THE PRECAUTIONARY PRINCIPLE IN ACTION

A HANDBOOK

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Written for the Science and Environmental Health Network

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I. INTRODUCTION

> "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." *from the January 1998 Wingspread Statement on the Precautionary Principle*

For years, the environmental and public health movements have been struggling to find ways to protect health and the environment in the face of scientific uncertainty about cause and effect. The public has typically carried the burden of proving that a particular activity or substance is dangerous, while those undertaking potentially dangerous activities and the products of those activities are considered innocent until proven guilty. Chemicals, dangerous practices, and companies often seem to have more rights than citizens and the environment.

This burden of scientific proof has posed a monumental barrier in the campaign to protect health and the environment. Actions to prevent harm are usually taken only after significant proof of harm is established, at which point it may be too late. Hazards are generally addressed by industry and government agencies one at a time, in terms of a single pesticide or chemical, rather than as broader issues such as the need to promote organic agriculture and nontoxic products or to phase out whole classes of dangerous chemicals. When citizen groups base their calls for a stop to a particular activity on experience, observation, or anything less than stringent scientific proof, they are accused of being emotional and hysterical.

To overcome this barrier, advocates need a decision-making and action tool with ethical power and scientific rigor. The precautionary principle, which has become a critical aspect of environmental agreements and environmental activism throughout the world, offers the public and decision-makers a forceful, common-sense approach to environmental and public health problems. This Handbook describes how it can be used to make preventive decisions in the face of uncertainty and to drive actions that will protect public health and the environment.

This comprehensive presentation of ideas is new, yet precaution is a concept citizen activists have promoted for years. We, the authors, invite you to try these ideas out and write the next chapters on the precautionary principle with us.

We are at an exciting juncture in the history of the world. On the one hand, we are faced with unprecedented threats to human health and the life-sustaining environment. On the other hand, we have opportunities to fundamentally change the way things are done. We do not have to accept "business as usual." Precaution is a guiding principle we can use to stop environmental degradation.

II. HISTORY OF THE PRECAUTIONARY PRINCIPLE

One of the most important expressions of the precautionary principle internationally is the Rio Declaration from the 1992 United Nations Conference on Environment and Development, also known as Agenda 21. The declaration stated:

> 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.

Because the United States signed and ratified the Rio Declaration, it is bound to use the precautionary principle. It is important for organizers to know that it is not a matter of whether the United States will abide by the precautionary principle, but how. Nevertheless, application of the principle is far more advanced in Europe and on the international level than it is in the United States.

The precautionary principle has its beginnings in the German principle of *Vorsorge*, or foresight. At the core of early conceptions of this principle was the belief that society should seek to avoid environmental damage by careful forward planning, blocking the flow of potentially harmful activities. The *Vorsorgeprinzip* developed in the early 1970s into a fundamental principle of German environmental law (balanced by principles of economic viability) and has been invoked to justify the implementation of vigorous policies to tackle acid rain, global warming, and North Sea pollution. It has also led to the development of a strong environmental industry in that country.

The precautionary principle has since flourished in international statements of policy; conventions dealing with high-stakes environmental concerns in which the science is uncertain; and national strategies for sustainable development. The principle was introduced in 1984 at the First International Conference on Protection of the North Sea. Following this conference, the principle was integrated into numerous international conventions and agreements, including the Bergen declaration on sustainable development, the Maastricht Treaty on the European Union, the Barcelona Convention, and the Global Climate Change Convention. (See Appendix) On a national level, Sweden and Denmark have made the precautionary principle and other principles, such as substitution for hazardous materials, guides to their environmental and public health policy.

In the United States, the precautionary principle is not expressly mentioned in laws or policies. However, some laws have a precautionary nature, and the principle underlay much of the early environmental legislation in this country:

The National Environmental Policy Act requires that any project receiving federal funding and which may pose serious harm to the environment undergo an environmental impact study, demonstrating that there are no safer alternatives.

The Clean Water Act established strict goals in order to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters."

The Occupational Safety and Health Act (OSHA) was designed to "assure so far as possible every working man and woman in the Nation safe and healthful working conditions."

The OSHA draft Carcinogen Standard (which was never put into practice) required precautionary actions whenever a chemical used in the workplace was suspected of causing cancer in animals. Early court decisions gave the Environmental Protection Agency considerable freedom to take action to prevent harm even before considerable evidence of cause and effect was gathered.

More recently, *The Pollution Prevention Act* of 1990 set prevention as the highest priority in environmental programs in the country. In addition, the President's Council on Sustainable Development expressed support for the precautionary principle in the form of a core belief that "even in the face of scientific uncertainty, society should take reasonable actions to avert risks where the potential harm to human health or the environment is thought to be serious or irreparable." In 1996, the American Public Health Association passed a resolution (number 9606), "The Precautionary Principle and Chemical Exposure Standards for the Workplace," which recognized the need for implementing the precautionary approach, including the shifting of burdens of proof so that every chemical is considered potentially dangerous until the extent of its toxicity is sufficiently known, and the establishment of strict, preventive chemical exposure limits.

However, despite U.S. acceptance of the precautionary principle in international treaties and other statements, little work has been done to implement the principle. In some cases, especially those involving trade and proactive legislation in places like Europe, the U.S. government is actively lobbying against precautionary actions by other governments. This has happened most recently with regards to phthalates in children's PVC toys, beef hormones, electronic take-back and genetically engineered foods. This lobbying threatens to undermine use of the precautionary principle in other countries, which will ultimately affect the pressure that other countries can exert on the U.S. to invoke the principle. Luckily, in the case of phthalates, Vice President Gore recently wrote a letter to U.S. trade representatives stating that European countries should be allowed to take precautionary actions to protect children's health without U.S. interference.

The first major effort in the United States to bring the precautionary principle to the level of day-to-day environmental and public health decision-making at the state or federal level was a January 1998 conference of activists, scholars, scientists, and lawyers at Wingspread, home of the Johnson Foundation in Racine, Wisconsin. Convened by the Science and Environmental Health Network (SEHN), participants discussed methods to implement the precautionary principle and barriers to that implementation.

The Wingspread definition of precaution (see Appendix) has three elements: threats of harm; scientific uncertainty; and preventive, precautionary action. The litmus test for knowing when to apply the precautionary principle is the combination of threat of harm and scientific uncertainty. Some would say the threatened harm must be serious or irreversible, but others point out that this does not allow for the cumulative effects of relatively small insults.

If there is certainty about cause and effect, as in the case of lead and children's health, then acting is no longer precautionary, although it might be preventive. In essence, the precautionary principle provides a rationale for taking action against a practice or substance in the absence of scientific certainty rather than continuing the suspect practice while it is under study, or without study.

Instead of asking what level of harm is acceptable, a precautionary approach asks: How much contamination can be avoided? What are the alternatives to this product or activity, and are they safer? Is this activity even necessary? The precautionary principle focuses on options and solutions rather than risk. It forces the initiator of an activity to address fundamental questions of how to behave in a more environmentally sensitive manner. The precautionary principle also serves as a "speed bump" to new technology, ensuring that decisions about new activities are made thoughtfully and in the light of potential consequences.

III. COMPONENTS OF PRECAUTION

An underlying theme of the principle is that decision-making in the face of extreme uncertainty and ignorance is a matter of policy and political considerations. Science can inform that decision but it is foolish to think that "independent" or "sound" science can resolve difficult issues over cause and effect. Thus, a decision for further study or not to do anything in the face of uncertainty is a policy decision not a scientific one just as as taking preventive action would be.

A precautionary approach to environmental and public health decision-making includes these specific components:

Taking precautionary action before scientific certainty of cause and effect. Most of the international treaties stating the precautionary principle incorporate it as a general duty on states to act under uncertainty. This provides a mechanism of accountability for preventing harm. General duties - obligations to act in a certain way even in the absence of specific laws - are not uncommon in the United States. For example, the Occupational Safety and Health Act demands that an employer "furnish each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical injury."

Setting goals. The precautionary principle encourages planning based on well-defined goals rather than on future scenarios and risk calculations that may be plagued by error and bias (see risk assessment discussion below). For example, Sweden has set the goal of phasing out persistent and bioaccumulative substances in products by the year 2007. The government is now involving a variety of stakeholders in determining how to reach that goal. Sometimes called "backcasting" in contrast to the more usual "forecasting" of an uncertain future, this type of planning creates fewer miscalculations and spurs innovative solutions.

Seeking out and evaluating alternatives. Rather than asking what level of contamination is safe or economically optimal, the precautionary approach asks how to reduce or eliminate the hazard and considers all possible means of achieving that goal, including forgoing the proposed activity. Needless to say, alternatives proposed to a potentially hazardous activity must be scrutinized as stringently as the activity itself.

Shifting burdens of proof. Proponents of an activity should prove that their activity will not cause undue harm to human health or ecosystems. Those who have the power, control, and resources to act and prevent harm should bear that responsibility. This responsibility has several components:

> *Financial responsibility.* Regulations alone are not likely to spur precautionary behavior on the part of governments or those who are proponents of a questionable activity. However, market incentives, such as requiring a bond for the worst possible consequences of an activity or liability for damages, will encourage companies to think about how to prevent impacts. Such assurance bonds are already used in construction projects as well as in Australia to minimize damage from development projects.
>
> *The duty to monitor, understand, investigate, inform, and act.* Under a precautionary decision-making scheme, those undertaking potentially harmful activities would be required to routinely monitor their impacts (with possible third party verification), inform the public and authorities when a potential impact is found, and act upon that knowledge. Ignorance and uncertainty are no longer excuses for postponing actions to prevent harm (see uncertainty discussion below).

Developing more democratic and thorough decision-making criteria and methods. The precautionary principle requires a new way of thinking about decisions and weighing scientific and other evidence in the face of uncertainty. This type of precautionary decision-flow, addressing both new and existing activities, is described in a later section. Because difficult questions of causality are in essence policy decisions, potentially impacted publics must be involved in the decision process. Thus, structures to better involve the public in decision-making are required under a precautionary approach.

IV. METHODS OF PRECAUTION

Preventive actions should be taken, when possible, at the design stage of a potentially hazardous activity to ensure their greatest impact. The precautionary principle does not fulfill its purpose unless preventive methods for carrying out precaution are implemented. Otherwise, risks may be shifted or the problem may persist, though to a lesser degree.

However, one can think of a spectrum of precautionary actions from weak (intensive studying of a problem) to strong (prohibiting or phasing out a specific activity). Numerous tools for carrying out precautionary policies have been used throughout the world:

Bans and phase-outs. A ban or phase-out could be considered the strongest precautionary action. At least 80 countries ban the production or use of a small number of highly toxic substances. The Nordic countries have particularly advanced the use of bans as a public health strategy. These countries see bans and phase-outs as the only way to eliminate the risk of injury or disease from a very toxic chemical or hazardous activity. Several chemicals, including cadmium and mercury, are now being phased out in Sweden. The International Joint Commission (see later discussion) recommended a phase-out of industrial chlorine chemistry in the Great Lakes region.

Clean production and pollution prevention. Clean production involves changes to production systems or products that reduce pollution at the source (in the production process or product development stage). Other clean-production activities address the dangers of products themselves, introducing sustainable product design, bio-based technologies, and the consideration of raw material and energy consumed in product creation, as well as questioning the fundamental need for products.

Alternatives assessment. Alternatives assessment is an accepted methodology as well as an underlying component of precaution. For example, the U.S. National Environmental Policy Act calls on the federal government to investigate alternatives (in an Environmental Impact Statement), including a no-action alternative, for all of its activities (or activities it funds) determined to have potential environmental impacts. Citizens have the right to appeal decisions if a full range of options is not considered. Several European countries have initiated such programs for all potential industrial polluters. Nicholas Ashford at the Massachusetts Institute of Technology has developed a structure for chemical accident prevention called Technology Options Assessment. Under this scheme, companies would be required to undertake comprehensive assessments of alternative primary prevention technologies and justify their decision if safer alternatives were not chosen.

Health-based occupational exposure limits. Over a period of several years, a group of occupational health experts in the United States has developed a list of occupational exposure limits based on the lowest exposure level at which health effects have been seen. These levels are proposed as new occupational exposure limits.

Reverse onus chemical listing. Proposals in Denmark and the U.S. have been put forward to drive the development of information on chemicals and their effects. In Denmark, one proposal would require a chemical to be considered the most toxic in its class if full information on its toxicity was not available. A U.S. proposal would require that all chemicals produced in high volume, for which basic toxicity information did not exist, would be added to the toxics-release inventory for emissions and waste reporting.

Organic agriculture. The U.S. Department of Agriculture is considering using the precautionary principle as a rule for deciding whether new technologies and substances may be permitted in organic agriculture. Although these decisions are now based on risk assessment upon evidence of "measurable degradation," organic agriculture lends itself to the precautionary approach. It is risk averse, premised on the principle of avoiding substances and practices that might cause harm rather than waiting for proof of harm.

Ecosystem management. Biodiversity issues are suited to the precautionary principle because their complexity and geographic scope increase scientific uncertainty, and because the results of errors can be devastating. Risk assessment and other tools have been unable to predict and prevent such disasters as the devastation of marine ecosystems and the collapse of fisheries. Ecosystem management, like epidemiology, calls for new approaches to the philosophy of science and new standards for human intervention. Applying the precautionary principle would suggest, for example, that interventions must be reversible and flexible. Any mistakes must be correctible.

Premarket or pre-activity testing requirements. The Federal Food and Drug Act requires that all new pharmaceuticals be tested for safety and efficacy before entering the market. This model could be applied to industrial chemicals and other activities.

V. EXAMPLES OF PRECAUTIONARY ACTION

The International Joint Commission

Perhaps the most noteworthy application of the precautionary principle in the United States has occurred in the Great Lakes Region. The Great Lakes have been threatened for years by the emission of persistent organic compounds into their waters. In the late 1970s, the United States and Canada signed the Great Lakes Water Quality Agreement (GLWQA) which establishes the goal of virtually eliminating discharges of persistent compounds from the Great Lakes. Under the GLWQA, the International Joint Commission (IJC), a 100-year-old bi-national body established to protect waters along the border, was designated to conduct research and issue statements on the quality of the lakes and threats to that quality.

In its Sixth Biennial Report on Great Lakes Water Quality (1992) the IJC noted the damage caused by persistent and bioaccumulative substances in the Great Lakes Basin and the critical need to address those. They also recognized that attempts to manage such chemicals, based on the notion of assimilative capacity in the environment, had failed miserably. The Commission issued a call to phase out all persistent toxic substances in the Great Lakes Ecosystem and stated:

> Such a strategy should recognize that all persistent toxic substances are dangerous to the environment, deleterious to the human condition, and can no longer be tolerated in the ecosystem, whether or not unassailable scientific proof of acute or chronic damage is universally accepted.

Gordon Durnil, who was appointed by President Bush to head the U.S. delegation to the Commission, recalled at the January 1998 Wingspread conference how the commission reached this conclusion: "When we commissioners asked scientists what they knew about the effects of pollutants on people and wildlife, they would say they knew nothing for sure. Finally we began asking them what they believed was happening, based on their vast experience and observations. What those scientists of diverse backgrounds said then convinced me that we knew enough about the effects of those discharges to try to eliminate them altogether."

Toxics use reduction in Massachusetts

The Massachusetts Toxics Use Reduction Act is a salient example of the principle of precautionary action. Passed in 1989, the Act requires that manufacturing firms using specific quantities of some 900 industrial chemicals undergo a biannual planning process to identify ways to reduce use of those chemicals. There are several aspects of Toxics Use Reduction that make it a good example of precautionary action:

Goal-setting. The Commonwealth established a goal of reducing toxic by-product (waste) by 50 percent.

Alternatives. Rather than instructing industrial facilities to identify the "safe" level of use, the Act considers any amount of use too much. Companies are required to understand why and how they use specific chemicals and to conduct comprehensive financial, technical, environmental, and occupational health and safety analysis of viable alternatives to ensure that the alternatives are indeed better.

Monitoring and reporting. Companies are required to measure their progress yearly at reducing their use of toxic chemicals. This information is available to the public.

Responsibility. While the burden is on the firm to identify alternatives and analyze their chemical impacts, Massachusetts provides support and incentives to ensure that progress is made in reducing toxic chemical use.

Firms are not required to undertake any particular option but in many cases the economic and environmental, health, and safety benefits provide enough justification for action. Costs associated with chemical purchases, tracking, and waste disposal are very high. From 1990 to 1995, companies in Massachusetts reduced their toxic chemical emissions by more than two-thirds, their total chemical waste by 30 percent, and their total use by 20 percent.The

Act saved Massachusetts industry some $15 million, not including the public health and environmental benefits gained through the program.

VI. TRIGGERING PRECAUTION: A PROCESS FLOW

This section describes a process for applying the precautionary principle to a specific problem. It includes case studies of two types, one addressing a new or proposed activity, the other addressing an existing problem. The approaches are nearly identical, but with subtle differences. For new activities the emphasis will be on shifting the burden of proof to proponents of a potentially harmful activity. Proponents should not only demonstrate that the activity will not be harmful, but also that they have considered a wide range of alternatives, including forgoing the questionable activity. Of course, such analyses should also be independently verified. For existing activities the most useful tool is the heart of the precautionary principle: action before proof of harm, again, with the burden on the proponent.

This decision tree provides a consistent basis for advocates to define, examine, and identify alternatives to threats to health and the environment. Following these common-sense, rational steps in the decision-making process, some of which are described in business textbooks, leaves activists less open to charges of emotionalism. Instead of taking a simple opposition stance, advocates can lead a community toward rational and wise solutions.

The steps are simple: first characterize and understand the problem or potential threat; understand what is known and not known; identify alternatives to the activity or product; determine a course of action, and monitor. (If the impacts of a particular activity are known, then the actions taken are no longer precautionary; they are either preventive or control actions.)

> Case study A, new product or activity: a proposal to spray aerially a new insecticide in your community.
>
> Case study B, existing problem: a leaking landfill.

Step One: Identify the possible threat and characterize the problem

The purpose of this step is to gain a better understanding of what might happen should the activity continue and to ensure that you are asking the right questions about this activity. Poor solutions are often a result of badly defined problems. Identify both the immediate problem and any other global issues that might go along with this threat. Here are questions to ask:

Why is this a problem? Presumably it has the potential to threaten public health or the environment.

What is the potential spatial scale of the threat - local, statewide, regional, national, global?

What is the full range of potential impacts? To human health, ecosystems, or both? Will there be impacts to specific species or loss of biodiversity? Are the impacts to waterways, air, or soil? Do indirect impacts need to be considered (such as a product's lifecycle-production and disposal)?

Will some populations (human or ecosystems) be disproportionately affected?

What is the magnitude of possible impacts (intensity)? Is the extent of harm negligible, minimal, moderate, considerable, catastrophic?

What is the temporal scale of the threat? There are two issues to consider: 1) The time lapse between a threat and possible harm (immediate, near future, future, future generations). The further in the future harm might occur, the less likely that impacts can be predicted, the harder it will be to identify and halt a problem, and the more likely that future generations will be impacted. 2) Persistence of impacts (immediate, short term, mid term, long term, inter-generational).

How reversible is the threat? If the threat were to occur would it be easy to fix or last for generations? (easily/quickly reversed, difficult/expensive to reverse, irreversible, unknown)

A note about existing problems: Defining a problem at hand is less difficult than projecting problems from a future project. But the first questions are similar: Is the problem local pollution from a particular facility or broader lack of attention to pollution prevention or both? Is it caused by a government failure or a company's negligence? Is it a serious threat or just an eyesore?

> A. In the aerial spraying case, the threat could be characterized as human and ecosystem exposure to pesticide drift, as well as impacts on non-target species. The spatial scale might be local, but if the pesticides are persistent or there are heavy winds, the impacts could be regional or even global. The magnitude and temporal scale would depend on the toxicity of the pesticide, as would reversibility.
>
> B. In the landfill case, the problem is caused by a faulty liner and inadequate inspection by town officials. The problem is likely localized but if the leachate runs into surface water, it might be carried long distances. The problem could be short or long term, depending on what is leaking out of the landfill (e.g., heavy metals or solvents). The leaking may disproportionately impact certain populations living around the landfill.

Step Two: Identify what is known and what is not known about the threat.

The goal of this step is to gain a better picture of the uncertainty involved in understanding this threat. Scientists often focus on the what we know, but it is equally, and perhaps more, important to be clear about what we don't know. There are degrees and types of uncertainty, as the later discussion explains. Relevant questions:

Can the uncertainty be reduced by more study or data? If so, and if the threat is not great, a project with substantial benefits might be continued.

Are we dealing with something that is unknowableÑor about which we are totally ignorant? High uncertainty about possible harm is good reason not to go ahead with a project.

What is known about additive and synergistic effects from exposure to multiple stressors and cumulative effects from combined exposures to various stressors?

Do industry and government claims that an activity is safe mean only that it has not yet been proven dangerous?

You might want to make a chart listing what is known and what is not known about the threat to gain a better comparative picture and understand gaps in understanding.

> A. In the case of the pesticide, you probably do not know the inert ingredients, which constitute the majority of the formulation. You probably do not know most human health effects other than neurotoxicity and carcinogenicity. You do not know about drift and volatilization. You do not know additive or cumulative effects to ecosystems or health. You do not know all the exposure routes (drinking water, showers, etc.) or how much exposure there will be. You do not know effects on beneficial insects and pollinators. You do have label information as well as information on wind direction and velocity on the day proposed for spraying. Perhaps there is also some monitoring data on drift.
>
> B. In the case of the landfill you do not know what materials are in the landfill, as they come from multiple sources. You also do not know what reactions may occur between materials in the landfill. You have some information on the hydrology of the area but do not know whether drinking water will be affected or over what time course.

Step Three: Reframe the problem to describe what needs to be done

The goal of this step is to better understand what purpose the proposed activity serves. For example, a development provides housing, a solvent provides degreasing, a pesticide provides pest management, a factory provides jobs and a product for a specific service. The problem can then be reframed in terms of what needs to be achieved in order to more readily identify alternatives.

A. In the case of the pesticide, reframing the problem leads to the more important issue of managing pests rather than spraying pesticides.

B. An existing problem may or may not call for a reframing. In the landfill case, is it time for the community to reconsider how it disposes of waste?

Step Four: Assess alternatives.

Proposed and existing activities are addressed somewhat differently in this step.

Proposed activities: Integral to the precautionary principle is a comprehensive, systematic analysis of alternatives to threatening activities. This refocuses the questions to be considered by a regulator or company from how much risk is acceptable to whether there is a safer and cleaner way to undertake this activity. Assessing alternatives drives ingenuity and innovation. It is more difficult to dismiss proposals that not only name problems but set forth alternatives, or demand that they be considered. The "no action" alternative must be considered: perhaps an activity should not proceed because it poses too much of a threat and/or is not needed.

Existing activities: At this point you would develop and assess a range of alternative courses of action to deal with the problem. The options can be to study further, to completely stop the activity, prevent, control, mitigate, or remediate.

In either case, the assessment of alternatives is a multi-stage process.

First, you might brainstorm a wide range of alternatives, then screen out those options that seem impossible.

The next stage is to assess the alternatives to determine whether they are politically, technically, and economically feasible. Do not let conventional wisdom limit this assessment. Keep in mind that something that is not economically or technically feasible today may be feasible in the near future. And government agencies and firms rarely consider the "external" costs of threatening activities harm to health, loss of species, etc. which are often unquantifiable.These concerns must be incorporated in the assessment.

The last step of the alternatives assessment is to consider potential unintended consequences of the proposed alternatives. A common criticism of the precautionary principle is that its implementation will lead to more hazardous activities. This need not be true: alternatives to a threatening activity must be equally well examined.

A. In the case of the pesticide, alternatives might include not spraying at all, using integrated pest management techniques, spraying with a less toxic pesticide, or ground spraying to avoid drift.

B. In the case of the landfill, several alternatives exist. Further study could be conducted to better understand what is leaching and how it is affecting local groundwater. Another action would be to close the landfill but then the community would need to find alternative disposal methods, which may include incineration, the emissions from which present a substantial problem. Another option may be to cap sections of the landfill that are leaching.

Step Five: Determine the course of action.

Take all the information collected thus far and determine how much precaution should be takenÑ stopping the activity, demanding alternatives, or demanding modifications to reduce potential impacts. A useful way to do this is by convening a group of people to weigh the evidence, considering the information on the range and magnitude impacts, uncertainties, and alternatives coming from various sources. The weight of evidence would lead to a determination of the correct course of action.

> A. In the example of pesticide spraying, it might be determined that spraying is unnecessary because it is unclear what pests are being fought and the extent to which they might harm crops. The course of action would be to monitor pest damage and conduct localized interventions when needed.
>
> B. For the landfill, the course of action could be further study to identify the range of impacts, with independent review. This could be followed by a local choice of options, closing the landfill or controlling leachate.

Step Six: Monitor and follow up

No matter what action is taken, it is critical to monitor that activity over time to identify expected and unexpected results. Those undertaking the activity should bear the financial responsibility for such monitoring, but when possible this should be conducted by an independent source. The information gathered might warrant additional or different courses of action.

> In the pesticide example, if spraying proceeds, you might require health tests and alert doctors to health consequences.
>
> If parts of the landfill are capped, regular monitoring would ensure that leaching does not occur, or that prompt action will be taken if it does.

VII. DIOXIN: AN ARGUMENT FOR PRECAUTION

Dioxin is one of the most intensively studied substances ever, but we remain ignorant about the full range of its impacts. Growing evidence suggests that dioxin is harmful to humans and other living things, but absolute proof of harm has not been established. The dioxin assessment and reassessment process instigated by the U.S. Environmental Protection Agency in the early 1990s, is a seemingly endless attempt to reduce the uncertainties about the impacts of this chemical. But it will not stop exposure to dioxin. Instead, it is likely to lead to more debate about controlling sources of dioxin and about how much of the substance can be tolerated by humans and the ecosystem.

This case presents a classic example of why and how the precautionary principle should be applied. First, the argument for precaution:

Evidence of harm. Dioxin is extremely toxic in laboratory experiments, both acutely and chronically at very low doses. As a result of laboratory evidence and mechanistic evidence, the most toxic dioxin, TCDD, has been identified as carcinogenic to humans by the International Agency for Research on Cancer. Dioxin has been associated with various other effects as well, such as chloracne, and may be associated with endometriosis and other diseases. There is some evidence that adverse effects occur at very low levels, near current "background" levels.

Persistence and irreversible harm. The time and spatial scale of dioxin contamination is vast. Dioxin has been measured throughout the globe and its persistence, both in humans and the environment, means that future generations will be exposed to dioxin produced today. Harm caused by dioxin to humans and ecosystems is likely to be irreversible, or reversible only over decades.

Difficulty of control and cleanup. Because small quantities may be harmful, controlling dioxin emissions, especially from open sources such as burning, to the extent that would protect public health is virtually impossible and extremely costly. Thorough cleanup is also virtually impossible.

Scientific uncertainty. Because cancer, one result of dioxin exposure, can take years to manifest itself, it is often impossible to link exposure and disease. The connectivity of impacts, mixtures of dioxins with other persistent organic chemicals and other stressors, is also relatively unknown. For example, how might work-related stress combine with dioxin exposure to affect the immune system? There is some laboratory evidence of interactions but interactions are extremely difficult to prove.

Prevention is possible. There is general consensus that dioxin is mainly created by human activities. Many sources of dioxin can be reduced or eliminated in the short term through precautionary action.

Current measures are insufficient. While some data suggest that levels of dioxin have fallen, possibly because old incinerators have been shut down or retrofitted and pollution control and technologies have changed, the problem is not solved. Levels of dioxin may increase in the future, for example, as more PVC products are incinerated or burned in accidental fires.

A precautionary approach to dioxin would no doubt set a goal of zero exposure, which would probably mean zero emissions. But there are degrees of precaution.

A moderate precautionary approach would first look at reducing or eliminating the largest sources of dioxin, which we know to be municipal and medical waste incineration, as well as pulp and paper production, iron and steel production, hazardous waste incineration, and open burning. But this approach might mean that materials producing dioxin would be transferred elsewhere, perhaps to landfills where they might catch fire and burn without controls, or to Third World countries.

A stronger version of precaution, a materials approach, would attempt to address the main sources of chlorine, the ultimate source of dioxin. The focus would be on chlorinated pesticides and solvents, pulp and paper production, and polyvinyl chloride plastics. Phasing out PVCs, by far the largest users of chlorine, would no doubt greatly reduce dioxin emissions. But we would then have to ask what the alternatives are to PVCs, whether they are safer, and whether they involve chlorine. We would also have to ask whether chlorine now produced for PVCs would be channeled into other products.

Phasing out chlorine is the only way to virtually eliminate dioxin, especially in industrial processes and products. Otherwise, we will always be chasing sources, debating how much dioxin is safe, and attempting to measure the emissions from each source. More science is critical to precautionary action, to monitor and measure sources and exposure, to uncover possible new sources of exposure, to research alternatives to chlorine, and to make sure that these alternatives do not pose serious problems of their own. But this process should not forestall action to reduce and eliminate dioxin emissions and exposure. Precaution must be taken at once.

VIII. UNDERSTANDING UNCERTAINTY

In the open, dynamic environments in which humans live and operate, knowledge often has limits, and scientific certainty is difficult to attain. Uncertainty itself comes in many varieties, nonscientific as well as scientific. Some kinds of uncertainty can be addressed and reduced; others cannot. When we make judgments affecting the environment and public health, understanding what we do not know, and why, is as important as pinning down facts.

Uncertainties can be placed in the following categories:

Parameter uncertainty refers to missing or ambiguous information in specific informational components of an analysis. Parameter uncertainty can often be reduced by gathering more information or using better techniques to gather and analyze it. However, if it is due to variability, this may not be the case. In environmental releases, individuals not only receive various exposures; they also vary in their susceptibility to harm. Attempts to measure and control exposure to hazards may inadequately protect many in the population.

Model uncertainty refers to gaps in scientific theory or imprecision in the models used to bridge information gaps, for example, in a dose-response model. Models are constructed to explain current or past events or predict the future. They are only as good as the information used to build them which is necessarily incomplete when models refer to open and interdependent environmental systems. Models can be improved as they incorporate more, and more precise, information.

Systemic or epistemic uncertainty refers to the unknown effects of cumulative, multiple, and/or interactive exposures. Systemic uncertainty can be an important confounding factor in large-scale or long-term analyses.

Smokescreen uncertainty refers to the strategies of those who create risks and have a stake in concealing the effects of a specific substance or activity. They may refrain from studying a hazard, conceal knowledge of effects, or design studies to create uncertainty. Critics of regulation often use uncertainty to avoid it.

Politically induced uncertainty refers to deliberate ignorance on the part of agencies charged with protecting health and the environment. The agency may decide not to study a hazard, limit the scope of its analysis or alternatives to solve a problem, downplay uncertainty in its decisions, or hide uncertainty in quantitative models.

Indeterminacy means that the uncertainties involved are of such magnitude and variety that they may never be significantly reduced.

Ignorance has two faces: Positively, it is a humble admission that we don't know how much we don't know. Negatively, it is the practice of making decisions without considering uncertainties.

Example: Toxicity testing for industrial chemicals

Under the Toxic Substances Control Act, chemical manufacturers and importers are required to submit data related to the potential health effects of chemicals before manufacturing them. The Environmental Protection Agency can then require additional testing before that chemical reaches the market. Companies must also submit evidence of substantial risk if that becomes available once the substance is on the market.

As early as 1984, the National Academy of Sciences noted the overwhelming lack of data on the health effects of industrial chemicals. The Academy found that 78 percent of the chemicals in highest-volume commercial use did not have even "minimal" toxicity testing.

The situation has not improved some fourteen years later, as noted by the Environmental Defense Fund [1997] and the Environmental Protection Agency [1998]. For the 3,000 high-production-volume chemicals, those with over one million pounds in commerce, the studies noted the following: 93 percent lack some basic chemical screening data; 43 percent have no basic toxicity data; 51 percent of chemicals on the Toxic Release Inventory lack basic toxicity information; and a large percentage of available information is based only on acute toxicity.

Vice-President Al Gore has ordered industry to perform basic screening of these 3,000 chemicals, but this will not include data on human exposure, health effects, and risk. The EPA will not be bound to act on the information it receives.

Numerous forms and sources of uncertainty and ignorance exist in industrial chemical testing and the approval process:

Ignorance is manifest in the EPA practice of permitting chemicals to be used and released into the environment without knowing their full range of health effects.

Parameter uncertainty exists in the lack of data on human exposure and various results of toxicity, including how specific toxic chemicals affect developing fetuses and newborns.

The lack of data leads to *model uncertainty*.

Systemic uncertainty exists because science has only begun to study the interactions of toxic chemicals in the environment and their cumulative effects.

Industry's failure to conduct or report on testing and attempts to focus discussions on other factors (mechanisms of action of disease, diet and genetics, and "natural" carcinogens) represents a form of *smokescreen uncertainty*. For example, when the EPA offered temporary leniency to industry to submit notifications of substantial chemical risk, the agency received some 11,000 notifications in a short period.

Politically induced uncertainty occurs when government agencies do not enforce or require chemical testing, and when they determine to study one chemical rather than another.

Traditional research science attempts to gather nearly complete and perfectly supportive information before claiming a cause-and-effect relationship. Statistically, scientists want to be 95 percent sure that the results they have observed are not due to chance alone. This paradigm of science unfortunately has been carried over to looking at hazards to human health and the environment. Decision-makers' quest for 95 percent certainty is an attempt to avoid what are called Type I errors, taking action or regulating when a hazard does not exist in reality. By focusing on avoiding these types of errors, decision-makers increase the possibility of not taking action when there actually is harm, that is, of making what is called a Type II error.

Uncertainty can be a source of power to government agencies and industry. Uncertainty can be used to say that we do not know enough yet, and that taking action would be irrational or based on "junk science." These spokespersons seldom say, though, how much they know or do not know. Industry representatives will use terms like "safe" or "approved" when a product has not actually been tested, or when there is uncertainty.

Uncertainty can also be a weakness for a government agency faced with justifying to industry why action should be taken in the absence of absolute proof of harm. It is much easier for a government agency to cover up uncertainty with quantitative analyses that look objective and scientific on their surface than to face the wrath of industry. This coverup is also a way of deflecting public wrath. Knowledge is equated with scientific and technical knowledge. The knowledge that has been gained through tradition or life experience is discounted in favor of knowledge that can be quantified.

Currently, uncertainty is used as a reason not to take preventive action for human health and the environment. But we can use uncertainty as a reason to act, realizing that we may never know how a particular hazard affects humans or the environment. We need to consider what we know and how we know it, and the limits to knowing. Environmental and public health advocates have to ask difficult questions of industry and regulators to expose the depths of our ignorance. Once this lack of knowledge has been exposed, the notion of needlessly exposing humans and the environment to hazards without information on their effects seems irrational, and precaution seems logical.

IX. RISK ASSESSMENT OR THE PRECAUTIONARY PRINCIPLE?

During the 1970s, the decision-making tools of risk assessment and cost-benefit analysis were developed to bridge the gap between uncertain science and the political need for decision-making to limit harm. However, in their development, a great deal of faith was placed in the ability of science to model and predict harm in extremely complex ecological and human systems. Risk assessment, which was originally developed for mechanical problems such as bridge construction, in which the technical process and parameters are well-defined and can be analyzed, took on the role of predictor of extremely uncertain and highly variable events.

Risk assessment is viewed by government agencies and those in industry as the "sound science" approach to decision-making, in which decisions are made on the basis of what can be quantified, without considering what is unknown or cannot be measured. These are lumped into the category of uncertainty, as discussed earlier. Although few scientists will admit it, risk assessment and other "sound science" approaches to decision-making are highly reliant on policy and scientific assumptions, which are frequently unscientific or subjective.

There is a proper, if secondary, role for risk assessment in increasing our understanding of the complexities of environmental harm. But as traditionally practiced, risk assessment has often stood in the way of protecting human health and the environment. Here are some of the major assumptions and flaws of conventional risk assessment:

Risk assessment assumes "assimilative capacity," that is, that humans and the environment can render a certain amount of pollution harmless. Eliminating risk altogether is not a plausible outcome of risk assessment. Risk assessment is used to manage and reduce risks, not prevent them. This deters more fundamental efforts to institute clean production.

Risk assessment focuses on quantifying and analyzing problems rather than solving them. It asks how much pollution is safe or acceptable; which problems are we willing to live with; how should limited resources be directed? While these are valid questions, they bar more positive approaches: how do we prevent harmful exposures; move toward safer and cleaner alternatives; involve society in identifying, ranking, and implementing solutions?

Risk assessments are susceptible to model uncertainty. Current risk assessment is based on at least 50 different assumptions about exposure, dose-response, and extrapolation from animals to humans. All of these have subjective and arbitrary elements. As a result, the quantitative results of risk assessments are highly variable.

The European Union recognized the limitations to risk assessment assumptions in its European Benchmark exercise in hazard analysis. In the exercise, eleven European governments established teams of scientists and engineers to work on a problem about accidental releases of ammonia. The result of the exercise was eleven different risk estimates ranging from 1 in 400 to 1 in 10 million. The organizers concluded that "at any step of a risk analysis, many assumptions are introduced by the analyst and it must be recognized that the numerical results are strongly dependent on these assumptions [Contini, et al. 1991. Benchmark Exercise on Major Hazard Analysis. EUR 13386 EN Commission of the European Communities, Luxembourg].

At the same time, current risk assessment leaves out many variables, especially multiple exposures, sensitive populations, or results other than cancer. Risk assessment is geared toward setting single chemical standards and is incapable of analyzing the mixtures of chemicals found in many communities. It does not adequately take into account sensitive populations, such as the elderly, children, or those already suffering from environmentally induced disease. It rarely looks at effects other than cancer, although many environmental health problems involve respiratory disease, birth defects, and nervous system disorders. Risk assessment is designed to analyze linear response (more exposure leads to more harm) and is stymied if this is not the case. For example, emerging evidence about the ability of some synthetic substances to disrupt the hormone system in humans is showing that low doses rather than high doses may lead to these effects.

Risk assessment allows dangerous activities to continue under the guise of "acceptable risk." Risk assessment provides an air of quantitative, technical sophistication to inexact, assumption-laden, and politically driven science. It allows the continuation of activities that lead to greater pollution and degradation of health under the premise that it is either safe or acceptable to those who are exposed. It staves off regulation and action in the face of uncertainty and insufficient evidence.

Risk assessment is costly and time-consuming. A single risk assessment may take up to five person-years to complete. It ties up limited resources in trying to quantify and rank risks when the effects of exposures may already be obvious (see dioxin analysis above). Risk assessments take resources away from prevention-focused solutions.

Risk assessment is fundamentally undemocratic. Those exposed to harm are rarely asked whether exposure is acceptable to them, what biologist Sandra Steingraber labels a violation of fundamental human rights, or toxic trespass. Risk assessment traditionally does not include public perceptions, priorities, or needs, and while some efforts have been made to involve the public in risk-assessment processes, widespread public participation in either scientific analysis or decision-making is not a likely prospect in the coming years. No mechanisms for this exist. The risk-assessment process is most often confined to agency and industry scientists, consultants, and sometimes a high-tech environmental group. Public involvement in risk assessments has generally only legitimized a pernicious process.

Risk assessment puts responsibility in the wrong place. It assumes that society as a whole must deal with environmental harm, and assumes a scarcity of resources for this task. The contention that "society" does not have enough resources for all environmental protection activities diverts attention from those responsible for harm, those who created it, not those who have suffered from it. If scarcity is a factor, it would be wise to shift government resources from studying problems ad infinitum to identifying safer alternatives to potentially dangerous activities.

Risk assessment poses a false dichotomy between economic development and environmental protection. Regulatory agencies often attempt to tie the "scientific" process of risk assessment to cost-benefit analysis, linking science and economic policy in environmental decision-making. The agencies fail to consider, however, the question of who assumes the costs and who reaps the benefits. Moreover, the economic benefits of pollution prevention and toxics use reduction strategies have been clearly demonstrated. An important consideration is that the cost of under-regulating will typically be greater than over-regulating, when considering subsequent clean-up and health costs.

These criticisms aside, risk assessment can play a role in implementing the precautionary principle. Instead of using risk assessment to establish "safe" levels of exposure, levels that are fundamentally unknowable, it can be used to better understand the hazards of an activity and to compare options for prevention. It can also be used, in conjunction with democratic decision-making methods, to prioritize activities such as hazardous waste site cleanups and restoration activities. But the underlying basis of policy and decision-making must be precaution and prevention, rather than risk.

X. ANSWERING THE CRITICS

The precautionary principle is a new way of thinking about environmental and public health protection and long-term sustainability. It challenges us to make fundamental changes in the way we permit and restrict hazards. Some of these challenges will pose large threats to government agencies and polluters and are likely to lead to powerful resistance. It is important to anticipate critics of precaution and to know how to respond to their comments.

The precautionary principle is not based on sound science.

Sound science is a matter of definition. Conventional understanding of "sound science" emphasizes risk assessment and cost-benefit analysis. These are value-laden approaches, requiring numerous assumptions about how hazards occur, how people are exposed to them, and society's willingness to tolerate hazard. In fact, because of great uncertainties about cause and effect, all decisions about human health and the environment are value-laden and political.

The precautionary principle recognizes this, and proposes a shift in the basis for making these decisions. Precaution is based on the principle that we should not expose humans and the environment to hazards if it is unnecessary to do so.

Precaution is more thorough than risk assessment because it exposes uncertainty and admits the limitations of science. This is a "sounder" kind of science. Precaution does not call for less science, but more, to better understand how human activities affect our health and environment. But the need for better understanding must not prevent immediate action to protect ourselves and future generations.

This is emotional and irrational.

Because we are human, thinking about babies born with toxic substances in their bodies tugs at our emotions. Caring about future generations is an emotional impulse. But these emotions are not irrational; they are the basis for our survival. Precaution is a principle of justice, that no one should have to live with fear of harm to their health and environment. Decision-making about health is not value-neutral. It is political, emotional, and rational. Not taking precautions seems irrational.

We will go bankrupt. This will cost too much.

There is more reason to believe that precaution will increase prosperity in the long run, through improved health and cleaner industrial processes and products. The skyrocketing costs of environmental damage, health care from pollution, and pollution control and remediation are rarely included in estimates undertaken when precautionary action is advocated. Despite initial outcries about precautionary demands, industry has been able to learn and innovate to avoid hazards. In the area of pollution prevention, thousands of companies have saved millions of dollars by exercising precaution early, before proof of harm. These companies and governments that act similarly become leaders in their field when firmer proof of harm comes along.

In taking precaution, however, we should also plan ahead to mitigate immediate adverse economic impacts. Transition planning pulls together different sectors of society to ensure that precautionary action has as few adverse side-effects as possible. Precaution is practiced by setting societal goals, such as that children be born without toxic substances in their bodies, and then determining how best to achieve that goal.

What do you want to do, ban all chemicals? This will halt development and send us back to the Stone Age!

Precaution does not take the form of categorical denials and bans. It does redefine development not only to include economic well-being but also ecological well-being, freedom from disease and other hazards.

The idea of precaution is to progress more carefully than we have done before. It would encourage the exploration of alternatives, better, safer, cheaper ways to do things, and the development of cleaner products and technologies. Some technologies and developments may be brought onto the marketplace more slowly. Others may be phased out.

Those proposing potentially harmful activities would have to demonstrate their safety and necessity up front. On the other hand, there will be many incentives to create new technologies that will make it unnecessary to produce and use harmful substances and processes. With the right signals, we will be able to innovate to create development that takes less of a toll on our health and environment.

Naturally occurring substances and disasters harm many more people than do industrial activities.

We must deal with the hazards for which we are responsible and over which we have control. Those creating risk and benefiting from their activities also have an obligation not to cause harm. But an important reason for precaution is that we do not yet know, and may never know, the full extent of the harm caused by human activity. Some violent natural events, for example, may be a result of global warming, which in turn is linked to human activity.

We comply with regulations. We are already practicing precaution.

In some cases, to some extent, precaution is already being exercised. But we do not have laws covering each possible industrial hazard or chemical. Also, most environmental regulations, such as the Clean Air Act, the Clean Water Act, and the Superfund law, are aimed at controlling the amount of pollution released into the environment and cleaning up once contamination has occurred. They regulate toxic substances as they are emitted rather than limiting their use and production in the first place.

Most current regulations are based on the assumption that humans and ecosystems can absorb a certain amount of contamination without being harmed. There is extreme uncertainty about "safe" or "acceptable" levels, and we are now learning that in many cases we cannot identify those levels.

You can't prove anything is safe.

It is possible to demonstrate that there are safer alternatives to an activity.

You could say that every activity has some impact. Every chemical is toxic at some dose.

Almost all human/industrial activities will have some impact on ecosystems. The virtue of the precautionary principle is to continuously try to reduce our impacts rather than trying to identify a level of impact that is safe or acceptable.

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XII. APPENDIX

Wingspread Statement on the Precautionary Principle
January 1998

The release and use of toxic substances, the exploitation of resources, and physical alterations of the environment have had substantial unintended consequences affecting human health and the environment. Some of these concerns are high rates of learning deficiencies, asthma, cancer, birth defects and species extinctions; along with global climate change, stratospheric ozone depletion and worldwide contamination with toxic substances and nuclear materials.

We believe existing environmental regulations and other decisions, particularly those based on risk assessment, have failed to protect adequately human health and the environment, the larger system of which humans are but a part.

We believe there is compelling evidence that damage to humans and the worldwide environment is of such magnitude and seriousness that new principles for conducting human activities are necessary.

While we realize that human activities may involve hazards, people must proceed more carefully than has been the case in recent history. Corporations, government entities, organizations, communities, scientists and other individuals must adopt a precautionary approach to all human endeavors.

Therefore, it is necessary to implement the Precautionary Principle: 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.

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Language from the Massachusetts Precautionary Principle Act

Commonwealth of Massachusetts......House Bill No. 3140, 1997

An Act to establish the Principle of Precautionary Action as the guideline for developing environmental policy and quality standards for the Commonwealth

Be it enacted by the Senate and House of Representatives in General Court assembles, and by the authority of the same, as follows:

The precautionary principle shall be applied to all policy and regulatory decisions of the administration in order to prevent threats of serious or irreversible damage to the environment. The precautionary principle shall be applied when there are reasonable grounds for concern that a procedure or development may contribute to the degradation of the air, land and water of the Commonwealth. Lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent costly environmental degradation. The precautionary principle, by virtue of which preventive measures are to be taken when there are reasonable grounds for concern that substances or energy introduced, directly or indirectly, into the environment may bring about hazards to human health, harm living resources and ecosystems, damage amenities or interfere with other legitimate uses even when there is no conclusive evidence of a causal relationship between the inputs and the effects. All state entities and contracting parties shall take all necessary steps to ensure the effective implementation of the precautionary principle to environmental protection and to this end they shall:

a) encourage prevention of pollution at source, by the application of clean production methods, including raw materials selection, product substitution and clean product technologies and processes and waste minimalization throughout society;

b) evaluate the environmental and economic consequences of alternative methods, including long term consequences;

c) encourage and use as fully as possible scientific and socioeconomic research in order to achieve an improved understanding on which to base long-term policy options.

Uses of the Precautionary Principle in International Treaties and Agreements

Ozone Layer Protocol

Parties to this protocol . . . determined to protect the ozone layer by taking precautionary measures to control equitably total global emissions of substances that deplete it, with the ultimate objective of their elimination on the basis of developments in scientific knowledge, taking into account technical and economic considerations. . . .
Protocol on Substances that Deplete the Ozone Layer, Sept. 16, 1987, 26 ILM 1541

Second North Sea Declaration

In order to protect the North Sea from possibly damaging effects of the most dangerous substances...a precautionary approach is addressed which may require action to control inputs of such substances even before a causal link has been established by absolutely clear scientific evidence. Ministerial Declaration Calling for Reduction of Pollution, Nov. 25, 1987, 27 ILM 835.

United Nations Environment Programme

Recommends that all Governments adopt "the principle of precautionary action" as the basis of their policy with regard to the prevention and elimination of marine pollution. Report of the Governing Council on the Work of its Fifteenth Session, United Nations Environment Programme, UN GAOR, 44th Sess. Supp No 25, 12th mtg at 153, UN DOC A44/25 (1989).

Nordic Council's Conference

And taking into account....the need for an effective precautionary approach, with that important principle intended to safeguard the marine ecosystem by, among other things, eliminating and preventing pollution emissions where there is reason to believe that damage or harmful effects are likely to be caused, even where there is inadequate or inconclusive scientific evidence to prove a causal link between emissions and effects. Nordic Council's International Conference on Pollution of the Seas: Final Document Agreed to Oct. 18, 1989, in Nordic Action Plan on Pollution of the Seas, 99 app. V (1990)

PARCOM Recommendation 89/1 - 22 June, 1989

The Contracting Parties to the Paris Convention for the Prevention of Marine Pollution from Land-Based Sources:

Accept the principle of safeguarding the marine ecosystem of the Paris Convention area by reducing at source polluting emissions of substances that are persistent, toxic, and liable to bioaccumulate by the use of the best available technology and other appropriate measures. This applies especially when there is reason to assume that certain damage or harmful effects on the living resources of the sea are likely to be caused by such substances, even where there is no scientific evidence to prove a causal link between emissions and effects (the principle of precautionary action).

Third North Sea Conference

The participants...will continue to apply the precautionary principle, that is to take action to avoid potentially damaging impacts of substances that are persistent, toxic, and liable to bioaccumulate even where there is no scientific evidence to prove a causal link between emissions and effects Final Declaration of the Third International Conference on Protection of the North Sea, Mar. 7-8, 1990. 1 YB Int'l Envtl Law 658, 662-73 (1990).

Bergen Declaration on Sustainable Development

In order to achieve sustainable development, policies must be based on the precautionary principle. Environmental measures must anticipate, prevent, and attack the causes of environmental degradation. 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. Bergen Ministerial Declaration on Sustainable Development in the ECE Region. UN Doc. A/CONF.151/PC/10 (1990), 1 YB Intl Envtl Law 429, 4312 (1990)

Second World Climate Conference

In order to achieve sustainable development in all countries and to meet the needs of present and future generations, precautionary measures to meet the climate challenge must anticipate, prevent, attack or minimize the causes of, and mitigate the adverse consequences of, environmental degradation that might result from climate change. Where there are threats of serious of irreversible damage, lack of full scientific certainty should not be used as a reasons for postponing cost-effective measures to prevent such environmental degradation. The measure adopted should take into account different socioeconomic contexts. Ministerial Declaration of the Second World Climate Conference (1990). 1 YB Intl Envtl Law 473, 475 (1990)

Bamako Convention on Transboundary Hazardous Waste into Africa

Each Party shall strive to adopt and implement the preventive, precautionary approach to pollution problems which entails, inter alia, preventing the release into the environment of substances which may cause harm to humans or the environment without waiting for scientific proof regarding such harm. The Parties shall cooperate with each other in taking appropriate measures to implement the precautionary principle to pollution prevention through the application of clean production methods, rather than the pursuit of a permissible emissions approach based on assimilative capacity assumptions. Bamako Convention on Hazardous Wastes within Africa, Jan. 30, 1991, art. 4, 30 ILM 773.

OECD Council Recommendation

The Recommendation is accompanied by Guidance which is an integral part of the Recommendation. It lists some essential policy aspects including: the absence of complete information should not preclude precautionary action to mitigate the risk of significant harm to the environment. OECD Council Recommendation C(90)164 on Integrated Pollution Prevention and Control - January 1991

Maastricht Treaty on the European Union

Community policy on the environment...shall be based on the precautionary principle and on the principles that preventive actions should be taken, that environmental damage should as a priority be rectified at source and that the polluter should pay. Treaty on the European Union, Sept. 21, 1994, 31 ILM 247, 285-86.

Helsinki Convention on the Protection and Use of Transboundary Watercourses and International Lakes

The precautionary principle, by virtue of which action to avoid the potential transboundary impact of the release of hazardous substances shall not be postponed on the ground that scientific research has not fully proved a causal link between those substances, on the one hand, and the potential transboundary impact, on the other hand. Convention on the Protection and Use of Transboundary Watercourses and International Lakes, Mar. 17, 1992, 31 ILM 1312.

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. Rio Declaration on Environment and Development, June 14, 1992, 31 ILM 874.

Climate Change Conference

The parties should take precautionary measures to anticipate, prevent, or minimize the causes of climate change and mitigate its adverse effects. Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing such measures, taking into account that policies and measures to deal with climate change should be cost-effective so as to ensure global benefits at the lowest possible cost. To achieve this, such policies and measures should take into account different socioeconomic contexts, be comprehensive, cover all relevant sources, sinks and reservoirs of greenhouse gases and adaptation, and comprise all economic sectors. Efforts to address climate change may be carried out cooperatively by interested parties. Framework Convention on Climate Change, May 9, 1992, 31 ILM 849.

UNCED Text on Ocean Protection

A precautionary and anticipatory rather than a reactive approach is necessary to prevent the degradation of the marine environment. This requires inter alia, the adoption of precautionary measures, environment impact assessments, clean production techniques, recycling, waste audits and minimization,, construction and/or improvement of sewage treatment facilities, quality management criteria for the proper handling of hazardous substances, and a comprehensive approach to damaging impacts from air, land, and water. Any management framework must include the improvement of coastal human settlements and the integrated management and development of coastal areas. UNCED Text on Protection of Oceans. UN GAOR, 4th Sess., UN Doct A/CONF.151/PC/100 Add. 21 (1991)

Energy Charter Treaty

In pursuit of sustainable development and taking into account its obligations under those international agreements concerning the environment to which it is a party, each Contracting Party shall strive to minimize in an economically efficient manner harmful Environmental Impact occurring either within or outside its Area from all operations within the Energy Cycle within its Area, taking proper account of safety. In doing so each Contracting Party shall act in a Cost-Effective manner. In its policies and actions each Contracting Party shall strive to take precautionary measures to prevent or minimize Environmental Degradation. The Contracting Parties agree that the polluter in the Areas of Contracting Parties, should, in principle, bear the cost of pollution, including transboundary pollution, with due regard to the public interest and without distorting investment in the Energy Cycle or International Trade. The Draft European Energy Charter Treaty Annex I, Sept 14, 1994, 27/94 CONF/104.

U.S. President's Council on Sustainable Development

There are certain beliefs that we as Council members share that underlie all of our agreements. We believe: (number 12) even in the face of scientific uncertainty, society should take reasonable actions to avert risks where the potential harm to human health or the environment is thought to be serious or irreparable. President's Council on Sustainable Development. Sustainable America: A New Consensus, 1996

XIV. CONTACT INFORMATION

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