Regulation and Scientific Complexity: Decision Rules and Processes in the Occupational Health Arena

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# REGULATION AND SCIENTIFIC COMPLEXITY: DECISION RULES AND PROCESSES IN THE OCCUPATIONAL HEALTH ARENA

By Carolyn J. Tuohy*

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I. INTRODUCTION

Like most issues of public policy in an interdependent political economy, the control of health hazards in the workplace is economically, politically, and ethically complex. Economic markets are characterized by externalities, barriers to mobility, and transaction costs. The political process is marked by a diversity of interests, constituencies, and jurisdictions. Ethical considerations require the reconciliation of conflicting rights, duties, and values, and a confrontation of the political and economic effects of unequal endowments. And economic, political, and ethical decision-making is further hobbled by uncertainties about individual and social preferences, and by the fluidity of those preferences.

These economic, political, and ethical complexities and uncertainties, moreover, are exacerbated by fundamental difficulties in establishing the scientific "facts" about health hazards. The highly complex interactive effects of numerous factors in biological and ecological systems, and the methodological difficulties of investigating and predicting low-probability events raise barriers to lay access to relevant information and generate uncertainty and controversy within the scientific community itself. The lack of a comprehensible and established base of scientific fact further disables economic markets, reduces the ground available for political consensus, and weakens the possibility of informed choice.

If decisions are nonetheless to be made, decision-makers require some organizing framework to structure complexity and reduce areas of uncertainty. A variety of frameworks can be drawn upon, depending upon whether one is concerned largely with the economic, political, ethical, or indeed scientific dimensions of the problem. Whichever framework is chosen is likely to derive more or less heavily from one of two competing decision-making paradigms, which might be termed "analytic" and "cybernetic". Each of these paradigms seeks, in different ways, to organize problems so as to limit the necessity for the exercise of discretion and judgment; and each entails somewhat different modes for the resolution of conflict within this delimited

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1 Numerous attempts have been made to capture this distinction, from Lindblom's original distinction between "synoptic" and "disjointed incremental" decision-making, through distinctions between "rational" and (implicitly) non-rational approaches, to Lindblom's latest distinction between "synoptic" and "strategic" decision-making and Wildavsky's contrasting of "cognition and interaction". See Lindblom, The Science of Muddling Through (1959), 19 Pub. Ad. 79; Politics and Markets (New York: Basic, 1977) at 314ff; Dye, Understanding Public Policy (Englewood Cliffs, N.J.: Prentice-Hall, 1972); Dror, Public Policymaking Re-examined (Pennsylvania: Chandler, 1968); Wildavsky, Speaking Truth to Power; The Art and Craft of Policy Analysis (Boston: Little, Brown, 1979). None of these labels captures the distinction I wish to make, since each of the two paradigms sketched here can be seen in its own terms as rational, strategic, and even interactive. The analytic-cybernetic distinction is found in Steinbruner, A Cybernetic Theory of Decision (Princeton: Princeton U. Press, 1974), although Steinbruner himself prefers to use the label "cognitive" for the paradigm which incorporates a cybernetic processing of information within the structure of a belief system. See also Beer, The Brain of the Firm (London: Allen Lane, The Penguin Press, 1972); Schick, "Toward the Cybernetic State," in Waldo, ed., Public Administration in a Time of Turbulence (New York: Chandler, 1971) at 214.
area. Within the analytic paradigm it is assumed that complexity and uncertainty can best be dealt with through the comprehensive organization of information: by arraying all relevant and available data and preferences for consideration. Within the cybernetic paradigm, on the other hand, it is assumed that complexity and uncertainty can be dealt with only through selective attention to information: by attending only to certain critical variables which are to be kept within an acceptable range, or to certain sources of information—as identified by an integrated belief system.

II. ANALYTIC AND CYBERNETIC DECISION-MAKING

Within the analytic paradigm, policy-making is seen as a process that proceeds by explicitly comparing the probable costs and benefits (measured, with varying degrees of quantitative precision, in terms of all relevant values) of a range of alternative policies, and choosing the alternative with the greatest expected net benefit. It operates on the basis of a causal “blueprint” of the environment and provides for the on-going collection and processing of information to improve that blueprint. Where different centres of decision-making are involved, it is assumed that each will engage in a partisan analysis and that these analyses, while similar in form, will produce different preferred outcomes depending upon the values of the participants and the information available to them. The over-all resolution of differences, then, will involve negotiations over value trade-offs and attempts to demonstrate the validity of disputed information. Although most analytic theorists concede that control over political and economic resources enhances both the power of participants to bargain for favourable value trade-offs and the ability of participants to develop a persuasive and informed analysis, the rules of the game in this model are clearly those of rational calculation.

Within the cybernetic paradigm, on the other hand, much adaptive problem-solving behaviour occurs without such deliberate and explicit calculation. Indeed, most cybernetic theorists would maintain that, for many complex problems, attempts to estimate probable outcomes of a wide range of policy alternatives, and to calculate explicit trade-offs across a range of objectively incommensurable values will either stall the process in the calculation mode, dissipate its energy in conflict over values, or lead to erroneous choices the magnitude of whose effects makes them difficult to correct. Adaptive behaviour, in the cybernetic model, consists rather in the monitoring of a limited number of critical variables and the adoption of a limited repertoire of responses in sequence as necessary to maintain each of these variables within an acceptable range as indicated by feedback from the environment. No explicit prediction of outcomes, no marginal trade-offs of values are made in this model. Value conflicts are handled, not by maximizing a

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4 See, e.g., the discussion of “The Law of Large Solutions” in Wildavsky, supra note 1, at 63-67.
utility function, but by pursuing different values *seriatim* or by redefining the problem so as to deny the existence of value conflicts.

The separate pursuit of conflicting values occurs in part through a process whereby the problem is decomposed into relatively simple sub-problems that must be hierarchically re-integrated. "Standard operating procedures" characterize the lower levels of these cybernetic hierarchies, and "sequential attention to goals" the upper levels. On this basis, the problem-solving process operates on the basis of a "recipe," rather than a "blueprint," and provides for learning on a trial-and-error basis what works but not why it works.

The resolution of conflicting values without making explicit marginal trade-offs can also occur, within the cybernetic paradigm, because structure is imposed on complex problems not by analysis but by cognitive inference. The cognitive principles of reinforcement (and the weight of information in memory), of the seeking of consistency and stability in perception, and of social concurrence shape the development of the belief systems within which new information is interpreted. But these belief systems themselves are subject to change, at a number of levels, with persistent changes in the shaping influences or in incoming information. Persistent value conflicts, then, will lead not to explicit marginal trade-offs but to adjustments to the belief system—or a cessation to consider one or more values.

It will be the burden of this paper to show that, given the particular types of complexity and uncertainty that characterize problems of occupational health hazards (and particularly the scientific complications), neither analytic nor cybernetic strategies can be relied upon exclusively. In any public policy response to these problems, both approaches will exist in tension. The task in the policy arena, then, is to shape a pattern of response in which these tensions enhance, rather than frustrate, a capacity to resolve complexity and uncertainty. And the appropriate mix of analytic and cybernetic strategies will vary according to the degree and type of complexity and uncertainty in particular policy arenas. Let us consider more closely the dimensions of the problem in the occupational health arena.

A. **Scientific Complexity and Uncertainty**

The distinctive contribution of science to decision-making about control of occupational health hazards is, potentially, an assessment of the magnitude of the risk entailed. In the health hazard arena, however, such risk assessment is highly complicated. The complex etiology of many of the disease outcomes (often various forms of cancer) is imperfectly understood. Various contending biopathological models generate different hypotheses to be tested, and different interpretations of test results. Moreover, experimental and statistical method-

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ologies for hypothesis testing must themselves contend with problems of limited data. Because so much of the scientific debate surrounding health hazards surrounds questions of carcinogenicity, a brief tracing out of the cancer controversy will serve to illustrate some of the scientific issues involved in this arena.

One of the basic issues relates to the appropriate models of carcinogenesis. Although the understanding of the pathogenic processes involved varies with different types of cancer and different carcinogens, most theoretical approaches acknowledge the likelihood that most cancers result from complicated interactive processes involving more or less susceptible cells and a variety of carcinogens. But various models differ as to the physical or chemical nature of those processes, and the causal significance of external agents and genetic predisposition.

The lack of generally accepted causal models complicates the identification of carcinogens. And even when a particular factor or set of factors has been identified as posing a cancer risk, competing causal models may imply different "dose-response" relationships; that is, different assessments of the precise magnitude of the cancer risk at varying levels of occurrence of the carcinogen. In particular, there may be different judgments as to the existence of safety "thresholds" below which no risk exists.

Without a firm theoretical base for the assessment of cancer risks, decision-makers must rely upon statistical evidence regarding the relationship between certain factors and cancer incidence. Such evidence may be gathered through bio-assays in which animals are exposed to varying levels of suspected carcinogens in carefully controlled laboratory experiments, and through epidemiological methods relating the incidence of cancer in human populations to the occurrence of suspected carcinogens. Both of these types of evidence are open to challenge. The relevance of bio-assay evidence rests upon the assumption that carcinogenic processes in non-human biological systems are similar to those in human biological systems. The weaknesses of epidemiological evidence arise from the difficulties in applying scientific control techniques outside the laboratory to mobile human populations.

Furthermore, both bio-assay and epidemiological evidence usually require that cancer risks at low doses of a carcinogen be estimated using techniques of statistical inference in order to extrapolate from the observation of cancer incidences at high dose levels. The use of high dosage levels in bio-assays stems from the practical necessity of keeping the sample of exposed animals to a manageable and affordable size. As for epidemiological evidence, the long latency periods of many diseases means that the relevant data regarding "dose" are measures of exposure beginning twenty to thirty years before

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8 The size of the sample required for tests of statistically significant differences in the cancer rates of exposed and unexposed groups depends in part upon the magnitude of the differences one expects to find. The smaller the expected difference, the larger the sample required. Conversely, by increasing the dose and hence the likely magnitude of the difference, the required sample can be kept to a manageable size.
the clinical manifestation of the disease. But past exposure levels, which occurred before the development and refinement of control technologies, typically entail high doses.

Apart from the distribution of the data regarding dose and response, there are problems with their quality, particularly that of epidemiological data. Changes in measurement technology, units of measure, and reporting requirements over time and across jurisdictions make for inconsistencies in time-series and cross-national data on exposure levels. Data regarding the incidence of disease are weakened by problems of mistaken diagnoses, particularly where the disease is rare or its clinical signs non-specific; by disincentives for employers to retain records regarding illnesses related to hazards in the workplace; and by problems in tracking workers who have left the site of exposure—such tracking being essential in order to distinguish between the effects of cumulative dose and the effects of time since first exposure, as well as to ensure that the full incidence of disease is captured.

The significance for public policy purposes of this scientific debate over causal models and experimental methods is not only the uncertainty it creates but also its tendency to erupt into the political forum. The lack of resolution in the scientific arena provides a range of models and methods from which a selection can be made in the service of a political position. Furthermore, any selection can also be criticized from an opposing political viewpoint. Hence, models that attribute carcinogenic potential to congenital factors or to "lifestyle" factors such as cigarette smoking and diet are perceived among environmental and occupational health activists as part of a strategy by industrial interests to "blame the victim". Conversely, models that indict a wide variety of substances as carcinogens, either alone or in combination, are derided by industrial interests as the result of "cancerphobia".

Experimental methods, as well as causal models, are also subject to this sort of "politico-scientific" debate. The high-dose, non-human evidence of bio-assays lends itself to caricature in this forum. Hence, the bio-assay evidence implicating cyclamates as carcinogens has been derided by an American official because "an adult would have to drink 138 to 552 12 ounce bottles of soft drink a day to get an amount comparable to that causing cancer in mice and rats." Conversely, the theoretical and experimental difficulties of assessing low dose response have been interpreted to mean that no safe

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10 Whelan, "Chemicals and Cancerphobia," *Society*, March/April 1981 at 5-8. Similarly, a recent address to the Canadian Nuclear Association attributed negative publicity regarding the development of nuclear power to a phobic response, "Fear of N-Power much like phobia, MD tells meeting", *Globe and Mail* (Toronto), June 10, 1981 at 9, col. 3.

threshold can be proved to exist, and that the suspected carcinogen ought to be banned. In the absence of firm experimental evidence, such arguments are often bolstered by anecdotal evidence of low dose responses. Such evidence is scientifically of extremely limited value; in any given anecdotal case, the dose may not in fact have been small; and in any event, possibly confounding variables may not have been taken into account. Nonetheless, such evidence is striking, immediate, and when science defaults, often persuasive.

The frequency and importance of this type of controversy in the public policy arena has led a number of observers to identify the emergence of "trans-scientific" or "science policy" issues and to speculate about the appropriate techniques for their resolution. In coining the term, Weinberg identified "trans-scientific" issues as those which "can be asked of science and yet which cannot be answered by science. . . . Though they are, epistemologically speaking, questions of fact and can be stated in the language of science, they are unanswerable by science, they transcend science." 3

Trans-scientific questions, then, have the following characteristics. They can be framed in terms of systematic models or "causal blueprints" of physical reality. The empirical testing and validation of these models by scientific methods, however, is constrained in any of a number of ways. One of the most obvious is the ethical objection to testing on human subjects—a consideration that clearly constrains scientific investigation of carcinogens. Another is the insufficiency of available data, when the generation of sufficient data is impossible within given resource, time, or technology constraints. It may be necessary to test millions of laboratory animals, to monitor human populations over decades or even generations, or to develop more refined techniques of measurement. These constraints are partly technological and logistical and partly imposed by the policy process itself. Policy-makers, for a variety of political, economic and ethical reasons to be noted below, are unlikely to be willing either to defer decisions about health hazards for decades or generations or to commit the enormous resources entailed in "mega-mouse" or "mega-monkey" experiments.

The range of trans-scientific issues is hence potentially very wide. Any constraint on empirical testing reduces the certainty with which a scientific model can be validated, although these constraints are more severe in some cases than in others. Within this range there is a grey area in which scientific judgment shades into a broader "policy" judgment.

Despite the difficulty of teasing out their separate influences upon a given decision, there are important distinctions to be made between these two forms of judgment as to the likelihood of a model's validity. Scientific judgments turn upon such factors as experience with the relative power of experimental techniques, analogy with more firmly established models, or even an intuitive "feel" for the data. Policy judgments are essentially result-oriented. They may be shaped in part by attitudes to risk, and by either analytic or cognitive de-

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Regulation and Scientific Complexity

vices dealing with risk. They may also be influenced by the credibility of various sources of scientific opinion. But policy judgments are likely to be most heavily determined by the evaluation of their probable "results" against a range of economic, political, and ethical criteria: how will various political constituencies respond to an increase or a reduction in exposure levels?; is a change in exposure levels likely to increase or retard the growth or efficiency of particular industrial sectors or of the macroeconomy?; who bears the costs and who receives the benefits of changes in exposure levels, whatever the magnitude of those costs and benefits?

These policy criteria themselves are not unambiguous, however. Policymakers are faced with complex networks of interdependent interests and values, and with uncertainties as to individual and collective preferences. They are faced, indeed, with perversely circular problems. Given the present state of scientific complexity and uncertainty about health hazards, it is necessary for those making decisions about exposure to those hazards to make policy judgments about the likely validity of scientific evidence and inference. These policy judgments are complicated by economic, political, and ethical complexities and uncertainties. But these economic, political, and ethical complications themselves are exacerbated by the lack of an established body of fact accessible to lay understanding.

B. Economic Complications

If the labour markets in which health hazards occur functioned perfectly, the economic criteria for optimal risk allocation could be met by adopting the straightforward policy of letting the market operate. Voluntary exchanges would lead to a Pareto-optimal or welfare-maximizing point at which the sum of the social costs of health hazards and the social costs of investment in risk reduction would be minimized. Individuals, fully informed of the magnitude of risk associated with a given hazard and free to choose among jobs, would demand "risk premiums", in the form of higher wages, equal to the expected costs to themselves of exposure to that hazard in the workplace. Employers would invest in hazard abatement until the marginal investment equalled the marginal reduction in the risk premiums demanded as a result.

In reality, labour markets in the health hazard arena do not display such perfection. Barriers to labour mobility are present in some sectors, most notably in mining communities. Another barrier may be erected by the very identification of the hazardous substance: workers already exposed may be considered poor health risks by potential alternate employers. Externalities also exist. Some, such as contamination of workers' families or mutagenic and teratogenic effects, may be partially captured in the bargaining process between labour and management. But in other cases, such as the venting or discharging of hazardous substances from the workplace into the general environment, the interests of workers and third parties are not coincident. Third parties in

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14 I am grateful to my colleague Michael Trebilcock, from whose insights and analysis I have drawn heavily in this section. See Tuohy and Trebilcock, *Policy Options in the Regulation of Asbestos-Related Hazards: Royal Commission on Asbestos (Ont.)*, Study No. 3 (Toronto: Ont. Pub. Centre, 1982) at ch. 3.
such cases face substantial transaction costs and enjoy little bargaining power in any attempt to negotiate a reduction in emissions. These externalities may be captured to some extent by relatively long-term market adjustments such as lower real estate values, but even such long-term adjustments are likely to entail windfall losses to third parties in the short term.

Information problems compound these disabilities of real-world labour markets in allocating risk from health hazards. The magnitude of the health risks from given hazards, particularly carcinogens, is in most cases either unknown or shrouded in such scientific complexity and controversy that it is inaccessible to lay understanding. Even in cases in which the probabilities of various outcomes are relatively well-understood, individual attitudes toward risk exhibit some strange biases and discontinuities (strange, that is, when viewed within the analytic framework associated with the application of economic criteria, but not when viewed from a cybernetic perspective). There appear to be consistent tendencies to over-value long-shots—to exaggerate the true expected values of outcomes with low probabilities of occurrence but high pay-offs (positive or negative). Specific cases, furthermore, command greater attention than probabilistic data.15

When the probabilities themselves are uncertain, strategies to reduce this uncertainty are likely to be devised to a limited extent, if at all, on the basis of an analytic assessment of the marginal net benefit of additional information. Organized labour, unorganized labour, and third parties face (in ascending degree) substantial transaction costs and “free rider” problems in organizing information search and dissemination activities. The magnitude of these costs is likely to deter them from any marginal calculations regarding the value of such activities, and they are more likely to engage in cognitive shortcuts to give shape to the perceived scientific chaos:16 that is, to rely on negative logic,17 to engage in analogic thinking,18 or to make anchored adjustments.19 Finally, when mobility is in fact limited, the perceived conflict between job security and health risk may be resolved by ceasing to consider the latter.

It is not clear that these cognitive strategies lead to an over-all inaccurate estimation of risk. But this lack of clarity in turn gives employers no clear and consistent incentive to invest in risk-reduction technologies—it is likely to be less costly to join the “trans-scientific” debate.

15 These various cognitive biases are discussed in Nemetz et al., Regulation of Toxic Chemicals in the Environment (Ottawa: Econ. Coun. Can., 1980) at 48ff.
16 Steinbruner, supra note 1, at 103-20, provides a review of the literature regarding these and other cognitive devices.
17 Negative logic is the practice of foreclosing a line of investigation by accepting a single contradictory example, as when attempts to estimate safety thresholds of exposure are deemed unnecessary on the basis of anecdotal evidence of disease incidence at very low exposures.
18 An example would be the structuring of collective decisions as if they were household decisions.
19 That is, relating new information to an established conceptual structure, making only marginal adjustments to those structures on the basis of the new information as the need arises.
These market imperfections appear to provide economic grounds for some form of state intervention, but only if these state instruments are likely to be less imperfect. The range of potential instruments are intended in varying degrees either to rehabilitate or to substitute for market forces.

Market-oriented instruments include those that would mandate or subsidize the generation and provision of information about health risks to employees, such as requirements for employers to maintain programmes of compulsory medical information and record-keeping for employees, to monitor exposure levels, and to regularly disclose exposure levels and morbidity and mortality rates.\(^{20}\) The interpretation of such data would be highly controversial, however, given the lack of scientific control techniques implicit in the mode of collection, together with the problems of tracking workers who change employment and the long latency period of many diseases. To be effective in genuinely reducing scientific uncertainty, such data would have to be fed into a larger, collectively subsidized research enterprise. Moreover, while operating on one type of market imperfection, these information-based strategies leave others untouched—specifically, barriers to mobility, negotiating costs, free rider problems, and externalities.

Another essentially market-oriented strategy would operate through insurance-type instruments. "Risk rating", for example, would relate an employer's contribution to workers' compensation plans to the record of his employees for occupationally-related disease and to his safety record. Employers might also be permitted to base tax deductions for worker compensation contributions on average premiums for their industry, thus again rewarding those whose records earn them lower premiums, and penalizing those with poorer records. Still, the long latency period of the diseases involved and the role of intervening factors in their etiology, would make such risk rating either scientifically suspect or prohibitively expensive. Such schemes would appear to have more merit in the realm of occupational safety than that of occupational health.

In general, the market adjustments to these various forms of intervention could be expected to occur marginally and over the long term. Even if they were effective in economic terms, they do not meet political and ethical demands, which are essentially for a strong symbolic response to intense concern over threats to life, and for a redressing of imbalances in political and economic markets.\(^{21}\)

Somewhat greater constraints on the operation of labour markets might be imposed by stricter schemes of tort liability on the part of employers for illness incurred as a result of exposure to occupational health hazards.\(^{22}\) This option goes some greater distance toward meeting political and ethical con-

\(^{20}\) The existence and scope of such market-oriented instruments is discussed in Brown, Canadian Occupational Health and Safety Legislation (1982), 20 Osgoode Hall L.J. 90 at 91-92.

\(^{21}\) See discussion under "The Political Context" and "The Ethical Context", infra.

\(^{22}\) This option is explored at some length in Tuohy and Trebilcock, supra note 14, at 7.1-7.44. See also Pierce, Encouraging Safety: The Limits of Tort Law and Government Regulation (1980), 33 Van. L. Rev. 1281.
cerns. But as shall be discussed in a later section of this paper, there are substantial problems in litigating matters fraught with scientific complexities: problems in establishing fact and in finding fault, problems of scope, and problems of increased delay and cost.

Other instruments, such as exposure level taxes or public standard-setting, entail a more active role for the state. Taxing exposure levels seeks to impose upon employers the true social costs of the hazard, and hence encourages them to set exposure levels at a point at which the marginal social cost of investment in risk reduction equals the marginal social benefit of that reduction. A correct tax schedule is crucial to this approach, and the calculation of one requires knowledge of the true social costs of the hazard (that is, the marginal benefit function for risk reduction). Standard-setting may place even greater demands upon public sector decision-makers. Here it is the public sector decision-maker who must determine the welfare-maximizing exposure level, and who must therefore know not only the relevant marginal benefit function but also the marginal cost function.

These public sector decision-making processes are complicated not only by the scientific uncertainty and complexity that disables economic markets, but also by the complexity and uncertainty surrounding individual and social preferences, and by the intrusion of the incentive structures of standard-setters themselves into the decision-making process.

Economic complications, exacerbated by scientific uncertainty, confound all mechanisms, market and non-market, for achieving a socially efficient level of exposure to health hazards in the workplace. They may lead, on economic terms alone, to some slight preference for market-oriented intervention strategies as the least flawed options. But what is more significant from a political and ethical point of view is the tendency of economic criteria, with their emphases on social welfare, to ignore distributive implications, and the tendency of market-oriented strategies to take endowments as given in achieving their outcomes. In the public policy arena, economic criteria interact with these and other political and ethical considerations in shaping decisions.

C. The Political Context

From a political perspective, the problem presented by the issue of occupational health hazards is the need to respond to competing demands for action (or inaction) with a policy that will be supported by an effective coalition of affected interests. The effectiveness of a coalition can be defined in negative terms: an effective coalition removes potentially crippling vetoes that might thwart either the development or the implementation of the policy.

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23 See discussion under “Decision Rules”, infra.

24 See Tuohy and Trebilcock, supra note 14, at 8.4-8.15. Most of the literature relevant to the “exposure level tax” is to be found in the area of environmental health hazards. See, e.g., Spence and Weitzman, “Regulatory Strategies for Pollution Control,” in Friedlander, ed., Approaches to Controlling Air Pollution (Cambridge: MIT Press, 1978).
Given the number of points in the political system at which vetoes (or at least delaying tactics in many cases equivalent to vetoes) can be exercised, the building of an effective coalition of support is considerably more difficult than is the crippling of a policy. Furthermore, the building of effective coalitions in particular policy areas must be accomplished in the general context of maintaining or extending the base of political support for governmental policymakers themselves. These complex decisions must be made in the context of considerable uncertainty, not only regarding technical aspects of policy but regarding constituency preferences.

Political decision-makers in Canada currently face a diffuse demand for the control of both occupational and environmental health hazards. Indeed, although the interests at stake in the workplace environment are not identical to, and are at times in conflict with, those in the general environment, public concern about hazards in one arena tends to reinforce concern in another. Hence, workers have been likened by some environmentalist spokesmen to human “early warning systems” analogous to the canaries once used to detect toxic gases in mines; and, conversely, concern over asbestos in public schools in Ontario has heightened public concern over the mineral as an occupational hazard.26

In part, this diffuse demand stems from a general concern, partly induced by government,26 about preventive health measures in the face of higher than average inflation rates in the curative medical care industry.27 And in part it arises from media attention to the agenda setting and maintaining activities of environmental and occupational health activists in the United States and to certain dramatic events at home. The demand, however, is volatile and its configuration uncertain, particularly as public perception moves through what Downs has termed the “issue-attention” cycle: the initial “alarmed discovery” of health hazards gives way to a focus on the costs of controlling those hazards, which in turn eventually yields an institutional response. The cycle is completed by a fading of public concern.28

Downs applied his analysis to the general issue of environmental pollution, but it is important to recognize that within the general issue-attention cycle of a problem such as environmental pollution there are a series of individual issue-attention cycles relating to particular hazards—a series that prolongs the life of the general issue but complicates the policy response. In both the workplace and the general environment, threats to health, each affecting a different numerical minority, become apparent at different times. Sequential

attention to these threats keeps the general issue on the political agenda. But the fact that different groups are beneficiaries or cost bearers of different hazards at different times makes political log-rolling complicated, institutional fragmentation likely, and hence substantially increases the negotiating costs of reaching a decision.

Furthermore, despite this general concern, the configuration of demand and support for policies in this area has not solidified. In large part, this stems from the difficulties of sorting out wins and losses from risk reduction measures.

Almost all occupational and environmental health measures involve more or less costly changes in production processes. There may be some offsetting benefits for industrial interests, such as technological innovations that allow for the recapture and use of material previously discharged into occupational and general environments or increased worker productivity through decreased absenteeism and disability. Widely ranging estimates of such costs and benefits to industry have characterized the political debate over the control of occupational health hazards. But whatever the costs, they are likely to be borne largely by industry in the first instance, and the ability of industry to pass those costs along to consumers or back to employees depends upon the particular characteristics of the product and labour markets in question.

There is no similarly concentrated constituency of perceived beneficiaries from occupational and related environmental health measures. It cannot be assumed, as some commentators do, that workers perceive themselves as unambiguous winners from controls on occupational health hazards. Unless such controls are accompanied by substantial compensation to those workers already exposed, which has not happened in the past, controls on health hazards may be of dubious perceived benefit to workers with relatively long histories of exposure to such hazards. Such controls may be seen as likely to threaten jobs and hold down wages by increasing production costs. And employees may fear that publication of the impaired health status of exposed workers will reduce their opportunities for alternative employment. Health hazards may therefore not be identified by workers most heavily exposed. Nonetheless, once hazards have been identified, organized labour may respond in defense of the interests of potentially or lightly exposed workers. Furthermore, as the actual cost of compliance becomes clearer through the process of policy development and implementation, the perceived threat to jobs and wages may decrease, and labour’s support may become firmer.

It is not surprising, then, that organized labour has not been an agenda setter regarding health hazards in the workplace, either in Canada or the United States. The initial identification of health hazards and pressures for control have almost invariably come from groups associated with, but outside, organized labour, from environmental groups, or from within government.

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agencies. Unions have tended to react to proposals once formulated and to provide political support for control measures once established.

Environmental interest groups contribute to setting the occupational health agenda, and often enter the arena in alliance or in competition with other interest groups. These environmental groups, however, face even greater difficulties in identifying and mobilizing constituencies. To develop political support by emphasizing widespread wins rather than widespread losses from the control of health hazards, citizens' lobbies or public interest groups have relied heavily on ideology and symbolism, in particular what McFarland has termed an ideology of "civil balance", emphasizing the need for citizen action to counterbalance the concentrated power of elites in the policy arena. Their tactical approaches to influencing policy, on the other hand, have in the United States and increasingly in Canada, focused on the building of ad hoc coalitions with politicians, journalists, agency officials and other pressure groups, as well as the extensive use of public interest litigation, all backed by substantial research and analysis.

In Canada, the existence of the New Democratic Party (NDP) as a forum of concern for both occupational and environmental health issues is of considerable political significance. Canadian institutional arrangements make both ad hoc coalition building among legislators and bureaucrats and public interest litigation considerably more difficult than in the United States. In the face of these difficulties, the NDP provides an electoral vehicle. Through its association with organized labour it has been concerned with the workplace environment. Its ideological distrust of concentrated corporate power, particularly multi-national corporate power, gives it an ideological affinity with environmentalist groups. Hence the pressing of these issues in Canada has been more closely tied to the agenda of a political party than has been the case in the United States.

In both the United States and Canada, the ideological forces bearing on the issue of controlling occupational health hazards include the current public policy ethos of "deregulation". So far, the regulation of health hazards seems to be virtually the only major area in which there is considerable support for a continued or increased governmental regulatory presence—support in public opinion and at the policy-making level. Nonetheless, in the United States,

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31 Canadian public opinion data in this area is, unfortunately, thin. Data from the United States suggest majority support in the order of 52 percent for occupational health and safety regulation (with 12 percent opposed and the remainder having no opinion). Support for environmental protection regulations was found to be considerably stronger at about 70 percent; reported in Levin, Politics and Polarity: The Limits of OSHA Reform (1979), 3 Regulation 33 at 39.
32 The areas of occupational and environmental health were the only exceptions to the general "deregulatory" sweep of the recent report of the Economic Council of Canada on its Regulation Reference. The Council firmly advocated a strengthening of governmental regulation in these areas. Economic Council of Canada, Reforming Regulation (Ottawa: n. pub., 1981) at 126-29, 112-14.
the establishment of a cabinet-level Task Force on Regulatory Relief, the character of recent appointments to regulatory agencies, and the proposals to relax standards under the Clean Air Act now generating substantial conflict in Congress indicate a strong ideological commitment and political will within the federal administration to deregulate in the area of health hazards; and the American example could well strengthen similar ideological currents in Canada. Indeed, the ideological tensions currently playing about the revisions to federal occupational health and safety legislation have been apparent in the federal labour minister's rhetoric in separate addresses.

In general, one should not over-emphasize the impact of the deregulatory ideology in Canada, particularly given the entrenchment of regulatory instruments in the political economy of this country. It is, however, likely to have an impact on political rhetoric and symbolism, and may lead to attempts to streamline regulatory instruments through omnibus legislation, consolidation of inspectorates, and reduction in paper burden.

A final type of political complication is introduced by the fragmentation of institutional authority. In Canada, institutional responsibility for policies relating to hazardous substances in occupational environments is divided not only between federal and provincial governments but also within both levels of government. The Ham and Beaudry Commissions observed that jurisdictional conflicts among provincial government agencies and departments in both Ontario and Quebec created, by default, situations in which industry was enabled essentially to regulate itself. A number of governments—Saskatchewan in 1972, Ontario in 1978, and Quebec in 1979—have attempted to consolidate legislative occupational health and safety provisions and the responsibility for their administration. Similarly, a consolidation of occupational health and safety provisions and revisions to Part Four of the Canada Labour Code are currently under way at the federal level.

These intra-governmental consolidations, however, do not directly address inter-governmental problems. Few formal mechanisms of inter-governmental

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34 In one address, Gerald Regan stated that "the politically fashionable cry for deregulation cannot be allowed to detract us from making workplaces safer." In another, however, he spoke approvingly of deregulation and, employing an increasingly popular means of reconciling an increased regulatory presence with a deregulatory ethos, advocated a more self-regulating occupational health and safety system; List, "Regan contradicts himself on whether to streamline work-safety provisions", The Globe and Mail (Toronto), June 20, 1981 at 16, col. 1.
co-ordination exist. Jurisdictional conflict in Canada has been handled less through formal measures than through the delegation of substantial discretion to administrative officials who then negotiate enforceable positions with each other and with those who must comply.40

Governments, then, are faced with fragmented, diffused, and shifting demand from the potential beneficiaries of policy changes, and integrated demand from the potential cost bearers. They also face high decision-making costs: high information costs are entailed in coming to grips with complex and controversial scientific and technological evidence relating to health hazards, and high transaction costs are entailed in mobilizing fragmented institutional authority in response. In such circumstances, political science would suggest that governmental responses will focus on structural change, delegating to an issue-specific body the tasks of generating relevant information, mobilizing institutional authority, and negotiating with affected interests.41

This type of policy response makes sense within either an analytic or a cybernetic paradigm of political decision-making. In analytic terms, it is rational for legislators to reduce their own transaction costs by delegation to an agency that has established or can establish expertise and a relevant policy network, as long as they, the legislators, can be seen on a symbolic level as having responded to demands for action. Given great uncertainties about volatile constituency preferences, moreover, it is rational for legislators to keep their response as general as possible. The need for discretion is further increased given that affected interests possess the organizational, technological, and financial resources to obstruct or support policies, and that policies must therefore be negotiated with those interests.

The delegation of discretionary standard-setting authority to a specialized agency is consistent not only with a rough calculation of the political costs and benefits of various policies in the present context, but also with the weight of past experience and established political routines. The propensity to grant broad discretionary powers to specialized agencies at both federal and provincial levels in Canada has been extensively documented.42 Diffuse demand for protection from potentially hazardous substances has traditionally provided the cue for governments to delegate to officials authority to negotiate quality standards with the providers of these substances. And the use of flexible standards is more readily available in the Canadian political repertoire than are,

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40 Doern, for example, has noticed the tendency to charge provincial officials with the enforcement of federal guidelines and standards, which may not be consistent with provincial standards, and to be granted considerable discretion in applying these various standards. See Doem, The Political Economy of Regulating Occupational Health (1977), 20 Can. Pub. 22 at 27-29. A somewhat similar situation exists in the environmental area; see Nemetz, supra note 15, at 157-59.


for example, civil liability remedies or more market-oriented strategies. A cybernetic approach would favour the continuation of similar responses in the absence of feedback indicating that they were no longer capable of maintaining an effective coalition of support.

The delegation of authority, of course, does not obviate the need to deal with political complexities and uncertainties. It simply establishes the forum, the standard-setting body. From an analytic perspective, the task of such a body is to discover and to make hard trade-offs among the preferences of affected constituencies. From a cybernetic perspective, the task is more likely to be seen as the shaping and mutual adjustment of those preferences. The implications of these differences will be more fully traced out in a later section.43

Although these two approaches to political thinking differ as to whether preferences are to be taken as given, they both accept political and economic endowments or resources as given. In the policy arena, however, ethical considerations prevent this simplification from being made and introduce yet another set of complications.

D. Ethical Dilemmas44

The major complications introduced into the policy-making process by ethical considerations concern the distribution of health risks among individuals as human and social beings.

One of the major ethical considerations is the assertion of a “right” to life that constrains both the allocation and the distribution of health risks. One of the major tensions in modern ethics, both at the level of philosophical discourse and at the level of popular belief systems, concerns the extent to which such a right can be considered absolute or contingent upon a range of other social and individual values. One major stream of thought finds such a “natural” right inhering in each individual, deducible from his essential nature as an autonomous being, and subject to curtailment only by his free consent. Another finds the basis of a right to life in its instrumental value for the attainment of all other valued things and, hence, presumably curtailable without consent only when it ceases to have such instrumental value— as, arguably, in cases of irreversible coma. And a third major stream, a utilitarian approach, would find all rights and obligations, including those relating to life, contingent on social utility.

The intermingling of these streams of thought has led to a concept of life, if not as an absolute right, at least as in a category of “specially valued things”. It is often argued that life, like love and friendship, cannot be subjected to a utilitarian calculus without destroying its “special value”.45 Even from a utilitarian perspective, life has been considered in a special class of

43 See discussion under “The Institutional Framework”, infra.

44 I am indebted to Michael Trebilcock and Alan Brudner for their contributions to my thinking about ethical issues in the occupational health area. See Tuohy and Trebilcock, supra note 14, at ch. 5.

social utilities "vastly more important and imperative than any others," to be "guarded by a sentiment not only different in kind but in degree."46

A thoroughgoing utilitarian perspective, however, would not differ substantially from the economic perspective presented earlier; it accepts a criterion of Pareto-optimality for the allocation of risk, and is not troubled by unequal distributive outcomes. That these outcomes will be heavily influenced by unequal endowments is inevitable, given the basic engine for achieving Pareto-optimal outcomes: an exchange economy characterized by freedom of accumulation.

In distinction to this utilitarian approach, however, much modern ethical philosophy finds it possible to assess the distributive outcomes of the operation of economic markets—and of political forces—as morally objectionable on a number of grounds. Taking the innate freedom and dignity of the individual, as opposed to social welfare, as its focus and ultimate criterion, this body of thought takes an essentially procedural approach to questions of distributive justice.

In some versions, the approach is explicitly procedural. A just outcome in this view is that to which the affected parties freely consent. To the extent that individuals are coerced into the bearing of health risks, the distribution of those risks is unjust.47 And this coercion may, of course, be political or economic as well as physical in nature: it may stem from the unequal distribution of political and economic resources.

In another stream of thought, the procedural aspects of the criterion of distributive justice are more implicit. Rawls' *A Theory of Justice*48 argues that just outcomes are those to which any of the affected parties would assent if he assessed it behind a "veil of ignorance" as to his own position in the resulting distribution. Under this criterion, one distribution of risk is to be preferred to another not simply if it improves someone's position while leaving no one worse off, but only if it improves the position of the least advantaged. Ultimately, such judgments would tend to an equalization of risk.

These more or less conflicting ethical principles have at least one thing in common: they are essentially analytic in nature, and turn heavily upon an ability to assess the magnitude of health risks. From an ethical perspective, then, there is a strong argument for the reduction of scientific uncertainty to the greatest extent possible. And in at least one ethical view, the marginal benefit of information (that is, reduction in uncertainty) is to be measured not as its social benefit but as its benefit for the potentially least advantaged individual in the existing distribution of risk.


But given the scientific complexity and uncertainty that, in addition to political and economic inequalities, constrains informed consent, how are ethical decisions about health risks to be made? Perhaps two criteria can be drawn from the varied philosophical opinions sketched here, both relating to the process of decision-making. In the first place, the process should be participatory: it should involve all affected interests in a way that removes as much as possible the barriers to their free and informed consent. In the second place, it should be deliberative: it should recognize the “special value” of life and should seek a deliberate reconciliation of that value with competing values and obligations.

It is likely that in this participatory and deliberative process, the competing values themselves will be shaped and their weights adjusted, that belief systems will evolve over time. In a similar vein, from a jurisprudential point of view, Fuller has described social decision-making processes as involving “not . . . disembodied ‘values’ but . . . human purposes actively, if often tacitly, held and given intelligent direction at critical junctures.”

III. THE CHOICE OF OPTION: STANDARD-SETTING

The most common governmental response (other than inaction) to occupational health hazards has been the establishment and enforcement of standards limiting workers’ exposure to those hazards. As argued earlier, there are compelling political reasons for the popularity of this response across jurisdictions and even across types of political systems. The political imperative for governmental decision-makers is to be seen to respond to a broad and diffuse constituency of concern over health hazards while maintaining sufficient flexibility to bargain with those concentrated interests who hold vetoes over effective policy development and implementation. The promulgation of a control standard, which is usually expressed as a maximum exposure level measured on a graduated numerical scale, is well suited to these political purposes. Such a response symbolizes control while allowing for negotiation of the level at which the standard is to be set and the de facto range around this standard within which exposure levels are judged acceptable in the enforcement process. These potential political advantages depend to a large degree upon characteristics of the standard set and of the standard-setting process itself.

Further, more than any other instrument under review, the design of the standard-setting process can potentially be adjusted to take account of ethical considerations; to redress imbalances in the ability of affected interests to influence decision-making about health hazards. The realization of these ethical advantages, however, is not likely to occur without sacrifice of some political advantages. Both political and ethical considerations, in other words, argue in favour of a programme of administered controls on exposure; but the two frameworks may well dictate different designs for such a programme.

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50 See discussion under “The Political Context”, supra.
A standard-setting approach also offers several scientific advantages. More than private bargaining or judicial or fiscal instruments, it can be structured to provide for direct scientific participation in the determination of exposure levels. And in comparison, at least to private bargaining and judicial instruments, it is likely to generate through its monitoring component a more consistent, comprehensive, and centralized record of exposure levels over time.

Strong support for this policy option, then, can be generated from political, ethical, and scientific perspectives. It is primarily from an economic perspective that a programme of administered standards appears less attractive. Economic analysis, as discussed above,\textsuperscript{51} demonstrates that market forces are unlikely to lead to a socially optimal allocation of risk. But it also demonstrates that the varied informational difficulties that hamper the efficient operation of the market are also likely to lead to errors on the part of standard-setters, even assuming they seek to approximate efficient market outcomes. Furthermore, to the extent that the programme is designed to take account of distributive concerns on political or ethical grounds, Pareto-inefficient outcomes may well be chosen over Pareto-efficient outcomes. Socially acceptable levels of risk, in political or ethical terms, may not be socially optimal from an economic perspective. Despite these fundamental critiques of administered standards as a means of achieving socially optimal levels of risk, however, economic analysis does discriminate among different programme designs on the basis of their relative efficiency in enforcing exposure levels once the levels themselves have been established.

The extent to which the potential political, ethical, and scientific advantages of a programme of administered standards are realized, and the relative efficiency with which they are realized, depends upon the design of the programme; on how and by whom standards are set. It depends, in other words, upon the decision rules employed, and the institutional framework within which they are employed.

IV. DECISION RULES

The contrast between analytical and cybernetic decision-making has been identified and referred to throughout this paper, but nowhere is it more apparent than in the designing of a standard-setting programme. Can a standard-setting programme impose an analytic rationality upon the determination of levels of exposure to hazardous substances? Should this framework be imposed, or is a programme design based on cybernetic principles more attuned to the realities of human decision-making and hence more feasible? In practice, these general questions are formulated as a debate over the relative merits of a number of decision rules as guides to the determination of acceptable risk.\textsuperscript{52}

\textbf{a) Zero Risk—The “Delaney” Principle:} On its face, the simplest decision rule would appear to be to tolerate \textit{no} risk. This is the principle behind

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\textsuperscript{51} See discussion under “Economic Complications”, \textit{supra}.

\textsuperscript{52} A similar categorization of decision rules is to be found in Nemetz, \textit{supra} note 15, at 195-239.
the 1958 Delaney Amendment to the \textit{Federal Food, Drug, and Cosmetic Act}\textsuperscript{53} in the United States, which prohibits the introduction to food of any additive found to be carcinogenic in either animals or humans.\textsuperscript{64} The implementation of a zero risk principle may involve either a ban on the use of the suspect substance, or the reduction of exposure to zero or to a level at which there are no detectible adverse effects—the safety threshold.

b) Technological Feasibility: Several jurisdictions tie the reduction of risk to the capability of control technology by requiring that risk be reduced to the extent possible with the "best available technology" or the "best practical means". Typically, technology-based criteria have been interpreted to imply economic as well as technological feasibility, and have provided channels for the introduction of explicit cost-benefit analysis in the selection of standards. As Nemetz \textit{et al.} have put it, "'best' implies some consideration of benefits from the regulation, while 'practicable' implies attention to economic feasibility."\textsuperscript{55}

c) Weighing Costs and Benefits: Increasingly, regulatory decision-makers are being pressed to make their decisions on the basis of an explicit weighing of costs and benefits of alternative policies, choosing only those alternatives whose benefits justify their costs. The least stringent cost-benefit criterion is one of cost-effectiveness: the minimizing of costs for a given objective; or the maximization of benefits for a given cost. Many practitioners would distinguish cost-effectiveness analysis from cost-benefit analysis entirely. Another criterion of comparison more consistent with the underlying theory and purpose of cost-benefit analysis is the ratio between benefit and cost. The quintessential cost-benefit criterion, however, is the maximization of net benefit. It is important nonetheless to recognize that there is in fact neither standard doctrine nor standard practice in cost-benefit analysis—although disagreements at the doctrinal level are less substantial than are divergences among actual practices and between practice and doctrine.

Let us consider briefly how each of these decision rules is likely, in the context of the scientific uncertainty and complexity surrounding health hazards, to respond to the economic, political, and ethical concerns in this arena.

Economically, the weight of approval is clearly with the explicit weighing of costs and benefits and the application of a cost-effectiveness, maximum net benefit, or cost-benefit ratio criterion. Fundamental economic concepts of welfare maximization or at least of technical efficiency underlie these prescriptions, and economic debate largely focuses on the application of particular criteria and techniques in given situations. The zero risk principle violates the most fundamental of economic principles by deeming opportunity costs irrelevant. The best available technology principle, to the extent that it smuggles in

\textsuperscript{55} \textit{Supra} note 15, at 198.
cost-benefit considerations, is more acceptable from an economic perspective, although there is considerable skepticism as to the efficiency and feasibility of this approach in practice. Similarly, it seems reasonable to argue from an economic perspective that if the best available technology principle is acceptable because it implies cost-benefit considerations, it is even more preferable to bring these considerations fully to light, while treating technological resources as a constraint.

The major economic reservation regarding explicit cost-benefit analysis relates not to its principles but to its feasibility, given pervasive uncertainties and imperfect measurement instruments. Relevant factors may be omitted in the specification of the models predicting future outcomes. The parameters of the model may be wrongly estimated because of problems with the format or the accuracy of available data. The difficulty of estimating one parameter—such as the effect of exposure level on disease incidence—when data are clustered in high dose regions has been noted above. Wrong assumptions may be made about the stability of the parameters over time, particularly if they are sensitive to the effects of omitted variables. Mortality rates, to take one of the starkest examples, may be profoundly affected by changes in therapeutic technology. Future changes in the levels of the factors outside the scope of the regulatory policy (such as discount rates or even, more narrowly, corporate tax rates) may be wrongly projected. An even more fundamental source of error lies in uncertainties about preferences regarding valuation of intangibles (such as years of life, disability, anxiety, and bereavement) that are not traded on markets.

Recognizing the possibility of such errors of assumption and technique, analysts often seek to test the sensitivity of their results to changes in model specification, parameter estimation, and projected values. Where results are fairly robust with respect to such changes, they can be more confidently accepted. Unfortunately, models relating to health hazards deal in very low probability ranges, in which changes of a fraction of one percent in estimated probabilities can have substantial effects on estimated outcomes. This is particularly the case where large values are involved, or where several low-probability parameters have compound effects.

In most cases, however, it is probably fair to say that the precision and rigour of the techniques involved in a cost-benefit analysis far surpass the precision of the data to which they are applied. Standard-setters are typically heavily dependent upon the regulated industry for data regarding likely capital and operating costs of compliance, production functions, and likely alternative resource uses. The accuracy of industrial responses to such data requests is likely to be reduced by real uncertainty, especially as to alternate uses, and by a clear incentive for industrial interests to bias upwards their estimation of compliance costs.


67 See text accompanying note 8, supra.
The estimation of benefits is similarly hobbled by data problems. The lack of firm scientific evidence upon which to estimate the parameters of a predictive model has been treated at some length above. Furthermore, data regarding the age structure, years of exposure, and health status and habits of the exposed population—all of which are ideally to be incorporated in a model predicting the effect of changes in exposure levels—is rarely available. The logical sources of such information (unions and labour ministries) have lacked either the will or the resources to assemble it.

From an economic perspective, such reservations may lead to a prescription for more rather than less cost-benefit analysis; that is, for staged cost-benefit analysis as more information, including the effect of incremental policy changes, becomes apparent. Furthermore, the undertaking of the analysis itself may be subjected to cost-benefit considerations, to ensure that it is undertaken only to the extent that the additional information it will generate at any point in time is at least equal in benefit to its marginal cost.

Cost-benefit analysis, particularly the flawed version possible in the present state of the scientific field, responds much less well to the ethical implications of the health hazard arena. Ethical considerations support, and may indeed prescribe, a clear setting out of the incidence of the costs and benefits of a policy, an identification of the winners and losers and the extent of their wins and losses. But cost-benefit analysis, with its emphasis on social costs and benefits, tends to mask these distributive implications; to be insensitive to the fact that a change which increases net social benefit may leave a particular segment of society much worse off. Furthermore, certain of the techniques of cost-benefit analysis tend not only to mask but to bias distributive outcomes.

Several of these biases stem from the methodological choices made in estimating the present value of future streams of costs and benefits, particularly where these outcomes are intangible. Valuing lives in terms of foregone earnings or foregone tax payments, to take the most egregious example, clearly places a higher value on the lives of high income earners and large taxpayers than those of low income earners and welfare recipients. Valuing reduction of the incidence of disease in terms of medical expenses saved places a higher value upon the prevention of chronic, disabling diseases as opposed to those that are swiftly fatal. High discount rates lead to a preference for immediate benefits and deferred costs (and against policies with immediate costs and deferred benefits), and hence discriminate against the interests of the young and of future generations.

Cost-benefit analysis can in theory be made to address explicitly distributive issues, although it cannot resolve them. Net benefit can be calculated for groups within society as well as for society as a whole, and the results arrayed for judgment. In such cases, cost-benefit analysis may at best clarify the options, but it cannot provide the criterion of choice.

Cost-benefit analysis may also discriminate against the consideration of

58 See discussion under “Scientific Complexity and Uncertainty”, supra.
intangible values at all. In the valuation process, for example, the techniques of deriving "maximum net benefit" or cost-benefit ratios (optimizing techniques such as linear programming and the calculus of constrained maximization) and the application of discount rates require that the value of positive and negative outcomes be measured on a ratio scale (a scale with equal intervals and a zero point). Hence, levels of bereavement, for example, if they were to be included in the analysis would have to be expressed on a scale such that two widows could be said in a real sense to suffer twice as much as one. Given that such measures would be so arbitrary as to be ludicrous, it is preferable to omit them from the formal process of predicting and valuing outcomes entirely. The analyst may still, of course, flag intangible costs and benefits for consideration alongside the prescriptions of the formal analysis, but cost-benefit criteria provide no guidance for their inclusion in the final judgment.

The problem of valuing intangible benefits in units compatible with cost-benefit criteria and techniques cannot, however, be avoided in the case of the central benefit of reducing exposure to health hazards: the increase in years of healthy life. Problems of valuing life have generated an extensive literature and, as specific occasions arise, heated public debate. 60

Some analysts seek, 60 sensibly, to avoid these various problems by defining the present value of future years of healthy life in terms of what individuals are willing to accept in order to assume risks of future illness—the "risk premiums" noted earlier. 61 But in the real world individuals make decisions about accepting these premiums in the context of very imperfect markets characterized by information gaps and mobility constraints. Furthermore, those individuals who choose to accept particular risks may well be atypical of the broader class of individuals who might be exposed to those risks. As Zeckhauser has pointed out, those whom we observe accepting risks are likely to be those who for one reason or another value those risks least in relation to the benefit they receive for assuming them. 62

Willingness-to-pay measures are further limited in that they capture at best only the valuations that an individual himself (and perhaps his family) places on the value of reduction of risk to his life. One response to these criticisms might be to look for measures of society's willingness to pay for risk reduction in a given situation by observing its revealed preferences in analogous situations. But these social decisions are taken in the context of limited information, and are constrained by political configurations particular to speci-

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61 See discussion under “Economic Complications”, supra.
62 Zeckhauser, supra note 59, at 436.
Specific hazards; and the following of revealed preferences may simply mean that the blind and the halt in one area lead the blind and the halt in another.63

In general, given the seemingly intractable difficulties in valuing life in units common to those used to measure other benefits or costs of a policy, some analysts would abandon the quest and seek at best to perform a cost-effectiveness analysis of the number of lives or years of life that can be saved at various levels of cost—in the present context, the number of lives or years of life saved with more or less costly exposure standards.64 This approach may well be the only feasible one as long as standards are adopted on a hazard by hazard basis. A higher or lower level of exposure to a given hazard increases or decreases total risk to life; it does not redistribute risk from one life to another, and one simply assumes that adding to the pool of years of life saved is better than subtracting from it. If one is considering the cost-effectiveness of investing in setting standards relating to different hazards, however, different lives are involved. Unless one is prepared to assume that "a year of life is a year of life" to whomever it accrues at whatever point in a lifespan, one is left again with the problem of valuing these lives according to a metric that allows them at least to be compared to each other.

More fundamental than the objection that certain values cannot be incorporated (at least not without great strain and potential bias) in a cost-benefit analysis is the ethical objection that certain values ought not to be subject to a cost-benefit criterion. This is the argument, traced out above,65 that there is a right to, or at least a "special value" in, life, which cannot be outweighed in a utilitarian calculus involving market-traded values, but rather, must be reconciled with competing values and rights in a process of moral judgment. In this sense it may be possible to speak of the right to a safe workplace that must be reconciled with the danger of requiring such a high level of safety that the workplace itself disappears.

The ethical complexity of the health hazard arena would seem to admit of no straightforward decision rule. The zero risk principle appears from an ethical perspective to be an attempt to avoid the difficult moral judgments implicit in investing in risk reduction in one area as opposed to another. The best available technology principle may at best provide sufficient flexibility and discretion for such judgments to be made, but to the extent that it pro-

63 In an attempt to determine the implicit criteria governing social decisions regarding risk, Starr has reviewed revealed social preferences in various areas of activity; Social Benefit and Technological Risk (1969), 165 Science 1232. Most commentators, however, point to the apparent inconsistencies in such decisions; see, e.g., Zeckhauser, supra note 59, at 447-49; Dobell, "The Arithmetic of Risk", Policy Options, June/July, 1980 at 53-55; Okrent, Comment on Societal Risk (1980), 208 Science 372.


65 See text accompanying note 45, supra.
vides direct guidance it is likely to become tantamount to a cost-benefit cri-
teron.

If the resolution of ethical complexities requires deliberate moral judg-
ment, at best informed by, but not restricted to, cost-benefit calculations, it
matters very much whose judgment is brought to bear. What is to prevent
the process of decision-making from degenerating either into confrontation and,
as one critic has put it, "holy war" among interest groups each claiming
"rights" and "special value," or into a paternalistic autocracy of regulators
with virtually unlimited discretion to make "moral judgments"? Clearly, we
are into the realm of politics, and need to consider the political implications
of these various decision rules.

The zero risk principle has a certain face attractiveness as a political
position. It accords with what Zeckhauser terms the social myth, as opposed
to the ethical axiom, that life is priceless. Furthermore, it promises to provide
political decision-makers with a clear and simple cue: it delegates to scientists
the investigation of the question of the existence of risk and asks only for a
yes-no response. The repertoire of policy responses to that cue is almost as
simple. In its purest form, the zero risk principle implies a ban on the use of a
hazardous substance. In practice, because of the severity of this instrument,
 attempts to impose a ban may lead to either substantially higher or substanc-
tially lower levels of protection against health risks than might prevail under
other decision rules.

In political debate surrounding hazard control, the imposition of a ban
is likely to turn less upon scientific evidence than upon political mobilization.
Of all the policy responses, it offers the highest rewards to successful political
mobilization—the winner literally takes all. Despite the fact that under this
principle no risk is to be tolerated whatever the potential benefits, maybe the
bearers of the costs of a ban will introduce considerations of foregone benefits
into the political debate while seeking to minimize evidence of risk. In such
circumstances, unless the scientific evidence is overwhelming, science itself is
unlikely to determine the outcome. Science does not lend itself to categorical
judgment. The results of epidemiological surveys and bio-assays are probabi-
listic in two senses: they estimate risk, and the estimates rest upon statistical
techniques that offer less than one hundred per cent confidence in their ac-
curacy. Opponents of the ban are likely to challenge such estimates on meth-
odological grounds, and to focus the debate on the question of how sure we
must be that a substance is risky before entirely foregoing its benefits. Pro-
ponents of the ban are likely, on the other hand, not only to defend the scien-
tific evidence, but to supplement it with reference to individual cases of di-
sease incidence at allegedly very low levels of exposure. Such cases may have
a persuasive power far beyond their scientific merit. appealing as they do to

66 Delong, Defending Cost-Benefit Analysis: Replies to Steven Kelman (1981), 5
Regulation 39 at 40.

67 Butters, Calfee, Ippolito, Defending Cost-Benefit Analysis: Replies to Steven
Kelman (1981), 5 Regulation 42.

68 Zeckhauser, supra note 59, at 447.
cognitive preferences for negative logic and specific cases as opposed to probabilistic data, and to the emotional significance of identifiable suffering.

Other, less draconian forms of implementing a zero risk principle, such as the reduction of exposure to zero or to a safety threshold through control technology, entail somewhat different political dynamics. Under a ban (unless it is selectively imposed or unless a black market develops), producers and consumers of the banned substance eventually adjust to its absence and dissolve as political constituencies. Where a substance remains in production behind a technological shield, on the other hand, political constituencies of beneficiaries and potential risk bearers remain in existence. Furthermore, the perceptions of the permeability of the shield and the effects of low doses are dependent on the technology of detection and the state of scientific knowledge, and they are susceptible to continual challenges on the grounds of negative logic and identifiable suffering similar to those surrounding the imposition of bans.

The political merits and demerits of the "best available technology" principle differ considerably from those of zero risk. The symbolic value of the principle is not as great: it can imply a capitulation to technology and to industrial interests. The cue it provides is not as simple, because the determination of the best available technology (or the best practical means) seems to imply the application of at least a cost-effectiveness if not a maximum net benefit criterion. But the principle does, in contrast to the zero risk principle, provide policy-makers with a wide range of discretion and flexibility in negotiating with affected interests.

It is with respect to cost-benefit decision rules that the most complex political problems arise, and the clashes and complementaries between analytic and cybernetic approaches to political decision-making become most apparent. At one level, cost-benefit analysis promises to reduce large amounts of complex information to relatively simple decision cues. Ironically, then, these highly analytic techniques may be chosen because they facilitate a cybernetic approach to decision-making at the political level. They allow the political decision-maker to delegate to the analyst, to a large extent, the cognitively difficult process of making judgments involving trade-offs, and to respond simply to the "bottom line" of the analysis. And they appeal, symbolically, to another social myth, the myth that government is accountable for efficient operation.

The naivety of this impression of the political role of cost-benefit analysis soon becomes apparent in practice. Cybernetic decision-makers are unlikely to embrace ultimately such analysis despite its cueing function as it accords poorly with the more usual cybernetic strategies of attending to familiar sources, making tentative probes of the environment, and responding to feedback with incremental change. Even for those who take a more analytic approach to political decision-making, an analysis of the positive and negative social impacts of a policy will not necessarily reveal the political costs and benefits of adopting that policy. The political calculus requires an understanding of the distributive implications of the policy and of the significance of various constituencies of affected interests to an effective coalition of support.
for the policy and the policy-maker. The balance of social costs and benefits of a policy is irrelevant if it generates sufficient political opposition to defeat itself or its sponsor. From a political perspective, a consideration of the costs of buying off vetoes needs to be overlaid on the analysis. And the more complex these analyses of the social, distributive, and political impacts of the policy become, the more likely it is that political decision-makers will resort to responding to relatively simple cues of approval or disapproval from their traditional constituencies of support and, if necessary, from potential supporters. The more uncertain are these preferences, the more likely it is that political decision-makers will attempt to shape those preferences through the very process of presenting, responding to, and modifying policy proposals.

It should not be assumed, moreover, that such negotiation necessarily imposes only costs on political decision-makers. For at least some politicians, the bargaining process is a more familiar and indeed enjoyable mode of making trade-offs than is analysis, and may in itself yield considerable psychic rewards. Even where an initial political commitment to formal cost-benefit analysis has been made, it may well dissolve in favour of a negotiated outcome, or at least be subject to continual political intervention.

This understanding may help to explain why cost-benefit analysis is more popular in the bureaucratic than in the legislative arena. Those drawn to bureaucratic careers may be less inclined by profession and temperament to derive enjoyment from the negotiation process; moreover, the bureaucracy is increasingly inundated with delegated issues for which the legislature has had neither the information, the time, nor the will to negotiate a resolution. In such a situation, bureaucratic decision-makers themselves may well seek to delegate the making of trade-offs to cost-benefit analysts and to limit their own role to a response to the relatively simple cues of cost-effectiveness and maximum net benefit measures.

Those decision-makers, elected or appointed, who seek such simple cues, however, are inevitably frustrated. Cost-benefit analysis is enormously sensitive to assumptions made therein—regarding the definition of factors to be considered as costs and benefits, discount rates, methods of valuing life, the specification of predictive models, and mathematical modelling techniques. At almost every stage the techniques are capable of extracting information from ratio scale data, but lose much information that does not initially present itself in those terms and must be “translated” or excluded. This information bias is no less strong for deriving from analytic capabilities than from cognitive predilections. Beyond this technical bias, however, the methods of cost-benefit analysis are highly manipulable. Mendeloff reports a study in which seventy-two estimates of net benefit of the Occupational Safety and Health Administration’s (OSHA) two fibre per c.c. standard for asbestos were computed, using various possible combinations of three assumptions about the number of asbestos-caused deaths, three assumptions about the trend of benefits and costs over time, two time periods of varying lengths, two discount rates and two measures of benefits. The resultant benefit: cost ratios ranged from 0.07 to 27.70.60

60 Mendeloff, Regulating Safety (Cambridge: MIT Press, 1979) at 63.
As in the case of conflicting scientific evidence, which often contributes in part to conflicting cost-benefit analyses, discrepancies in the results of cost-benefit analysis are usually biased in favour of the political and economic interests of their sponsors, and are fast eroding the political credibility of the approach. Cost-benefit analysis is increasingly viewed as a political as much as an analytic tool. Although the assumptions that lead to widely differing estimates may be laid bare in the debate over rival analyses (a point which is made much of by proponents of the technique who applaud its ability to reveal underlying assumptions and ideologies), debate over those technical assumptions tends to exclude all but the initiate. In the words of a former OSHA head, “you can make your study; I can make my study. Nobody really knows.”

Not only may cost-benefit analyses be used to support a particular political position, they may be used to delay action on a policy. Requiring standard-setting agencies to undertake such analyses may reduce the number of hazards that the agency can address, and may delay the action that it can take on any one. And it must be noted that delaying agency action may not simply defer the costs to the regulated industry, but may also substantially reduce them. Delay may provide time for the coalition of support for a standard to unravel, or for the issue to move to a point in the “issue-attention cycle” at which costs of control are more heavily weighted or where concern with risks has abated.

In the light of these considerations, it makes little sense to mandate cost-benefit analysis unless one is seeking a mechanism, with some face validity, for hamstraining the regulatory agency. It also seems unlikely, on the other hand, that cost-benefit analysis can be avoided. The industrial interests, who at least in the first instance bear the costs of compliance, may be benefitted by the introduction of cost-benefit considerations. Not only do such interests have ready access to the information and the economic expertise necessary to conduct such analyses, but they can also delay action by engaging the regulators in a cost-benefit debate. In response, regulators and prospective beneficiaries of the standard may be driven to performing or commissioning countervailing analyses or appealing to rights, duties, and other values.

Some would maintain, indeed, that this process of partisan analysis and value reconciliation through political interaction is the most intelligent that can be expected in the public policy arena. It draws upon both the analytic and the cybernetic capabilities of the political system. By so doing it ensures that the widest range of values is brought to bear upon policy choice, and that bias, to some extent, counteracts bias in the interpretation of relevant information. This is Lindblom’s now familiar thesis of the “intelligence of democracy” — a thesis captured in the inimitable prose of one of Lindblom’s most faithful disciples, Wildavsky, as follows:

the truth [that analysts] have to tell is not necessarily in them, nor in their clients, but in what these cerebral prestigitators often profess most to despise, their give

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70 Cited in id. at 65.
and take with others whose consent they require, not once and for all, as if the social contract were forever irrevocable, but over and over again. This policy process is certainly exhausting, hardly exhilarating, but hopefully enlightening.\textsuperscript{72}

We return, then, from a political as well as an ethical perspective, to the need for deliberate reconciliation of competing values in standard-setting. In that process, cost-benefit analysis will play a role, but conflicting analyses will themselves have to be reconciled. What this discussion of decision rules leads to is the central question of who is to participate in this reconciliation process. Who is to identify the rights and duties at stake, and the relevant positive and negative outcomes to be considered? Who is to do the deliberate reconciling of these factors? What is to be the structure of the relationship between decision-makers and affected parties?

V. THE INSTITUTIONAL FRAMEWORK

The institutional framework of standard-setting under general enabling legislation shapes the relationships between the decision-makers and the affected interests, and the relations among affected interests themselves. Different structural and procedural options have different implications for the range and weighting of the interests involved, the range and nature of options considered, the source, type, and format of the information used, and the transactions entailed. In general, the options coalesce into four different models of the relations between decision-makers and affected interests—bargaining, managerial discretion, adjudication, and consultation. Each of these models exhibits a rather different mix of analytic and cybernetic characteristics, which renders it well or ill suited to the conditions that characterize the health hazard arena.

A. Bargaining

On first consideration, it may strike the reader as somewhat naïve to treat bargaining as a model of relationships separate from managerial discretion, adjudication, and consultation, when each of the latter three models in practice entails elements of bargaining. Nonetheless, it is worth tracing out the implications of a model based upon bargaining relationships among affected interests, a model in which bargaining is essential to decision-making. In this model, the bargaining process is what produces the decision and gives it its legitimacy; the decision is the consensus reached by affected interests.

In its pure theoretical form, bargaining is a process of reciprocal control among actors, based on their respective control of mutually valued resources, and entailing “a voluntary exchange...which each believes will render him better off than he was before (or would be in the absence of) the exchange.”\textsuperscript{73} Practical incarnations of this model are rare in North American standard-setting systems; perhaps the closest approximation is the “offeror” procedure utilized by the Consumer Product Safety Commission (CPSC) in the United

\textsuperscript{72} Wildavsky, supra note 1, at 405.

\textsuperscript{73} Schuck, Litigation, Bargaining and Regulation (1979), 3 Regulation 26 at 30.
States. Its organic statute authorizes the CPSC to contract with an outside organization (the offeror) to develop a product safety standard through systematic negotiations with affected interests such as consumers, large and small manufacturers, retailers, and the like. The CPSC, however, may accept, reject, or modify the standard developed by the offeror.

It is necessary to step outside the North American system to a considerably different system of political culture and institutions to find a closer approximation of the bargaining model in the standard-setting process. In Sweden, to take the outstanding example, commissions representative of a variety of affected interests make binding standard-setting decisions regarding occupational and environmental health hazards. The strong corporatist aspects of Sweden's political culture and institutions have rendered this bargaining process more accommodationist than adversarial. As several political commentators have noted, Canadian regulatory processes also exhibit corporatist elements; but these processes have not effectively embraced labour interests, and a bargaining model could be expected to work very differently in the Canadian context. It is in that context that the model will be evaluated here.

The strengths of the bargaining model are compelling, particularly in the face of the complexities that characterize decision-making about health hazards. It does not require a central decision-maker to deal "synoptically" with all of the inter-related variables and the multiple criteria relevant to the decision; but rather, makes more limited (though still substantial) demands of human intelligence. That is, it requires of each participant the capacity to perceive the effects of a variety of solutions upon his own interests, and to have sufficient appreciation of the preferences of other participants to be able to devise a bargaining strategy.

The bargaining process, moreover, has the capacity to generate a wide range of potential solutions, as each participant makes proposals and revises them in the light of reactions from others. Furthermore, these proposals are generated by those directly affected by, and therefore sensitive to, the problem at hand.

The major strength of the bargaining process, however, is in the character of the relationships that it encourages. It brings affected parties face to face with each other (we are dealing here with an explicit bargaining model, not a

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77 The term is Lindblom's. See, supra note 71.
model of tacit bargaining where, for example, various parties make independent submissions to an arbiter). Face to face participation in decision-making, as Lowi has implied, constitutes an important political resource for each participant vis-à-vis non-participants, and encourages log-rolling and compromise among participants, increasing the likelihood of a mutually acceptable solution. And, to a greater extent than the other models to be considered, bargaining leaves decision-making power (even if not institutional authority) with the affected interests themselves, and reduces the coercive presence of the state. As Schuck has put it: "A bargained solution depends for its legitimacy not upon its objective rationality, inherent justice, or the moral capital of the institution that fashioned it, but on the simple fact that it was reached by consent of the parties affected." Given their legitimacy, and the process of mutual adjustment that shapes them, bargained solutions are likely to face fewer vetos and contrived obstacles in the implementation process than those more coercively derived and imposed.

Bargaining processes are, however, susceptible to severe biases from imbalances in the bargaining power and in the participation of affected interests, and from particular bargaining strategies. The imbalances among the organizational, financial, and political resources of concentrated and diffuse interests, and of management and labour interests in the health hazard arena have been reviewed above; but it is worth devoting some attention here to biases introduced by bargaining strategies.

These biases are largely concerned with the distortion of information about preferences and technical aspects of issues. The ability of affected interests to exploit scientific controversy and uncertainty by presenting those scientific interpretations and inferences that best support their respective policy preferences has also been noted earlier. The bargaining process must rely upon these information biases themselves to counteract each other; it provides no source of information apart from the contending parties. And it provides no mechanism for the resolution of scientific uncertainty itself. It may therefore exaggerate areas of scientific controversy; put another way, it may define legitimate scientific issues as "trans-scientific" issues and resolve them on the basis of negotiation rather than scientific judgment. McGarity refers to this as the problem of the "contrived" science policy issue, in which an affected party may "attempt to convert a well settled scientific question into a science policy question by locating a very biased or radical scientist... to testify that a scientific dispute exists on that issue." The pure bargaining process entails no mechanism, apart from the bargaining power and sophistication of rela-

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79 Schuck, supra note 73, at 31.
80 See discussion under "The Political Context", supra.
81 See text accompanying note 9, supra.
tively evenly matched participants, for establishing a boundary between contrived and real trans-scientific issues. Indeed, there is no mechanism, again apart from the resources and sophistication of the bargainers, for determining the assumptions entailed in the models upon which varying scientific interpretations are based and for establishing the core of scientific "fact" upon which the effects of a policy might with as much accuracy as possible be predicted. Bargaining, in short, allows trans-scientific issues to be resolved at the risk of ignoring areas of relative scientific certainty.

Another type of bargaining strategy may reduce the flexibility which this model theoretically offers. As Schelling has pointed out, bargaining power can be manufactured, in the absence of other resources, by binding oneself to a particular position; for example, by making a commitment to a third party, and thereby forcing other participants to adjust to one's own position—a "burning of the bridges" ploy.\footnote{Schelling, \textit{The Strategy of Conflict} (New York: Oxford University Press, 1963) at 29-31.} This is, of course, a risky strategy, given the possibility of stalemate; and some sophisticated casuistry may have to be employed by one or more participants to redefine the original commitment and to allow for some movement to reach a negotiated outcome. A related strategy is the assertion of non-negotiable "rights" as a constraint on the bargaining process. Bargaining, based as it is on consent and not on inherent justice, can be disabled by claims of right unless, again, a good deal of casuistic reinterpretation is employed. Finally, bargaining processes are susceptible to a strategy of delay. Such a strategy is likely to be employed, for example, by a participant who believes that delay will give a coalition of other participants time to unravel. But there is an outer limit on the use of this strategy, given the assumption underlying the bargaining model, namely that coming to some agreement is preferred by all participants over failing to reach agreement at all.

The strengths of the bargaining model, in summary, derive largely from its cybernetic characteristics—from the capacity of face to face group dynamics to generate shared perceptions and consensus, from its relatively limited demands upon the information processing capabilities at any one point in the system, and from its iterative and flexible process of "trying out" various proposals and varying them in the light of reactions. The shortcomings of the model relate largely to its analytic weaknesses: its tendencies to bias the weighting of interests and the review of information according to the bargaining power of the respective parties.

Even the cybernetic strengths of the model in coping with complexity and uncertainty, however, are likely to be realized only under certain conditions. First, affected interests must be roughly equal in bargaining power, informational resources, and expertise so that information biases may counteract each other and scientific and trans-scientific issues may be realistically identified. Second, the political and legal contexts must discourage the assertion of substantive claims of right, which can limit the flexibility of the bargaining process.
The health hazard arena, however, is characterized both by unequally endowed interests and by assertions of claims of rights. Hence bargaining alone is unlikely to resolve the scientific, political, economic, and ethical problems presented by health hazards. It is likely to leave potential areas of scientific agreement unestablished, to leave diffuse political demand unsatisfied, to reach Pareto-inefficient outcomes (by distorting information regarding preferences and technical effects), and to weight interests according to their political and economic endowments rather than by their free and equal interaction.

B. Managerial Discretion

A more common model for the structure of relationships between decision-makers and affected interests in the standard-setting process draws its theoretical integrity from the analytic paradigm. The model of managerial discretion assigns to one centre of decision-making, separate from the interests affected by the hazard, the responsibility of developing and enforcing specific standards under a general legislative mandate. In theory, the identification and weighting of interests and the generation of information in this model are not dependent on the degree of organization or the bargaining power of particular interest groups. The decision-maker is charged with balancing a variety of interests and values, as more or less explicitly identified in his mandate, regardless of the organization and resources of affected parties. He is free to choose the standard which, in his disinterested, analytic, and "synoptic" view, is most consistent with his mandate, and is not bound to choose from options presented by affected parties—or indeed to consult with those parties at all. It is this model that underlies the formal structure of most Canadian standard-setting processes in the occupational health arena.

In the most analytically inspired version of this model, decisions are to be taken in accordance with the precepts of management science and policy analysis: preferences are taken as given in the mandate; complex information is organized into systematic models, decisions about reductions in uncertainty are made on the basis of the marginal net benefit of further information, and alternate standards are compared on the basis of given preferences, analytic models, and available information. Consultation with affected interests may be necessary to refine the models and to obtain information, but it occurs at the discretion of the decision-maker.84

In practice, the discretionary setting of standards by administrators under general enabling legislation is not nearly so analytic. The analytic model assumes a given set of preferences and an information-generating and processing capacity—but the mandate and the resources that usually accompany the delegation of standard-setting authority are rarely sufficient in these respects. Typically, in Canada as elsewhere, mandates have been vague (usually because conflicts in preferences have not been resolved at the legislative level) and programmes of standard-setting and enforcement have been added to existing workloads with little increase in resources.85 Under such circum-

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85 Doern, supra note 41, at 28-29.
stances, theories of organization predict, and experience confirms, that the process will be subsumed within the established operating routines of the administering agency. In the less common case in which a relatively vague mandate is accompanied by resources, on the other hand, the mandate is likely to be re-interpreted in the direction of the goals or "world view" of the dominant coalition within the administering agency. It may indeed precipitate some re-grouping of coalitions within the agency.\(^8\)

The standard operating routines in Canadian regulatory administrations have been likely to involve considerable interaction with the regulated industry, which, in the absence of a specific mandate or of information resources, can provide a source of decision criteria and technical information. The desire to promote a less arbitrary and more comprehensive canvassing of interests and information by regulatory decision-makers, while maintaining a disinterested and independent centre of decision-making, has led to proposals for various forms of guaranteed access by affected parties to regulatory decision-makers. One of these models, which is increasingly coming to characterize administrative rule-making in the United States, is the model of adjudication.

C. \textit{Adjudication}

Following Fuller\(^8\) and Eisenberg,\(^8\) we can define adjudication as a process that structures the relationship between affected interests and decision-makers around the following norms:

a) Each party must have the opportunity to present proofs and reasoned arguments for a decision in his favour to the decision-maker.

b) The decision-maker must be impartial and must attend to and be capable of comprehending those arguments.

c) The decision-maker should normally answer those arguments in explaining his decision.\(^8\)

d) "The decision should be strongly responsive to the parties' proofs and arguments in the sense that it should proceed from and be congruent with those proofs and arguments" and should not be based on principles, facts, or arguments not presented by the parties themselves.\(^9\)

This general model comprises a number of variants of relative degrees


\(^7\) Fuller, \textit{supra} note 48.


\(^9\) Eisenberg treats this as a "norm"; \textit{id.} at 412; for Fuller, explanation is not necessary, but promotes the fairness and effectiveness of the adjudicative process, \textit{supra} note 49, at 387-88.

\(^9\) Eisenberg elevates this norm to definitive importance, \textit{supra} note 88, at 413; for Fuller, it is an unobtainable ideal which should be approximated as closely as possible, \textit{supra} note 49, at 388.
of formality: all entailing rights to notice and hearing by an impartial judge; most entailing rights to counsel and rights to cross-examine adverse witnesses; and the more formal, entailing a keeping of a written record against the possibility of subsequent review, and increasingly strict rules of evidence.

Traditionally, this model has been held to apply only to those administrative decisions that apply general policy rules to individual parties in specific cases according to their particular circumstances, and not to the decisions formulating the general rules themselves.91 This distinction between "adjudication" and "rule-making" has never been clearcut, however, and it is particularly difficult to maintain regarding the standard-setting activities of administrative agencies. Although the standards governing exposure to health hazards, to take the issue at hand, are clearly "rules" in the sense that they are generally applicable and prospective in effect, they may have a retrospective effect on a relatively small number of identifiable parties. In the extreme case, a ban on a hazardous substance, while prospective from the point of view of those whose exposure to the substance is thereby prevented, imposes costs retrospectively on producers left with existing stocks of the substance, and those with capital (including human capital) investment in its production.92

In the United States, the Administrative Procedure Act93 has, since 1946, required rule-making agencies to follow "notice and comment" procedures involving the publication of proposed rules and the provision of an opportunity for affected parties to respond in writing to those proposals. Indeed, the Act in effect codified the principles that had already evolved in administrative practice and case law. In the last fifteen years, moreover, rule-making procedures in the United States have increasingly become subjected to the constraints of the adjudicative model.

To some extent, this judicialization of rule-making procedures in the United States has been the result of Congressional action. Unable to frame specific mandates, Congress has sought to constrain administrative discretion by imposing procedural requirements on the adjudicative model, or stringent standards of judicial review upon a wide range of regulatory decision-making. Another source of the perception of the increasing judicialization of the regulatory process in the United States is the increasing tendency of affected parties to litigate standards. Administrative law itself appears to be in a state of flux regarding the applicability of the adjudicative model to the activities of regulatory bodies. Several lower court decisions have tended to a relatively broad ap-

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91 In the United States, the Supreme Court in United States v. Florida East Coast Railway, 410 U.S. 224 (1973), held that the Interstate Commerce Commission was not required by administrative law to conduct trial-type procedures in promulgating an across-the-board incentive, per diem rate increase. The Court relied on what it termed "a recognized distinction in administrative law between proceedings for the purpose of promulgating policy type rules or standards...and proceedings designed to adjudicate disputed facts in particular cases," and referred to Bi-Metallic Investment Co. v. Board of Equalization, 239 U.S. 441 (1915) and Londoner v. Denver, 210 U.S. 373 (1908). See also academic treatments of this distinction in Davis, Administrative Law of the Seventies (Rochester: Law. Co-op. Pub., 1976), and McGarity, supra note 82, at 770-71.

92 Id.

plication of the formal adjudicative model, while the United States Supreme Court has ruled that the courts cannot require an agency to adopt more formal procedures in rule-making than are required by its organic statute or by the Administrative Procedures Act. Finally, regardless of whether American courts are judicializing regulatory rule-making by requiring agencies to meet formal procedural requirements, they are certainly judicializing it by taking an active substantive role in the process themselves. The courts are increasingly unwilling to defer to agency judgment in substantive matters, and are increasingly committed to taking a "hard look" at both substantive and procedural aspects of agency decision-making.

In the face of these Congressional signals, litigious interest groups, jurisdictional uncertainties, and judicial activism, it is not surprising that regulatory agencies in the United States are adopting more formal procedures in an increasing number of cases to protect themselves against reversal on appeal. OSHA, for example, includes a standard clause in notices of proposed rule-making hearings giving the presiding administrative law judge authority to permit the questioning of witnesses, and cross-examination is typically permitted in important cases, such as the asbestos and vinyl chloride hearings.

In Canada, rule-making authority regarding occupational health hazards rests with federal and provincial ministries and cabinets, and few procedural requirements are imposed by enabling statutes. Various provincial environmental protection acts, on the other hand, require or provide for public hearings to assess the environmental impact of specific projects, including matters of health hazards, but even these have been weakened and discredited in some cases, notably Ontario, by liberal use of exemption clauses. Furthermore, no procedural requirements have been imposed upon ministerial or cabinet standard-setting by the courts, although there have been some recent indications of movement in this direction. Indeed, even in reviewing regulatory decisions of independent regulatory agencies, Canadian courts have shown enormous restraint compared with their American counterparts. They have generally granted agencies broad discretion in substantive and procedural matters, applying standards of ultra vires and natural justice to agency decisions, and interpreting the range of applicability of the adjudicative model very narrowly—especially its more formal variations.

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96 See, e.g., Environmental Assessment Act, R.S.O. 1980, c. 140. The Cabinet has used its authority under the Act to exempt a number of public projects from the requirement of holding environmental impact hearings; see Makin, "Environment Act weakened by exemptions, group says," The Globe and Mail (Toronto), June 2, 1981.

97 McGarity, supra note 82, at 776n. 237.

There have been a number of recent proposals for the imposition of procedural requirements upon cabinet decision-making in regulatory matters. At the federal level, an administrative directive of the Treasury Board\(^9\) instructs departments and agencies subject to Treasury Board review to follow certain notice and comment procedures in the preparation of "major" regulations involving matters of health, safety, and fairness. For the most part, these proposals and reforms are derived more from a "consultative" model of the structure of relationships between decision-makers and affected interests than from an adjudicative model, and shall be discussed more fully in that context below.\(^10\)

Although the procedural fairness of the Canadian standard-setting process regarding health hazards is clearly in need of vast improvement, it is important that reform efforts not be modelled too closely on adjudicatory procedures. The adjudicative model has, in theory, undeniable advantages. It guarantees affected parties or their representatives face to face access to decision-makers and often to opposing parties. More than any other model, its dynamics demand that the factual basis of decisions be carefully scrutinized from both adversarial and "impartial" viewpoints. And it requires that decisions be legitimated by overarching principles of "right" and "wrong" and not simply reflect the balance of power in the health hazard arena.

The disadvantages of adjudication, however, are also considerable. It exacerbates conflict, structuring relationships on an adversarial basis and creating clear winners and losers in each case, and enhances the likelihood that the loser will seek to delay implementation of the decision through further appeal or other tactics of obstruction. To a greater extent than the bargaining model, but less than the managerial discretion model, it further alienates both winners and losers from the decision-making process by making them aware of their loss of freedom to an institution of the state. It distorts information, not only by encouraging adversarial presentations of facts and preferences, but also by requiring those presentations to meet certain rules of evidence; and it leaves decision-making authority with an arbiter whose "feel" for the issues at hand is likely to be less sensitive than that of the parties. To a greater extent than any other model, it increases the likelihood that parties will advance relatively inflexible claims of right or accusations of guilt. Indeed, as Fuller has noted, such a mode of presentation of the issues is virtually demanded by the institutional framework within which litigants and adjudicators function.\(^101\)

Finally, adjudication appeals to precedent in what has been called the "gradual tracing out of the full implications of a system already established,"\(^102\) and it ill suited to finding innovative solutions to conflicts between interests that have not been resolved even in general terms through a contract or through an accommodation of interests at the legislative level.

\(^10\)See text accompanying notes 110-12, infra.
\(^101\)Supra note 49, at 369.
\(^102\)Fuller, *supra* note 49, at 377.
These shortcomings may well be outweighed by the power of the adjudicatory process to clear through adversarial presentations to a core of established fact, and to maintain the role of principle, as opposed to power balance, in the operation of the state. But it is likely to do so only to the extent that the issues do indeed revolve around a firm core of established fact, implicate principles of “right” and “wrong”, and affect a range of interests that is capable of being captured in a single dispute. In the health hazard arena, these conditions do not prevail. Pervasive complexities and uncertainties, particularly in the scientific field, limit the applicability of the adjudicative model. In the first place, the adjudicative process is unsuited for the resolution of trans-scientific issues. Scientific evidence is treated in this model as factual evidence—but as we have seen, the degree of certainty with which scientific facts can be stated in the health hazard arena is relatively low. Extrapolation from limited data, the construction of research designs and test methodologies, and the construction of interpretative models all involve the exercise of scientific judgment. Careful examination and cross-examination of expert witnesses may be useful in order to identify the assumptions underlying different scientific models and the different interpretations of and inferences from existing data. But as McGarity has noted in a review of OSHA experience with the adjudicative model, the “administrative and judicial review process... can test these assumptions... only to the extent that a lay person’s understanding is an appropriate litmus.” To require that administrators and courts follow an adjudicative model in decision-making about health hazards tends to demand that decisions be based on scientific evidence whereas the level of uncertainty requires that they be based on policy. In other words, whereas bargaining risks treating scientific issues as trans-scientific, adjudication risks treating trans-scientific issues as scientific.

The applicability of an adjudicatory model to standard-setting regarding health hazards is limited not only by the uncertainties associated with the issues involved but by their complexity. Building upon Fuller’s analysis, Eisenberg has argued that the “norm of strong responsiveness” inherent in the adjudicative model (that is, its requirement that the judge’s decisions proceed from the arguments, and only from the arguments advanced by the parties appearing before him) makes it ill suited for the resolution of “polycentric” problems. Polycentric problems are those involving complex interactions among a large number of interests, such that different solutions may implicate different sets of interests (or, put another way, different solutions may change the parameters of the problem). Fuller analogized the polycentric problem to a spider web; “it is ‘many centred’—each crossing of strands is a distinct centre for distributing tensions.” To essentially limit the focus of decision-making (through the norm of strong responsiveness) to two opposing interests in a given dispute—in Fuller’s analogy, to a single “crossing of strands” —ignores the overall structure of the problem; the complex web of interactions.

Polycentricity is a matter of degree, and the scope of adjudication would

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103. Supra note 82, at 747.
104. Supra note 88.
105. Fuller, supra note 49, at 395.
be narrowly defined indeed if all polycentric tasks were placed beyond its pale. Nonetheless, problems of health hazards are polycentric to a very high degree: they involve complex interactions due not only to political and economic interdependencies but also to the operation of biological and ecological systems. In this context the following critique of adjudicative procedures is particularly relevant:

Polycentric problems can be solved only by taking account of numerous interdependent and highly variable factors which oblige the decision-maker to manage a kind of cybernetic process involving tentative probe, feedback, adjustment, and reconciliation... Such a problem (for example, the selection of a water quality standard) requires the exercise of substantial discretion rather than the application of pre-existing decision rules, and its solution will often require interaction between the decision maker and others—interaction that would be inconsistent with traditional norms of litigation.\(^\text{106}\)

It is conceivable that certain polycentric problems could be solved through the exercise of managerial authority aided by systems analysis, or through a process of bargaining which represented all affected interests.\(^\text{107}\) But each of these models suffers from the limitations and biases suggested earlier, affecting the weighting of interests and the processing of information. There remains to be considered a hybrid model, that of consultation.

D. Consultation

The consultation model combines elements of each of the models discussed so far. Like the adjudication model, it assures affected interests of the opportunity to present arguments, though not necessarily face to face, to the decision-maker in authority, and obliges decision-makers to attend to those arguments and to respond to them in explaining their decision. Like the model of managerial discretion, it leaves the decision-maker free to gather his own evidence and to base his decision on considerations not adduced by any party. As with both managerial discretion and bargaining, it admits the relevance of a wide range of evidence of varying degrees of certainty. And although it does not explicitly encourage bargaining among affected interests, it does at least free, and indeed encourage, decision-makers to enter into negotiation with affected interests, thereby expanding the range of options considered and encouraging innovative solutions.

The consultation process may, in practice, take a number of institutional forms of various degrees of openness. At one extreme, it may entail only the striking of advisory committees representative of a range of affected interests, whose reports may or may not be made public. In the mid-range are minimum notice and comment procedures such as those governing the promulgation of regulations relating to designated hazardous substances under Ontario's *Occupational Health and Safety Act*,\(^\text{108}\) which requires that the Minister of Labour:

(a) Shall publish in the Ontario Gazette a notice stating that the substance may be designated and calling for briefs or submissions in relation to the designation; and

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\(^{106}\) Schuck, *supra* note 73, at 29.


\(^{108}\) R.S.O. 1980, c. 321, s. 22.
(b) Shall publish in the Ontario Gazette a notice setting forth the proposed regulation relating to the designation of the substance at least 60 days before the regulation is filed with the Registrar of Regulations.

Access to submissions by affected parties may be more or less restrained under such provisions—in the Ontario case it is granted at the discretion of the Minister. Somewhat more open and interactive procedures are typical under the notice and comment provisions of the Administrative Procedure Act in the United States, noted earlier, which explicitly admit of the possibility of oral testimony and which place some obligation on decision-makers to explain their actions.

Even more explicit in its requirements for explanation (though less firm in its authoritative base) is the Socio-economic Impact Analysis (SEIA) programme of the federal Treasury Board in Canada. Under this programme, the Treasury Board has instructed all departments and agencies under its purview (including all those engaged in health and safety regulations) to publish in draft form all “major” regulations touching upon matters of health, safety, and fairness; to accompany the publication with a socio-economic impact analysis assessing the cost and benefit of “all technological and policy-instrument alternatives considered,” to allow 60 days for public comment upon the proposed regulation and the accompanying SEIA; and to reply to those comments.

Most extensive in terms of their requirements of explanation are the provisions of President Reagan’s recent Executive Order that requires regulatory impact analyses to accompany both notices of intent and drafts of “major” rules.

It is worthwhile to take a general evaluative look at the basic elements of the consultation model: assured participation for a range of affected interests, interaction between decision-makers and affected interests on the basis of reasoned argument, and ultimate administrative discretion. As a hybrid, the consultation model exhibits some of the shortcomings as well as the strengths of the models discussed so far. In the first place, like bargaining and adjudication, it may delay decision-making. The procedures themselves,


110 Section 553 of the Act provides for, but does not require, oral submissions, and requires the publication of proposed regulations to be accompanied by a brief statement of their basic purpose.

111 Supra note 99.

112 Executive Order 12291, issued on Feb. 17, 1981, 46 F.R. 13193. Both the SEIA programme and the American programme define “major” rules as those whose estimated costs exceed a specified economic threshold, although in the United States, the Office of Management and Budget may designate any rule as “major”.

113 This model is traced out in Eisenberg, supra note 88.

114 Canadian experience with the federal SEIA programme and the Ontario Occupational Health and Safety Act requirements, for example, suggests that the time required to promulgate regulations through these consultative processes may be a year or more rather than the few months implied in the 60-day minimum period for comment. Some of this delay is attributable, no doubt, to the newness and unfamiliarity of these processes. In the federal programme, delay was compounded in one case when one of the parties invoked a public hearings provision of a relevant statute. See Anderson, “The Federal Regulation-Making Process and Regulatory Reform, 1969-1979,” in Stanbury, ed., Government Regulation: Scope, Growth, and Process (Montreal: Inst. for Res. on Pub. Pol’y, 1980).
however, are less time consuming and less subject to manipulation than are those, such as cross-examination and judicial review of the record imposed by the adjudication model. And the fact that ultimate discretion remains with the administrative decision-maker reduces the pressure that an interest group can bring to bear by delaying indefinitely, as is possible in a pure bargaining process.

Like each of the other models, moreover, the consultation process is susceptible to limitations and distortions in the flow of information, but the problems are least acute in this case. The tolerance of uncertainty is greater in a consultation process than it is under an adjudication model with the latter's template of "facts" and "law". The biases of adversarial sources of information that characterize the bargaining and adjudication models remain problematic here, but at least the consultation process leaves the administrative decision-maker free to develop information and analysis independently. Like each of the other models, moreover, the consultation process is susceptible to limitations and distortions in the flow of information, but the problems are least acute in this case. The tolerance of uncertainty is greater in a consultation process than it is under an adjudication model with the latter's template of "facts" and "law". The biases of adversarial sources of information that characterize the bargaining and adjudication models remain problematic here, but at least the consultation process leaves the administrative decision-maker free to develop information and analysis independently. Furthermore, while leaving the decision-maker free to garner his own information, a consultation process does not leave him dependent on his own resources or on his own judgment in identifying relevant information and sources of information. By guaranteeing a wide range of interests access to the centre of decision-making, consultation procedures potentially uncover information that might be ignored under a model of pure managerial discretion.

The feasibility of consultation and the realization of its potential advantages depend on the particular institutional devices adopted, their degree of formality, their phasing and their scope. There are some general criteria to be considered in these respects. The logic of the model demands that consultation procedures be sufficiently institutionalized that the access of affected interests to the centre of decision-making, at least in terms of an exchange of arguments on paper, is not dependent upon the discretion of the decision-maker. It demands that the process be phased to allow affected interests early and periodic notice of the progression of the decision-maker's thinking about the issues, so that the parties may prepare relevant responses. But notice should not be so early or so frequent that groups become overloaded in responding to matters irrelevant to the ultimate course of decision-making, and hence become alienated from the process. Institutionally established deadlines for response should not be immutable, but should be available to be invoked to thwart strategies of delay on the part of particular interests. Finally, to avoid the deliberate or unintentional overloading of the process, there should be some mechanism for exempting routine or insignificant matters from its requirements.

Against these general criteria it is possible to assess a number of versions

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115 In practice, of course, it is often the case that adversarial interests remain the only source of certain crucial information such as past exposure levels and medical histories—in which case only a trial-type adjudicative process with powers to compel the production of documents and records could free such information. Given the scientific uncertainties surrounding the interpretation of such data, however, it is unlikely that the benefits of access to them would outweigh the loss of flexibility in the exercise of policy judgment by going the adjudicative route.

116 Econ. Coun. of Can., supra note 33, at 74.
of consultative structures and processes. Let us consider first the use of advisory committees representative of a range of affected interests.

Although the logic and effectiveness of the consultation model require that advisory committees have some legislative base and not be struck entirely at the discretion of the administrative decision-maker, the actual structure of the committee may exhibit varying degrees of permanence and formality. The enabling statute might, for example, require the administrative standard-setter to strike and to disband advisory committees on a serial basis as particular hazards are considered. Although this approach provides for a recruiting of representatives with expertise and interests specific to a given hazard, these advantages are likely to be outweighed by those of a permanent advisory committee. A number of trans-scientific issues recur as particular hazards are considered, and there is much to be gained from a continuing panel whose members do not have to resolve these issues anew in each instance. Furthermore, a permanent committee can be provided with a research and analysis capability—a capability essential to the effectiveness of the consultation procedure. Given the extent of the politicization of the scientific debate surrounding health hazards, and the varying resources of affected interests, it is likely that the only credible research and analytic enterprise is one conducted under the aegis of a body representing various contending groups in a specific jurisdictional context.

In this respect, both British and American experience can be instructive. The British Health and Safety Commission, whose membership comprises representatives of labour, business, consumer associations, and local authorities, as well as scientific and medical experts, provides an ongoing forum for the scientific evaluation of health hazards, such as that recently undertaken by its Advisory Committee on Asbestos. Such a broadly representative group would appear, both in theory and in the light of experience, to be more credible to a wide range of affected interests than are agencies more closely identified with government itself, which may be seen as more vulnerable to shifting political pressures. In the United States, for example, the National Institute for Occupational Safety and Health has at various times been perceived as allied with industrial or with labour interests.

The research and analysis overseen by an advisory committee need not

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117 The Occupational Safety and Health Act of 1970, 29 U.S.C.S. §§ 651 et seq. (1982), at the federal level in the United States, provides for, but does not require, the appointment of such ad hoc committees at the stage of drafting proposed OSHA rules. Such committees are frequently appointed and are required by the Federal Advisory Committee Act, § 10, 5 U.S.C.S., App. I § 10 (1980), to open their meetings to the public and to make accurate transcripts and minutes of any hearings (see Kelman, supra note 29, at 244-45). This degree of publicity would seem to mitigate the advantages of flexibility and frankness to be gained from face-to-face contact among affected interests.

118 This Commission is constituted under the Health and Safety at Work Etc. Act, 1974, c. 37 (U.K.).


120 See Epstein, supra note 9, at 352-54.
be conducted entirely in-house; indeed, the most effective use of available facilities and expertise is likely to entail the committee's functioning as a funding agency for external research. This approach is, of course, not without its pitfalls as recent revelations of fraudulent testing of pesticides by the private Industrial Biotest Laboratories under contract to the government of the United States have indicated, and the committee should possess sufficient in-house research and analytic capability to give close scrutiny to contract and grant research.

The credibility and effectiveness of an advisory committee depends essentially on the manner of its composition: upon the range of interests represented and on the relationship between the representatives and their respective constituencies. The range of interests is particularly problematic in the hazard arena, with its pervasive externalities and concomitant difficulties of representing diffuse third party interests. Furthermore, as the Economic Council of Canada noted in its Interim Report on its Regulation Reference, there is usually "a set of obvious candidates" for participation in the consultative process, a phenomenon that carries the danger that governments will fall into "the convenient habit of consulting only with "established groups". There is no effective way of avoiding this danger through a legislative stipulation of committee membership while still preserving the flexibility that is the major advantage of a consultation process. But the problem is less acute if the advisory committee approach is complemented by notice and comment procedures, assuring access for and attention to a much wider range of interests.

A further point regarding the committee's composition—that is, the formal relationship between committee members and the interests they represent—needs to be made. Recent theories of public accountability, shaped by a pluralist approach to the understanding of politics, have argued strongly that "one is accountable to agents who control scarce resources one desires" and that the accountability of a representative to his constituency is only as great as the sanctions that can be exercised against him by the constituency. Applying this argument to the case of the representation of affected interests in the regulatory process, some commentators have argued that, to be effectively accountable to their respective constituencies, representatives must be specifically nominated by organized groups within those constituencies, who then hold the sanction of renewing or rescinding the nomination.

Some reservations about this prescription have been expressed elsewhere. Apart from the fact that it favours the organized over the unor-

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121 Keating, "Safety tests faked, but 79 pesticides left on market", The Globe and Mail (Toronto), April 27, 1981 at 1.
122 Supra note 33, at 74-75.
124 Id. at 435.
ganized segments of particular constituencies, it can lead to the taking of inflexible positions by participants. This results not only from a desire on the part of delegates to be able to present themselves to their constituents as vigorous defenders of constituency interests, but also from the logic and strategy of bargaining through agents. Schelling’s point about the bargaining power to be gained from establishing a credible commitment to a particular position is relevant in this context.\(^{126}\) He argues that such a commitment can be made credible where a delegate can assert that he is bound to carry out his mandate or lose his position with his parent organization, and that gaining approval for such a change in position would entail a process too lengthy to be accommodated in the timetable of the negotiating process. To reduce the significance of these tactics and incentives, it is preferable that representatives be drawn from identifiable constituencies of interest but not nominated or appointed by specific organizations. A statutory clause such as that contained in Ontario’s *Occupational Health and Safety Act*\(^{127}\) regarding the composition of the Advisory Council on Occupational Health and Occupational Safety, established therein, strikes an appropriate balance between assured access for relevant constituencies and freedom of action for both administrative decision-makers and constituency representatives. That statute provides that the Council’s twelve to twenty members

shall be appointed for such term as the Lieutenant Governor in Council determines and shall be representative of management, labour, and technical or professional persons and the public who are concerned with and have knowledge of occupational health and occupational safety.\(^{128}\)

Great care must be taken in the selection of members of such a committee. It is, after all, the only forum in which affected interests will be guaranteed the important resource of face to face access to the centre of decision-making. Even so, standing alone, these provisions for a representative advisory committee are insufficiently comprehensive in the range of interests to whom access is assured, and offer insufficient checks on the “convenient habit” or cognitive routine of consulting only conventional sources of information. Advisory committees need to inform and to be informed by a broader scan of interests and information through notice and comment procedures. Through such procedures, constituencies unrepresented on the advisory committee, or segments of constituencies who disagree with the position taken by their representative on the committee, are assured an opportunity to gain the attention of decision-makers.

The institutional basis of these notice and comment procedures should comprise a set of statutory provisions. Enabling legislation should require an administrative decision-maker, having tentatively determined in consultation with an advisory committee to set or modify a standard regarding control of a health hazard, to publish a notice of such intent and to allow a comment period of specified length to be accorded for the receipt of written submissions.

\(^{126}\) Schelling, *supra* note 83, at 29.

\(^{127}\) R.S.O. 1980, c. 321.

\(^{128}\) Id., s. 10(2).
After this period, another provision should require the publication of any proposed standard and the according of a second comment period before the standard becomes effective. As to the content of these notices, the enabling legislation should require that the initial notice of intent be accompanied by a statement of the general lines of argument and evidence upon which the decision was based; and that the publication of the proposed standard itself be accompanied by a general outline of the arguments and evidence supporting that particular standard.

It is important that these requirements for explanation not be overly ambitious. In light of the limitations and biases of cost-benefit and cost-effectiveness analysis outlined above, the requirements of the federal SEIA programme provide an example of what is to be avoided in statutory prescriptions. The Treasury Board directive requires the presentation of cost-benefit data for all feasible alternatives considered in the development of the regulation in question.\textsuperscript{129} As noted earlier,\textsuperscript{130} it is difficult in standard-setting procedures to avoid the deadlocks resulting from partisan cost-benefit analyses with their highly manipulable assumptions, but it is not necessary to invite such problems. Nor is it practical to invite delay by requiring a given set of decision-makers to manufacture a wide range of options to meet paper requirements. Innovation is more likely to arise from diversified sources of information and analysis than from paper requirements to “identify alternatives”. In a similar vein it is worth noting that SEIA-type requirements tend to defeat one of the major purposes of notice and comment procedures—that is, to ensure that relevant interests and evidence are not overlooked—by channeling the consultation process into areas accessible largely to those “cerebral prestidigitators” capable of manipulating the techniques of cost-benefit analysis. The results, moreover, are likely to be ultimately unpersuasive and unhelpful to decision-makers increasingly skeptical of such manipulations.

While not requiring an elaborate setting out of evidence and analysis, the statute ought nonetheless to guarantee access for all parties to the various partisan analyses and submissions—including those of the advisory committee—generated by the process. If a genuine joining of issues appears to be emerging as interest groups attempt to rebut each other’s submissions, it may be necessary to extend one or other of the comment periods, or even to bring the groups face to face in an informal hearing; but such options should be left to the discretion of the decision-maker lest they become routinely exploited in the bargaining strategies of particular groups.

The resource implications of these provisions, and their demands on the patience of the participants, require that some limit be placed on the range of standard-setting instruments to which they pertain. It is tempting to limit their application to a particular class of instrument defined by its legal status (such as regulations); but to do so would provide a clear incentive for administrators wishing to circumvent the process to use an exempt instrument such as a

\textsuperscript{129} Can., Treasury Board, \textit{supra} note 99, discussed in Econ. Coun. of Can., \textit{supra} note 33, at 113n. 17.

\textsuperscript{130} See text accompanying notes 69-70, \textit{supra}.
If the standard-setting process is to be subject to consultation requirements regardless of the instrument used, it is particularly important that there be some mechanism of exempting relatively insignificant changes in policy from the full consultation process. The federal SEIA programme establishes an economic threshold; only those regulations whose estimated social costs exceed specified levels are subject to its provisions. This economic threshold approach suffers from the same problems of cost estimation noted earlier, however, and provides an incentive for those who would circumvent the consultative process to underestimate costs. On the other hand, exemption at the discretion of the administrative decision-maker undermines the integrity of the consultation process. The most reasonable intermediate course would seem to be to have exemptions from the process routinely reviewed and approved by the advisory committee.

One final point remains to be addressed: the question whether regulatory standards ought to be set within government departments and hence under the direct authority of Cabinet, or by independent agencies.

One of the major principles traditionally advanced in favour of locating a function in an independent agency is the necessity of removing quasi-judicial functions, that is, the application of general rules to individuals according to their particular circumstances, from the governmental policy-making process itself. Despite the fact that exposure standards may have retrospective effects on a few concentrated interests, however, it is difficult to construe their development as a quasi-judicial function. The other reason most commonly advanced for placing a function in an independent agency is the need to structure a balance of interests in the decision-making process different from that which prevails in the general ministerial-Cabinet-legislative process. But in practice, given conventions of ministerial responsibility and Cabinet collegiality, it is impossible to isolate a contentious and politicized issue such as health hazards from the general political process. In such a context, the standard-setter's obligation and ability to receive public advice from a representative advisory committee and to follow notice and comment procedures is more important than where he sits in the administrative apparatus.

One related point should be raised in this context, however. The question of the appropriate institutional level at which standard-setting processes should be established—federal, provincial, regional, industrial, firm—is one that requires much fuller attention than can be given within the scope of this paper. Again the choice of appropriate response requires a balancing of analytic and cybernetic considerations. An analytic approach would look for economies of

131 On a similar point, see Econ. Coun. of Can., supra note 33, at 112n. 15, and Standing Joint Committee on Regulations and Other Statutory Instruments, Second Report (Ottawa: Min. of Supply and Services, 1977) at 84.
132 See note 112, supra.
133 See discussion under “Decision Rules”, supra.
134 See Doern, supra note 41, at 25-27; Econ. Coun. of Can., supra note 33, at 64 et seq.
scale in information processing and, other things being equal, would tend to favour a more centralized response than would a cybernetic approach. The latter, with its emphasis on incremental change within an established response repertoire, would argue for an exploitation of the learning potential of diversity in the repertoires at different institutional levels. The cybernetic concern with the shaping of preferences of affected interests in concrete situations would reinforce an argument for a more decentralized approach. But the relevance of each of these approaches can best be judged in particular situations, taking into account the diversity and variation in the factors bearing on health risk and risk reduction, and the analytic and cybernetic capacities of the relevant institutions.\textsuperscript{136}

VI. CONCLUSION

Science is at present incapable of providing unambiguous assessments of the magnitude of risk from a variety of occupational health hazards. The complex inter-relationships of the factors involved, and the scientific uncertainties as to their effects, place great strains upon the analytic capabilities of policymaking systems. These strains are compounded by uncertainties about social and individual preferences, and by the unequal distribution of political and economic resources that facilitate the expression of preferences.

As a result, highly analytic aids to policy-making, such as cost-benefit analysis and adjudicatory procedures, have a useful but limited contribution to make in this arena. Carefully employed, they can be useful in clarifying the assumptions that underlie various proposals. But, especially in the absence of firm scientific data, they are highly manipulable. Furthermore, because they are costly and time consuming, and because they favour action whose positive net benefit can be factually demonstrated, their general effect in the occupational health hazard arena is to bias outcomes in favour of industrial interests or at least of the status quo. Finally, because of their manipulability and bias, they lead to skepticism about, and alienation from, the policy process.

These analytic techniques are best employed as adjuncts to an essentially deliberative and participatory process. Amorphous preferences are likely to take shape, and learning about complex issues to occur, in the interactive process of generating, opposing, defending, reviewing, and modifying concrete options.

This emphasis upon essentially cybernetic mechanisms needs to be qualified in at least two respects. First, it should not be taken to imply that analysis cannot play a larger role in Canadian standard-setting processes than it has in the past. Indeed, the encouragement of partisan analysis through notice and comment procedures, and the role of advisory committees in overseeing and funding research and analysis, with the implied governmental budgetary commitment, are central to the consultation model proposed here. Finally, we cannot lose sight of the inevitable limitations of both analysis and cybernetics, and the irreducible core of judgment upon which all public policy decisions ultimately turn.

\textsuperscript{136} See Tuohy and Trebilcock, supra note 14, at ch. 9.