossed

Box 1A

The Precautionary Principle in the United States

The United States has endorsed international agreements that contain the Precautionary Principle—for example, the Ozone Treaty and other environmental protocols, the 1992 Rio Declaration (signed by the first President Bush), and the Stockholm Convention on Persistent Organic Pollutants (endorsed in 2001 by President George W. Bush). In addition,

- Since 1978, the International Joint Commission, a monitoring body recommending U.S. and Canadian policy on transborder issues, has called for total elimination of discharges into the Great Lakes of persistent and bioaccumulative substances. In its seventh biennial report in 1994, the Commission said, “Precaution in the introduction and continued use of chemical substances in commerce is a basic underpinning of the proposed virtual elimination strategy” (IJC 1994).
- In 1996, the President’s Council on Sustainable Development recommended that “even in the face of scientific uncertainty, society should take reasonable actions to avert risks where the potential harm to human health and the environment is thought to be serious or irreparable” (PCSD 1996).

The precautionary principle, though not specifically mentioned, is the basis of some U.S. environmental and food and drug legislation. These laws incorporate foresight, prevention, and care, and many give regulators authority to take action to prevent possible but unproven harm. Following are some examples:

- Under the U.S. Toxic Substances Control Act, the Environmental Protection Agency (EPA) may halt the marketing of a new substance and require safety testing or other measures if the agency determines the substance may present an unreasonable risk or if exposures are predicted to be significant.
- As a precautionary measure, the Food and Drug Administration requires testing of all new drugs before they are put on the market.
- Several uses of organophosphate pesticides are to be phased out under the Food Quality and Protection Act of 1996, which builds in a safety factor for children.
- The National Environmental Policy Act (NEPA) is precautionary in two ways: (1) it emphasizes foresight and attention to consequences by requiring an environmental impact assessment for any federally funded project, and (2) it mandates consideration of alternatives, including a “no-action” alternative. NEPA is one of the best national examples of precautionary action.

Other examples of precautionary intent abound. The Pollution Prevention Act of 1990 is at the center of a continuing movement toward reducing toxic waste and emissions. The Wilderness Act sets aside certain areas as inviolable.

The Occupational Safety and Health Act imposes a general duty on employers to provide safe working conditions and workplaces. The Endangered Species Act sets the overarching goal of protecting biodiversity. The Clean Water Act establishes strict goals to “restore and maintain the chemical, physical, and biological integrity of the nation’s waters.” The Centers for Disease Control have begun monitoring body burdens of a wide variety of substances, providing important data for future precautionary policies (CDC 2003).

precaution to the winds. The systems that have evolved in the past three decades to protect humans and the environment, based on sensible notions such as precaution, have not done their job. Humans have routinely leapt without looking, and right into dire messes.

No More “Assimilative Capacity”

In her parting speech as president of the American Association for the Advancement of Science in 1997, zoologist Jane Lubchenco outlined the scope of these messes. Lubchenco’s eloquent litany, drawn in turn from her work with Peter M. Vitousek and others (1997), summed up the emerging case against “assimilative capacity”—the widely accepted notion that the Earth had the capacity to assimilate damage and humans had not yet pressed those limits. Lubchenco (1998) noted that

Between one-third and one-half of the land surface has been transformed by human action; the carbon dioxide concentration in the atmosphere has increased by nearly 30% since the beginning of the Industrial Revolution; more atmospheric nitrogen is fixed by humanity than by all natural terrestrial sources combined; more than half of all accessible surface fresh water is put to use by humanity; about one-quarter of the bird species on Earth have been driven to extinction; and approximately two-thirds of major marine fisheries are fully exploited, over exploited, or depleted.

Changes in Human Health Patterns

Ecologists say that changes in ecological systems may be incremental and gradual, or surprisingly large and sudden. Change large enough to cause a system to cross a threshold creates a new dynamic equilibrium that has its own stability and does not change back easily. These new interactions become the norm and create new realities.

Something of this new reality is evident in changing patterns of human disease. By some measures, human health has improved greatly in the last century. We have battled nature, with more or less success, against many infectious diseases, and we've made major improvements in nutrition—at least in the developed world. The public health interventions during the twentieth century helped prolong life and decrease childhood mortality in many parts of the world. But other disease patterns are emerging that are essentially new. If we measure only longevity and childhood mortality, we could miss the following trends altogether:

- Chronic diseases and conditions affect more than 100 million men, women, and children in the United States—more than a third of the population. Cancer, asthma, Alzheimer's disease, autism, birth defects, developmental disabilities, diabetes, endometriosis, infertility, multiple sclerosis, and Parkinson's disease are becoming increasingly common.
- Nearly 12 million children in the United States (17 percent) suffer from one or more developmental disabilities. Learning disabilities alone affect at least 5 to 10 percent of children in public schools, and these numbers are increasing. Attention deficit hyperactivity disorder, conservatively, affects 3 to 6 percent of all school children, and the numbers may be considerably higher. The incidence of autism appears to be increasing (Schettler et al. 2000).
- Prevalence of asthma has doubled in the last 20 years.
- Incidence of certain types of cancer has increased. The age-adjusted incidence of melanoma, lung cancer in women, non-Hodgkins lymphoma, and cancers of the prostate, liver, testis, thyroid, kidney, breast, brain, esophagus, and bladder has risen over the past 25 years (SEER 1996). Breast cancer, for example, now strikes more women worldwide than any other type of cancer. Rates have increased 50 percent during the past half century. In the 1940s, the lifetime risk of breast cancer was 1 in 22. Today's risk is 1 in 8 and rising (Evans 2002).
- In the United States, the incidence of some birth defects, including male genital disorders, some forms of congenital heart disease, and obstructive disorders of the urinary tract, is increasing (Pew 2003, Paulozzi 1997). Sperm density is declining in some parts of the United States and elsewhere in the world.

Scientific Evidence, Scientific Uncertainty

How do we explain these trends? The changes in the environment and human health are well documented. However, for many of the human

health problems, proving direct links with causative factors is more complicated.

Here is how the scientific reasoning might go: Sun exposure, smoking, and diet explain few of the health trends listed here. Genetic factors explain up to half the population variance for several of these conditions—but far less for the majority of them. This suggests that other environmental factors play a role. Emerging science suggests this as well. In laboratory animals, wildlife, and humans, considerable evidence documents a link between environmental contamination and malignancies, birth defects, reproductive success, impaired behavior, and immune system function. Scientists' growing understanding of how biological systems develop and function leads to similar conclusions (Schettler 2002).

But serious, evident effects such as these can seldom be linked *decisively* to a single cause. Scientific standards of certainty (or “proof”) about cause and effect are high. These standards may never be satisfied when many factors are working together, producing many different results. Sometimes the period of time between particular causes and particular results is so long, with so many intervening factors, it is impossible to make a definite link. Sometimes the timing of exposure is crucial—a trace of the wrong chemical at the wrong time during pregnancy, for example, may trigger problems in the child's brain or endocrine system, but Mom might never know she was exposed.

In the real world, we have no way of knowing for sure how much healthier people might be if they did not live in the modern chemical stew, because the chemicals are everywhere—in baby's first bowel movement, in the blood of American teenagers, and in the breast milk of Inuit mothers. No unexposed “control” population exists. But clearly, significant numbers of birth defects, cancers, and learning disabilities are preventable.

Scientific uncertainty is a fact of life in even the most obvious environmental problems, such as the disappearance of species, or most potentially devastating trends, such as climate change. We seldom know for sure what will happen until it happens, and we seldom know all the causes until well after the fact, if ever. Nevertheless, scientific knowledge, as incomplete as it may be, provides important clues to all of these conditions and what to do about them. When lives and the future of the planet are at stake, we must learn to act on these clues and prevent as much harm as possible, despite our imperfect knowledge and even ignorance. That is the essence of the precautionary principle.

Environmental Policies Have Failed

The environmental policies to date have not met this challenge. Part of the explanation for this is that the dimensions of the emerging problems are only now becoming apparent. The limits of the earth's assimilative capacity are much clearer now than they were when the first environmental legislation was enacted 30 years ago.

Another part of the explanation is that, although some environmental policies are preventive, most have focused on cleaning up messes after the fact—what environmentalists call “end of pipe” solutions. Scrubbers on power plant stacks, catalytic converters on tailpipes, recycling, and super-sized funds dedicated to detoxifying the worst dumps have not been enough. Earlier, more comprehensive and preventive approaches are necessary. Nor is it enough to address problems only after they are so obvious they cannot be ignored—often, literally waiting for the dead bodies to appear or coastlines to disappear under rising tides.

The third factor in the failure of environmental policies is politics. After responding to the initial burst of concern for the environment, the U.S. regulatory system was subverted by commercial interests, with the encouragement of political leaders and, increasingly, the complicity of the court system. Environmental laws have been subjected to an onslaught of challenges since the 1980s; many have been modified or gutted, and all are enforced by regulators who have been chastened by increasing challenges to their authority from industry and the courts.

Moreover, commercial interests were reinforced and expanded globally in the last years of the twentieth century, culminating in sweeping, enforceable agreements giving unprecedented leeway to international commerce. The World Trade Organization, established in 1995, and the 1997 North American Free Trade Agreement institutionalized, on a multinational scale, the ascendancy of commerce over environmental and public health concerns (Wallach & Sforza 1999).

Quantitative Risk Assessment

Ironically, one tool that has proved highly effective in the battle *against* environmental regulations was one that was meant to *strengthen* the enforcement of such laws: quantitative risk assessment. Risk assessment was developed in the 1970s and 1980s to systematically evaluate the degree and likelihood of harmful side effects from products and technologies. With precise, quantitative risk assessments in hand, regulators could more

convincingly demonstrate the need for action. Risk assessments would stand up in court. They could “prove” a product was dangerous, would cause a certain number of deaths per million, and should be taken off the market (NRC 1994).

Or not. Quantitative risk assessment, which became standard practice in the United States in the mid-1980s and was institutionalized in the global trade agreements of the 1990s, turned out to be most useful in “proving” that a product or technology was *not* inordinately dangerous. More precisely, risk assessments presented sets of numbers purporting to state definitively *how much harm might occur*. It was then incumbent on laws and those who enforced them to determine *how much harm was acceptable*. Quantitative risk assessment not only provided the answers; it dictated the questions.

As quantitative risk assessment became the norm, commercial and industrial interests were increasingly able to insist that harm must be proven “scientifically,” by a quantitative risk assessment demonstrating harm in excess of acceptable limits, before action could be taken to stop a process or product. These exercises were often linked with cost-benefit assessments that gave much weight to immediate monetary costs of regulations and little, if any, to costs to the environment or future generations.

This process—determining acceptable limits of harm, putting numbers to possible harm, and quantifying the costs of taking action to prevent harm—was viewed as “sound science” by those who used it. It was, indeed, based on important scientific tools, but it placed a heavy burden on those tools, requiring precise and certain answers from an inherently inexact process. These tools were particularly unsuited to situations in which uncertainties were difficult, or even impossible, to resolve and the stakes were high—the health and learning power of children, life or death for an unknown number of individuals, the survival of species and ecosystems.

Although risk assessments tried to account for uncertainties, projections were necessarily subject to assumptions and simplifications. Quantitative risk assessments usually addressed a limited number of potential harms, often missing social, cultural, or broader environmental factors. These assessments have consumed enormous resources in strapped regulatory agencies and have slowed the regulatory process and diverted attention from questions that need to be answered: Do better alternatives exist? Can any harm be prevented?

Late Lessons from Early Warnings

The slow pace of regulation, the insistence on “scientific certainty,” and the weighting toward immediate monetary costs often give products and technologies the benefit of doubt, even when harmful side effects are suspected. One result is that neither international environmental agreements nor national regulatory systems have kept up with the increasing pace and cumulative effects of environmental damage.

A 2001 report by the European Environment Agency tallied the great costs to society of some of the most egregious failures to heed early warnings of harm. Case studies of radiation, ozone depletion, asbestos, mad cow disease, and other problems show a familiar pattern: “Misplaced ‘certainty’ about the absence of harm played a key role in delaying preventive actions.” The authors add that

The costs of preventive actions are usually tangible, clearly allocated and often short term, whereas the costs of failing to act are less tangible, less clearly distributed and usually longer term, posing particular problems of governance. Weighing up the overall pros and cons of action, or inaction, is therefore very difficult, involving ethical as well as economic considerations. (Harremoes et al. 2001)

The Wingspread Legacy

As environmentalists viewed looming problems such as global warming, they were appalled at the inadequacy of policies based on quantitative risk assessment. Although evidence was piling up rapidly that human activities were having an unprecedented effect on global climate, for example, it was difficult to say when the threshold of scientific certainty would be crossed. Good science demands caution in drawing hard and fast conclusions. Yet, the longer humanity waited to take action, the harder it would be to reverse any effect. Perhaps it was already too late. Moreover, action would have to take the form of widespread changes not only in human behavior but also in technological development. The massive shift away from fossil fuels that might yet mitigate the effects of global warming would require rethinking how we produced and used energy. Nothing in the risk assessment–based approach to policy prepared society for that.

The global meetings called to address the coming calamity were not helping much. Politicians fiddled with blame and with protecting national economic interests while the globe heated up. Hard-won and heavily

compromised agreements such as the 1997 Kyoto agreement on climate change were quickly mired in national politics, especially in the United States, the heaviest fossil fuel user of all.

In the United States and around the globe, a different kind of struggle had been going on for decades: the fight to bring attention to industrial pollution in communities. From childhood lead poisoning in the 1930s to Love Canal in the 1970s, communities had always faced an uphill battle in proving pollution and toxic products were making them sick. Risk assessments often made the case that particular hazardous waste dumps were safe, or a single polluting industry could not possibly have caused the rash of illnesses a community claimed. But these assessments missed the obvious fact that many communities suffered multiple environmental assaults, compounded by other effects of poverty. A landmark 1987 report by the United Church of Christ coined the term “environmental racism,” confirming that the worst environmental abuses were visited on communities of color (cited in Shabecoff 1993, p. 241). This growing awareness generated the international environmental justice movement. (See “Principles of Environmental Justice,” available at www.sehn.org/state.html.)

The many community efforts to eliminate pollution, prevent the incineration of toxic wastes, and promote recycling were not futile. Among other things, they led to the Pollution Prevention Act of 1990, which established the national policy of preventing or reducing pollution at the source whenever possible. The Pollution Prevention Act became the foundation for some of the most progressive U.S. government-sponsored environmental programs, including Green Chemistry (see chapter 5).

But prevention has not been a total cure. The enigma of scientific uncertainty remains a barrier to dealing with existing and suspected harm. With the basic approach still being to measure and manage risk, when do we know enough to act, and who decides?

In early 1998, a small conference at Wingspread, the Johnson Foundation’s conference center in Racine, Wisconsin, addressed these dilemmas head-on. What participants were groping for was a better approach to protecting the environment and human health. At that time the precautionary principle, which had been named in Germany in the 1970s, was an emerging precept of international law. It had begun to appear in international environmental agreements, such as the following instances:

- Beginning in 1984, a series of protocols called for a “precautionary approach” to reduce pollution in the North Sea.

- The 1987 Ozone Layer Protocol called for “precautionary measures” to control global emissions of ozone-depleting substances.
- In 1990, both the Bergen Declaration on Sustainable Development and the Second World Climate Conference contained this statement: “Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.”

At the Rio Earth Summit in 1992, precaution was enshrined as Principle 15 in the Rio Declaration on Environment and Development:

In order to protect the environment, the precautionary approach shall be widely applied by states according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

In the decade after Rio, the precautionary principle began to appear in national constitutions and environmental policies worldwide and was occasionally invoked in legal battles, as in the following examples:

- The Maastricht Treaty of 1994, establishing the European Union (EU), named the Precautionary Principle as a guide to EU environment and health policy, along with the principle of preventing pollution at the source, the polluter-pays principle.
- The precautionary principle was the basis for arguments in a 1995 International Court of Justice case on French nuclear testing (Order 22 IX 95). Judges cited the “consensus flowing from Rio” and the fact that the precautionary principle was “gaining increasing support as part of the international law of the environment.”
- At the World Trade Organization in the late 1990s, the EU invoked the precautionary principle in cases involving imports of hormone-fed beef and genetically modified organisms.

The Wingspread participants believed the precautionary principle was not just another weak and limited fix for environmental problems, but could bring far-reaching changes to how those policies were formed and implemented. Action to prevent harm in the face of scientific uncertainty alone, however, did not translate into sound policies protecting the environment and human health. Other norms would have to be honored simultaneously and as an integral part of a precautionary decision-making process. Several other principles were often linked with the precautionary principle in various statements of the principle or in connection with precautionary policies operating in northern European countries. The

statement released at the end of the meeting, the Wingspread Statement on the Precautionary Principle, was the first to put four of these primary elements on the same page: acting on early evidence of harm, shifting the burden of proof, exercising democracy and transparency, and assessing alternatives. These standards form the basis of what has come to be known as the overarching or comprehensive precautionary principle or approach:

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.

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. (Wingspread Statement, cited in Raffensperger & Tickner 1999)

The conference generated widespread enthusiasm for the principle among U.S. environmentalists and academics as well as some policymakers. This interest was complemented by continuing and growing support for the principle among Europeans as well as its ready adoption in much of the developing world. And in the years following Wingspread, the precautionary principle gained new international status. In international environmental agreements of the 1980s and 1990s, the principle had taken the form of a general directive or guiding principle. Two treaties negotiated in 2000, however, incorporated it for the first time as an enforceable measure:

- The Cartagena Protocol on Biosafety allows countries to invoke the precautionary principle in decisions on admitting imports of genetically modified organisms. It became operative in June 2003 (see chapter 14).
- The Stockholm Convention on Persistent Organic Pollutants prescribes the precautionary principle as a standard for adding chemicals to the original list of 12 banned by the treaty (see chapter 11). This treaty went into force in February 2004.

Appendix A includes portions of these treaties citing the precautionary principle.

What Is Happening Today

The principle seems to be an idea whose time has come. It is appearing in many places at once. The precautionary principle and the values and ideas it represents have leavened the discussion of environmental and human

health policy on many fronts—in international treaty negotiations and global trade forums, in city resolutions and national policies, among conservationists and toxicologists, and even in corporate decision making. This book describes many precautionary actions. Here are a few instances in which the precautionary principle appears explicitly: policy statements of the pharmaceutical company Bristol-Myers Squibb (2002; see chapter 3); the code of conduct of the International Society of Ethnobiologists; a resolution on children’s health by the American Public Health Association; and legislation on new technologies introduced in the New York State legislature in 2004 (see www.sehn.org for these documents and others).

Why the Precautionary Principle Must Be Overarching

Our premise is that the principle is indeed a guide for changing environmental policy, and we hope to demonstrate how that change can place. We describe the application of the precautionary principle in detail, with lots of examples. It will become obvious, however, that no single formula applies to every situation.

On the simplest level, the emerging principle of international law known as the precautionary principle is “invoked” to justify taking action when serious harm might otherwise occur. Used this way, the principle is a kind of emergency measure—to slow development of a new technology, such as genetically engineered crops, until its side effects are better understood; to bar imports of scientifically controversial substances, such as beef containing hormone residues; to limit fishing before a species disappears altogether.

But the stubborn controversies swirling around these uses of the principle show that even these are far from simple cases. They involve judgment calls about what is dangerous, since science cannot provide definitive answers; what risks a society is willing to take; and how far limits should be pushed. When opposing interests are involved, or different societies with different values and standards, any decisions will be challenged. The result is often a stalemate.

This narrow invocation of the precautionary principle in certain limited circumstances is not enough. We need to back up “simple” judgment calls with a logic and ethic powerful enough to expose and counter prevailing myths and errors in current actions. We must clarify and act on the values that result in such judgments. And we must supplement these judgments with a comprehensive and consistent approach to decision-making about

how we develop and use technologies and products, and how we treat the Earth and its most vulnerable inhabitants—including generations of our own descendents.

In other words, we, especially in the United States, must change our way of thinking. This is no simple task. That is why part I of this book presents a collection of tools for recalibrating attitudes, policies, and decisions toward precaution. Sooner or later we must learn to think and act this way instinctively. But developing such instincts requires practice and example. Because policies of the last 20 years have been so heavily influenced by values, attitudes, and decision systems *antithetical* to precaution, teaching ourselves and our leaders a consistent precautionary approach is something like learning to tie shoes by following verbal instructions. It is hard to do at first and may require explanation, justification, repetition, and reassurance. But once we get the hang of it and have practiced for a while, we will wonder why it seemed so hard.

This book provides a foundation for improvising on the precautionary principle. It provides detailed instructions and examples to help citizens and policymakers think more clearly and act more effectively in precautionary ways.

How This Book Is Organized

This book presents three approaches to explaining and illustrating how to implement the precautionary principle: a toolchest of precautionary habits and options, a decision guide, and case studies.

Part I: The Precautionary Toolchest

Part I is organized like a toolchest with four drawers, illustrated in figure 1.1. We often think of regulatory tools as the main expression of environmental policy. However, as this book illustrates, regulatory action, especially in the form of restrictions and limits, represents only one set of tools for implementing precautionary policies—and often not the first step. We've put many regulatory tools in the middle drawers of this diagram. But much of our attention should be on the precautionary tools in the top and bottom drawers. These may or may not be expressed in regulations, codes, and laws. Primarily, these tools of choice are preregulatory; if they prevail, fewer regulations may be needed, and the necessary regulations will fit the task more precisely.

Chapter 2, *Precautionary Procedures: Tools of Analysis and Intention*, describes the top drawer of precautionary tools, the habits of thought,

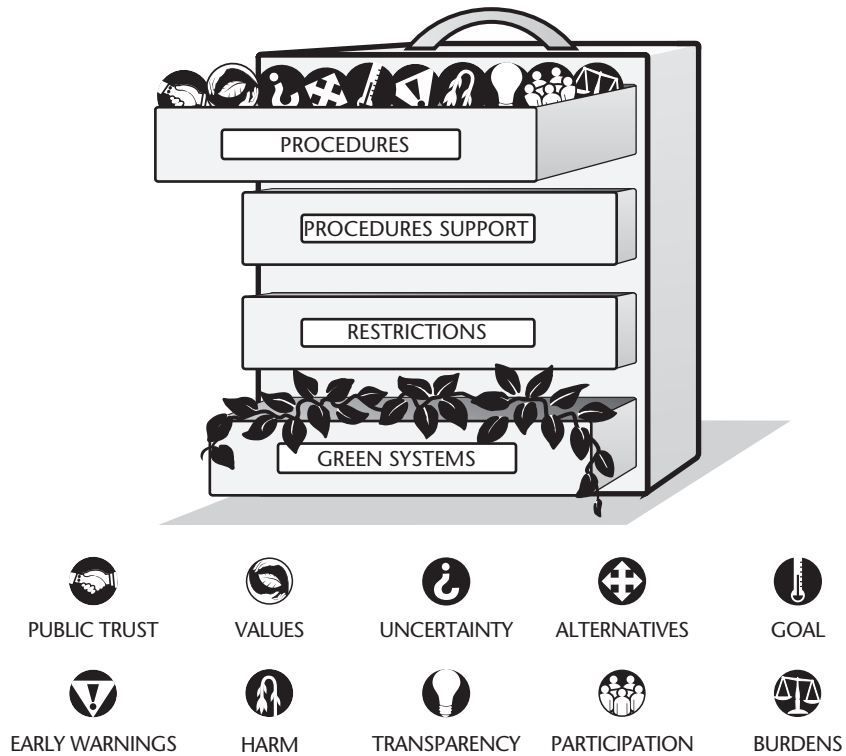


Figure 1.1
The Precautionary Toolchest

values, types of analysis, and ethical stances that both stem from and support the simple precautionary notion of taking action to prevent harm even when there is some uncertainty. This chapter begins with the public-trust role of government and how it is expressed in the values on which precaution is based. It breaks down and clarifies vague terms such as “harm” and “uncertainty” in a precautionary context, describing why the practices of goal-setting, alternatives assessment, burden shifting, transparency, and public participation are components of a precautionary system. Each procedure is represented by an icon.

These top-drawer tools are so important they appear in different forms throughout this book. They are the backbone of precautionary policy and action, representing the essence of what this concept offers the world of the twenty-first century. These tools help us develop the procedures that will put environmental policy on a new, sounder footing. In parts

II and III we elaborate on these top-drawer tools in different ways. Part II uses them in decision-making, and part III illustrates them in case studies.

Chapter 3, *Precautionary Options*, describes some of the most important policy and action tools associated with precaution, usually in a regulatory context. These tools are more specific and limited in application than the procedural tools described in the previous chapter. The options described here fall into the middle drawers of the precautionary toolchest:

- The second drawer holds a set of specific practices closely linked to the Drawer-1 precautionary tools of analysis and intention. They represent some possible ways to make those tools more concrete and specific.
- The third drawer contains an array of regulatory tools primarily concerned with curbing abuses and harmful activities—various degrees and types of “stop action” and governing codes.

Each option is accompanied by brief, real-world examples of its use. Many more such examples exist and are being developed every year. This list of precautionary options is not meant to be comprehensive. It only suggests the wide range of possible actions that may support precautionary policy.

Chapter 4, *Democratic Tools: Communities and Precaution*, elaborates on an important set of democratic-participation tools. It describes how to start building strong public participation in communities to implement precaution. The methods described are particularly suited to the local level. Some of the democratic tools recommended for use by governments, however, are suitable for regional and national issues as well. This chapter includes an annotated reading list.

Chapter 5, *Green Systems*, explores the deepest, richest level of the toolchest, describing a few intriguing integrated systems that incorporate the full range of precautionary values and methods. The systems often build from the ground up in fields such as agriculture, design, medicine, and ecosystem management. These systems represent some of the most creative, hopeful trends associated with precautionary thinking.

More than any of the specific, limited tools discussed in this book, this chapter describes the practices of a society based on the precautionary principle. When such systems become the norm rather than the exception, environmental policy will indeed be on a sounder footing. The more we develop and rely on these bottom-drawer systems, the more likely we are to reach the goal of healthy, sustainable communities and ecosystems. This chapter, too, is only a sample, of the rich and rapidly growing literature

on these methods. But these examples help us understand the importance of researching, developing, and practicing sustainable ways of doing things.

Part II: A Guide for Precautionary Decision Making

Part II is the heart of this book. The checklist in chapter 6 distills the ideas and procedures described here into a set of provocative questions. We summarize it on page 20. Anyone could lift these questions off the page and immediately apply them to environmental policy decisions. We hope, however, that this great array of practical tools and examples will stimulate citizens and policymakers alike to develop even better checklists, decision trees, and procedures that implement a precautionary approach.

Our checklist is not a step-by-step procedures but a screen through which to pass problems, plans, and decisions. It invokes all the basic Drawer-1 tools of precautionary analysis and intention. To illustrate this, the icons representing these tools appear in chapter 6, alongside the questions expressing them.

These questions are meant to evoke precautionary intelligence and good judgment. It is up to those posing these questions to decide how to answer them—and the answers may require tools from every drawer in the box and more.

Two brief chapters round out the basic “how-to” section of this book. Chapter 7 describes how this checklist might serve as a guide and springboard for discussion and decisions. The examples presented are hypothetical but based on real situations. Chapter 8, *Answering the Critics*, is an important reference for those advocating the precautionary principle. It lists many of the arguments they are likely to encounter and suggests responses.

Part III: Precautionary Successes, Failures, and Near Misses: Case Studies

This section of the book describes the real world in which a precautionary approach must operate. Each case study addresses a major issue and illustrates the importance of one or more of the Drawer-1 tools—basic precautionary procedures—and how it applies to the situation. Many of the case studies also draw on other tools described in part I. These are noted in the introduction to each chapter.

In chapter 9, *The Public Trust and Public Values: Elk Farming and Cattle Farming*, Mary O’Brien points out that the distinguishing feature of the precautionary principle is not precaution but the values behind it. The

Box 1B**A Precautionary Checklist**

1. What do we care about?
2. What are we trying to accomplish?
 - a. Who shares this goal?
 - b. Do the goals reflect what we care about?
3. What choices do we have?
 - a. What is feasible and likely to move us toward the goal?
 - b. How do choices compare and rank?
 - c. How do we find even better solutions?
 - d. How do we adopt better solutions?
4. What is the bigger picture?
 - a. What are the “upstream” problems? What are the downstream repercussions? What is the broader context?
 - b. What are the earlier solutions? The most elegant? Is there a systemic solution that could create multiple benefits? Where can we intervene in the system to set in motion the best solutions?
5. Do we know enough to act? Do we know so little we must act with caution?
 - a. How would we know if harm was occurring or about to occur?
 - b. What do we know about harmful effects?
 - c. Where does our knowledge come from?
 - d. How can we predict from what we know already?
 - e. Do we know enough to act?
 - f. Do we know so little that we must act with caution?
 - g. Are we getting all the information we need from those who have it? Is testing thorough? Is monitoring adequate? How will we learn?
6. Who is responsible?
 - a. Are those responsible accountable?
 - b. Is government acting responsibly as public trustee?
 - c. Who has the burden of proof—those who harm or those who are harmed?
 - d. How can we distribute power, costs, benefits, and responsibilities more justly?

author uses two diseases of livestock and wildlife in the western United States, and the different responses to them, to illustrate the competing “public” and “privatist” values out of which the precautionary principle and resistance to it arise. The cases show how government agencies carry out or lose sight of their duty to uphold the public good, depending on which set of values guides them.

In chapter 10, *Setting the Right Goals: Marine Fisheries and Sustainability in Large Ecosystems*, Boyce Thorne-Miller describes one arena in which the precautionary principle has actually been implemented. The precautionary principle came to the fore internationally in agreements and protocols meant to protect oceans and fisheries. This chapter surveys the history of fisheries development that has led the world to recognize the need for a precautionary approach to fisheries management. But the precautionary approach developed in recent fishing codes and regulations has been too limited and too late to protect devastated marine habitats and maintain fish populations. The author shows how two simple but radical shifts in the *goals* of these regulations could make fisheries part of a truly sustainable food production system consistent with the natural cycles of a living planet.

In chapter 11, *Early Warnings: The History of DDT*, Ted Schettler describes the challenge of coming to terms with evolving and uncertain scientific information. We have learned only gradually about the devastating and long-term impacts of “persistent organic pollutants.” That history shows how the different values of economic sectors, special interests, political institutions, and the public influenced the policy responses to that information. This chapter contains lessons in the importance of heeding early warnings on toxic chemicals and science that analyzes harm and uncertainty and considers alternatives. The DDT story shows the value of public participation and how it can influence the way government interprets its public trust responsibilities.

In chapter 12, *Harm and Alternatives: Cultures under Siege*, Kelly Banister and Katherine Barrett show how ethnobiologists are developing broad, precautionary definitions of harm to protect Indigenous cultures threatened by bioprospecting, the search for useful products from wild plants and animals. They show how full disclosure and the participation of all affected parties can help in developing sound voluntary professional codes of conduct as well as international treaties and agreements that reduce harm.

In chapter 13, *Wrestling with Uncertainty: Genetically Modified Organisms*, Katherine Barrett tells a story of corporate efforts to quash science exposing harmful side effects of a new technology. Barrett goes on to

examine the science of uncertainty and the political, as well as scientific, nature of decisions about harm. She sets out a framework for applying the precautionary principle to the release of new and existing genetically modified (GM) crops into the environment and food systems. Barrett presents a broad view of how the precautionary principle points the way forward in the current debate on GM crops and other emerging technologies. She emphasizes that, where technology is concerned, especially new technologies, decisions about complex and contentious issues require continuing, meaningful dialogue among people with a wide range of experience, knowledge, and values.

Chapter 14, *Transparency: A Precautionary Economic Analysis of Coalbed Methane*, by Joshua Skov and Nancy Myers, addresses a plan endorsed by the federal Bureau of Land Management to greatly expand coalbed methane extraction operations in the Powder River Basin of northern Wyoming and a small section of southeastern Montana. The huge energy project is bringing a welcome tax windfall to the states, but it poses financial, environmental, and social issues of national importance.

The chapter addresses the subject of how to analyze the hidden costs accompanying the easy money. The goal of any thorough economic analysis is to provide a sense of the net gain or loss to the public good from a particular course of action, as well as how those gains and losses will be distributed. The authors demonstrate a new way of looking at costs and benefits through the wide-angle lens of the precautionary principle, taking in the unknown as well as known factors, the important vague or hidden costs as well as the immediate and clear benefits, and the interests of all concerned. This kind of economic analysis is based not only on numbers but also on values.

Finally, chapter 15, *Shifting Burdens: A Proposal for Tort Reform*, by Carolyn Raffensperger and Nancy Myers, shows how the U.S. federal court system, once a dependable safety net for people harmed by products and chemicals, has shifted radically in the last decade in favor of corporate defendants. The chapter is a lesson in how obscure complexities of the law and science can be exploited to serve special interests, a story that appears in many forms throughout this book. But the opposite lesson is also embedded in this story: justice can be restored not by exploiting complexities but by returning to basic ethical principles—in this case, placing the burden of responsibility back where it belongs, on the shoulders of perpetrators of harm and risk. A key component of this shift has been developed in Europe in a new regulatory system for chemicals called REACH.

Indeed, the United States, which was once a world leader in environmental protection, has fallen far behind on this front. We now have much to learn from Europe and other parts of the world where policies are grounded in the precautionary principle. But we do not have to look that far. The precautionary principle is making changes right in our own backyards. The good news is that plenty of field experiments are already underway in the United States. The precautionary principle, linked with government's public-trust responsibilities, is producing a new wave of imaginative and effective environmental policies.

The case studies in this text are only representative. The precautionary principle applies to a whole spectrum of urgent environmental and health policy issues and questions, from global warming to pesticides and from nuclear power (and waste and weapons) to nanotechnology. We hope these case studies will help shape our collective thinking and action on both the enormous problems created by our lack of foresight in the past and the direction of our future ingenuity.

We at the Science and Environmental Health Network would like to know how you use this book and what you are doing to implement the precautionary principle. Contact us at info@sehn.org. SEHN and the BE SAFE campaign track precautionary implementation on our websites at www.sehn.org/precaution and www.besafenet.com. Both sites augment and update the many examples in this book.

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