

Promoting Collaborative, Values-Based Decision Making

Ways of Better Managing Risk in a Complex World

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Abstract

We are just beginning to recognize the links between environmental contaminants and a host of new public health problems that challenge the tenets of traditional toxicology, medicine, and risk-based decision making. Yet risk assessment, as a combination of guesswork and science, raises serious questions of politics and ethics, while its enormous complexity creates additional risks around value judgments and manipulation of policy. Solutions can only be achieved through interjecting an ecological perspective into public health practice and governmental decision making based on broader, cross-sectoral and multidisciplinary collaboration. This paper discusses ways to improve the decision-making process; explores the precautionary principle as an alternative paradigm; analyzes participatory and collaborative approaches to risk management; and proposes collaborative, values-based decision making as the appropriate approach to environmental and health policy decisions. The author argues further that open and systematic communication of stakeholders' underlying assumptions and value judgments would serve to better inform such decisions. Environmental bridging organizations and networks may play a key role in this new collaborative approach.

1

Defining the Problem: Health, Environment and Risk

Brothers and sisters, a new child is born. While in the womb, it was one woman's. Safely delivered, it is everybody's child.

– Igbo naming tradition, Nigeria

Why has so little attention been paid to the human health dimension of environmental deterioration?

Since the Industrial Revolution, the health status and quality of life in most industrialized countries have improved. Indeed, it is easy to be misled by the observation that, in the short term, consumption-driven economic growth has been accompanied by improved population health. Canadians are living longer than ever before. Increased longevity has been attributed to declines in mortality rates for most leading causes of death, such as cancer and heart disease. With steadily lengthened lifespan and increased personal resources, many Canadians believe that a risk-free lifestyle is attainable. However, many of the improvements in human health have been made at the expense of the environment and have degraded ecosystem health.

The past several decades have seen a rise in public concerns over the health risks of late industrial development and technological advancement, which to many Canadians appear to threaten their well-being and future security. These risks arise from both personal and social choices, which in themselves reflect complex patterns of decision making by individuals, governments and business. But when those risks – genetically modified organisms (GMOs), global atmospheric change, food-borne pathogens, endocrine disruptors, exposure to ionizing radiation, fluoridated drinking water, to name just a few – are described in scientific and statistical terms, including the huge uncertainty factors inherent in the data, the mounting complexities make many people uneasy and distrustful of the information they are receiving.

Historically, public health was organized in an effort by society and the state to ameliorate the adverse effects of squalid living conditions: poor sanitation, poor housing, dangerous work environments and air pollution. The changes that transformed local pollution problems into national conditions required an understanding of the determinants of poor health and an improvement of the level and the desire for equality of health within populations. In spite of the warnings of a few far-sighted individuals, several decades of experience were required before society as a whole became aware of the insidious nature and by now massive scope of environmental degradation. This public health issue is unprecedented and has occurred on a wide front, requiring a population-wide attempt at reversal.

Today human activity is altering entire global systems such as the atmosphere and the oceans at an unprecedented rate. The major factors impacting public health which have resulted from this altered state include population pressures; land degradation; climate change; depletion of groundwater; loss of biodiversity; depletion of both renewable and non-renewable resources; increase of greenhouse gases; increased urbanization; escalating energy demands; and development of toxic chemicals. Consider a few highlights compiled by Carl Cranor (2001):

- Comparatively pristine air, water, oceans, and wilderness are vanishing or are on their way to vanishing. In the past fifty years the world's forested lands have shrunk substantially.
- Water tables are falling around the world; humans are over-pumping aquifers in China, India, North Africa, Saudi Arabia and the U.S. by about 160 billion tons of water per year. Humans are mining water from non-renewable resources sufficient to produce the food for 480 million people per year; this is simply unsustainable. The overuse of water is particularly acute in India and China.
- The worldwide cropland per person has fallen from 0.24 hectares to 0.12 hectares in the last fifty years, and may shrink to 0.08 by 2050.
- About two-thirds of major marine fisheries are fully exploited, overexploited or depleted.

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- About 11 percent of bird species, 25 percent of mammal species and an estimated 34 percent of all species are vulnerable or in immediate danger of extinction.
 - Some tropical forests have been turned into inferior, rapidly degrading pasture, with attendant loss of biodiversity.

As is well known in the field of ecology, the health and survival of a population cannot be sustained if the carrying capacity¹ of its ecosystem is exceeded. Ecology is concerned with the healthy interaction of living creatures in a closed system. Humans interact with each other as well as with other living creatures, and these interactions can have important effects on the health of all partners in the complex closed ecosystem of our planet. Thus, whatever the health outcome of interest – death, disease, illness, well-being or quality of life – the environment is a key factor or, put another way, a key determinant of health.

Unlike all the other determinants of health, the environment is not generally controlled by individuals or by mandated programs such as health care. It is a complex system where human activities interfere with nature and where involuntary exposure to risks and hazards occur. It is the involuntary risks of being a part of the environment that are often poorly understood, assessed and managed. Of utmost importance is the recognition that the environment, as a determinant of health, should not be solely concerned with “body counts’ (i.e., death and disease); rather, the concern should be based on well-being and quality of life. If toxic exposure occurs during critical growth stages, the systems of the human beings so affected can sustain permanent damage. Although this may manifest itself in a disease such as cancer, most involuntary, chronic low-level exposures are more likely to cause subtle effects such as learning disabilities or disorders of the reproductive and immune systems.

As a result of these involuntary exposures, we are just beginning to recognize the link between environmental contaminants and a host of new public health problems that challenge the tenets of traditional toxicology and medicine. The classical approaches and

¹ Carrying capacity is defined as the maximum number of a given species that can be supported indefinitely by a particular habitat, allowing for seasonal and random change, without any degradation of the natural resource base that would diminish the maximum population in the future (Goodland and Ledec 1987).

models used in both toxicology and epidemiology, premised on single agents disrupting individual organs, do not explain these health problems.

We are beginning to realize that in order to understand the environment as a determinant of disease, we must look at entire physiological systems (such as the endocrine system) rather than focus on specific target organs (such as the heart). Moreover, few single causes with single health outcomes have been identified. There is still no good understanding of the effects of long-term, multiple, simultaneous low-level exposures; consequently, there is little understanding of the broad impacts or the extent to which environmental hazards affect health, since most forms of disease and illness are caused, or contributed to, by multiple factors. Given the long latency period before some effects manifest themselves, the interval between the initial exposure and the appearance of the illness can be long enough to obscure the connection between the real contaminant and the specific negative health outcome.

Toxic Substances and Human Health

In the world of toxics, the creation of chemical substances appears to be beyond the control of the institutions whose job is to protect the public and the environment. Businesses are producing and utilizing many more chemical compounds than our legal institutions can evaluate properly before environmental, public or workplace exposure to these substances occurs. Current methods of assessing substances on a case-by-case basis *after* they become commercially available is not a helpful approach to understanding the toxicity of a great many substances that might well have been removed from circulation if it was known in advance that they might pose significant health risks.

Human behaviour has resulted in the introduction of many tens of thousands of different chemicals to the environment over the last half-century. The rate of production of new chemicals has overtaken the capacity to fully characterize their potential to cause harm to people. Today's children are growing up in an environment that is radically different from that of their parents and grandparents – one that has an incomparable potential to impact on health throughout their lives.

In general, little is known about the universe of approximately 23,000 chemical substances or their derivatives registered for commerce in Canada. The knowledge gaps about toxic substances will be slow to close because of the sparseness and uncertainty of the scientific knowledge of the health hazards addressed and because both animal and human studies are costly and take years to conduct, interpret, and understand. For substances with long latency periods or associated with erratic exposure patterns, these problems are exacerbated (Cranor, 2001).

We have in fact entered a new era. As Jane Lubchenco, Past President of the American Association for the Advancement of Science, has argued (1998), “We are modifying physical, chemical and biological systems in new ways, at faster rates, and over larger spatial scales than ever recorded on Earth. Humans have unwittingly embarked upon a grand experiment with our planet [and on our children].”

Given the current size of the chemical universe and our limited understanding of it, we are likely to remain forever ignorant of the properties of most of these substances. Thus, we need to find more precautionary approaches to addressing the universe of potentially toxic substances in order to prevent some risks from becoming real threats and threats from materializing into actual harm – and ultimately to provide long-term sustainable conditions for human and ecosystem life.

Human Health, Environment and Risk

Some say we are now living in a “risk society” – a new era in human history, in which industrial development is producing risks that are global in scale and threaten to undermine or even destroy ongoing economic progress. There is much to be said for this line of argument. Certainly, the environmental impact of industry is higher than ever before, and there is widespread concern about the risks involved in developments such as biotechnology.

Although many of these concerns have emerged explicitly as risk issues, many more take the form of a widespread public unease with the unknown consequences of these advances. During the 1970s and 1980s such unease was framed around the environment and the potential for long-term ecological damage. However, as public environmental

concern waned in North America in the 1990s, it was replaced by a rise in anxiety over the potential human health impacts of anthropocentric (human-induced) environmental change. At the base of this concern have been the struggles over how to cope with the highly contentious, uncertain and complex relationships between the environment and human health.

In the last twenty years, a quiet but persistent effort has developed to incorporate different types of formal analytic methods, such as cost-benefit analysis and risk analysis into environmental decision making (Lynn 1986, 40). Supporters of these techniques view them as a means to make environmental decision making more rational and less highly charged. Critics challenge their use both on the grounds of methodological flaws and also because they believe that embedded within the techniques are value-laden assumptions masked by a false precision in the use of numbers and statistics.

Scientific knowledge is not produced in a social vacuum, but rather is influenced both by other scientists and by the actions and cultures of non-scientists (Garvin 2001, 446). Traditional views of science see the operation of science as outside the political world of policy and policymaking. Ideally, scientists are rational, logical and objective; policymakers are politically motivated, reactive and subjective (ibid., 448). On the one hand, scientific facts are the justification for a good many policy decisions. On the other hand, the uncertain nature of much scientific evidence means that scientists cannot provide concrete answers to policy questions.

It is acknowledged that the nature of scientific proof is complex, open, and always provisional. Yet science is expected to provide the policy process with simple answers and certainty. It is rarely accepted that the public can also bring important information to the regulatory appraisal process. This brings us to a deep dislocation between the policy institutions and the public about understandings and representations of scientific uncertainty and ignorance. The European Environment Agency, in its report *Late Lessons from Early Warnings* (2001), explains this dislocation as follows:

While risk-based decision making focuses on known uncertainties, public concerns focus instead on the unacknowledged ignorance lying behind even the best science. A major public concern is the possible consequences of ignorance. The reaction can be summed up as “if we can never fully know the consequences, then we had better at least ensure

that the purposes driving the enterprise, and the interests which control the responses to the resultant surprises, are good ones’.

Yet the policy response, in order to reassure the public, has often been to intensify research on identified uncertainties, with the intention of demonstrating intellectual mastery of the issue, and to show that concern about known risks is unfounded. These policy responses to what are believed to be misconceived public demands for zero risk and zero uncertainty are futile, because they presume the problems of public mistrust lie with the public’s erroneous expectation of certainty, and the public’s supposed misunderstandings of science, risk and uncertainty. (EEA 2001, 185)

Environmental policy debates often seem to engender conflict between science and public values. Yet values are inherent and essential in both science and the policy process.

Each of us makes decisions because we must. We participate in societal decisions affirmatively or by omission. Decisions are choices, and we make choices, consciously or unconsciously, by comparing outcomes. We use whatever knowledge we have to estimate the impact of what we may choose to do or not to do, and then we weigh how much that impact matters to us. (Lash 1994, 70)

There is always a danger that we misunderstand our disagreements about policy, imagining them to be based upon differences in understanding or rationality, rather than upon differences in values. We bring to each choice a set of values and preferences, our own framework of choice and experience. It is the interaction of what we value with what we believe to be reality that determines how to act (ibid.).

Although the majority of Canadians seem to have confidence in the risk analysis process, there is a need to recognize the fundamental weaknesses in both risk assessment and risk management as tools for policy decisions. Risk management decisions are fundamentally reliant on the risk assessment exercise; therefore, only those substances which have been identified as health risks under the risk analysis process have risk management decisions made about them and become candidates for public policy. Risk assessment as a tool, as well as part of an overall policy of risk management, has been criticized on several counts. Some of these criticisms target the approach itself, while others focus on the misuse or weakness of risk assessments in specific applications.

Quantitative risk assessment is generally used, not to calculate the impact of a decision on society or on an ecosystem, but to quantify the risk to a theoretical maximally exposed individual. Thus, quite apart from any questions about the accuracy of the underlying risk and exposure models, the risk assessment employed in order to make such case-specific regulatory decisions is not even intended to establish actual risk levels or to predict actual consequences. This use of risk assessment provides a narrow technical basis on which to resolve a difficult policy question. It allows for at least superficially consistent treatment of similar situations, but that seeming consistency is undermined by the obvious inconsistency in environmental results.

Case-specific risk assessment leaves out big questions of consequences and interrelationships, and it often encourages solutions that move pollution from place to place and medium to medium but do not eliminate it. By focusing on a narrow question using narrow standards (technology, cancer risk, cost) the decision-making process may be simplified to the point that the answers produced are wrong.

It is indeed important to consider which consequences are most likely, most serious and most irreversible, and how they will affect human health, welfare and ecological resources. But it is essential to recognize that doing so involves values and judgments. It is at best undemocratic, and at worst fraudulent, to insist that deciding which risks are most important is purely a question of science.

The problem of uncertainty is a problem that is not occasional but fundamental to questions of human health and the environment. We lack data on exposure and effects. We lack understanding of the mechanisms by which effects are caused and of the interaction of effects within the human body and within ecosystems. Judgment is required to estimate risk in the face of uncertainty. While such judgments can be informed by knowledge and experience, they inevitably reflect attitudes about uncertainty and the significance of the consequences of errors of underestimation or overestimation (Lash 1994, 76). For example, how does death compare with disease? How shall we compare the risks of birth defects to damaged intelligence from exposure to lead? How much does nature matter? Only to the extent that we now know it supports human life and wealth? Or does nature have inherent value? (ibid., 79).

The methods we choose for assessing risk and the assumptions we make can involve as many political choices as the decisions about managing risk themselves. Values pervade the environmental risk-based decision-making process. Normative decisions are part of every step of the process of assessing and comparing risks. This does not mean the process has no value or importance in determining risk; nor does the presence of values in the analytical process exclude science. Values and science are necessarily and appropriately connected in the formulation of environmental policy. The intimacy is unavoidable. It would be better, however, if the two communicated openly and systematically.

A Call to Action

There is an antagonism between these two sets of values, technical and social, that may be growing. It seems that the more the lay public questions the wisdom of risk programs and challenges the authority of institutions, the more the risk community seeks legitimacy in scientific expertise, quantitative analysis and expert formulations. Similarly, the more scientific and administrative elites achieve methods that are exacting, accurate and replicable, the more insistent becomes the demand for action in the political arena, whatever the scientific basis or analytical justification. The lesson should be clear: rather than aiming only to refine and improve our technical model, we should be working to expand our understanding of the democratic model and the mechanisms for reconciling the two sets of values.

According to Daniel Fiorino (1989, 297), risk-based decision making could move in one of two directions.

The first would be to continue to insulate risk analysis from democratic controls by reinforcing the separation of scientific assessment from the political evaluation of risk, relying further on cost-benefit analysis and other analytical models for making risk decisions, and failing to accept the merit and legitimacy of lay as compared to expert judgments of risk.

A second direction would be to accept the ethical validity, instrumental wisdom, and practical inevitability of the democratic model, and to aim for a working synthesis of the two sets of values. In risk perception, this means accepting the legitimacy of lay judgments; in risk communication, it means studying communications to experts and

decision-makers as well as the process of elites informing non-elites; in making decisions about risk, it means adopting a two-dimensional perspective that assesses policy processes and institutions not only by their compatibility with substantive and procedural democratic values.

Fiorino further contends that at a theoretical level, reconciling technical and social values could include several tasks (ibid.):

1. Reassessing current mechanisms for citizen participation
2. Re-evaluating our reliance on formal analytic models, some of which displace political judgment and further insulate decisions from public control
3. Adapting those analytic models we continue to use so that they incorporate lay values more effectively

The first means building upon existing evaluations of participatory mechanisms and their applications to risk-based decision making. The second requires a certain skepticism that would regard traditional analytical models in the light of more broadly applicable ethical and methodological criteria. The third entails a synthesis of technical and social values explicitly within the context of analytical assessment, either through lay participation in the design of the models themselves, or through techniques that incorporate lay values in the weighing of risks and their acceptability.

An important perceptual shift would be to view risk analysis as a political process informed by expert judgment, rather than as an expert process in which the lay public can occasionally be expected to intervene. This would move risk analysis beyond the notion that democratic process begins where technical consensus ends. This would require greater attention to be devoted to the development of methods to enable those groups with potentially valuable knowledge to provide this knowledge, and for that knowledge to be fully taken into account (EEA 2001,178).

There are several reasons why informed public discussion should be part of the risk-based decision-making process. First, it enhances the tenuous faith of the public in governmental institutions. Second, it improves public understanding of the nature of the

choices that must be made. Third, it facilitates decision-makers' understanding of the nature of public concerns. Last but not least, it results in better decisions.

The entire population of Canada cannot become engaged in a dialogue over risks, uncertainty, values and trade-offs; but that does not mean we should not at least encourage episodic public involvement in the form of collaborative, values-based decision making. The public needs to be involved in structuring the risk analysis process, defining the questions, evaluating data, comparing risks and – considering the social values at stake – making the decisions. Recognition of the importance of interdisciplinary, lay knowledge and divergent stakeholder viewpoints in the characterization of risk issues and of appropriate assessment approaches is urgently needed.

Scientific uncertainty, like scientific knowledge itself, when deployed to lend authority to risk-based decision making, is not just a matter for scientific bodies to autonomously resolve, define, or otherwise interpret on behalf of the public. The involvement of stakeholders in risk-based decision making needs to “begin at the beginning” (EEA 2001, 186), rather than being artificially confined to the later management stages of the conventional approach.

The lack of defined associations between exposures to environmental contaminants and health outcomes makes it technically and politically difficult to develop the extensive body of evidence needed to regulate and manage many of the industrial processes and subsequent contaminants potentially linked to detrimental effects. For this reason, protection of population health from environmental hazards will require new organizational and social responses in order to manage environmental health risks more effectively. This can only be achieved through interjecting an ecological perspective into public health practice and governmental decision making by building broader, cross-sectoral and multidisciplinary collaborations. Without focusing on proactive and preventive activities based on the precautionary principle, our society is unlikely to achieve the mutually reinforcing goals of environmental and human well-being.

This paper seeks to focus attention on ways to improve the risk-based decision-making process through the critical evaluation of traditional risk-based decision making; to

explore the values inherent in conventional analytical processes and the precautionary principle as an alternative paradigm; to analyze participatory methods and collaborative approaches to better management of risks; and to promote collaborative, values-based decision making as a solution to the problem of environmental degradation and its impacts on human health .

2

Risks and Risk Assessments

We should be on our guard not to overestimate science and scientific methods when it is a question of human problems and we should not assume that experts are the only ones who have a right to express themselves on questions affecting the organization of society.

– Albert Einstein

Safeguarding human and environmental health from exposure to harmful levels of toxic substances is one of the most important obligations of public authorities in Canada. The various government agencies – provincial, territorial, federal and intergovernmental – are responsible for setting standards, guidelines and policy on matters regarding environmental contamination. Decisions concerning such substances are generally made using a risk-based model, which relies on a range of assumptions, such as how susceptible humans are to various contaminants. These assumptions are supposed to be health-protective; that is, they should err on the side of being overprotective rather than under-protective.

However, there is considerable debate over whether the current risk assessment protocols and methodologies used to assess “acceptable” levels of risk protects the health of Canadians and ensures children will grow up safe from exposure to environmental contaminants.

Risk Assessment and Risk Management: Origins, Approach, Controversy

Although there are different approaches to standard-setting, the underlying framework for most of them is risk assessment. Risk assessment, or more accurately risk assessment and risk management (RA/RM), includes a complex suite of tools applied by regulatory agencies and others to the setting of environmental standards, environmental assessment and planning decisions, remediation of contaminated lands or hazardous waste sites, and

many non-environmental settings as well. It is a process of estimating damages that may be occurring, or may occur, if an activity is undertaken (O'Brien 2000, 4). The standard four-step risk assessment paradigm – hazard identification, dose-response assessment, exposure assessment and risk characterization – is shown in Figure 1 and Figure 2.

Risk assessment is considered a science-based exercise, while risk management is a broader policymaking step. Views differ on whether these distinctions are valid. Risk assessment is strongly criticized for inappropriately presuming to be an objective, science-based process, since it involves choices among numerous “guesses” and estimates (O'Brien 2000, 17). Thus, many ethical issues arise.

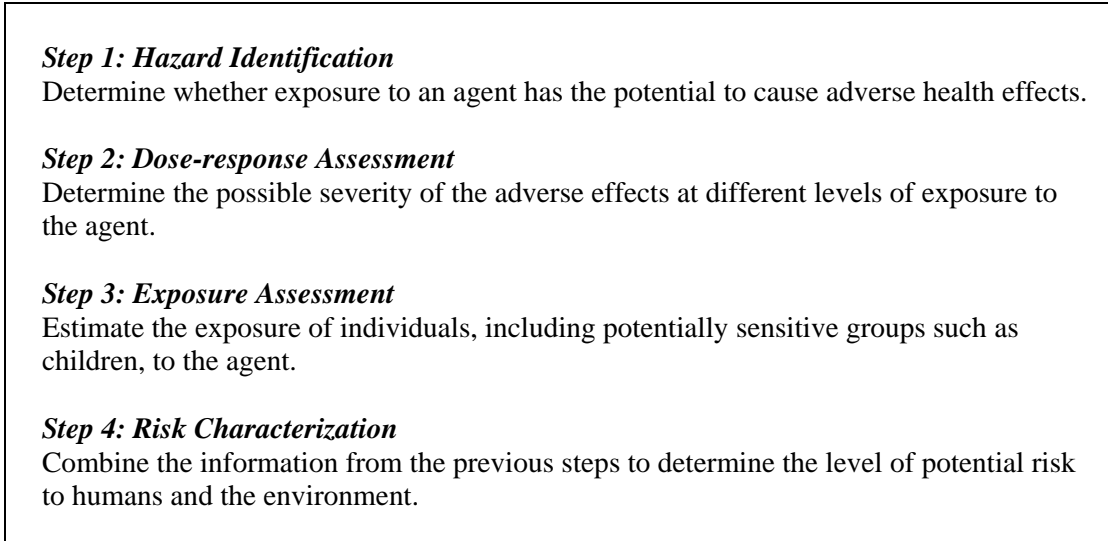
Why is Risk Assessment Controversial?

In 1983 the US National Academy of Sciences (NAS), through its National Research Council, released *Risk Assessment in the Federal Government: Managing the Process* (Crawford-Brown 1999, 30), a pivotal study that had a far-reaching influence on risk assessment practices. The NAS recommended that risk-based decisions be divided into two stages that it felt were separable (National Research Council 1983). The first was a *risk assessment* stage, in which the analysis was intended to be purely scientific. The second stage was *risk management*, in which the risk assessment results were combined with human values to produce a final decision.

The National Academy of Sciences had urged that this risk assessment stage be guided entirely by scientific methods, free from the influence of extraneous values. The reason for proposing this was the sense that risk assessment is too often tainted by the desire to justify some particular decision that has already been reached by other means. Risk assessments had thus become liable to manipulation by interested parties rather than being authentic tools for value-neutral analysis (Crawford-Brown 1999, 31).

Since the landmark NAS report, risk assessment has become the regulatory tool of choice. It increasingly replaced early decision making that, in some cases, banned very hazardous substances (such as DDT and PCBs) due to their inherent toxicity. Risk assessment has enabled the continued use of toxic chemicals at scientifically sanctioned “acceptable” levels. As part of the ongoing refinement of risk assessment, attention has

focused on correlating risk assessment techniques with increased knowledge of environmental health issues.

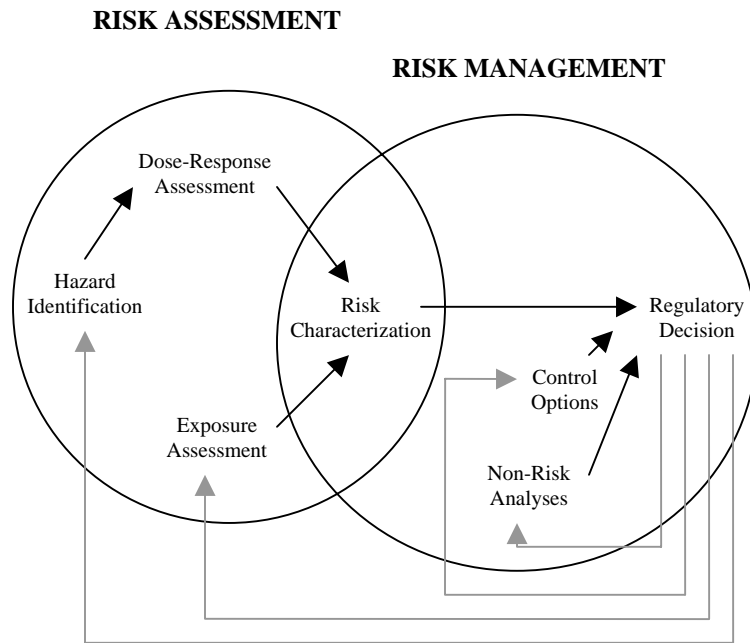


SOURCE: EEA 2002, 199.

Figure 1. The Risk Assessment Process

The fortunes of risk assessment as a basis for decision making have varied dramatically over the past several decades. Proponents see it as tool for making rational decisions: a way to make decisions on alternative environmental and social policies more objective by focusing limited resources on the problems posing the greatest threat to health and the environment (Crawford-Brown 1999, 22). It is seen as tool to replace piecemeal environmental policy with the systematic evaluation and prioritization of environmental and health problems based on sound science (K. Cooper, personal communication, 12 July 2002). Risk assessment is considered by many academics and regulated industries as an objective, scientific exercise; risk management, as the subsequent policy step, would then consider a broader range of economic and social factors.

Uncertainty, variability, error and large gaps in basic data and methodology occur in two of the four risk assessment steps: hazard identification, dose-response assessment, exposure assessment, and risk characterization. Dose-response assessment and exposure assessment are especially difficult, due to a basic lack of critically important theoretical



SOURCE: Baker 1996, 86.

Figure 2. The Risk Assessment/Risk Management Paradigm

findings, empirical data and assessment methodologies. Even when risk assessors are considering a single chemical at a time, basic data and methodologies are lacking to be able to calculate exposure and a dose-response relationship. This problem is greatly magnified when considering multiple exposures and the chance of cumulative or synergistic effects.

Risk assessors, for example, simply do not know exactly (in some cases, not even remotely) how much of a chemical (or a group of chemicals) constitutes exposure in any particular person. They do not know whether the adverse effect levels detected in laboratory experiments on rats are comparable to, or even approach, the range of possible adverse effects in a human fetus, infant, child or adolescent. To be able to carry through to the risk characterization step and assign exposure and dose-response numbers for incorporation into a risk management strategy, such as setting a standard for exposure or

permitting the use of a chemical, gaps are filled by “inference choices.” Also called “science policy choices” or “default assumptions,” these gaps in critically important scientific and empirical data and methodologies are filled by what is essentially guesswork. It may be the product of “best guesses,” “informed guesses” or the “informed judgment” of experts; but it is still guesswork, not science (O’Brien 2001, 17).

Nor is it simply a matter of doing more research or spending more money to fill in these gaps. It is certainly true that more research can and does eliminate data gaps and uncertainty. Improvements in methodology can also reduce the broad range in risk estimates that risk assessments can generate. However, the enormity of the data collection task is formidable. According to one risk assessment expert and advocate, toxicologists know a great deal about a few chemicals, a little about many, and next to nothing about most (Rodricks 1992, 192).

Politics, Ethics and Values

Despite these criticisms on the utility and desirability of risk assessment, there is broad agreement that risk is only one of many factors that must be taken into account when making a decision. In dealing with potential risks associated with environmental contaminants, society certainly has the goal of protecting the health of the public and other species. But it also has the goal of keeping the economy moving, of stimulating innovation, of ensuring that our processes of decision making are democratic, and so on. However, risk-based decision making is essentially mute on these latter goals.

Risk assessment is a complex, opaque system, in which unacknowledged or unrecognized complexity and lack of transparency may obscure the value judgments inherent in the process of assessing risk. It demands that decisions as to the harmfulness of a substance be determined according to the very high standard of proof demanded of scientific inquiry. This standard is nearly impossible to achieve, given the arguably problematic scientific foundation of risk assessment. Yet to suppose that action might legitimately be taken only if warranted by rigorous proof of harm is, in effect, to maintain that chemicals have greater rights than human populations (CELA 2000, 4). Each chemical, assessed in isolation, may be allotted an acceptable risk level; but it does not follow that human

beings will avoid the cumulative risk of real-world exposure to many different “acceptable” chemicals simultaneously or consecutively present in the environment.

The political and ethical hazards of risk assessment stem directly from this combination of guesswork and science. With all its gaps in basic information and methodologies to implement key steps, risk assessment remains enormously complex – the domain of specialized experts. This complexity makes several things possible: value judgments and questionable assumptions can be concealed; policymakers can be manipulated or misled during the political decision making or risk management phase; and, an intellectual elite and those wealthy enough to hire them can dominate discussions, the political process and the outcome (O’Brien 2001, ch.5).

It is not surprising that a methodology that requires the making of frequent choices based on inference, or what many consider to be significant and influential value judgments, will raise important issues of ethics and social equity. Commentators frequently note that risk assessment tends to impose risk on those groups – the poor, the elderly, children, minority groups – who are often most susceptible to harm and least able to confront or resolve the source of harm. Moreover, risks can be imposed on these groups without their consent and under circumstances where those being placed under the highest risk receive few or none of the benefits that may result from whatever activity the risk assessment sanctions.

Two additional ethical issues arise directly from the shaky scientific foundation of risk assessment. First, our vast ignorance about the toxic effects of chemicals leads to each chemical being treated as “innocent until proven guilty” (O’Brien 2001, 84). Risk assessment calculations (where these have been done at all) guarantee the granting of a risk level (e.g. one in a million, also called the “negligible” cancer risk level) or a risk range (between one in 10,000 and one in 10 million) for each chemical (CELA 2000, 124). Hence risk calculations have customarily been done to establish the one-in-a-million risk level for a chemical in food, air, drinking water, etc. Although a multi-media approach may be employed such that a risk assessment accounts for aggregate exposure via different pathways, this may be very difficult to do, or it may apply controversial methods – or may not be done at all (CELA 2000, 124).

According to the Canadian Environmental Law Association (2000, 124),

this approach of providing a guaranteed risk level for each chemical is exactly that; each chemical is entitled to its one-in-a-million risk level. The human population on the other hand is faced with hundreds if not thousands of these one-in-a-million risks. While each chemical is allotted a one-in-a-million risk level, (or sometimes even higher risk levels), the human population does not have the right to avoid the cumulative risk of real world exposure circumstances.

The second ethical problem with guaranteeing a risk level to each chemical is that risk assessment has only recently begun to consider health end points other than cancer. There may in fact be other end points, such as endocrine disruption and neurodevelopmental effects, which may occur at even lower exposure levels or under circumstances different from those the cancer risk assessment considered. These other unknown or poorly understood effects have to be assumed to be non-existent. Alternatively, they require the application of default assumptions and there is great uncertainty as to whether these assumptions adequately inform the risk assessment calculations. Further, those chemicals that are unidentified, untested or otherwise not part of the analysis (including the real-world situation of complex mixtures of small amounts of chemicals) must also be assumed to be safe as they are simply not part of the risk assessment exercise (CELA 2000, 124).

The situation is not improved by the fact that the critique of risk assessment is frequently not accepted by risk assessment practitioners or advocates as valid or worthy of consideration. Instead, it is seen as an unjustified attack on their scientific credentials. This reaction is ironic since what is at issue is the very lack of scientific integrity at key steps within an exercise that otherwise should be, and must be, highly dependent on “good science.”

Alternatively, for those risk assessment practitioners and advocates that recognize the scientific limitations of the process, the approach is to accept the level and degree of default assumptions as inevitable and a valid part of the exercise and something that ever more effort at refining techniques will ultimately overcome. In the meantime, they consider the solution to the problem to be a matter of improvements in risk characterization and communication (Stern and Fineberg 1996).

Finally, and most fundamentally, risk assessments ultimately depend on the values or subjectivity of the scientist. One way in which subjectivity permeates risk assessments is in the dependence of such assessments on judgments at every stage of the process, from the initial structuring of a risk problem to deciding which end points or consequences to include in the analysis, identifying and estimating exposures, choosing dose-response relationships, and so on (Slovic 1999, 690).

In *Risk and Culture* (1983), Mary Douglas and Aaron Wildavsky find systematic differences in the ways in which groups conduct and reach conclusions within a risk assessment. These groups differ in their commitment to egalitarianism, hierarchical decision making, etc. Each group constitutes a different culture with different values and conceptions of rationality, and individuals working within one group will tend to adopt the values of that group. These values, in turn, affect how the individual conducts an assessment, interprets the assessment, and reports the results to risk managers (Crawford-Brown 1999, 32). While the view oversimplifies a complex situation, since there is wide variation even within a group with respect to the values adopted and the methods employed in risk assessment, there is enough similarity within groups and differences between groups to suggest at least an aspect of culture at work even in the acts of risk assessment (Crawford-Brown 1999, 32).

As noted in his working paper prior to the release of the 1983 NAS report, *Risk Assessment in the Federal Government*, Lawrence McCray, labelled as “naïve” the underlying premise that matters of science could be segregated from matters of value and left to an organization primarily responsive to scientific authority (McCray 1983, 13).

Unfortunately, despite these cautions, procedures for risk assessment and risk management have not yet adequately recognized the role of human values.

The values of scientists, therefore, can taint a rigorous and rational assessment of risk. If the assumptions and value judgments used by scientists are deficient, the resulting assessment may be quite inaccurate. How, then, should we decide which measure to use when planning a risk assessment, recognizing that the choice is likely to make a big difference in how the risk is perceived and evaluated?

3

The Interplay Between Science and Values: Seeking New Paradigms

Imagine if every policy and business decision were made with the underlying realization that it might affect a child on the way to your own home and heart. It would be a different world.

– Rabbi Daniel Swartz

In an attempt to ensure scientific authority, quantitative risk assessment was selected as the basis for setting standards and deciding on regulations in environmental policymaking. Ideally, such a method would provide systematic standards of evaluation and management. It would answer the question of when evidence is sufficient to show the existence or absence of specific risks and benefits. However, answers to questions about the acceptability of risks – for example, when a risk is substantial enough to warrant regulatory measures – clearly involve social values.² On the other hand, the information in quantitative risk assessments was supposed to incorporate scientific knowledge uncoloured by such values. If we were seeking answers to questions of acceptable level of risk, then the matter of what constitutes credible evidence would be *scientific* and not political. However, this is simply not the case.

It is now generally recognized in the scholarly literature on the nature of risk analysis that many aspects of the task of assessing the magnitude of technological risks and managing them within the limits of safety involve judgments and decisions that are not themselves strictly scientific (Salter 1988). They involve value judgments related to such issues as the appropriate way to handle uncertainties in scientific data and results, assignment of the burden of proof among stakeholders in risk issues, standards of proof, definition of the scope of the risk issue, and, of course, the central issue, what levels of risk should be considered “acceptable.” Such “extra-scientific” judgments are inherent in any

² A summary of the values that may impact on environmental risk-based decision making is presented in the Appendix.

assessment of risk and in the judgments about the technological and social mechanisms for maintaining it within safe limits.

The way we make decisions concerning the environment reflects the biases in our society, and that is acceptable if these are acknowledged.

Much more frequently than they may expect to, technical leaders and advisory committees find themselves drifting into – and then becoming immersed in – heated discussions of personal rights, or “the natural,” or obligations to future generations, or John Rawls’s theory of justice, or the ethical dimensions of cost-benefit analysis. Often these considerations turn out not to be peripheral, but central. At issue may be the substance of decisions, or institutional or professional roles, or social procedure. (Lowrance 1986)

However, unacknowledged values and value judgments pervade the process of risk assessment and risk management as major factors in environmental health decision making and thus affect the outcome in a real, continuous, and profound way (Cothorn 1996, 39). While values, value judgments, ethics, or perceptions are often the main bases used in making decisions, existing models for risk assessment do not contain any explicit mention of them.

Different people looking at the same set of environmental data and information can come to different conclusions due to different value systems. The very selection of a methodology for decision making involves a value judgment. The selection of which environmental contaminants to study and analyze involves value judgments. Weighing different risks involves value judgments. Furthermore, in setting standards for toxic substances we have a choice of using the “average” person or the most susceptible. This choice is value-laden.

Thus, values and value judgments cannot, and should not, be excluded from the risk-based decision-making process, as they are fundamental to understanding the political nature of regulation and decisions that involve environmental health for humans and all living things. These values need to be disclosed and should be central to the development of a new paradigm in the field of risk-based decision making.

Subjectivity in Risk Assessment

Scientists are trained to be objective empiricists in their approach to science. They formulate present-day testable hypotheses based on the conclusions of hypotheses tested in the past, and their own conclusions are used in the future to postulate and test still more hypotheses. Yet even for the most disciplined of scientists, it is difficult to separate subjective personal beliefs, as extensions of self, from objective experimental observation and interpretation (Baker 1996, 90). Furthermore, one can observe that in traditional risk assessment there is no opportunity for admitting the subjectivity of the risk assessor. As noted in Section 2, the separation between risk assessment and risk management was intended to prevent the corruption of the risk assessment process by the values of the risk manager; however, the paradigm does not guard against subjectivity entering the risk assessment process.

In a similar way, while the 1983 United States National Academy of Sciences report separated risk assessment and risk management and included a two-way communication between them, the common misinterpretation is to put *all* value considerations into risk management alone. Without communication of value considerations to risk assessment, there can be no opportunity to discuss public values in the risk assessment process. Our environmental regulatory system has done little to enable regulators to respond to public concerns, and virtually nothing to recognize the essential role of community values in the shaping of environmental solutions.

A number of opportunities for this kind of intervention occur naturally in the discussions and analysis involved in quantitative risk assessment – topics demanding value judgments such as: uncertainty, no causal link or only a correlation, synergism or antagonism, latent period, morbidity vs. mortality, threshold, and comparing different health end points (or which are the most important). According to Walter Rosenbaum (1991),

[Perhaps] fifty opportunities exist in the normal risk assessment procedures for scientists to make discretionary judgments. Although scientists are presumed to bring to this task an expertise untainted by social values to bias their judgment, they are not immune to social prejudice, especially when their expertise is embroiled in a public controversy.

In each of these cases, the risk assessor must make assumptions to complete the analysis – the choices are inevitably value-laden. Nevertheless, in some decisions, attempts are made to disguise these characteristics of values and ethics with other labels such as scientific or technical (Cothorn 1996, 53). As eloquently stated by US District Court Judge David L. Bazelon in a 1979 speech on “Risk and Responsibility,”

[In] reaction to the public’s often emotional response to risk, scientists are tempted to disguise controversial values decisions in the cloak of scientific objectivity, obscuring those decisions from political accountability (cited in Lynn 1986, 47).

Since scientific, technical, and other specialists who may not be trained in ethics or value studies make judgments involved in risk decisions, it is important that those performing the risk assessment identify with clarity and precision uncertainties, assumptions, and ethical issues, as well as costs and other trans-scientific considerations involved (Cothorn 1996, 50).

Risk Perception Differences Related to Gender and Institutional Affiliation

One clearly value-laden decision is the determination of acceptable risk and safe level of exposure. When it comes to questions along the line of how safe is “safe enough,” the limitations of scientific expertise become evident quickly enough. Scientists are as capable of offering answers to this question as are any other citizens, but their answers are neither more valid nor more scientific by virtue of having been offered by scientists. Their answers may very well depend on obvious, if non-scientific, factors such as whether they are neighbourhood parents or far-away investors (Freudenburg 1996, 15). Each of us, as an individual, may have a particular notion of what constitutes acceptable risk; there is no universal acceptable level. Some of the criteria that influence our individual decisions on this question are: is it voluntary or involuntary, old or new, catastrophic or ordinary, known or unknown? (Margolis 1996, 1).

Findings by several researchers have shown that the answers to the question of how safe is “safe enough” are also likely to depend on less obvious factors, such as gender, race, political world views, institutional affiliation, emotional affect and trust. These factors are

strongly correlated with risk judgments. Equally important is the fact that these factors influence the judgments of experts as well as laypersons (Slovic 1999, 692).

Gender is strongly related to risk judgments and attitudes. Several dozen studies have documented the finding that men tend to judge risks as smaller, and less problematic, than do women (Slovic 1999, 692). For example, Barke et al. (1997; cited in Slovic et al. 1999, 692) found that female physical scientists judge risks from nuclear technologies to be higher than do male physical scientists. Similar results with scientists were obtained by Slovic et al. (1997; *ibid.*), who found that female members of the British Toxicological Society were far more likely than male toxicologists to judge societal risks as moderate or high.

In a study by Flynn et al. (1994), 1,512 Americans were asked, for each of 25 hazard items, to indicate whether the hazard posed (1) little or no risk, (2) slight risk, (3) moderate risk or (4) high risk to society. Across a wide range of hazards, white males consistently rated the risks as being more acceptable than did white females, but also as more acceptable than did either the females or the males who were members of minority groups. The group of white males with the lowest risk perception scores were better educated, had higher household incomes, and were politically more conservative. Particularly noteworthy is the finding that the low-risk-perception subgroup of white males also held very different attitudes from the other respondents. For example, they were more likely to:

- *agree* that future generations can take care of themselves when facing risks imposed on them from today's technologies
- *agree* that if a risk is very small it is okay for society to impose that risk on individuals without their consent
- *agree* that government and industry can be trusted with making the proper decisions to manage the risks from technology
- *disagree* that technological development is destroying nature

In sum, the subgroup of white males who perceive risks to be quite low can be characterized by trust in institutions and authorities and by anti-egalitarian attitudes, including a disinclination toward giving decision making power to citizens in areas of risk management (Slovic 1999, 693).

It is important to note that while white males are a distinct minority in society as a whole, they still make up a high proportion of scientists in the field of risk analysis (Freudenburg 1996, 15). The race and gender differences in perceptions and attitudes point toward the role of power, status, alienation, trust, perceived government responsiveness and other sociopolitical factors in determining perception and acceptance of risk. To the extent that these sociopolitical factors shape public perception of risks, we can see why traditional attempts to make people see the world as white males do, by showing them statistics and risk assessments, are often unsuccessful (Slovic 1999, 693).

The underlying reasons for these competing views include differential distributions of values, not just across but also within the many segments of society. The risk assessment controversy goes beyond science and is deeply rooted in the social and political fabric of Western societies. Even when the focus is limited to scientists, studies have found that answers about the acceptability of environmental risks can depend on whether the responding scientists are employed by industry, government or academia (Lynn 1986).

In a 1986 survey of occupational physicians and industrial hygienists working for industry, academia and government, F. Lynn confirmed the initial hypothesis that there were links between political values, place of employment, and scientific beliefs. Scientists employed by industry tended to be politically and socially more conservative than government and university scientists. They chose scientific assumptions that decreased the likelihood that a substance would be accepted as safe. Government scientists were the most liberal politically and most protective in choosing among scientific assumptions, and university scientists fell in between their governmental and industrial colleagues (Lynn 1986, 41).

A high proportion of industry scientists, for example, supported the statement “risks associated with advanced technology have been exaggerated by events such as Three Mile Island and Love Canal” (82%) versus the government and university occupational

health scientists who were more evenly divided in their responses (49% and 47% respectively). Furthermore, when asked about regulations to protect employees from working conditions that cause health risks like cancer, the majority of industry scientists (67%) wanted the regulations kept the same. These findings contrast with the responses of government scientists, 80% of whom wanted the regulations made stricter (Lynn 1986, 41).

From this snapshot of studies, it is clear that risk assessment is inherently subjective and represents a blending of scientific judgment with important psychological, social, cultural, and political factors. *Whoever controls the definition of risk controls the rational solution to the problem at hand.* If you define risk one way, then one option will rise to the top as the most cost-effective or the safest or the best. If you define it another way, perhaps incorporating qualitative characteristics and other contextual factors, you will likely get a different ordering of your action solutions (Slovic 1999, 699).

Technical and Democratic Value Models: Experts Versus Lay People

One of the reasons risk analysis is so intriguing yet so frustrating is that people look at it in different ways. What to some is a rational, objective process of scientific assessment and formal analysis is to others a more intuitive, experiential process of cultural assessment and sociopolitical analysis (Fiorino 1989, 293).

Different assumptions, conceptions, and values underlie much of the discrepancy between expert and lay views of chemical risks. Members of the public and experts can disagree about risk because they define risk differently, have different world views, different affective experiences and reactions or different social status. Non-scientists have their own models, assumptions and subjective assessment techniques (intuitive risk assessments), which are sometimes very different from the scientists' models (Slovic 1999, 690). Whereas experts tend to evaluate risk according to probabilities, the lay public evaluates risk in a more contextual and socially constructed way in relation to personal, historical experiences (Garvin 2001, 450). What results from these differences are expert charges of scientific illiteracy among the lay public confronting public charges of technocratic elitism and oppression.

People react less to risk in the abstract than through the filter of social and political values. The risk expert or administrative official may ask what the probability and magnitude of harm will be in evaluating a risk. The lay public will ask about the source of the risk, the process for apportioning it, the social distribution of risks and benefits, and the opportunity to exercise control over actions posing the hazards. It is not only the fact and degree of risk that matters but who agrees to it, through what social processes, and where the locus of control will be.

Research has shown that the public has a broad conception of risk, qualitative and complex, that incorporates considerations such as uncertainty, dread, catastrophic potential, controllability, equity, risk to future generations, and so forth, into the risk equation. In contrast, experts' perceptions of risk are not closely related to these dimensions or the characteristics that underlie them. Instead, studies show that experts tend to see risk as synonymous with probability of harm or expected mortality, consistent with the ways that risks tend to be characterized in risk assessments (Slovic 1999, 691). As a result of these different perspectives, many conflicts over risk may result from experts and laypeople having different definitions of the concept.

It is clear that there are two sets of often competing values at work in defining how different people approach similar kinds of risk problems. As a means of understanding the tensions that characterize technological policymaking in a democratic society, Fiorino (1989) proposed two models of risk analysis – the technical model and the democratic model. Each model describes a different approach to defining, assessing, and making decisions about risk. In abstract form, the technical model is elitist and the democratic model participatory (Fiorino 1989, 293).

The democratic model reflects lay or non-expert perceptions of risk, which are not probabilistic in a formal sense and are rooted in cultural and group contexts. Voluntary, discrete, or familiar risks are of less public concern than those that are unknown, assumed involuntarily, dreaded, or seen as potentially catastrophic (ibid., 294).

Fiorino further asserts that the democratic model evaluates risk based on its social and political consequences, “such as possible disruption in the social fabric or loss of communality” (1989, 296):

Lay criteria for assessing the impact of risk decisions are not explicit, like those of the risk analyst, but are embedded in cultural values. Similarly, lay evaluations of risk incorporate substantive and procedural democratic values, such as the acceptability of processes for making decisions, the ethics of the distribution of risk, and the capacity to control a source of risk in the community's interests. Finally, the democratic model relates judgments about risks to the competence (can we trust them?) and the legitimacy (should we trust them?) of the social institutions that impose and control those risks. The public's judgments about risk are not inferior, but different, and arguably richer than those of experts.

The technical model, on the other hand, reflects several characteristics of elite theory. Its emphasis on results exhibits a one-dimensional approach, because it equates interest with the substance of policy outcomes and ignores process. It is assumed that the general public interest is achieved when governmental policy is in accord with the judgment of elites. Judgments about the acceptability of risk are seen as a matter for risk experts – that they should just tell people what is best for them. Resolution of technically based policy issues begins with an effort to secure a consensus from scientists and administrative elites, and democratic value considerations only enter into a decision when the outer limits of that consensus are reached. Technical and analytical values are judged to be more legitimate than lay values. Issues are cast in a technical language that reduces the possibility of a dialogue between the public and elites. The ethical values of the technical model (linearity, commensurability) replace those of the democratic model (participation, equity, popular control) (Fiorino 1989, 297).

T. Garvin (2001) takes this technical and democratic model discussion a step further, using a critical theoretical approach to explore how evidence is recognized and validated, and how limits are placed on knowledge by scientists, policymakers, and the public. As Table 1 shows, the three groups not only have different (although sometimes overlapping) sources for their information; there are also visible disparities in each group's criteria for legitimizing supporting evidence and dismissing conflicting evidence. These begin to shed light on how a single risky environment and health relationship can be interpreted as a different problem by each of the groups: each uses evidence with slightly different legitimating criteria within its own realm. Conflict arises among groups when those various legitimating criteria are applied to other realms (Garvin 2001, 452).

Table 1. Conflicting Analytical Paradigms

| | Scientists | Policy-makers | Public |
|---|---------------------------------------|---|---|
| <i>Origin of evidence</i> | Scientific studies | Availability | Popular sources |
| <i>Legitimization of supporting evidence</i> | Adherence to scientific method | Political, social, and economic implications | Received wisdom |
| <i>Dismissal of conflicting evidence</i> | Adherence to scientific method | Expediency | “Common sense” |
| <i>Conceptualization of certainty and uncertainty</i> | Probabilistic | Context specific | Polarized (either certain or uncertain) |
| <i>Understanding of complex issues</i> | Compartmental | “Need to know” | Limited by sources |
| <i>Resultant knowledge</i> | Specific and limited | Political, contextual, instrumental | Tacit, experiential, individual |
| <i>What is done with the knowledge</i> | Added to cumulative body of knowledge | Applied to current situation and context only | Added to body of personal experience |
| <i>Analytical paradigm</i> | Scientific | Political | Social |

The three groups also display considerable differences in how they conceptualize certainty and uncertainty, as well as the way in which they understand complex issues. Garvin (2001, 452) explains these differences as follows:

Scientists appear to follow the rational actor model, using probability to operationalize uncertainty and compartmentalization to deal with complexity. By contrast, policymakers adopt a more political model based on context and evaluating complex issues on a need-to-know basis, weighing it against the more objective knowledge provided by science. The public’s conceptualization of uncertainty seems more straightforward than the others; the public sees issues in a polarized certain-uncertain manner. This is due, in part, to the public’s conceptualization of science as one of many components in the social, cultural, economic, and political context.

Science identifies and outlines problems to be solved, policymakers choose from the alternatives, and the public is presented with a solution. Such a model implicitly assumes that all groups have similar interests and definitions of what is in the public interest. It also assumes that all voices involved in the debates operate in naked self-interest and that they share an overarching definition of scientific rationality. However, Table 1 shows that although such shared definitions can exist among scientists, policymakers, and the public, they do not necessarily always exist (Garvin 2001, 453).

These are among the many reasons why, while it can make a great deal of sense for narrow, technical questions to be delegated to narrow, technical experts, we also need to recognize that many of the most important questions about technology are neither narrow nor technical. The strength of the expert is in the technical details, not the broader philosophy; the job of the technical specialist is to implement social choices about values, not to make them (Freudenburg 1986, 16). Charles Perrow, in *Normal Accidents* (1986), states that an expert is “a person who can solve a problem better or faster than others, but who runs a higher risk than others of posing the wrong problem.”

For deciding on value-based questions, including the question of what is the right problem, perhaps the guiding principle of a democracy has less to do with technical expertise than with whether the answer reflects social values. Mutual understandings of the competing and conflicting paradigms of scientists, policymakers, and the public may lay the groundwork for the future cooperation of these three important players in contentious and risky environmental health issues.

It is important to note, however, that there is no reason to trust the values or judgments of the public more than those of experts. Publics, after all, can be misled. Publics are likely to be distracted by the pursuit of their own comforts, by the oratory of popular figures, by their own short-term interests, etc. Thus, in short, what we need is to encourage multi-vocal discussions.

Dealing with Scientific Uncertainties

One of the most significant opportunities for value judgments to emerge in risk-based decision making is in the area of uncertainty. All too often, the concept of uncertainty in risk assessment is used to cloud important issues. In *Risk and Rationality* (1991a), Kristin Schrader-Frechette contends that uncertainty is always present in science-based decisions and what causes controversy and divisions among the interested parties is determining the amount or nature of the uncertainty that can be tolerated in order to resolve the issue. She further asserts that the divorce between risk assessment and risk management is “uneasy” and is a result of bad management and unscientific assessment. Whatever the cause, it is a process that is constantly being re-examined.

A key issue to be addressed in dealing with the environment and human health is what level of proof is to be used when making a decision. The level of proof can vary from very high to very low, depending on the issue being addressed. A sound scientific approach normally requires a high level of proof, such as that provided by the coexistence of: valid experimental studies; consistency and coherence of results among different studies on the same subject; evidence of a dose-response relationship (i.e., the greater the exposure, the greater the effect); and, a plausible biological rationale to explain the investigated causal link (EEA 2002, 202).

Nevertheless, the above requirements are often not met due to a variety of factors, including the continuous development of new chemicals and technologies, the pressure by the industry and the public to introduce them into the market before completing rigorous scientific scrutiny, and the difficulties entailed in this scrutiny. The result can be a high degree of scientific uncertainty about the actual risk to human health or the magnitude of the health impact produced by a new substance. This problem becomes particularly serious when the substance or technology has the potential to produce serious or irreversible damage. This applies both to the risks posed by unplanned non-routine events and to risks posed by ongoing exposure to environmental agents.

Developing the scientific basis to protect the health of humans will require sustained effort by many disciplines. When data are insufficient, the development of a sound basis to deal with uncertainty may be equally or more challenging (EEA 2002, 202). For this reason, there has been a growing movement to adopt the precautionary principle to the assessment and management of health risks in the face of scientific uncertainty. This new paradigm is necessary to supplement, and in some instances to replace, the current risk assessment framework in science and policy, because its focus is on a different set of values; and the values inherent in its adoption imply a shift of emphasis in favour safety, ensuring that any errors of judgment made will lead to excessive, rather than inadequate, protection. Precaution and prevention are thus seen to involve value-based judgments, which require action be taken on the basis of reasonable evidence of the possibility of risk even if this may sometimes result in controls that may later be proven to be unnecessary.

The Need for a New Paradigm

The value judgments of all involved in risk assessments and risk decisions have a strong effect on their nature, character, and outcomes. The value-laden approach is used widely in making decisions without much acknowledgment. Thus, values should be included in the risk-based decision-making process for three reasons: they are already a major component, although unacknowledged; ignoring them causes almost insurmountable difficulties; and because it is the right thing to do (Cothorn 1996, 38).

Many who think that science is value-neutral confuse the findings of science with the activities of science; data are neutral, but actions may not be (*ibid.*, 47). Values and ethics seem like perfectly good ways to analyze, balance, and choose in the risk-based decision-making process, and since they are widely used, why not acknowledge this and formally include them in the models?

The limitations of risk science, the importance and difficulty of maintaining trust, and the subjective and contextual nature of risk-based decision making point to the need for a new approach – one that focuses on introducing social values, such as precautionary action and increased public participation, into risk-based decision making to make the decision process more democratic, improve the relevance and quality of technical analysis, and increase the legitimacy and public appearance of the resulting decisions.

Others before have seen the wisdom of acknowledging the place of values in risk-based decision making. For example, D. Brown (1988; cited in Cothorn 1996) concludes that

Environmental decisions must be viewed primarily as ethical choices rather than as technically dictated conclusions. It is important in an age of increasing scientific complexity that interested parties attempt to understand the value positions and ethical issues that underlie scientifically derived policy choices. Experts and concerned citizens must realize that crucial policy choices concerning environmental pollution and toxic chemicals are value judgments, matters of morality, and social and political judgments.

One overall objective is to use the value of honesty and ask that the values, value judgments, and ethical considerations used in risk-based decisions be expressed and discussed. To a scientist, Jacob Bronowski's statement (1965) that "truth in science is like Everest; an ordering of the facts" expresses a most important value. We should

therefore acknowledge and, if necessary, expose the values inherent in environmental decision making and challenge the decision-makers to exercise transparency and clearly state how they are using such values, which should be central to the development of a new paradigm in the field of risk-based decision making.

There is no doubt that technical risk analysis is vital for making risk decisions better informed, more consistent, and more accountable. However, value conflicts and pervasive distrust in risk management cannot easily be reduced by technical analysis. Trying to address risk controversies primarily with more science is, in fact, likely to exacerbate conflict (Slovic 1999, 699). The precautionary principle offers us a new way of thinking about and managing environmental risks in society, but it will almost surely require a fundamental shift in risk-based decision-making processes before the principle can exert any real influence.

And while the precautionary principle arguably represents society's values in terms of better assessing and managing environmental risks, before we can even embark on operationalizing this new paradigm in environmental decision making, we need to explore ways of engaging the public and creating more participatory democratic processes on issues of fundamental cultural and social values. For it is these values that will ultimately shape the future of risk-based decision making provided the participatory processes are afforded to the public.

4

Making Values Explicit: Participatory Methods and Collaborative Approaches

I know of no safe depository of the ultimate powers of the society but the people themselves; and if we think them not enlightened enough to exercise their control with a wholesome discretion, the remedy is not to take it from them, but to inform their discretion.

– Thomas Jefferson

In western democracies, decisions regarding science and technology policy have traditionally been influenced by scientific experts or determined by political leaders advised by technical experts. The public is often assumed incapable of comprehending technical information and therefore, is often excluded from the decision-making process.

As the previous chapter makes clear, risk assessments and the decisions based on these assessments are inevitably value-laden. The degree to which the risk assessment process tends to be protective is strongly influenced by beliefs and values. As well, they will always reflect the moral suasion of those involved in the process. Making decisions without knowing what biases and values are influencing them can lead to serious errors. The challenge is whether to expose these values and value judgments, and if so, how to do so.

In recent years, the debate on public participation in technological decision making has increased. In particular, issues surrounding environmental concerns have practically demanded public involvement; in numerous cases, communities have taken it upon themselves to learn about highly technical issues and applicable technologies to clean up their neighbourhoods or prevent future contamination. Yet on the whole the lay public does not play a very active role in technological issues. Some may argue that this how it ought to be – that only individuals with appropriate scientific training should have a voice in any decision surrounding the choice and use of advanced technologies. On the other

hand, if the public is affected in some way by a technology, others may argue – even on ethical grounds – that lay people should actively take part in such decisions.

The limitations of risk science, the importance and difficulty of maintaining trust, and the complex, sociopolitical nature of risk point to the need for a new approach – one that focuses upon introducing more democratic participation and intersectoral collaboration into both risk assessment and risk decision making in order to make the decision process more democratic, improve the relevance and quality of technical analysis, and increase the legitimacy and public acceptance of the resulting decisions (Slovic 1999, 689).

Building upon existing approaches and models of collaboration and democratic participation can help focus on finding alternatives to or supplements to traditional risk-based decision making. While the precautionary principle arguably represents a better approach to assessing and managing environmental risks, it can be asserted that the paradigm cannot be effectively implemented or operationalized until the public becomes actively engaged and more democratic participation processes are created to explore issues of fundamental cultural and social values.

How then do we find out what values each sector holds regarding the acceptability of risk, uncertainties in science and move toward more protective strategies? How can environmental policies be designed in a way that achieves both effective protection of nature and an adequate representation of public values? In other words, how can we make the environmental decision process competent and fair?

Answering these questions is not nearly as difficult as it may first seem. This is because an individual's values are reflected in their preferences, priorities, goals, objectives, choices, and decisions. They are therefore reflected in and revealed by words and actions. This leads to an obvious conclusion: the best way to find out what people value is simply to ask them. This is why public participation is such an important part of the environmental risk assessment process. Democratic participation and intersectoral collaboration open the door to the exploration of the values that the public and other stakeholders believe should guide economic development decisions and choices.

The challenges we face in dealing with the increasing complexities and uncertainties related to environmental health call for new actions at local, provincial, national and international levels; actions that will result in a net benefit to both human health, environmental sustainability, and economic efficiency.

Incorporating Values into Decision Making

Values are principles used for evaluation. We use them to evaluate the actual or potential consequences of action and inaction, of proposed alternatives, and of decisions. They range from ethical principles that must be upheld, to guidelines for preferences among choices.

It is clear that we need to spend more of our decision-making time concentrating on what is important: articulating and understanding our values and using these values to select meaningful decisions to ponder, to create better alternatives than those already identified, and to evaluate more carefully the desirability of the alternatives (Keeney 1992, 4).

Values should and can guide all the effort that should be expended on risk-based decisions (ibid., 22). However, the question of how we begin to identify the values relevant to a decision situation remains.

The values relevant to a given decision-making situation indicate what information is important. Value judgments specify what is important in the decision problem. They are what should be discussed when people talk about the pros and cons of alternatives. For most public problems, values, rather than facts, are the aspects of the problem about which many members of society will have knowledgeable viewpoints (ibid., 23). Discussion of the details of the consequences of various alternatives often depends on technical and complex concepts from various professional fields; without discussion of values, many people are excluded from participation and others are limited to minor contributions.

It can be argued that in environmental risk-based decision making, all assumptions and value judgments involved in the decision-making process need to be critically evaluated at the outset not only by scientists and policymakers but also by the lay public. Lowrance

(1976) gave the following guidelines for scientists concerning the impact of the intertwining of facts and values in developing public policy:

Recognizing that they are making value judgments for the public, scientists can take several measures toward converting an arrogation of wisdom into a stewardship of wisdom. First, they can leaven their discussions by including critical, articulate laymen in their group. Second, they can place on the record their sources of bias and potential conflicts of interest, perhaps even stating their previous public positions on the issue. Third, they can identify the components of their decisions being either scientific facts or matters of value judgment. Fourth, they can disclose in detail the specific bias on which their assessments and appraisals are made. Fifth, they can reveal the degree of certainty with which the various parts of the decision are known. Sixth, they can express their findings in clear jargon-free terms, in supplementary non-technical presentations if not in the main report itself.

While it can be argued that incorporating these guidelines into the decision-making process will assist in exposing some of the value judgments and assumptions of scientists in the decision-making process, the challenge persists of how to engage a discussion of values that involves the Canadian public in environmental risk decisions.

Democratic Participation: Rethinking Methods for Citizen Engagement

While industrial democracies have made impressive gains in improving their capacity to understand and respond to threats to their natural environment, they have been less impressive in designing institutional mechanisms for democratic participation in environmental risk-based decision making (Fiorino 1996, 194), or for incorporating values-based discourse³ into the decision making process. According to Fiorino, this is a result of “economic and social complexity” (1996, 198):

[Large] populations and concentrations of political and economic power, among other trends, have reduced opportunities for citizens to participate in government decisions. The scale of modern industrial societies makes it difficult for most citizens to influence the decisions that affect their lives. As administrative power has grown in this century,

³ The word *discourse* implies equality among the participants, peer review as a means for verifying understandings (i.e., holding knowledge claims up to public scrutiny) and an orientation toward resolving conflicts in a consensual rather than adversarial ways (Renn et al. 1995, 3).

regulatory authority has been concentrated more and more in agencies that are removed from direct electoral control.

Proponents of democratic participation maintain that the views of citizens should be seen to be as valid as those of the technical experts and agency officials (Fiorino 1990; Schrader-Frechette 1985). The assumption in a democracy is that citizens can best judge what is in their interests. That people should have the opportunity to influence or at least voice an opinion on issues that affect them is a fundamental precept of democracy and inherent in the idea of citizenship. The democratic ideal is that “citizens share in governing” (Fiorino 1996, 195).

Democratic participation also may make government decisions more legitimate. When the opportunity for effective participation exists, even if the outcome necessarily is not what some of the participants would have wanted, a decision is more likely to be seen as legitimate than if people had been excluded. Furthermore, participation leads to better social choices (ibid.). Experts and elites are not infallible. As previously discussed, experts and elites are limited by their world views and the bias that flow from their professional training and interests. They are neither politically neutral nor value-neutral; and their interests and values will inevitably affect their scientific judgments. Nevertheless, while we should not over-rely on expert knowledge, especially from people who may have vested interests in the decisions, we should not disregard their counsel and rely solely upon public opinion.

Many would argue that there are already ample opportunities for people outside government to participate in environmental policymaking. With its expansive rules on public participation through consultation, vigorous legislative oversight and relatively open access to courts and review of agency actions, environmental policymaking may be suffering from too much, not too little participation. However, it can be argued that environmental *risk-based* decision making may as yet involve too little *democratic* participation.

Participation theorists such as Barber (1984, xi), Renn and Fiorino argue for greater empowerment through reinvigorated citizenship:

[Citizens] can best judge what is in their best interests and can acquire the political skills that are needed to take an effective part in governance; and, that, participation can

engender civic competence by building democratic skills, by overcoming feelings of powerlessness and alienation, and by contributing to the overall legitimacy of the political system. (Fiorino 1996, 199)

New forms of participation are needed in a world in which people feel that they are losing control over decisions that affect them. Deliberation and discussion are essential in a democracy. Public participation should be guided by shared social values about what type of society participants would like to have and expectations about how people should interact (Renn 1995, 9). Through public participation, we can invent alternative futures, create mutual purposes, and construct competing visions of community (Barber 1984, 177). Discussion and deliberation ultimately allow people as citizens to discover common interests, challenge their beliefs when presented with other points of view and transform conflict into consensus. Dialogue with citizens as equal partners, who are informed about the cognitive aspects of the problem and consequences, is one good way to realize better decision making (Renn 1995, 4).

Public Participation Models for Environmental Risk-based Decision Making

To accommodate the demands for participation that have emerged over the last several decades, decision makers in western democracies have used many participatory mechanisms. However, traditional public participation⁴ is often structured as an internal/external, us-versus-them, zero-sum conflict relationship. Public hearings and consultations have been the mainstay of these mechanisms in Canada and the United States. Some agencies have used negotiations to bring parties together to reach consensus on proposed regulations. Many nations have used citizen initiatives and public surveys.

Public participation occurs in a fairly rigid format. Because an agency's public participation activity is largely the result of external mandates, there is a considerable body of legislation, regulation, and guidelines that collectively defines the adequacy of those efforts (i.e., the Canadian Environmental Protection Act, the Canadian

⁴ *Public participation*: forums for exchange that are organized for the purpose of facilitating communication between government, citizens, stakeholders and interest groups, and businesses regarding a specific decision or problem (Renn et al. 1995, 2).

Environmental Assessments Act, and the federal Consultations Directive). The requirements are usually crafted in terms of specific periods for public comment, each with a minimum number of days, a minimum number of local papers in which legal notices must be published, guidance documents for carrying out public consultation, etc. Quite understandably, a common agency response is to comply with those minimums, and not undertake additional or different kinds of public participation, which might risk additional delay or an unforeseen procedural error. Going beyond the letter of the law is not precluded; but there seems to be little incentive for doing so.

The problems with all these mechanisms for public engagement are that public decisions are still made by administrators who listen to and balance demands of contending interest groups. At best, these mechanisms provide an opportunity to hear from some of these groups; at worst they provide an opportunity for the administrators to offer public justifications of decisions (Hadden 1989, 206). Thus, there is an urgent need to develop processes by which experts, regulators and the public can deliberate on issues associated with risk-based decision-making processes and decisions utilizing a framework embedded in shared values.

Trust, and other social factors, must be recognized as important in developing this discourse between the different stakeholders. It is essential that public trust in the regulatory framework associated with issues of risk and safety be improved. There has been much debate by policymakers emphasizing the importance of increasing transparency in the decision-making framework, as a method of improving consumer confidence in the risk-based decision-making process. Transparency, however, appears to have different implications within the different contexts associated with risk-based decisions. Lynn Frewer of the UK Institute of Food Research (1998) suggests that the concept of transparency might be best represented as incorporating three levels of public engagement or involvement:

The first level, with lowest public engagement, is that of increased transparency relating to risk-based processes themselves. At this level, increasing transparency would permit the identification of “weak” points in any risk assessment, which could be easily identified and debated by other experts in the area. Public scrutiny of these procedures is dependent on effective public understanding of the scientific issues involved in risk assessment, and assumes the procedures and results are placed in the public domain. Effective risk communication with the public at this level might address the issue of

regulation of hazards from the risk management perspective itself, rather than from the regulatory viewpoint.

The second level involves increasing transparency in the decision-making process regarding selection of risks for prioritization and mitigation efforts. Risk characterization is useful in determining public demands for risk prioritization. It is also important to take account of other hazards which may be causing major health problems, but which are not necessarily recognized as threatening by the public. It is essential that the decision making process associated with risk mitigation priorities be open to public scrutiny.

The third level has the highest level of public engagement, and involves increasing transparency through public involvement in risk-based decisions. While it should be noted that this third level is, at least in part, dependent on successful implementation of the first two levels, there are additional questions relating to how public participation in policy formulation might be operationalized.

There are numerous models proposed to provide opportunities for public participation in risk-based decisions. However, many may be discounted in the present context, as they do not provide the opportunity to develop a dialogue between the various stakeholders.

Clearly, the appropriate role of public involvement in making environmental risk-based decisions is contingent on the type of decision to be made and the type of conflict associated with the decisions (Renn 1995, 354). Several models exist for increasing potential values input and for creating greater citizen authority over environmental decisions. These models do not function exactly as may be needed to democratically implement new paradigms (such as the precautionary principle), but they provide important examples of how new models could function. Since it has been argued that the issues surrounding environmental risk-based decision making are fundamentally about values, three possible mechanisms for encouraging values-based discourse will be examined as innovative approaches, which bring small groups of citizens together to serve as “value consultants” on policy issues.

Three Tools for Values-based Discourse

Deliberative Dialogue. Deliberation (or deliberative dialogue) is a “social technology” that provides opportunities for people to deliberate on key social issues, and may be a useful tool for encouraging values-based discourse in environmental risk-based decision

making. Through the course of a deliberation, participants work through tough choices to explore the areas of common ground from which alternatives can develop and some action can spring. They are values-based dialogues as opposed to agenda-driven debates (CCIC 2000).

Deliberation has developed in response to Canadians' growing frustration with the ways high priority social issues are dealt with in our society today. Most people want to be able to work their way through different options, to weigh pros and cons, explore trade-offs and perhaps together find new solutions or at least common ground for action. Deliberation involves bringing together people from a variety of backgrounds and viewpoints to work through different approaches to solving a problem (ibid.).

People do not need to be experts to participate in a deliberation, because deliberation is ultimately about values. Deliberation provides a chance to explore approaches, test ideas, and consider grey areas. It can help people break out of habitual viewpoints and consider new options (ibid.).

In a successful deliberation, people must face up to the contradictions and long-term consequences of their opinions, and make choices. By working through the conflicts and trade-offs associated with an issue, people clarify what is most important to them, improve their understanding of the issue, and may find common ground from which alternatives can develop. Any common ground that does emerge represents a more considered public judgment than the top-of-the-head opinions collected through surveys and polls (ibid.).

As a tool for values-based discourse, deliberation offers a way for people to think about and reflect collectively on an issue. Despite some of its shortcomings as a citizen engagement strategy, such as lack of time to address hard choices and trade-offs and the intellectual nature of the process, deliberation nonetheless offers a unique method of discourse which could be useful in discussing value judgments in risk assessment, the precautionary principle, acceptable risk, scientific uncertainty, and sound science.

Consensus Conferences and Planning Cells. One method that has been proposed as an effective means of incorporating lay perspectives into the development, application and

policy formulation associated with risk-based decisions is that of the consensus conference. Consensus conferences (from Denmark) and planning cells (from Germany) represent two mechanisms to involve citizens in examining broadly defined questions of regional or national importance. Planning cells, which may address more narrowly defined questions than consensus conferences, may be held at the local level, and multiple planning cells may be held at once in different regions. Both mechanisms rely on randomly chosen citizens being trained in an issue, being able to reframe questions, and informing social debates on broad technological and policy issues before decisions have been made. They rely on citizen judgment and values in addressing problems of complexity and uncertainty. They both help to clarify the issues, questions, and concerns for and of the general public, introducing perspectives that may coincide with or be different from those held by experts and other traditional stakeholders.

The consensus conference has been defined as “a forum in which a group of lay people put questions about a scientific or technological subject of controversial political or social interest to experts, listen to the experts’ answers, then reach a consensus about this subject and finally report their findings at a press conference” (Joss and Durant 1994). The lay panel is the main actor in the process, determining the expert panel, determining the questions to be asked and reaching consensus (Joss and Durant 1994). The multi-day process consists of three steps: education and reception of information on the topic, so that the panel members can formulate specific questions to be explored; processing of information through panel discussions, hearings, cross-examination and questioning of experts, and other interaction with experts; and evaluation of questions and information through groups (Dienel and Renn 1995, 123). Problems addressed by these lay panels are generally of current interest, well defined, and involve unresolved issues. The process is facilitated by a neutral third party. The sponsor of the panel generally has little role in the process, except as a witness. Results of the panel are generally widely distributed in the media and local hearings are held, both as a way to stimulate informed public debate and improve public understanding of technologies and to inform and influence decision-makers.

Consensus conferences generally result in broadly defined recommendations that address technological, social, and economic issues, beyond those normally addressed by experts. However, the process may not be appropriate where a yes/no decision is needed or where

there are major inequities involved (ibid., 129). Further, the sponsor agency may not defer to the panel's decisions (although in Europe these panels have had a strong influence in government deliberations). Finally, through random participation these panels may not adequately represent the populace.

Citizens' Juries. A similar approach to the consensus conference, called the "citizens' jury," has been used in Germany and the United States, and also, more recently, in the UK. Like the consensus conference, it is an attempt to meaningfully involve members of the public in decisions that affect them in their own communities. Citizen juries represent a direct form of public participation in decision-making processes, modeled after the criminal jury system. The goal is that a group of randomly selected citizens, when exposed to good information presented by witnesses from differing points of view, should be able to make sound judgments on public policy matters, even though many others, by virtue of their training and experience, might supposedly be more competent to do so (Crosby 1995, 161). In a citizen jury, a randomly selected group of jurors designed to represent the general public is given a specific local or regional public policy issue to study (though juries on national issues have been completed).

A non-partisan facilitation organization is hired and develops a narrow charge presented to jurors at the beginning of the process, which needs to be satisfactory to the sponsor organization, fair to stakeholders (affected parties), and provides a framework from which the jurors can make good judgments (ibid.). The charge generally contains a clear statement of the problem to be addressed, often asking jurors to choose between three or four pre-selected options, and subsequent follow-up questions to consider. The jurors participate in a four-to-five day hearing, facilitated by a neutral moderator, where participants hear from "witnesses" so that they are exposed to a wide range of views on the issue. Jury members can then propose questions to the witnesses. The jurors then deliberate the information received and issue findings and recommendations to policymakers in writing in response to the charge (Crosby 1995, 158).

There are some general limitations to the citizen jury approach, however. First, the process is designed, like a criminal jury, to examine a narrowly defined charge. While jurors are encouraged to ask questions within that charge and to collect relevant information, the juries are limited in the amount of background information and training

jurors receive in the issue and do not promote critical enquiry into issues outside the limited mandate (Renn 1995, 345). As the decisions are made by majority vote, minority positions may not be adequately considered in the jury discourse. Finally, unlike the criminal jury system, there is no guarantee that the sponsor agency will actually incorporate the results of the citizen jury into final decisions. There is a need for a clear mandate for agencies to use the results and a need for stakeholders to acknowledge the legitimacy of the jury process.

Toward Shared Visions, Shared Values: The Role of Collaborative Approaches

While a number of older forms of social organization such as trade unions, religious groups, ethnic associations, municipal governments, school boards, student body associations, etc. can act as venues for voicing concerns, some new forms of public participation may assist in uncovering some of the value judgments inherent in risk-based decisions, and will aid in identifying the values held by various stakeholders around acceptable risk, uncertainty, and the precautionary principle. However, neither the traditional forms of social organization nor the newer democratic participation approaches will be sufficient in bringing about long-term, sustainable environment and health decisions.

Collaboration across different economic sectors can bring together business, government, non-governmental organizations, and the lay public to tackle important social and environmental issues (Gray 1989; Westley and Vredenburg 1991). It is considered to be beneficial for participants because parties who see different aspects of a problem can constructively explore their differences and search for solutions that go beyond their own limited vision of what is possible (Gray 1989, 5).

Collaboration is a process in which interdependent parties work together to affect the future of an issue of shared interests (Gray 1989). It does not demand that participants set their self-interest aside, nor does the success of collaboration hinge on their doing so. On the contrary, participants are expected to clearly voice their interests and energetically work to achieve them. The key is that their efforts are oriented not in opposition to those of their fellow participants, but in concert. An environment needs to be created in which exploring differences is encouraged rather than hindered. To the extent that differences

are not openly addressed, they may fester below the surface and become the impetus for discontent with the process and dissatisfaction with the results.

Collaboration emphasizes dialogue, through which parties develop a common understanding of the situation. Activities might include information exchange, imagining best and worst possible futures, and visual representations of the situation. Participants focus on concerns and interests, and how their concerns relate to the concerns of others. Out of these expressed concerns, parties identify possible changes that could be made. Participants deliberate whether or not the improvements represent desirable and feasible changes in the present situation, and move into implementation.

The characteristics of collaboration are consistent with the underlying notions of participatory democracy as outlined above. Three features in particular – dialogue, learning and power sharing – would seem to be essential elements of any participatory process. Collaborative approaches appear responsive to the value of diversity of participants, ideas, and worldviews.

A new model of decision making is needed which is in accordance with the principles and values of society, where the idea of government provides a notion of the political domain as a public realm, where the members of the political community listen to, argue with, and persuade each other as equal citizens, so as to find solutions to their common problems (Ekins 1992). There must also be a clear barrier between economic and political power and those who wield this political power must be elected by, accountable to, and replaceable by the people over whom power is exercised. In essence, this approach to decision making necessitates shared approaches between government and society, combining devolution and decentralization with the exercise of power from the bottom up.

Collaboration is necessary in order to build bridges between the public and governments, governments and industry, industry and citizens and other stakeholders. Such collaboration will gradually lay a base that will enable us to respond effectively to health and environment issues. Thus a collaborative approach to risk-based decision making should observe the process outlined in Figure 3 above. A schematic diagram of this process is presented in Figure 4.

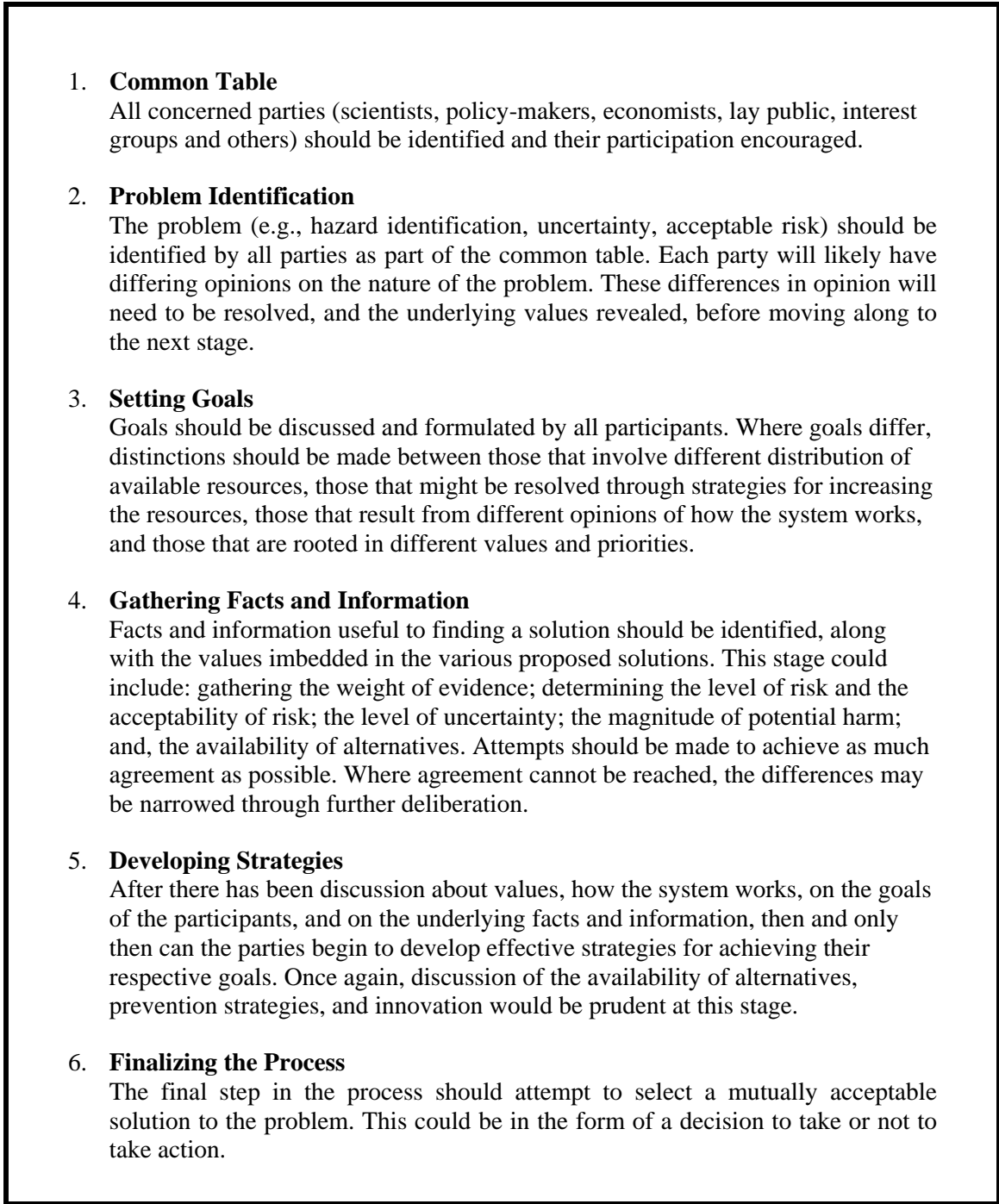


Figure 3. Collaborative Approach to Risk-based Decision Making

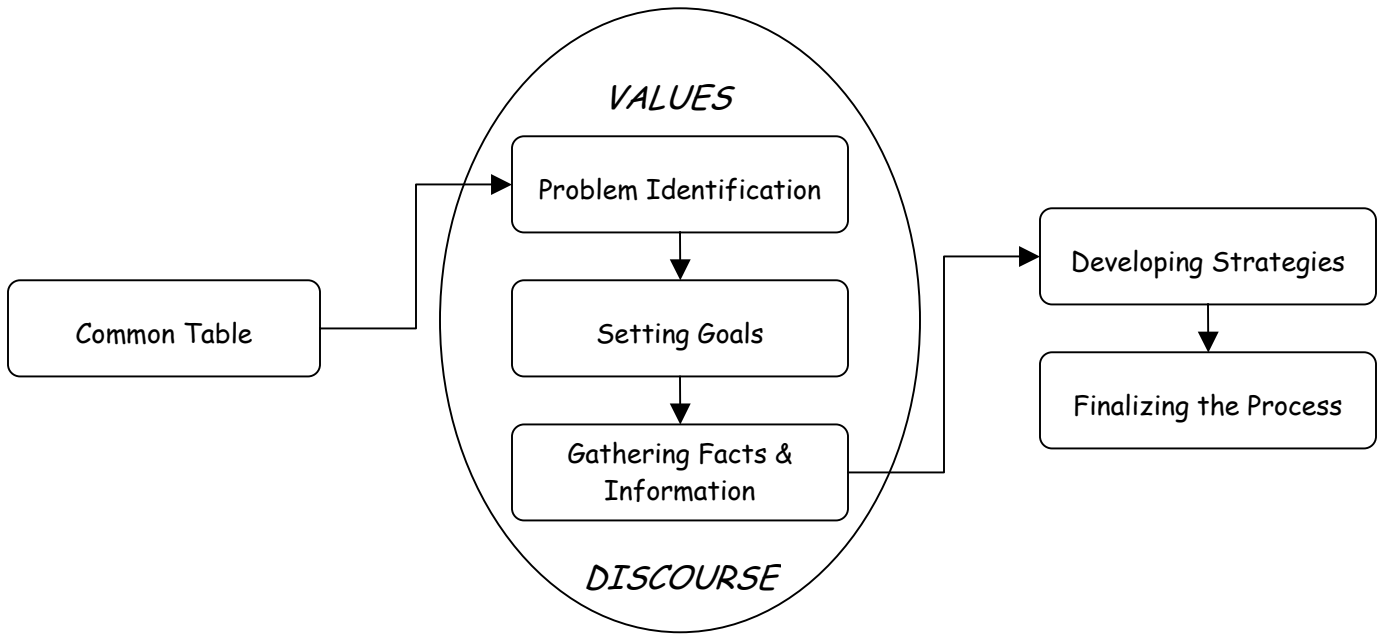


Figure 4. Toward Shared Vision

If these steps are followed, the adversarial debates and power struggles that are commonplace in our current system will be minimized. A common agenda for health and the environment must begin by recognizing the common thinking and common concerns they share; the reality of the common threats we all face – declining health, degraded environments and depressed economies; and the common root of those problems – a form of economic development and political decision making that is unsustainable in terms of both human health and environmental security (Hancock 1989). Our actions must be guided by a set of common principles and values rooted in our new understanding and the new values that flow from it.

5

Promoting Collaborative, Values-based Decision making

We must rapidly begin the shift from a “thing-oriented” society to a “person-oriented” society. When machines and computers, profit motives and property rights are considered more important than people, the giant triplets of racism, materialism and militarism are incapable of being conquered.

– Martin Luther King, Jr.

There is a need to invent new democratic methods for making environmental and health decisions in the face of uncertainty – when precaution is a critical consideration. Furthermore, it is clear that the effectiveness of participatory mechanisms and collaborative approaches can only be assessed by perceptions of public ownership of risk-based decision and high levels of public trust in the risk analysis process, as well as mutual alignment of beliefs about risk prioritization between different actors in the debate about risks themselves. Impact on public risk perceptions is not an appropriate assessment of the effectiveness of public participation.

Decisions about technology and the environment involve values and judgments that are not technical. And what has happened is that we pretend that isn't so. Bureaucrats and technocrats believe it is their role to make decisions, though these decisions, in fact, have value judgments embedded in them. The vision is that input from citizens can be used for more farsighted, comprehensive and sustainable technological and social development.

Decision-makers as well as the scientific community should be aware of the need to involve interested parties in the assessment process: this is necessary to incorporate the views and experiences of the communities concerned and is a requisite for participatory decision making (WHO 1999). In order to ensure transparency, the public should be involved in evaluating assessments, as well as participating in the assessments themselves from the beginning. For example, scientists, policymakers, the voluntary sector, industry and the general public all need to dialogue around the values each sector holds with regard to environmental contaminants, in order that these values can be included in the

risk assessment or the risk management process. Various mechanisms for values-based discourse have been outlined in the previous chapter, and could hold some promise for the integration of these into the environmental risk-based decision-making process.

Collaborative risk-based decision making is an approach to translating scientific information into timely and useful insights that inform policy in the face of uncertainties. Collaborative risk-based decision making is an ongoing process that engages stakeholders – researchers, decision-makers and the lay public – in analyzing, evaluating and interpreting information from multiple disciplines to draw conclusions that are timely and useful for decision-makers. This process provides stakeholders with the opportunity to participate in the process of evaluating acceptable levels of risk and appropriate responses. Throughout the process, key research gaps are identified and research needs prioritized to provide the information needed to inform future decisions. The process includes: ongoing collaboration between the research, assessment and stakeholder communities; a focus on stakeholder information needs; multidisciplinary approaches; use of scenarios to deal with uncertainties; and an evaluation of risk management options.

Collaborative risk-based decision making would involve all stakeholders early on in the process of characterizing and assessing risks rather than presenting a complete finalized solution to them, and thus truly integrate the risk assessment phase with the risk management one. Here, the process of risk-based decision making is an interactive process involving both analysis and deliberation. It does not diminish the role of scientific assessments, but is aimed at eliciting the values of the community involved and thus avoiding the risk of generating “facts” without respect to values. From this perspective, today’s conflicts and controversies surrounding technological risks no longer appear to be the result of public irrationality or ignorance; rather they are the side-effects of an imperfectly participatory democratic society’s attempts to come to grips with technological and social change. The success of such an approach mainly depends on its ability to respond to the needs of all interested stakeholders. This would include representatives from industry, regulators, standardization organizations (international and national levels), international organizations (trade, regulation, etc.), voluntary sector organizations and private associations (consumer protection, etc.), risk assessors and managers, researchers, and so on.

The benefits of such a process are described by Renn et al. (1995, 366):

The creation of communitarian values and social preferences transcend the egoistic perspectives many parties bring to the discourse process. This development of new values is a learning experience based on empathy (understanding the concern others) and quest for social rationality (common good perspective). The major accomplishment of a discourse is to create a set of shared values and goals that serve the common interest of all parties without placing undo burden on any one party. Such a learning experience is contingent on a group process in which all participants develop a common understanding of the problem and a desire to find a commonly acceptable solution.

A crucial condition of a healthier relationship between science and society is that science and scientific policy bodies learn to listen to publics and understand public concerns, in a way that has previously been ignored. The exposure of scientific deliberations about public issues to public questions and input can lead to better informed decisions by the policymakers and renders scientific authority over public policy matters properly conditional, not absolute as is typically assumed by many scientists. For environmental policies to be effective and legitimate, we need to involve the people who are, or will be, affected by the outcomes of these policies. There is no technocratic solution to this problem.

Many people will be challenged as they attempt to function effectively in processes that require them to (1) interact with people with differing worldviews, (2) articulate their values and goals persuasively, but not defensively, (3) craft solutions that represent quality public policy, and (4) be sensitive to the impact of the decision on groups who will be negatively impacted by it, or who were advocating for an alternative outcome. Few of us have much experience in processes that make these demands. Therefore, making progress in environmental risk-based decision making is not merely a matter of learning new skills; some old attitudes and assumptions will need to be un-learned as well.

Fair and competent participation will not occur through the rigid application of these models, but by creatively tailoring the models to be responsive to the problem setting. There are opportunities to improve upon these models and such reforms ought to be encouraged. Clearly, any participation exercise must combine technical expertise and rational decision making with public values and preferences.

Toward Values-based Decision Making

The interplay between science and social value judgments emerges again and again in discussions about the precautionary principle. Trying to integrate the precautionary principle into the risk assessment process as traditionally defined and generally understood may be extremely difficult, due in large part to the fact that value judgments are embedded throughout the process; such judgments should be part of a broader social discourse that sets the context for decision-making processes such as risk assessment. This discourse has not occurred adequately in Canada, and certainly not to the same extent as in Europe and even the United States.

The concepts of risk and uncertainty, and the science that underlies these concepts, are clearly of central importance to defining and implementing the precautionary principle. The distinction between risk and uncertainty needs to be made and to be better understood. Risk relates to an event with a known (or assessable) probability of occurrence, whereas uncertainty is an event with unknown probability. The precautionary principle is concerned with uncertainty, not risk per se, even though risk assessment has always addressed some level of uncertainty.

Risk assessment is a useful tool where sufficient evidence exists to make an informed judgment and assessment of probability. But risk assessment is not the only, or sometimes even the appropriate, tool to apply to the precautionary principle when a high level of uncertainty exists about the effects of, and probable exposure to, a toxic substance. Risk assessment, then, can be a valuable approach to controlling the risk of exposure to many toxic substances. It has accomplished significant risk reductions when properly applied. It is not, however, a complete answer to concerns relating to the precautionary principle. These concerns transcend purely scientific considerations.

A number of the criticisms and concerns of stakeholders need to be incorporated in a modified risk assessment decision-making framework that would be better suited to dealing with the complexities of the precautionary principle. The value judgments inherent in both risk assessment and in taking precautionary principle decisions are of fundamental importance and should set the context within which scientific and economic criteria are applied to managing toxic substances. Value judgments cannot be reduced to a set of decision criteria that scientists can apply on their own during the risk assessment

process. While the introduction of public values as a key discussion element both within and outside of the risk assessment process may complicate decision making for certain toxic substances, incorporating public values will also lead to more legitimate and stable decisions from a social perspective. The social consensus that would legitimize the decision-making process and the setting of public policy standards is unlikely to occur otherwise.

Environmental Organizations as Bridges: The Role of the Voluntary Sector

Whereas traditional science builds knowledge mainly by breaking questions and concepts into ever-smaller parts, a systems perspective focuses upon how all the parts fit together. Both approaches are useful, but when undue attention is placed upon the parts, the aggregate impacts are often lost. This is particularly obvious through the analysis of traditional environmental risk-based decision making, which provides incontrovertible evidence of the need for more integrative approaches. Systems thinking has also led to thinking of organizations and issues as intersections of stakeholder interests, and the importance of correctly defining and meaningfully engaging a system's stakeholders.

The systems approach also brings out the need to act with more careful reflection about the interaction of the environment with our three key societal systems: political, economic and social. These systems are represented by organizational sectors of government, business and civil society; change within the larger system can be approached by working with organizations in each of these sectors: governments and their agencies, businesses, and voluntary sector organizations.

Bridging organizations focus on relationships – which is the basis of systems thinking. Instead of an earlier partiality toward single-focus organizations divided into self-contained divisions, systems thinking encourages much greater interest in flexible specialization, network development and multi-purpose organizational forms. Bridging organizations strive to reintegrate diverse knowledge and perspectives, both by creating a forum for people and organizations with diverse ideas, and by engaging with or building bridges to other networks and groups in order to create more integrated responses (Westley and Vredenburg 1991).

Waddell and Brown (1997, 2) suggest that these types of collaborations happen for several reasons:

One reason is that the parties simply want to increase the scale of their activity. Another is that they want to take advantage of the strengths of a partner. A third reason is that they want to exchange technologies or information – to learn from one another. And a fourth reason is that they want to develop undefined opportunities, based in the understanding that dynamic interaction creates new ideas and solutions to problems.

Bridging organizations, according to Westley and Vredenburg (1991) can be distinguished from other forms of interorganizational collaborations such as joint ventures and multi-party roundtables, in that they have identities and interests that are independent of the other stakeholders. As a consequence, they engage in bilateral negotiations with stakeholders and they may seek to impose their own perspectives and solutions on other stakeholders (Brown 1992, 3).

Bridging relationships range in intensity from loose associations of similar organizations for information sharing to the formation of coalitions and strategic social movements that impact national policy formulation. Between the two extremes are horizontal networks of different types of organizations that are focused on addressing a particular issue. These organizations can span social gaps to mobilize cooperation among diverse stakeholders who cannot solve particular problems by themselves (Brown 1991).

Bridging organizations aim to create collective understanding and actions between the diverse perspectives in society. A large and growing number of bridging organizations and networks of organizations have emerged in recent years in response to the array of complex problems facing the world, acting as catalysts for defining problems and mobilizing resources. Many of these problems – including climate change, poverty, finance and trade – call for innovative systems to deepen and broaden shared understanding about the issues, devise solutions, and implement them. The critical contribution they can make to social issues is their ability to create consensual knowledge and action among diverse stakeholders. It can be argued that some environmental organizations in Canada, and in particular, those involved in environmental health issues, represent such a bridge.

Those active in the environmental voluntary sector in Canada will readily agree that there exists an “ENGO community,” a group that shares a sense of common identity in the pursuit of an ecologically sound, health protective and economically just world. Voluntary sector organizations involved in environmental issues, in particular those organizations dealing with preventing environmental health risks, share a common set of values and norms, which form the basis for coordination and cooperation. Anne Bichsel suggests that they “are motivated by belief in a mission, not necessarily by political imperatives, as in the case of government, or economic incentives, as with corporations. Moral obligations and professional ethics guide behaviour” (1996, 235). Their primary function is to respond to the needs of civil society and to purposively organize people to reach common objectives.

While it can be argued that environmental organizations are special interest groups, the above characteristics differentiate them from the commercial sector, which may also organize itself into non-profit, non-governmental organizations to advocate commercial interests. Civil society is distinguished from the state and market by its concern with common goods as defined by social groups. Kalegaonkar and Brown point to the strengths of civil society as a sector, including “its capacity to be responsive to various issues through the diversity of organizations that comprise it and the values-driven energy of individuals and organizations. The involvement of many civil society organizations in grassroots activities and their closeness to marginalized groups permits them not only access to these primary stakeholders, but also the ability to gain the information and sensitivity necessary for responding to [environmental]-related issues effectively” (2000, 3).

It is clear that the three sectors of society – state, market, and civil society – are organized around quite different values, interests and concerns. According to Waddell and Brown, “the institutions of the state are concerned with the creation and maintenance of public order and the distribution of public goods. The institutions of the market are concerned with the efficient production of goods and services. The institutions of civil society, on the other hand, are concerned with the expression and preservation of core community values and beliefs” (1997, 4).

The confrontation of these economic, political, and social differences can sometimes create misunderstanding, mistrust and antagonism that hamper effective joint action

between these three sectors. In a globalized world of growing interdependence and blurring national and international boundaries, organizations that bridge such differences to solve common, yet complex, problems are vital to the development and even the viability of societies (Brown 1992, 2).

Those organizations involved in the broad environmental movement, along with those involved at a smaller scale in ensuring the protection of the public from exposure to environmental contaminants, are articulating strategic directions, fostering joint action, managing turbulent environments, linking diverse stakeholders, and reshaping the environmental context. It is these organizations and their social change activities that may create the external contexts within which many other organizations will operate (ibid.).

Bridging organizations promote social changes that involve stakeholders with diverse economic, political and cultural interests (Brown 1992, 4), and are particularly suited to promoting collaboration when stakeholders are not motivated to cooperate and the problems are not well-organized and understood (Westley and Vredenburg, 1991). Furthermore, they can catalyze the creation of shared understanding and solutions, and they can link different stakeholders to jointly implement those solutions (Brown 1992, 4). In summary, they are key actors in articulating shared visions and in constructing institutional arrangements for achieving them.

Dealing with multiple stakeholders is difficult. However, for bridging organizations helping diverse stakeholders work better together is a primary concern, and the gaps spanned may involve multiple perspectives, clashes of values, and histories of escalated conflict. The combination of social change agendas and stakeholder diversity can exacerbate challenges for bridging organizations, including, conflicting stakeholder demands, internal fragmentation, vulnerable leadership, strategic diffusion, and threats from success (Brown 1992, 6).

Nevertheless, we need agencies that can articulate visions and create institutions for cooperation across institutional sectors and societal levels. Bridging organizations, even though they possess neither formal authority nor critical resources, often are able to influence the process of social construction that forms the domain, because they have

discursive legitimacy (Hardy and Phillips 1998, 219) and thus are understood to be speaking legitimately for issues and organizations affected by the domain:

[They] can foster new visions and reconceptualize problems by facilitating deliberation and synthesis among diverse stakeholders. They can provide the institutional contexts for identifying shared [values], interests and goals, redefining problems, articulating alternative solutions, and implementing joint action. Carrying out these roles requires that bridging organizations formulate strategies and social change theories that explain the interests and interactions of many stakeholders. (Brown 1992, 20)

It is these types of organizations and networks of organizations that must lead the charge in re-constructing environmental risk-based decision making. Environmental bridging organizations and networks can provide the institutional contexts for identifying shared values, interests and goals; redefine the problems associated with traditional risk-based decision making; articulate alternative paradigms and solutions such as the precautionary principle, and implement joint action to better manage environmental health risks.

Conclusions

Calls for reform of risk assessment procedures assume that these procedures can be put on a sound scientific basis, yet environmental risk decisions must be made in the face of pervasive scientific uncertainty, a limitation of risk assessment that is not likely to change in the foreseeable future. Scientific uncertainty exists in risk assessment for a variety of reasons. Data are generally incomplete, inadequate, inconclusive, non-existent, and disputable. Tools are imperfect and methods depend on debatable assumptions. Errors are inevitable. Different estimates of risk for the same event or environmental contaminant may vary widely, sometimes in several orders of magnitude. Causal relations are often extremely difficult or impossible to establish; inferences of various levels of plausibility may be the only options. Finally, risk deals only with probability, not certainty – and that in radically different degrees.

While the public and its politicians may want precision and simplicity, decision-makers faced with uncertain evidence of potential harm cannot avoid deciding either on the side of human and environmental protection (which means that better information may prove that the decision imposes unnecessary costs), or to avoid unnecessary costs (which means

that better information may be understood to have allowed human or environmental injury). If the decision-makers wait until the scientific proof is in, then they are making an ethical judgment that favours the status quo.

Moreover, because scientists are taught to be silent in the absence of scientific proof, if there is urgent need to take action to prevent environmental destruction where scientific proof is not conclusive, scientific norms may be inconsistent with ethical principles (Brown 1996, 120). Thus the principle that scientists ought to refrain from speculation in the absence of proof may conflict with the public policy need to protect public health and the environment. Although decision-makers need to have the best science to inform them about consequences of decisions, they must understand that norms that insist on high levels of scientific certainty may be inconsistent with valid public policy objectives.

If we, therefore, let traditional risk-based decision making dominate our public policy discourses, we are unlikely to see more environmentally protective action. If we are to manage environmental and health risk more effectively, emphasis on scientific information and decision making will need to be partially replaced by values-focused thinking and discourse.

Although it is admittedly important to continue to improve our analytical skills and our ability to make mathematical estimates of risk, it is also critically important to develop the ability and procedures to identify and discuss the many values-laden questions that are often central to making a risk-based decision, but is hidden in the risk-assessment jargon. Organizational and societal responses and values-based discourse need to be developed in order to get at the underlying values, perceptions and assumptions inherent in risk-based decision making. Collaborative approaches to risk-based decision making may offer such an approach.

While the population is exposed to a range of both natural and human-made hazards during their lifetime, exposures to toxic substances and other environmental hazards deserve special scrutiny because they are largely preventable. Applying precaution to environmental risk-based decision making will require the development of innovative scientific and policy methods and tools, together with an operational social values discourse, that shift the focus of decision making toward primary prevention. It will also

require both a willingness and a capacity on the part of government and private institutions to undertake these changes.

However, this does not mean that we should discard the many useful tools we currently use to assess and reduce environmental risks. It does mean that we need to continuously refine and improve upon them as our knowledge of exposures, hazards, and disease progress, as well as disclose and better manage the underlying assumptions and limitations of current tools.

Precaution demands that we develop a vision for the type of world we want and aggressively work toward achieving that vision. The voluntary sector, both in terms of national organizations and grassroots local citizens groups, ought to lead the charge.

Appendix

Values That Impact on Environmental Risk-based Decision Making

- *Aesthetic*: Values having to do with beauty.
- *Ecological*: Values of nature independent of human use or enjoyment (e.g., the value of the existence of a plant, an animal, a species or an ecosystem for its own sake, even if it is of no use or benefit to people).
- *Economic*: Values having to do with the generation of material wealth.
- *Educational*: Values having to do with the passing on of knowledge and of skill in the use of knowledge.
- *Environmental*: Values having to do with features of environment that are useful or enjoyable to humans or that support human life (e.g., the value of clean air and water, of quiet, of wildlife that people enjoy, of protection from dangerous solar radiation, etc).
- *Health/Safety*: Values having to do with human physical well-being and safety.
- *Legal*: Values having to do with laws, rules and orders enforceable in a court (e.g., the value of acting within the law, of being law-abiding, or of deciding on the basis of legal principles).
- *Moral*: Values having to do with right and wrong, good and evil, and such virtues as justice and fairness.
- *Personal*: Values of a private or idiosyncratic character, such as sentimental attachments, individual tastes, personal preferences, etc.
- *Political*: Values having to do with legitimately authorized actions, procedures and decisions of governments and government agencies, and with efforts to influence governments and government agencies (e.g., the value of a government or government agency's acting within its mandate and jurisdiction, following proper procedures, acting in a fair and democratic manner, etc, or the value of a lobby group's acting in an effective and appropriate manner).
- *Recreational*: Values having to do with pastimes whose goals are relaxation, amusement, refreshment etc.
- *Religious/Spiritual*: Values having to do with what is thought, understood or perceived to be sacred.

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- *Scientific*: Values having to do with gaining knowledge through systematic observation and/or experimentation (e.g. the value of a forest or stream as a site for biological research).
 - *Social*: Values having to do with human relationships such as families, friendships, communities, cultures and ways of life.
 - *Subsistence*: Values having to do with provision of the necessities of life outside of a cash economy.

SOURCE: (Health Canada 1999).

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