SOCIAL CONCERNS FOR ENVIRONMENTAL EXPOSURES TO TOXIC SUBSTANCES

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Summary

Toxicology and epidemiology are the principle disciplines that have contributed to our understanding of the effects of exposure to environmental contaminants. These disciplines provide important information about how specific agents affect specific populations. They have been critical to the development of the field of environmental health and have served as the basis for the development of methods of risk assessment. Risk assessment is increasingly being used to quantitatively assess and describe the significance of environmental exposures.

As risk assessment methods have developed in the last decade, limitations have also become increasingly clear. Social impacts of environmental exposure to toxic substances are also emerging as important and worthy of research and policy intervention. Consideration of social factors leads to a broader perspective on environmental health. Some of the most important ways of considering social impacts of exposures to environmental contaminants include:

- Risk Communication - how people understand and assess risks from such exposures and how to fairly integrate public perceptions into decisions about these issues;
- Health Disparities and Environmental Justice - consideration of disparities of exposure by demographic status, environmental justice concerns, and the potential

interactions of multiple factors in producing effects;
- Global Environmental Health - paradigms for policy and analysis that consider larger systems and the implications of global change, including the broad goal of achieving sustainability and the precautionary principle.

1. Assessing and Communicating Risks from Environmental Exposures

How we understand the significance of environmental exposure has changed over the last two decades. Rather than describe air or water as dirty or clean, governmental and international agencies increasingly use methods that quantify environmental problems in terms of risk. Highly technical methods are used to describe and quantify the significance of environmental exposures, particularly with respect to health. Such methods, including quantitative risk assessment, analyze the likelihood and magnitude of effects expected to result from exposure to environmental contaminants. They result in statements about numeric risks of cancer after a lifetime of exposure, for example. Whether problems are worthy of attention is described in terms of the amount of risk they represent.

Use of risk assessment to quantify the significance of environmental problems has been advocated as a means to rationalize environmental policy. In the US, for example, the federal Environmental Protection Agency (EPA) uses risk assessment methods in setting standards for contaminants in drinking water. Risk assessment is used to determine concentrations of contaminants that correspond to a particular level of risk, such as a lifetime cancer risk of one per ten thousand. Risk assessment methods are also used to estimate health risks that result from pesticide residues on foodstuffs, prepared as part of reviews to consider whether controls are needed to protect the public.

In the US, the move toward the quantification of risks has occurred in part because of a judicial review of administrative regulations. Courts have required the demonstration of risks of environmental and occupational health problems in regulations issued by federal administrative agencies. The US reliance on risk assessment is also a response to the contentious public administrative process used to adopt environmental standards. This process requires that agencies justify their actions in the face of commentary and critiques by affected parties.

Many countries have adopted quantitative risk assessment methods. The European Community has adopted Action Programs on the Environment addressing topics including air pollution, drinking water quality, toxic waste, and notice of use of chemicals. The European Commission is setting numerical standards to provide guidance to member states. For example, a key environmental policy requires notification of the use of chemicals that may pose risks. Risk assessment methods similar in approach to those used in the US are being used to determine whether action is needed to reduce risk from chemicals.

Countries in Western Europe differ significantly in their emphasis on environmental protection and their styles of policy-making. Sweden has emphasized environmental protection and sustainability and has relied on a consensual style of policy making that draws a variety of parties into an active role and is not driven solely by technical

analysis. In the UK, environmental policy processes in the past had been characterized by reliance on expert groups, rather than a formal or public administrative process. However, this may be changing, partly as a result of interaction with the European Commission on environmental policy and partly as a result of political demands within the country.

Use of risk assessment methods may increase in developing countries over time, although in areas where health effects of pollution are directly observable, there may be less impetus for the use of such methods.

1.1. Technical Risk Assessment for Environmental Agents

The approach to risk assessment most widely cited is a paradigm put forth by the US National Academy of Sciences (NAS) in 1983, and implemented in the US. Under this approach, risk assessment is seen as a technical and scientific process. Technical experts are to use scientific evidence to estimate risks associated with environmental conditions or exposures. The process includes four steps: hazard identification, exposure assessment, dose-response assessment, and risk characterization. Quantitative risk assessment estimates how much of an adverse outcome may be expected given environmental exposures. This approach relates cause to expected effect. Risk is considered to be a product of the likelihood of an adverse event and its magnitude or severity. The effects are usually expressed as expected mortality and morbidity. This is the principal way of viewing risks used by those trained in natural and health sciences. Any non-technical, social, or political factors relevant to the decision-making are to be considered after completion of technical analyses of health risks, during the decision-making process, termed "risk management."

Risk assessment draws primarily upon short-term assays, toxicology studies, and epidemiology to determine how exposure may be linked to effect. It relies upon default assumptions, estimates, and theoretical models to fill in gaps in data and knowledge. It is dependent on the extent of research completed in these areas and places a premium on what can be quantified.

Attempts have also been made to use risk-based methods to set priorities in targeting environmental problems for action. Some argue that the best way to understand risks is to compare them. The US Environmental Protection Agency and some states assessed and compared the risks associated with many different environmental problems. EPA concluded that certain problems, including hazardous waste sites, receiving considerable resources, posed lower risks than others receiving fewer or no resources. The resulting report advocated wider use of risk assessment to set priorities for allocation of budget resources, though it is not clear that a reallocation of resources ultimately occurred.

Environmental advocates are uneasy about the use of risk assessment to describe the significance of environmental exposures. This is partly because such methods are often used define a level of risk considered to be acceptable and then to authorize a corresponding degree of pollution. In addition, the process may be manipulated to obtain results desired for policy reasons, as participants may use scientific arguments to

promote policy positions and cloak policy arguments in technical terms.

Risk assessors think of the limitations of their method as resulting from uncertainty and variability, which can be addressed by development of better methods and better information. However, debates over environmental issues may not be resolved this way. As Jasanoff writes,

. . . increasing knowledge is often likely to create new frontiers of uncertainty, where the evaluation of evidence depends primarily on the interpreter's individual judgment and institutional or personal values. Thus, the potential for conflict may never be eliminated, only displaced to new technical arenas. (Jasanoff 1986).

Because risk assessment is based on limited information and uncertainty, some argue that results do not represent expert judgment but rather technically-informed opinion. Affiliation, as with industry or academia, of technical risk assessors is an important predictor of their views on the toxicity of chemicals. Experts do not agree on the value of tests and methods routinely used in risk assessment. Moreover, those responsible for managing risks have strikingly different views than those of the public that they are supposed to represent.

Increasing use of risk assessment to define the significance of environmental problems raises a concern both because the technical assessment methods are fallible and because they do not address all of the things that people care about. As Otway writes:

If a public debate is structured to consider only the technical system and its observable (sometimes equated with insurable) risk, then many . . . other, but important, concerns may be ruled out of bounds. Anyone who insists on discussing them will certainly be considered disruptive and is likely to be labeled “irrational” as well. It follows, therefore, that whoever has the power to define the limits of the system in public discourse also implicitly decides who is being rational. You can quite rationally oppose a technical system that engineers have certified as ‘safe “ if it turns out that their definition of “the system” did not include the things you care about the most. (Otway 1992).

The reality that risk assessment is malleable to policy preferences and rife with uncertainties means that it is important to examine other types of input that are appropriate in defining environmental problems.

1.2. Challenges to the Technical Paradigm

Community representatives and environmental advocates have long been critical of reliance on risk assessment to describe the significance of environmental problems. Risk assessment practitioners initially understood such objections to represent failures of understanding by lay people, who were thought to have an emotional, rather than rational, response to environmental concerns. The initial response was to sponsor more risk communication to better explain the results of technical analyses to the public. The assumption was that people were uncomfortable with risk assessment results because they did not understand them. However, this way of looking at the problem did not

prove to be correct. The concerns about risk assessment were more fundamental.

Two perspectives have significantly contributed to understanding of how people view risks – psychosocial and cultural perspectives.

1.2.1. Psychosocial Research

Psychosocial research looks at beliefs and ways of processing information. Psychosocial researchers have looked at factors affecting the way that individuals define risk. This research reports that differences in perceptions of risk between risk assessors and the public do not result from failure of communication, but from fundamentally different ways of thinking about the significance of risks. People consider a broader array of factors, such as the nature and distribution of risk, when making judgments about actual or possible environmental exposures. People do not view the two key components of technical risk assessments – the probability and magnitude of morbidity and/or mortality – as the only important attributes. Peoples views of the seriousness of risks do not correspond to measures such as annual mortality.

Lack of ability to control a risk looms as a major concern for many members of the public. Some researchers suggest that this may be directly related to stress, which can be defined as the gap between demands made and the ability to respond. People with a greater sense of stress and lack of control perceived greater threats from industrial facilities in a study in the Netherlands, for example. Research in several areas shows that people do not like to accept a risk that they cannot control.

The potential for catastrophe is very important. The potential for many deaths in a short period of time is seen as worse than the potential for the same number of deaths if they are spread out over many years. A catastrophic event is seen as more risky. Some suggest that this view of risk is rational in that catastrophes would be more highly disruptive for communities than more modest effects over a long time period.

Members of the public may focus on additional factors important to community well-being. A study of public views of a hazardous waste treatment site found that the risk perceived by the residents of the areas was the dislocation that could occur if leaking was detected in the future. Other concerns included the economic value of individual homes, the future of residential growth, and the long-term viability of the community itself. Such wide-ranging concerns may conflict with technical reviews that determine whether narrowly-drawn regulatory requirements are met. Some researchers note that when government agencies focus on the methods that experts use to describe risks (changes in expected mortality or morbidity), they ignore other consequences that could be important and consequently accept more risk than would be viewed as appropriate by the public.

Different views of risks are not primarily related to the quantitative extent of the risk, but its significance.

1.2.2. Cultural Theories of Risk

Scientists working largely in the fields of anthropology and sociology have identified cultural influences on the ways that people understand and assess risks. These influences occur at the group level, as in a society or a key social grouping. Some proponents of these theories would argue that cultural influences are the most important predictors of how people see risks. The cultural perspective is that risks are assessed and, ultimately, managed according to principles that originate in social groupings Cultural theory focuses on the role of the social group, rather than the individual. The group may play an active role in determining what activities or conditions are considered to represent risks worth communicating or considering. In this respect, the group intervenes earlier in the process of information processing than would be the case in any of the other approaches. Risk communication is seen as the development of a common understanding that begins with the selection of issues to pay attention to and may not involve any exchange of quantitative information. A central premise is that a social unit acts to define threats, dangers or risks in a way that contributes to maintaining the cohesiveness and functionality of the group.

1.3. Issues for Decision-Making

Studies of major development projects that have engendered substantial public controversy in many parts of the world have contributed insights applicable to decision-making for environmental risks. The nuclear energy debate provides important lessons about differences in how experts and the public understand risks.

As with other environmental risks, the initial understanding of public opposition to nuclear power saw it as an emotional and uninformed reaction in the face of objective expert opinion. Research initially focused on identifying biases that needed to be overcome for the public to accept the experts' arguments for the safety of the technology. However, disagreements among experts came to light, leading to a conclusion that experts' views might be based at least in part on their opinions. Research on factors most salient to different groups reported that those who supported nuclear power development focused more on economic benefits and that those who opposed it placed greater weight on environmental and public health concerns. People had a similar view of the magnitude of economic benefits, for example, but very different views about whether the economic benefits were important. Concerns about peace of mind were highly influential for those opposed to the development of nuclear power.

People may view complex problems such as proposals for implementation of large-scale new technologies on the basis of their social, political, or ethical values, rather than as an assessment of what they personally stand to gain or lose. This is particularly true in cases where questions cannot be answered with scientific certainty and where judgment is consequently required. The field of social judgment theory research investigates how people arrive at decisions in these cases and finds that the process consists of rational and intuitive components. Research into these processes shows that there are great differences between individuals in judgments reached.

How assessments are conducted also affects the public acceptance of the outcome. Assessment methods may need not only to result in answers but also to inspire

confidence. As MacLean has written:

The problem is not simply to come up with just any common measure of risk that will homogenize all differences and present all factors on a single scale. It is not more difficult here than anywhere to cook up an artificial technique that will churn out an answer in any situation. The literature on risk abounds with them. What we need are acceptable techniques for measuring and evaluating risk, ones to which reasonable people would consent, even if this means, in the end, that no single metric is entirely adequate. (MacLean 1987).

The process itself may lead to changes in the understanding of problems, available solutions, or other aspects, as participants emerge from a process with revised views. This may be because the process of experiencing other views and constraints changes the preferences of those involved to be more focused on the needs of the group at large.

Many environmental debates do not have well delineated alternative outcomes. Thom Bezembinder describes these as complex social decisions and notes that they may be resolved, "through a process of deliberations and negotiations directed at creating an option that all parties finally accept after a process of give and take". Characteristics of such a process are to clarify the problem to be resolved, to define the constraints and elements of evaluation for the affected parties, and to arrive at a decision that includes tradeoffs and distributes gains and losses.

Some researchers have tried to define a normative theory of public participation in public decisions. This would be a theory of what public participation should represent. In this effort, they have tried to adopt an approach not tied to any particular outcome of public participation, neither advancing social stability nor social change. Key principles they have found to be most widely accepted as normative for public participation are fairness and competence. Models identified for public participation include citizen advisory committees, citizen juries, negotiated rule-making, and mediation.

How agencies perceive their role in complex decision-making also affects the outcome. For the siting of facilities, one group of researchers identified four ways that public agencies view the role of the public: a) a technical approach in which people are viewed as being motivated by emotions and fear; b) a public participation approach in which people are assumed to make rational decisions and participate in a fair process that considers a wide array of options; c) a market approach, in which people who are adversely affected are expected to object because the costs to them outweigh the benefits and in which these objections may be overcome by paying necessary compensation; and d) distribution justice approach in which the government is seen as responsible for ensuring equitable distribution of social benefits and risks in a society.

Conflicts may be based on differences in knowledge, understanding and analysis. Such differences may be able to be overcome through "reconciling approaches that rely on steps of integrated analysis to develop an acceptable approach, without attempting to address underlying differences. Alternatively, conflicts may be based on genuine differences in interests that cannot be overcome through analytic steps. Such issues may best be resolved through bargaining that allows each participant to maximize their

interests as they define them. This is typically associated with adversarial situations where parties have significantly different interests. A third, mediation-like approach, explored the where the true bases for participants' views with the goal of identifying previously unrecognized areas of agreements in underlying interests.

Sweden is one country that has developed a plan for management of radioactive wastes over the long term. This was developed using a technique called "scientific mediation," in which technical issues were identified and explained to political actors and the public, to facilitate understanding. Difficult and controversial issues were discussed openly by proponents and opponents. Ultimately, a policy for limited nuclear energy development, and for radioactive waste disposal, was developed, using a participatory process underlain by technical explanations.

There may be limits to what can be seen as legitimate areas for compromise on environmental decisions. People may feel that the government has core responsibilities for public health and the environment that should not be devolved to the local level. A hazardous waste siting act passed by the State of Massachusetts in the US, for example, provided monetary and technical support to allow communities to bargain directly with companies seeking to open hazardous waste treatment facilities. This program failed, apparently because the commitment of the government to these basic responsibilities fell into question. Similarly, an attempt by the US EPA to increase the role of the local community in setting standards for releases from a metal smelter in Tacoma Washington in the 1980s proved unsuccessful. This perception may vary in different political systems. France, for example, has a highly centralized and expert-driven government that has successfully sited nuclear plants.

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Biographical Sketch

Amy Kyle holds appointments as research scientist and lecturer in the Environmental Health Sciences Division of the School of Public Health at the University of California, Berkeley. Her work focuses on improving the use of scientific findings to develop sound policy for the protection of the environment and public health. Current projects include developing environmental health indicators that better describe

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Dr. Kyle teaches in the environmental health sciences program at the School of Public Health and in the Environmental Science Policy and Management Program at UC Berkeley and at the University of California at San Francisco.

Dr. Kyle also works as a consulting scientist on environmental science and policy issues for states and non-governmental organizations. She received a Switzer environmental leadership award to complete an analysis of the scope and public health significance of the accumulation of contaminants in fish.

She received her Masters of Public Health and PhD in Environmental Health Sciences and Policy from the University of California at Berkeley. Her undergraduate degree in physical sciences was from Harvard University.

Dr. Kyle has a background in public service. She served for five years as Deputy Commissioner for the Alaska Department of Environmental Conservation, a state agency responsible for environmental protection and for many public health functions. She worked on both state and national legislation on oil and hazardous substance spills, including the Oil Pollution Act of 1990 and several pieces of state legislation. Before that, she was executive director of the Alaska Coastal Management Program and was an analyst specializing in environmental policy in the Office of the Governor.