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PROTECTION OF LIFE

workplace pollution

Working Paper 53

Canada

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Law Reform Commission
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Working Paper 53

WORKPLACE POLLUTION

1986

Notice

This Working Paper presents the views of the Commission at this time. The Commission's final views will be presented later in its Report to the Minister of Justice and Parliament, when the Commission has taken into account comments received in the meantime from the public.

The Commission would be grateful, therefore, if all comments could be sent in writing to:

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Introduction

"Workplace pollution" is not a familiar phrase, but it describes a reality of working life for a great many Canadians. The critical evaluation of ways in which the laws which protect Canadians from the effects of this reality can and should be improved, is the purpose of this Paper.

The effects of physical and chemical agents in the work environment on the health of employees have much in common with other kinds of work hazards, such as unsafe machinery: they involve the same distinctive set of employer–employee relationships, and are generally controlled under the same legislation. At the same time, a number of factors make their control both more complex and more contentious than that of safety hazards. It is for this reason that this Paper deals specifically with workplace *pollution*, encompassing both physical and chemical agents, rather than attempting to cover the entire area of occupational health and safety.

Chapter One explores several aspects of the distinctive complexity of workplace pollution problems. It is emphasized that public policy with respect to workplace pollution must often operate in a context of uncertainty. Indeed, much of it is *about* uncertainty: which values (and whose values) to emphasize in choosing among alternative courses of action based on the projected consequences of varying assumptions about the real long-term health effects of workplace pollutants. Another crucial aspect of the workplace pollution problem, of course, is the nature of employee–employer relationships and the fact that, for many if not most of the victims of workplace pollution, exposure is "voluntary" only in a superficial sense.

Chapter Two reviews several sets of policy responses to the problem of protecting employees, with particular emphasis on how well (or badly) adapted they are to the peculiarities of workplace pollution. The two most significant are: first, the evolution of the internal responsibility system as a set of legal institutions; second, the development and enforcement of regulations limiting exposure levels or embodying other, more general norms. The performance of both these approaches is critically reviewed, as is the relevance of workers' compensation and collective bargaining to protection from workplace pollutants. A necessarily brief discussion is also provided of a number of substantive issues in standard setting.

Chapter Three focusses on compliance and enforcement mechanisms. Prosecution is generally the major mechanism by which sanctions can be imposed on violators, especially violators of exposure standards. Yet it has a number of serious limitations. These limitations are compounded when the attempt is made to apply the criminal law to the injury of workers, attractive though that attempt may be on grounds of principle. Yet the fact that behaviour which endangers workers may not be treated as criminal

does *not* therefore mean that it is a matter of moral indifference: indeed, it could be argued that the protection of employees is too important to be left, except in special cases, to the time-consuming machinery of the criminal justice system.

Chapter Four takes up the challenges presented in Chapter Three in two ways. First, it briefly puts forward arguments of principle for treating some kinds of acts and omissions which endanger workers as criminal. Second, it presents a number of proposals for law reform outside the area of criminal law, most importantly with respect to: the review of the adequacy of exposure standards; the development of more effective non-criminal sanctions; and the broadening of access to remedies for the potential victims of workplace pollution. One of the striking features of the problem, it is argued, is the extent to which those who may be affected by pollutants are denied any effective way of seeking the protection to which the law entitles them.

A cautionary note must be sounded here. Once outside the realm of the criminal law, thirteen different jurisdictions become involved in the protection of employee health and safety. No attempt has been made here to be comprehensive in treating the strengths and weaknesses of various jurisdictions' approaches in this area. When examples from outside the federal jurisdiction are cited, they are just that — examples — and are not, with a few exceptions which are clearly identified, intended as either criticisms or endorsements of the approach of any provincial jurisdiction. Neither are they, as a rule, intended as "best" or "worst" cases. However, trying to say anything meaningful about the protection of employee health and safety in Canada would be impossible without looking, however incompletely, at the richness of provincial experience with legal mechanisms that are, with a few exceptions, surprisingly similar across jurisdictions with dramatically different assortments of work environments.

CHAPTER ONE

Workplace Pollution: Defining the Problem

I. The Dangers of Workplace Pollution

"Work is dangerous to your health."[1] That observation, the title of an extremely significant book on workplace health and safety issues which appeared more than a decade ago, remains true today for a great many Canadian workers.

In 1982, there were 854 fatal on-the-job accidents in Canada, and more than half a million cases of disabling accidents or work-related illnesses (that is, accidents or illnesses which kept an employee off the job for at least one full day after the occurrence). Between 1972 and 1981, more than 10,000 Canadians died from injuries received on the job. And throughout that decade, there were roughly six disabling injuries every year for each 100 workers employed in Canada.[2] Fatality and injury rates obviously vary widely from industry to industry, and by occupation within industry: in general, primary industries (mining and quarrying, forestry, fishing, hunting, and trapping) are the riskiest in terms of a worker's chances of being killed on the job.[3] For example, in 1982 the fatality rate in forestry was 119.7 deaths per 100,000 employees. Were this fatality rate to remain constant, the implication is that over a 30-year working life an employee in forestry stands one chance in 28 of being killed on the job. For employees in mining, quarrying and oil wells, performing the same calculation based on the 1982 fatality rate of 83.6 per 100,000 employees yields a lifetime risk of being killed on the job of one chance in 40.[4] This is obviously an oversimplification, since fatality rates have generally declined at least over the short term[5] and since it assumes

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1. J.M. Stellman and S.M. Daum, *Work Is Dangerous to Your Health* (New York: Vintage, 1973).

2. Figures from *Employment Injuries and Occupational Illnesses, 1972-1981* [including preliminary data for 1982] (Ottawa: Labour Canada, 1984).

3. *Id.*, p. 66; C. Reasons *et al.*, *Assault on the Worker* (Toronto: Butterworths, 1981), p. 25.

4. Fatality rates from *supra*, note 2, p. 14.

5. For example, between 1972 and 1981 the fatality rate in Canadian mining declined from 141.3 to 70.8 per 100,000 employees, and in forestry from 136.3 to 91.5 per 100,000 employees. However, this long-term trend hides some dramatic "peak" years in which fatality records were particularly bad — for example, 1973 and 1979 for forestry and 1979 for mining, in which fatality rates were over 150 per 100,000 employees. *Supra*, note 2, p. 57.

all employees in a given sector are equally at risk, but it does illustrate the seriousness of the problem.

Statistics on disabling injuries may be subject to considerable error as a result of under-reporting, because accident and illness statistics in Canada are based on approved claims for workers' compensation:

> Since compensation payments are less than earnings, workers may ignore minor injuries, and may also be reluctant to claim where they feel they will not be fairly treated by the Board. ... Employers may under-report their injury rate where their workers' compensation assessments are related to their accident record, in spite of fines for concealing injuries. Accidents are probably under-reported in some workplaces where there is no labour union or health and safety committee. And, since statistics are derived almost solely from workers' compensation boards, injuries suffered by workers not covered by these boards will often go unreported.[6]

Problems of this sort become drastically more severe when the issue is not work-related injuries, but rather work-related illness as a result of the workplace pollution which is the focus of this Working Paper. For reasons discussed in more detail in Chapter Two, as well as those quoted above, compensation claims initiated or approved are of extremely limited value as an indicator of the seriousness of the problems of workplace pollution and work-related disease. Weiler has calculated that on the basis of a conservative estimate by Doll and Peto[7] of the percentage of cancer deaths attributable to occupational factors, there are some 700 such deaths a year in Ontario. Yet in one recent year, only 95 were reported to the province's Workers' Compensation Board and only 44 were accepted as compensable. "This is less than 1 out of 17 occupational cancer fatalities predicted by the conservative end of the scientific debate, let alone the one out of every 75 deserving cases predicted by those of more radical persuasion."[8]

In some cases, the effects of workplace pollutants on the health of those exposed to them can be observed immediately. Recent reports in the *Journal of the American Medical Association* include the cases of two workers who died of ethylene dibromide poisoning after trying to clean a tank which contained residues of the pesticide,[9] and of a worker who died from inhaling hydrogen cyanide at a plant which recovered silver from used photographic films.[10] After this incident, many other workers were found to

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6. *Mosaic of Mosaics: A Report on Occupational Health and Safety in Canada* (Hamilton, Ont.: Canadian Centre for Occupational Health and Safety, 1983), p. 8.

7. R. Doll and R. Peto, *The Causes of Cancer: Quantitative Estimates of Avoidable Risks of Cancer in the United States Today* (New York: Oxford University Press, 1981), pp. 1238-45.

8. P. Weiler, *Protecting the Worker from Disability: Challenges for the Eighties* (Toronto: Government of Ontario, 1983), pp. 22-4. For an explanation of these disparate estimates of the number of occupational cancers, see the references cited in *infra*, notes 34 to 37 inclusive, and pp. 10-1.

9. G.A. Letz *et al.*, "Two Fatalities after Acute Occupational Exposure to Ethylene Dibromide" (November 2, 1984), 252:17 *JAMA* 2428.

10. P. Blanc *et al.*, "Cyanide Intoxication among Silver-Reclaiming Workers" (January 18, 1985), 253:3 *JAMA* 367.

have the symptoms of acute cyanide poisoning, some of which were still evident seven months after the plant was shut down by health authorities. Asphyxia is another frequent pollutant-related cause of death on the job: in early 1981, two maintenance workers at a plant in Alberta went into a confined space filled with nitrogen gas to retrieve dropped tools and died of the oxygen deprivation which resulted. This case resulted in the unsuccessful prosecution of the employer, Syncrude Canada Limited, on charges of criminal negligence causing death.[11]

No reliable data base exists which would allow an assessment of the frequency of cases where the health impacts of workplace pollution are readily observable on a relatively short-term basis. The experiences of industrial workers recounted in a recent book entitled *Workers at Risk*[12] and a few anecdotes from recent Canadian experience suggest that such cases (and the risk thereof) may remain depressingly widespread. For example, despite the long history of knowledge about the dangers of lead,[13] one worker at a plant in London, Ontario suffered a "near collapse" in December 1981 as a result of lead-poisoning.[14] In cases like this, "medical removal" (simply taking the worker off the job until his blood lead levels fall below a level considered "acceptable") remains a common alternative to controlling lead levels in the work environment.

In many other cases, the symptoms of work-related illness may appear only gradually. Perhaps the most familiar work-related *respiratory disease* is silicosis, a fibrosis of the lung which results from inhalation of silica particles. Silicosis is a hazard for miners, stone workers and workers in abrasive blasting operations, among others.[15] The destruction of lung function it involves, which may continue even after exposure ends, can be totally disabling; there is no satisfactory treatment; and victims are also more likely than the general population to die of other causes such as lung cancer, non-malignant respiratory disease, and tuberculosis.[16] Equally debilitating, and particularly important in the Canadian context, is asbestosis, which has had a devastating impact on the health of workers in Canada's asbestos industry.[17] Debilitating

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11. *R.* v. *Syncrude Canada Ltd.*, Alta. Q.B., District of Edmonton, No. 8303-0644-CO. See generally L. Osbern, "Simple Asphyxiants," in *Environmental and Occupational Medicine*, ed. W. Rom (Boston: Little, Brown, 1983), p. 285.

12. D. Nelkin and M.S. Brown, *Workers at Risk* (Chicago: University of Chicago Press, 1984). This compilation of worker interviews is extremely highly recommended for readers unfamiliar with the details of industrial workplaces, and as a dramatic illustration of the gap between the black-letter law and the reality of day-to-day employment hazards.

13. See A. Fischbein, "Environmental and Occupational Lead Exposure," in Rom, ed., *supra*, note 11, p. 433.

14. J. Hayashi, "Plant Lead Blamed for Long List of Ills," *The London Free Press*, March 31, 1982, pp. A1, A8.

15. J.K. Corn, "Historical Aspects of Industrial Hygiene — II. Silicosis" (February 1980), 41 *American Industrial Hygiene Association Journal* 125; R.N. Jones, "Silicosis," in Rom, ed., *supra*, note 11, p. 197.

16. M. Finkelstein *et al.*, "Mortality among Miners Receiving Workmen's Compensation for Silicosis in Ontario, 1940-1975" (September 1982), 24:9 *Journal of Occupational Medicine* 663.

17. W. Rom, "Asbestos and Related Fibers," in Rom, ed., *supra*, note 11, pp. 160-7; L. Tataryn, *Dying for a Living: The Politics of Industrial Death* (Ottawa: Deneau and Greenberg, 1979), pp. 15-60.

lung diseases can also result from occupational exposure to a variety of other mineral dusts, including coal-dust (''black lung''), aluminum, beryllium, talc, mica, iron oxide (a hazard for arc welders and metal grinders), and many other substances. ''An example is 'Labrador lung,' which occurs in iron ore miners in Labrador who are exposed to silica and asbestos'' in the workplace.[18]

Cancers at a variety of sites including lung, bladder, liver and prostate are now acknowledged as being caused by many workplace pollutants.[19] As a rule, cancers develop only many years after the initial exposure, and their origins in the workplace are often hotly disputed in particular cases. The time interval between onset of exposure and manifestation of the disease, known as the latency period, is often 20 years or more for many cancers.[20] The International Agency for Research on Cancer (IARC), which conducts an ongoing review of the literature on selected substances suspected of causing cancer, classifies seven industrial processes and 23 chemicals or groups of chemicals as being proved carcinogens on the basis of evidence from epidemiological studies of exposed human beings.[21] Occupational exposure to carcinogens is almost certainly widespread in the case of the industrial processes, which include: boot and shoe manufacturing and repair; furniture manufacturing; nickel refining; and certain occupations in the rubber industry. And substantial occupational exposure can also be predicted for chemicals such as: arsenic and its compounds; asbestos; benzene; benzidine; chromium and some of its compounds; soots, tars and oils; and vinyl chloride.

An additional 61 chemicals and processes are considered *probably* carcinogenic to human beings, on the basis of combinations of animal and human evidence.[22] Among these are such relatively common workplace contaminants as acrylonitrile, benzo[a]pyrene (one of the carcinogenic constitutents of coke oven emissions), beryllium and beryllium compounds, nickel and certain nickel compounds, cadmium and cadmium compounds, carbon tetrachloride, chloroform, chlorophenols, ethylene dibromide, formaldehyde gas, and occupational exposure to phenoxy acid herbicides. Individual studies or groups of studies exist which link a variety of other specific industries or occupations with an excess risk of death from cancer.[23]

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18. W. Rom *et al.*, ''Other Occupational Lung Diseases,'' in Rom, ed., *supra*, note 11, pp. 251-2.

19. Reviews of the evidence linking occupational exposures and cancer are provided in P. Decoufle, ''Occupation,'' in *Cancer Epidemiology and Prevention*, ed. D. Schottenfeld and J. Fraumeni (Philadelphia: Saunders, 1982), p. 318; D. Schottenfeld and J. Haas, ''Carcinogens in the Workplace'' (1979), 29 *CA: A Cancer Journal for Clinicians* 144.

20. Decoufle, *id.*, pp. 325-7.

21. International Agency for Research on Cancer, *IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans*, Supplement 4: *Chemicals, Industrial Processes and Industries Associated with Cancer in Humans* (Lyon, France: IARC, 1983), pp. 14-5. On the limitations of epidemiological evidence as a basis for determining human carcinogenicity, see *infra*, pp. 13-5.

22. *Id.*, pp. 15-6.

23. See *supra*, note 19.

Reproductive hazards, including sterility and birth defects resulting either from chromosomal abnormalities in germ cells or from damage to the embryo or fetus *in utero*, are another area of concern.[24] As in the case of cancers, effects are not always quickly observed: "an occupational exposure may have reproductive effects that are not manifest as gross congenital malformations or even apparent at birth,"[25] further complicating the task of linking workplace pollutants with their eventual impact. Reproductive hazards in the workplace have received particular attention as a result of the policy of some industrial firms of excluding fertile women from work exposing them to certain known reproductive hazards, such as lead.[26] Appendix A provides a partial list of substances which appear to cause reproductive damage in human beings and animals to which workers might reasonably be expected to be exposed, synthesized from some recent literature reviews.

Damage to the brain and nervous system is a particularly unsettling potential consequence of workplace exposure to a variety of pollutants.[27] In some cases, the neurotoxic effects of workplace exposures may be so serious as to be observable almost immediately: workers exposed to the pesticide Kepone at a plant in Virginia where it was manufactured began to develop "Kepone shakes" sometimes within weeks of the initial exposure.[28] But other kinds of damage may be done only gradually, as a result of prolonged exposure. This is one of the major sources of concern with respect to workplace exposure to lead.[29] Appendix B is a list of substances treated in a recent text on environmental and occupational health as posing a danger to the nervous system. According to another recent text: "More than 100 chemicals (including virtually all solvents) can cause central nervous system depression"[30] — an extremely important observation in view of the myriad industrial and commercial uses of chemical solvents.

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24. N. Chenier, *Reproductive Hazards at Work: Men, Women and the Fertility Gamble* (Ottawa: Canadian Advisory Council on the Status of Women, 1982); I.C.T. Nisbet and N.J. Karch, *Chemical Hazards to Human Reproduction* (Park Ridge, N.J.: Noyes Data Corp., 1983); J. Stellman, "The Occupational Environment and Reproductive Health," in Rom, ed., *supra*, note 11, p. 75; J.A. Thomas, "Reproductive Hazards and Environmental Chemicals: A Review" (Spring 1981), 2:4 *Toxic Substances Journal* 318.

25. L. Sever, "Reproductive Hazards of the Workplace" (October 1981), 23:10 *Journal of Occupational Medicine* 685, p. 686.

26. Chenier, *supra*, note 24, pp. 41-4; P. Sheridan, "Reproductive Hazards: Probing the Ethical Issues" (May 1983), 45:5 *Occupational Hazards* 72; W. Williams, "Firing the Woman to Protect the Fetus" (1981), 69 *Georgetown Law Journal* 641.

27. E. Baker, Jr., "Neurological Disorders," in Rom, ed., *supra*, note 11, p. 313.

28. C.B. Kelly, "Kepone," in *Who's Poisoning America?*, ed. R. Nader *et al.* (San Francisco: Sierra Club Books, 1981), p. 85.

29. See, *e.g.*, P. Campara *et al.*, "Psychological Performance of Workers with Blood-Lead Concentrations Below the Current Threshold Limit Value" (1984), 53 *International Archives of Occupational and Environmental Health* 233.

30. B. Levy and D. Wegman, "Recognizing Occupational Disease," in *Occupational Health*, ed. B. Levy and D. Wegman (Boston: Little, Brown, 1983), p. 35. See also E.L. Baker *et al.*, "The Neurotoxicity of Industrial Solvents: A Review of the Literature" (1985), 8 *American Journal of Industrial Medicine* 207.

These are merely illustrations, and do not represent the only, or necessarily the most important, kinds of damage to human health which result from workplace pollutants. For example, exposure to many relatively widespread workplace pollutants including carbon monoxide, methylene chloride, nitrates, fluorocarbons and heavy metals has been linked with varying degrees of certainty to such cardio-vascular effects as heart attacks, cardiac arrythmias, and increased risk of coronary artery disease and hypertension.[31] Acute hepatitis can result from excessive exposure to carbon tetrachloride, chloroform, dinitrobenzene, a number of chlorinated hydrocarbon pesticides, ether, and epoxy resins.[32] Acute renal (kidney) failure may result from exposure to high levels of ethylene glycol, carbon tetrachloride, oxalic acid, or inorganic mercury, and chronic failure from inhalation of lead and cadmium, and from inhalation or absorption of carbon disulphide or chromium compounds.[33] (In 1983, a number of workers who had been exposed to the fumes of solder containing cadmium for many years at a plant in eastern Ontario were diagnosed as having suffered permanent kidney damage.[34]) The catalogue of work-related pollutant hazards is a long one.[35]

II. The Scope of the Problem: Living with Uncertainty

Lists of hazardous substances cannot reliably provide an indication of the dimensions of the potential damage caused by workplace pollutants. At a minimum, we would need to know how many workers were exposed to a particular pollutant or group of pollutants. Yet even knowing that (for example) 20 million workers in the United States may be exposed to chemicals which cause nervous system damage[36] tells us only a limited amount, since no information is provided about the level and duration of exposure. Thus, such an approach is vulnerable to the criticism that it implicitly overstates risks: some of the affected individuals may be exposed at far higher levels than others, or for longer periods of time. For this reason, the estimates of the number of Ontario workers exposed to a few selected hazardous substances which are reproduced in Appendix C are best read as an indication of the *possibilities* for health

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31. L.J. Fine, "Occupational Heart Disease," in Rom, ed., *supra*, note 11, p. 359; K. Rosenman, "Cardiovascular Disorders," in Levy and Wegman, eds., *supra*, note 30, p. 331.

32. G. Pransky, "Hepatic Disorders," in Levy and Wegman, eds., *supra*, note 30, p. 373.

33. H. Hu, "Renal and Urinary Tract Disorders," in Levy and Wegman, eds., *supra*, note 30, p. 381.

34. "Get Poisonous Cadmium Out of Plant," *UE* [United Electrical, Radio and Machine Workers'] *News*, August 15, 1983, p. 2.

35. An extensive guide to the short-term health effects and symptoms of over-exposure to common industrial chemicals is provided in the *NIOSH/OSHA Pocket Guide to Chemical Hazards* (Washington, D.C.: National Institute for Occupational Safety and Health, 1978). A systematic review of the health hazards of major industrial processes is provided by W. Burgess, *Recognition of Health Hazards in Industry* (New York: Wiley-Interscience, 1981).

36. A. Anderson, "Neurotoxic Follies" (July 1982), *Psychology Today* 30 (citing estimates produced by the National Institute for Occupational Safety and Health).

damage resulting from workplace exposure to those few substances, in that particular industrialized jurisdiction.

An alternative way of estimating the dimensions of the workplace pollution problem involves attempting to relate occupation or exposure to a particular chemical to the employee's likelihood of contracting or dying from a particular disease. This approach has been most widely applied to studies of cancer deaths; it has been found, for example, that coke oven workers may be as much as 15 times more likely than the general population to die of lung cancer, depending on the length of time worked and the worker's particular location on the coke oven battery.[37] More generally, using a variety of data, Doll and Peto have estimated, based on approximations of the percentage of cancers at each major site which might be attributable to occupational factors, that roughly four per cent of cancer deaths in the United States is attributable to past occupational exposures.[38] Another study, which extrapolated from risk estimates derived from studies of workers exposed to six specific occupational carcinogens, came up with a much higher, and equally widely cited estimate of 20 to 38 per cent.[39]

Both sets of estimates are seriously flawed, for different reasons. There are a number of reasons to believe that the figure of 20 to 38 per cent may be exaggerated,[40] but there are also reasons to believe that Doll's and Peto's figure contains a bias on the low side, particularly when used as the basis for an assessment of *future* cancer deaths attributable to occupational factors.[41] In addition, both sets of estimates were developed in the United States context. In 1984, Miller[42] published an estimate suggesting that nine per cent of Canadian cancer deaths are attributable to occupation. Since roughly 40,000 Canadians die from cancer every year, this estimate implies that there are approximately 3,600 work-related cancer deaths per year. And even the much lower four per cent figure developed by Doll and Peto implies some 1,600 occupational cancer deaths a year — a considerably higher toll than that from accidents on the job.

Even greater uncertainty surrounds the extent of most work-related diseases other than cancer, and makes arriving at reliable estimates of the full extent of the workplace disease problem all but impossible. Most illnesses which may result from exposure to

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37. C.K. Redmond, "Cancer Mortality among Coke Oven Workers" (October 1983), 52 *Environmental Health Perspectives* 67.

38. Doll and Peto, *supra*, note 7.

39. National Cancer Institute, National Institute of Environmental Health Sciences, and National Institute for Occupational Safety and Health, "Estimates of the Fraction of Cancers in the United States Related to Occupational Factors" (1978), reproduced in *Banbury Report 9: Quantification of Occupational Cancer*, ed. R. Peto and M. Schneidermann (Cold Spring Harbor, N.Y.: Cold Spring Harbor Laboratory, 1981), p. 701.

40. Doll and Peto, *supra*, note 7, pp. 1240-1.

41. D.L. Davis *et al.*, "Estimating Cancer Causes: Problems in Methodology, Production and Trends," in *Banbury Report 9*, *supra*, note 39, pp. 293-8. See also R. Peto, "Distorting the Epidemiology of Cancer: The Need for a More Balanced Overview" (March 27, 1980), 284 *Nature* 297, p. 299.

42. A.B. Miller, "The Information Explosion — The Role of the Epidemiologist" (1984), 8 *Cancer Forum* 67, p. 73.

workplace pollutants are not sufficiently distinctive to enable the diagnosis of individual cases as unequivocally occupational in origin. Relatedly, attempts based on currently available information about illness and exposures will almost certainly represent *underestimates* of the extent of illness caused by workplace pollutants, because we have only partial and incomplete information on the impact of work-related contaminants on human health.

Many common workplace pollutants have been exhaustively studied. Yet on an overall basis there is a massive shortage of information about the potential hazards of many such pollutants. In 1984, the United States National Research Council released the report of a study which assessed the availability and quality of toxicological information about a small random sample of the roughly 65,000 chemicals which appear on the inventory compiled under the *U.S. Toxic Substances Control Act*. Based on an extrapolation of the results of a search for information about that random sample of substances, the study estimated that for roughly four-fifths of the industrial and commercial chemicals other than those such as pesticides and food additives which are specifically regulated, *no toxicity information at all* would be available. At best, a "partial health hazard assessment" would be possible for roughly one-tenth of such chemicals.[43] The National Research Council study emphasizes the limitations imposed on estimates of the size of the workplace pollution problem by incomplete information. The importance of information deficiencies was further dramatized by the Bhopal (India) pesticide plant disaster, after which it became apparent that very little was known about the long-term effects of the methyl isocyanate which had been released from the plant.[44]

The number of synthetic organic chemicals in commercial use, and the overall production volume of chemicals with known damaging effects on human health such as benzene, perchloroethylene and vinyl chloride, have increased dramatically in the years since World War II.[45] In the case of diseases with long latency periods, such as most cancers or some types of nervous system damage, any assessment of the magnitude of health problems in exposed human populations resulting from exposure during this "chemical explosion" is premature. We simply do not know yet what the ultimate impact will be on the health of those exposed to such substances in the workplace.

Data base limitations can be manifested in other ways, as well. In some cases, evidence may simply have been overlooked: for example, regulatory action in the United States followed relatively swiftly on the 1974 revelation that three workers exposed to vinyl chloride at an American chemical plant had died of a rare cancer

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43. U.S. National Research Council, *Toxicity Testing: Strategies to Determine Needs and Priorities* (Washington, D.C.: National Academy Press, 1984); see especially pp. 81-124.

44. R. Dagani, "Data on MIC's Toxicity Are Scant, Leave Much to Be Desired" (February 11, 1985), *Chemical and Engineering News* 17.

45. Davis *et al.*, *supra*, note 41.

known as angiosarcoma of the liver.[46] By the time this discovery was made, no fewer than nine cases of the same disease had been diagnosed among workers at a vinyl chloride polymerizing plant in Shawinigan, Québec[47]; yet the high incidence of the disease at that one plant appears to have provoked no regulatory interest until after the highly publicized American announcement.[48] On a broader scale, the carcinogenicity assessments of the International Agency for Research on Cancer (IARC) are widely quoted as authoritative, yet the IARC has looked at the literature only on a limited number of substances and processes.[49]

It should further be pointed out that the overwhelming bulk of the research on occupational health hazards had, at least until the past few years, been concerned with industrial pollutants and the industrial workforce. It does not in any way minimize the continuing importance of pollutants in the industrial workplace to point out that a majority of today's workforce is *non*-industrial. Research on the health implications of such potential hazards as "indoor pollution" in office complexes[50] is a relatively recent phenomenon, as is the sealed office building which gives rise to this particular problem. The information on which to base any kind of quantitative estimate of the present and future size of the problem created by office health hazards simply does not exist. But this does not mean, by any stretch of the imagination, that the problem does not exist.[51]

The methods used to gather evidence about relationships between occupational exposure and disease in human subjects themselves contain a built-in limitation: the seriously limited statistical power of most epidemiological studies. "Statistical power" is a measure of the likelihood that a particular study will be able to detect an underlying relationship which, in fact, exists.[52] A recent review of 33 published occupational mortality studies concluded that many of them had "a low probability of detecting,

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46. D. Doniger, *The Law and Policy of Toxic Substances Control: A Case-Study of Vinyl Chloride* (Baltimore: Johns Hopkins University Press for Resources for the Future, 1978), pp. 1-8, 36-66.

47. F. Delorme and G. Thériault, "Ten Cases of Angiosarcoma of the Liver in Shawinigan, Quebec" (May 1978), 20:5 *Journal of Occupational Medicine* 338.

48. G.B. Doern, *Regulatory Processes and Jurisdictional Issues in the Regulation of Hazardous Products in Canada*, Background Study No. 41 (Ottawa: Science Council of Canada, 1977), pp. 97-103.

49. Clearly, substances not yet evaluated by the IARC are not therefore less hazardous. Yet there exists widespread confusion between negative evidence, or evidence of no hazard, and a simple lack of evidence about available hazards; see *infra*, pp. 17-8.

50. See, *e.g.*, B. Meyer, *Indoor Air Quality* (Reading, Mass.: Addison-Wesley, 1983); T. Sterling and D. Kobayashi, "Exposure to Pollutants in Enclosed Living Spaces" (1977), 13 *Environmental Research* 1; R. Wadden and P. Scheff, *Indoor Air Pollution* (New York: John Wiley, 1983).

51. See, *e.g.*, J.C. McDonald, "Investigation of Employee Health Complaints at Les Terrasses de la Chaudière: Final Report to Treasury Board/Public Service Alliance of Canada Steering Committee," mimeographed (Ottawa: July 1984). This study was carried out in response to employee illness at a federal government office complex in Hull, Québec, which had been a persistent problem since the complex was first opened in 1977, and concluded (p. 38) that "the health complaints at Les Terrasses de la Chaudière are entirely typical of the many other episodes of 'Building Illness' or 'Tight Building Syndrome' investigated so far, without satisfactory explanation, in North America and Western Europe during the past decade."

52. See *infra*, p. 15.

among exposed subjects, an increase in the incidence of disease ... of 50% above that among unexposed subjects."[53] For statistical reasons, the best epidemiological studies in the world may well "lose" moderate percentage increases in disease or death, yet the total number of individuals exposed to such moderately increased risks may be extremely large.[54] This is an *inherent* limitation, quite distinct from the problem of bias introduced by improper methodology (for example, failure to take the long latency period into account in studies of cancer mortality).[55] It means that even if work-related diseases were always correctly diagnosed and all possible connections between work and sickness were studied, the resulting conclusions about the impact of work-related disease would be underestimated.

But it can frequently be a problem, at both statistical and clinical levels, to disentangle work-related from other factors in the development of diseases. At the statistical level, a familiar case is that of workers who are exposed to known causes of lung cancer or other respiratory disease on the job, but who also smoke. Researchers have attempted to determine the proportion of disease attributable to occupational factors as opposed to smoking by comparing disease rates among all four possible combinations of the two relevant variables.[56] Usually, however, the issue will be more complex: several hazards and/or several kinds of health damage may be involved. Frumkin reports the case of a young car painter complaining of generalized forgetfulness, dizziness, and excessive fatigue — symptoms which had developed gradually over two years. On the job, he was or had been exposed to nine different organic solvents, four paint binders, and other substances including dyes, zinc, chromates, and titanium dioxide.[57]

A general connection between work and illness seems obvious in this case, because of the widely acknowledged nerve-damaging effects of solvents; however, it is not necessarily the case that this connection would meet legal standards of proof even for purposes of workers' compensation or other civil liability. In many other cases the connection between illness and workplace pollutants, individually or in combination, may be less well or conclusively established. To state the problem in another way, many kinds of health damage are not distinctively or unequivocally attributable to a particular occupational factor. Levy and Wegman contend that possible occupational causes are often neglected in the diagnosis of respiratory, liver, and neuropsychiatric

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53. T. Haines and H. Shannon, "Sample Size in Occupational Mortality Studies: An Analysis of the Literature" (August 1983), 25:8 *Journal of Occupational Medicine* 603, p. 606.

54. See C. Muir, "Limitations and Advantages of Epidemiological Investigations in Environmental Carcinogenesis" (1979), 329 *Annals of the New York Academy of Sciences* 153, pp. 160-1.

55. P. Enterline, "Pitfalls in Epidemiological Research" (March 1976), 18:3 *Journal of Occupational Medicine* 150, pp. 150-2.

56. E.C. Hammond *et al.*, "Asbestos Exposure, Cigarette Smoking, and Death Rates" (1979), 330 *Annals of the New York Academy of Sciences* 473.

57. H. Frumkin, "Toxins and Their Effects," in Levy and Wegman, eds., *supra*, note 30, p. 132. Since the victim was only 24 years old, an obvious question is that of what subtle damage to his body may become apparent in later years in a way which will never be connected to the occupational poisons of his youth.

disease, and in the case of "illnesses of unknown cause."[58] It is probably unrealistic to expect to be able, in the foreseeable future, to diagnose all the subtle impacts on human health of workplace pollutants, much less (for reasons discussed in the context of the limits of epidemiology) to quantify their impact. Yet the seriousness of the workplace pollution problem is in no way diminished, and may indeed be emphasized, by that inescapable uncertainty.

III. Weighting Uncertainty: Competing Problem Definitions

The inability of most epidemiological studies used in assessing occupational health effects to detect moderate increases in disease incidence or mortality rates illustrates the importance of a much neglected dimension of the use of scientific evidence in public policy. As a starting-point for understanding some of the problems involved, it is essential to define two types of errors which can be made in any enterprise which attempts to test a hypothesis: false positives and false negatives. A false negative represents, in this context, a failure to find sufficient evidence to confirm the hypothesis (for example, that substance *X* causes cancer in species *A*) which is nevertheless true. A false positive result, conversely, is an inaccurate confirmation of a hypothesis which is, in fact, not true.

Like the criminal justice system, most scientific investigation operates on the principle of minimizing false positives: it is (rightly) considered much more objectionable to convict an innocent man, or to consider an incorrect hypothesis as proved, than to let an innocent man go free or to declare that not enough evidence exists to prove the hypothesis being tested.[59] In scientific inquiry, the principle of minimizing false positives is normally manifested at the level of individual experiments or studies as a requirement for a 95 per cent statistical level of confidence — that is, a probability of five per cent or less that the results are due to chance. But this requirement often implies accepting high likelihoods of a false negative — such as failure to detect the damaging effects of a particular compound. "For a given body of data analyzed with a particular approach, it is possible to reduce the probability of one type of error only by increasing the probability of the other type."[60] The high probability of false negative results is by no means unique to epidemiological studies: laboratory experiments using animals may also be very likely to generate false negative results in some contexts.[61]

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58. Levy and Wegman, "Recognizing ...," *supra*, note 30.

59. T. Page, "A Generic View of Toxic Chemicals and Similar Risks" (1978), 7 *Ecology Law Quarterly* 207, p. 220.

60. A. Fisher, "The Scientific Bases for Relating Health Effects to Exposure Levels" (1982), 3:1 *Environmental Impact Assessment Review* 27, p. 35.

61. *Id.*, p. 39; see also T. Page, "A Framework for Unreasonable Risk in the Toxic Substances Control Act" (1981), 363 *Annals of the New York Academy of Sciences* 145, pp. 147-50.

This somewhat academic discussion is relevant to workplace pollution for two reasons. First, in the course of debates about whether, and how strictly, to control exposure to particular substances, it is superficially plausible to argue that the same weight should be given to positive and to negative evidence.

> In recent years industry groups have increasingly asked for negative findings to be taken into account in the regulatory process. *However, there is literally no information content* in a negative finding unless there is an analysis of statistical power, or equivalently the probability of a false negative.[62] [Emphasis added]

Superimposed on this set of uncertainties, which has only been described in superficial terms, is the fact that for regulatory purposes the real issue is that of the comparative *consequences* of the two types of errors. What will happen if, on the one hand, governmental authorities regulate a substance whose damaging effects on human health turn out to be less serious than they appear to be on the basis of currently available evidence — or if, on the other hand, they defer stricter controls on the basis that the available information does not provide sufficient proof of the existence of a hazard which is later shown conclusively to exist? This point has been emphasized by a former senior official of the United States Environmental Protection Agency in a discussion of "the inevitability of being wrong" in regulatory decisions:

> Enormous scientific uncertainty surrounds the potential risks and benefits of most chemicals. Yet the risks and benefits are there. This means the regulator's every action — or inaction — represents a decision of some kind. For example, postponing action on some chemical until there is better information is a decision; taking precautionary action in the meantime is a decision; delaying action for the time being because of limited or other priorities is a decision.[63]

As one example of the practical importance of these observations, consider the debate over whether or not thresholds (levels of exposure below which the risk is zero, or proportionately much reduced) should be assumed to exist for cancer-causing chemicals. The problem arises because of the need to extrapolate from the high doses of a suspect substance given to laboratory animals to the far lower doses to which human beings may expect to be exposed.[64] For some categories of carcinogens, whose mechanism is not believed to involve direct damage to genetic material, it is argued that biological thresholds can be assumed to exist. It is also pointed out that carcinogens are known to vary widely in their potency, and that for many such substances an

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62. Page, *supra*, note 61, p. 162.

63. S. Jellinek, "On the Inevitability of Being Wrong" (1981), 363 *Annals of the New York Academy of Sciences* 43.

64. Suspected carcinogens are tested on animals at doses several orders of magnitude higher than those to which a human being would be exposed, because this is the only way to induce a high enough incidence of cancer to produce a statistically significant result without using a vast (and prohibitively expensive) number of test animals. In effect, what is done is "to make one animal stand in for a thousand — by increasing the dosage." U.S. Council on Environmental Quality, *Environmental Quality 1979* (Washington, D.C.: U.S. Government Printing Office, 1980), p. 209. See also U.S. Congressional Office of Technology Assessment, *Assessment of Technologies for Determining Cancer Risks from the Environment* (Washington, D.C.: U.S. Government Printing Office, 1981), pp. 162-3.

"effective threshold" may exist because of the limited life span of the human species.[65] In response to these and related arguments, Rall counters:

> [T]he issue is not thresholds or no thresholds; it is one of adding a new carcinogen to a pool of present carcinogens. I would suggest, therefore, that there may well be thresholds with carcinogenic substances when given to a very clean animal in an environmentally controlled situation ... The human population is different, however: the mouse doesn't smoke or breathe hydrocarbons or sulphur oxides from fossil fuels, doesn't drink, doesn't take medicine, doesn't eat bacon or smoked salmon, but man does.
>
> The current controversy regarding the occurrence of thresholds for carcinogenic and mutagenic chemicals will in the normal course of scientific events be resolved as a scientific consensus, but this will take years to decades. In the meantime, judgments and regulatory decisions must be made on the basis of incomplete information.
>
> One wonders however about the implications of each of the two possible decisions that might turn out to be wrong.
>
> If thresholds do exist and the regulatory decisions are based on a no-threshold concept, there will be short-term economic losses. If thresholds do not exist and the regulatory decisions are based on thresholds, then there will be fewer short-term economic losses, but we would face a future of damaged human somatic and germinal DNA and an increased incidence of neoplastic diseases.[66]

Discussions about cancer-causing chemicals are replete with disputes like that over thresholds. A related debate, which helps to illustrate the inseparability of science and values in the area of occupational health policy, is that over how evidence from animal experiments should be used in assessing cancer risks to exposed human beings. Even when it is conceded that such extrapolation is justified, at least in qualitative terms, the question remains of how to assess the strength of the available evidence. The IARC shares the view of many other scientists and scientific organizations that "in the case of chemicals for which there is *sufficient evidence* of carcinogenicity in experimental animals, it [is] considered reasonable to recommend that, for practical purposes, such chemicals be treated as if they presented a carcinogenic risk to humans."[67] [Emphasis added] But this does not remove value-judgments about uncertainty from the debate; it merely moves them somewhere else. The IARC only considers results from animal experiments as "sufficient" evidence of carcinogenicity when the results include those from multiple experiments, experiments with multiple species (to answer the objection that some positive results reflect the extreme susceptibility of a particular species), or

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65. Summaries of the arguments with respect to thresholds and dose-response relationships are provided by: T. Maugh, "Chemical Carcinogens: How Dangerous Are Low Doses?" (October 6, 1978), 202 *Science* 37; R. Truhaut, "The Problem of Thresholds for Chemical Carcinogens" (October 1980), 41 *American Industrial Hygiene Association Journal* 685.

66. D. Rall, "Thresholds?" (1978), 22 *Environmental Health Perspectives* 163, pp. 164-5.

67. IARC, *supra*, note 21, p. 7. The IARC will, however, consider a substance as a probable human carcinogen in a case where "limited" animal evidence is accompanied by some evidence from exposed human subjects, and is at pains to emphasize the extent to which its classifications are ultimately reliant on scientific judgment.

experiments which show a very high or unusual incidence of cancer.[68] When for standard-setting purposes a chemical is not considered carcinogenic until the evidence meets a sufficiency criterion like that of the IARC, the effect may be to accept one category of risks on behalf of those exposed *solely* by virtue of the limited extent of information about the likely health effects. This crucial distinction between negative evidence and the simple lack of definitive positive results[69] is often ignored in debates over the appropriate level of protection from workplace hazards.

Problems of the strength of evidence come up in other legal and policy contexts, as well. When evidence of harm to a particular individual must meet a specified standard of proof, whether in a criminal case or in a workers' compensation claim, the statistical nature of epidemiological evidence, superficially the strongest kind of evidence because it is derived from observing human subjects, creates its own set of problems. "[S]tatistical associations are qualities of certain *categories* of events, not of individual instances."[70] Pointing to evidence that coke oven workers are several times more likely to die of lung cancer than the general population is not the same as being able to state that coke oven emissions caused any *particular* worker's lung cancer.[71]

The issues raised here have immense practical importance. Many policy choices in the area of occupational health inescapably involve not "scientific" disagreements, although these are often present as a background, but rather conflicts of values and priorities about how uncertainties should be weighted. Industry, and government officials, may argue that a "firm scientific basis"[72] should be demonstrated for controlling exposure to toxic substances, when the real issue is whose priorities should prevail in terms of balancing the risks and benefits of over- and under-regulating. The decision about the strength of evidence for the existence of a particular danger which will be required before action (or further action) is taken to protect exposed employees is a *policy* decision, not a scientific one.[73]

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68. IARC, *supra*, note 21, p. 12. The issue of whether positive results from tests in multiple species or from multiple tests in a single species in fact strengthen the evidence for the carcinogenicity of a particular chemical is in itself a complex one, and would be dealt with here in more detail were this a Working Paper on cancer policy and not on the general context within which policy decisions about workplace pollutants must be made.

69. Cf. comments of Arthur Upton, New York University Medical Center as cited at p. 237 of "Regulatory Procedures and Public Health Issues in the EPA's Office of Pesticide Programs," Staff Report (December 1982), *EPA Pesticide Regulatory Program Study*. Hearing before the Subcommittee on Department Operations, Research, and Foreign Agriculture, Committee on Agriculture, U.S. House of Representatives, December 17, 1982, Serial 97-NNNN (Washington, D.C.: U.S. Government Printing Office, 1983).

70. Comments of Brian McMahon in "Scientific Panel: Cause/Effect Relationships in Health Risk Cases" (Summer 1982), 22:4 *Jurimetrics Journal* 378, p. 394.

71. Weiler, *supra*, note 8, pp. 30-2.

72. W. Jaeschke, "Anatomy of Unreasonable Risk" (1981), 363 *Annals of the New York Academy of Sciences* 49.

73. See T. McGarity, "Substantive and Procedural Discretion in Administrative Resolution of Science Policy Questions: Regulating Carcinogens in EPA and OSHA" (1979), 67 *Georgetown Law Journal* 729, pp. 733-49.

It is useful to expand on this point by outlining two alternative definitions and interpretations of the problem of workplace pollution — paradigms which suggest quite distinct kinds of policy responses. The first can be thought of as *reactive*. In this frame of reference, the need for controls on exposure to a particular pollutant should be based on strong scientific evidence of the relationship between exposure and damage to employee health. Even when the concern is a contaminant whose potential dangers to health are well documented, regulators may respond not by imposing or enforcing exposure controls but by setting up a study of the health of the employees in a particular workplace.[74] Among occupational health professionals, expanded emphasis is being placed on the measurement of exposure levels using biological monitoring of the actual level of a substance present in an employee's body, rather than relying on evidence of the concentration of contaminants within a workplace, as a basis for deciding on the need for exposure controls.[75] This last trend exemplifies the reactive problem definition; it involves, "to some extent, employing the subject as a 'guinea pig,' that is, putting emphasis on the control of clinical effects *following* exposure rather than the prevention of exposure in the first place."[76] Conversely, limited weight is attached to the risks of waiting for more conclusive evidence.

The second problem definition may be characterized, in contrast, as *preventive*. Concern for the proper testing of scientific hypotheses is tempered by the realization that inaction or the demand for further research is in itself a decision, and that effective strategies for disease prevention in the area of public health have in the past been developed and implemented long before the specific mechanisms of disease causation were understood in any detail.[77] Emphasis is placed not on assessments of the strength of evidence linking a particular pollutant to a specific health effect, but on the seriousness of the *potential* impact on employees' health of failing to control exposures or eliminate hazards.

This preventive approach is far more defensible, for two reasons. First, it is more sensitive to the inescapable uncertainty about the actual extent of health damage within which occupational health policy and law must operate. Second, it reflects the degree to which respect for life, health and bodily integrity are fundamental values, and the fact that policy decisions involving workplace pollution are very often life-and-death (or health- and ill-health) decisions.

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74. See comments of R. Mackenzie, MPP and A. Robinson of the Ontario Ministry of Labour, *Legislature of Ontario Debates*, Standing Committee on Resources Development (Estimates, Ministry of Labour), December 17, 1979, pp. R1142-R1143 (study of concentrations in the bodies of workers exposed to arsenic at Dickenson Mines, Red Lake, Ontario) and of E. Martel, MPP and officials of the Ministry, pp. R1147-R1150 (study of bronchitis incidence among smelter workers exposed to sulphur dioxide).

75. S. Tola and S. Hernberg, "Strategies of Biological Monitoring," in 1 *Recent Advances in Occupational Health*, ed. J.C. McDonald (Edinburgh: Churchill Livingstone, 1981), p. 185.

76. J.M. Stellman and L.R. Andrews, "The Assessment of Toxic Exposure in the Workplace" (1983), 4:2 *Toxic Substances Journal* 104, p. 109.

77. D. Davis, "Cancer in the Workplace: The Case for Prevention" (1981), 23:6 *Environment* 25; D. Bates, "Preventing Occupational Cancer," [Editorial] (1979), 28 *Environmental Health Perspectives* 303.

Like the analysis of uncertainty which gives rise to them, these alternative problem definitions are of more than academic significance; they can be observed both at the level of specific policy responses and at the level of institutional systems. At this latter level, obviously no institutional system is exclusively reactive or preventive in orientation. However, it is possible to view the approach to standard setting embodied in the quantitative exposure limits put forth by the American Conference of Governmental Industrial Hygienists as a largely reactive response to the problem of workplace pollutants.[78] On the other hand, the "internal responsibility system," with its emphasis on setting up institutions within the workplace capable of involving employees themselves in designing and implementing solutions to workplace hazards, can be seen as embodying a much more strongly preventive approach.[79] Both sets of responses are discussed in Chapter Two, where it is argued that both suffer (in the Canadian context, at least) from major problems at the level of legal and administrative implementation.

At the level of individual policy decisions, the distinction between the two problem definitions is illustrated by contrasting Canadian responses to the contentious issue of the health hazards of video display terminals (VDTs). Concern about their health effects has been generated not only by possible visual and ergonomic hazards, but by a number of "case clusters" of birth defects and miscarriages among women working with VDTs.[80] Despite the consensus among much of the scientific community that existing knowledge about the health effects of electromagnetic radiation would not suggest that birth defects can be produced by the radiation levels emitted by VDTs,[81] a Labour Canada task force recommended in 1982 that federal government workers not be required to use VDTs for more than five hours per day, as a precautionary measure pending the availability of more extensive evidence.[82] This preventive approach was flatly rejected by Treasury Board in 1983, on the basis that there was no scientific evidence of serious health or vision hazards.[83] Intriguingly, late in 1984 a report submitted to IBM, a major manufacturer of VDTs, endorsed adding inexpensive shielding to the flyback transformers of VDTs to reduce electromagnetic radiation emissions as a precautionary measure.[84] This recommendation illustrates that the real issue in this case, as in so many other cases, is not the conclusiveness or inconclusiveness of the scientific data, but the relative consequences of over- and

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78. See *infra*, pp. 36-40.

79. See *infra*, pp. 23-35.

80. S.G. McCloud, "Pink Collar Blues: Potential Hazards of Video Display Terminal Radiation" (1983), 57 *Southern California Law Review* 139, pp. 142-50.

81. *Investigation of Radiation Emissions from Video Display Terminals*, 83-EHD-91 (Ottawa: Environmental Health Directorate, Health and Welfare Canada, 1983).

82. *In the Chips: Opportunities, People, Partnerships*, Report of the Task Force on Micro-Electronics and Employment (Ottawa: Labour Canada, 1982).

83. C. Montgomery, "VDT Use Won't Be Curbed, Gray Says," *The Globe and Mail*, July 21, 1983, p. 5.

84. Reported in "IBM Report Recommends Shielding of Older VDTs" and "VDT Radiation: Guy's Report for IBM," *Microwave News*, April 1985, pp. 4, 11 (respectively).

under-protection: in this case, the costs of a potential need to expand the ranks of the public service on the one hand, and possible effects on the health of an extremely large population of workers on the other.

IV. "The Social in the Technical"[85]: The Social Context of Work

So far, workplace pollution problems have been treated without specific reference to the social context of the workplace, or the special nature of the work relationship. Most of us work for a living, in one way or another. It is superficially plausible, based on the appearance of the employment relationship as a contract freely entered into by both parties, to regard exposure to the hazards of the workplace as in some sense "voluntary." Economic analyses often embody this point of view by suggesting that wage differentials between more and less hazardous occupations reflect workers' willingness voluntarily to trade off increased risk against increased remuneration — that is, their "willingness to pay for improved workplace safety."[86]

But the superficial appearance of consent to the imposition of risk, in either legal or economic terms, does not reflect reality. Employees are incompletely informed of the hazards involved with employment, particularly when these hazards involve workplace pollutants whose identity may not even be known to employees.[87] And the employment alternatives open to many employees may be severely limited, particularly in times and regions of high unemployment. "Your job or your life" is a singularly unappetizing trade-off. It is also qualitatively different from the trade-offs, such as those between increasing worker protection and maintaining or improving shareholders' return on investment, which managements face in deciding whether, and how much, to reduce hazardous working conditions.[88] The combination of these factors, as MacCarthy observes, "does not mean that workers are coerced into accepting risky jobs in the same way that draftees are. But external conditions frequently limit options so severely that coercion is not needed."[89]

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85. R. Sass, "The Social in the Technical: Effects on Workplace Health and Safety" (Winter 1980), 9:1 *Alternatives: Perspectives on Society, Technology and Environment* 45.

86. W.K. Viscusi, "Setting Efficient Standards for Occupational Hazards" (December 1982), 24:12 *Journal of Occupational Medicine* 969. For a devastating critique of this approach, see N. Ashford, *Crisis in the Workplace: Occupational Disease and Injury* (Cambridge, Mass.: MIT Press, 1976), pp. 363-5; see also T. Schrecker, *Political Economy of Environmental Hazards* [Law Reform Commission Study Paper] (Ottawa: Supply and Services, 1984), pp. 55-8.

87. Ashford, *supra*, note 86, pp. 335-8; *Reforming Regulation*, final report of the regulation reference study (Ottawa: Economic Council of Canada, 1981), pp. 101-2.

88. See *infra*, pp. 32-3.

89. M. MacCarthy, "A Review of Some Normative and Conceptual Issues in Occupational Safety and Health" (1982), 9 *Boston College Environmental Affairs Law Review* 773, p. 780.

A further set of factors is perhaps even more important: the unequal status of employees and employers in terms of the day-to-day operations of the workplace. Employers have, subject to legal restraints of various degrees of intrusiveness and effectiveness, the power to hire and fire employees and to determine the organization and speed of work. In addition, most if not all of the investment decisions central to health and safety protection remain managerial prerogatives. "Apart from conditions negotiated under collective bargaining or laid down under labour standards regulation, workers have only a nominal voice over their own health and safety ...."[90] Employers, not employees, make decisions of the sort typified by the installation of local exhaust ventilation systems in industrial workplaces; the choice of terminal equipment for office automation installations; or the rate at which fresh outside air will be drawn in by office building heating, ventilating and air-conditioning systems.

To a great extent, therefore, the appearance of a contract or market transaction freely and equally entered into hides the reality of a workplace in which one party to the contract has unilateral control over a great many health-related aspects of the work environment. This observation should not be taken to minimize the significance of legal requirements, or the extent to which collective bargaining can provide (for that minority of the Canadian labour force which belongs to unions) a degree of employee influence in health-related decisions about the work environment. But managerial prerogatives related to health and safety remain largely unchallenged — a fact which has obvious implications for the design of effective legal mechanisms to protect employees from workplace pollution.

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90. *Reforming Regulation*, *supra*, note 87, p. 101.

CHAPTER TWO

Policy Responses

I. The Internal Responsibility System

Perhaps the most distinctive feature of Canadian occupational health and safety law as it has evolved and been consolidated over the past decade has been the emergence of a distinctive set of institutions and requirements including joint labour–management health and safety committees; the right to refuse unsafe work; and the (limited) legal guarantee of access to information about workplace hazards. These institutions, and the legal framework within which they operate, are referred to here as the "internal responsibility system" — a phrase taken from a 1976 Ontario Royal Commission report.[91] Since 1972, when the province of Saskatchewan entrenched these institutions in its legislation,[92] many Canadian jurisdictions have adopted a similar approach modelled, in many cases, directly on the provisions of the Saskatchewan law.[93]

These provisions can be seen as having developed on the basis of two rationales. The first, practical rationale is the clear impossibility of inspecting in detail the large number of workplaces in a modern industrial society with any frequency. As a former Ontario Minister of Labour has put the issue:

> There are approximately three million employees in Ontario covered by the *Occupational Health and Safety Act*. On the industrial and mining side alone, there are approximately 67,000 separate establishments.
>
> ...

91. *Report of the Royal Commission on the Health and Safety of Workers in Mines* (the Ham Commission Report) (Toronto: Government of Ontario, 1976). This report is widely held to have been influential in the entrenchment of joint health and safety committees and the right to refuse unsafe work in Ontario legislation.

92. *The Occupational Health and Safety Act*, R.S.S. 1978, c. O-1, as amended.

93. Interview with Robert Sass, former Associate Deputy Minister of Labour, Government of Saskatchewan, October 1984.

> If we were to increase our inspectorate a hundredfold, even a thousandfold, there is no way this complex tapestry of industrial-construction commercial enterprises could be policed in any comprehensive way.[94]

However, the Saskatchewan legislation and its imitators can be seen as embodying a normative commitment to a form of industrial democracy,[95] and as defending "the right to know; the right to refuse; the right to participate"[96] in a moral as well as a legal sense. Whatever the rationale, it has been argued that these rights cannot be separated, but are inextricably interdependent:

> The Saskatchewan approach considers the right to know, participate (through legislated mandatory committees) and refuse as three rights in one, or one in three: none will operate effectively without the others.[97]

A. The Right to Participate

Legislation in the jurisdictions in which most Canadians work now provides for the establishment of joint health and safety committees, composed equally of employee and employer representatives, in all workplaces above a certain size. Ontario, for example, requires them in all workplaces covered by its legislation with 20 or more employees, and in some other cases (for example, where a "designated substance" under the province's legislation is in use).[98] In Saskatchewan, the figure is ten employees;[99] and in British Columbia (the only jurisdiction to require joint committees before 1972), the number is either 20 or 50 depending on the hazardousness of the work.[100] Extremely large numbers of workplaces may be involved; for example, in Saskatchewan committees are required in 3,000 workplaces,[101] and in Ontario the number is 25,000. Recent amendments to the *Canada Labour Code* mean that in the federal jurisdiction, where joint committees had previously been required only at the discretion of the Minister of Labour, such committees must now be set up in all

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94. The Hon. Robert Elgie, in Estimates of the Ministry of Labour, *Legislature of Ontario Debates*, Standing Committee on Social Development, December 14, 1981, p. S1000.

95. K. Swinton, "Regulating Occupational Health and Safety: Worker Participation through Collective Bargaining and Legislation," in *Essays in Collective Bargaining and Industrial Democracy* (Toronto: CCH Canadian Ltd., 1983), pp. 55-6.

96. R. Sass, "Cancer in the Work Environment" (Summer 1983), 11:3-4 *Alternatives: Perspectives on Society and Environment* 37, p. 41.

97. *Ibid.*

98. *Occupational Health and Safety Act*, R.S.O. 1980, c. 321, s. 8(2).

99. *The Occupational Health and Safety Act*, R.S.S. 1978, c. O-1, as amended, s. 24(1).

100. *Industrial Health and Safety Regulations*, B.C. Reg. 585/77, as amended, s. 4.02.

101. Personal communication, W.C. Nelson, Ministry of Labour, Government of Saskatchewan, January 1985.

workplaces with more than 20 employees, except where the Minister has specifically waived this requirement.[102]

The provisions of the *Canada Labour Code* setting out the duties and powers of the joint committee are fairly typical of those embodied in other legislation. The joint committee:

> (*a*) shall receive, consider and expeditiously dispose of complaints relating to the safety and health of the employees represented by the committee;
>
> (*b*) shall maintain records pertaining to the disposition of complaints relating to the safety and health of the employees represented by the committee;
>
> (*c*) shall cooperate with any occupational health service established to serve the work place;
>
> (*d*) may establish and promote safety and health programs for the education of the employees represented by the committee;
>
> (*e*) shall participate in all inquiries and investigations pertaining to occupational safety and health including such consultations as may be necessary with persons who are professionally or technically qualified to advise the committee on such matters;
>
> (*f*) may develop, establish and maintain programs, measures and procedures for the protection or improvement of the safety and health of employees;
>
> (*g*) shall monitor on a regular basis programs, measures and procedures related to the safety and health of employees;
>
> (*h*) shall ensure that adequate records are kept on work accidents, injuries and health hazards and shall monitor data relating to such accidents, injuries and hazards on a regular basis;
>
> (*i*) shall cooperate with safety officers;
>
> (*j*) may request from an employer such information as the committee considers necessary to identify existing or potential hazards with respect to materials, processes or equipment in the work place; and
>
> (*k*) shall have full access to all government and employer reports relating to the safety and health of the employees represented by the committee but shall not have access to the medical records of any person except with the consent of that person.[103]

The *Code*, like the law in several other jurisdictions, requires that employee members of health and safety committees be remunerated for time spent attending meetings and carrying out "any other functions,"[104] and requires periodic meetings of

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102. *Canada Labour Code*, R.S.C. 1970, c. L-1, as amended by *An Act to amend the Canada Labour Code and the Financial Administration Act*, S.C. 1984, c. 39, s. 92. All references to the *Canada Labour Code* are to the 1984 amendment.

103. *Canada Labour Code*, s. 92(6).

104. *Canada Labour Code*, s. 92(9).

the committee.[105] Unlike some other jurisdictions,[106] the federal jurisdiction does not provide committee members with the specific entitlement periodically to conduct an inspection of the workplace for hazards.

The legislation of some jurisdictions provides for a health and safety representative,[107] selected by employees in workplaces too small to have a joint committee. The *Canada Labour Code* now provides for such representatives in workplaces too small to be covered by the provisions for mandatory joint committees, but which have at least five employees.[108] Where the law provides for their selection, health and safety representatives generally enjoy most or all of the same duties and powers as those enjoyed by a joint committee.[109]

A few jurisdictions are notable for providing joint committees (sometimes along with health and safety representatives) with more extensive powers and duties. In Saskatchewan, for example, the joint committee's duties include the investigation of refusals to perform work believed to be unsafe.[110] Some jurisdictions require instead that an employee member of the joint committee, where there is such a committee, be present during investigation by supervisors and (if necessary) inspectors of an employee refusal.[111] Québec has perhaps gone farthest in expanding the duties and powers of joint committees, which under the province's *Act Respecting Occupational Health and Safety* include: selecting of the physician in charge of plant health services; approving the health program he/she prepares; selecting personal protective devices and equipment; and participating in the identification of hazardous substances as required by section 52 of the Act.[112] Indirectly, the expanded duties of committees provide employee members with important resources in terms of the right to information[113] and the development of

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105. *Canada Labour Code*, s. 92(8).

106. *E.g.*, *Occupational Health and General Regulations*, R.R.S., c. O-1, Reg. 1, s. 11; *Occupational Health and Safety Act*, R.S.O. 1980, c. 321, s. 8(8), which empowers the employee members of a committee to "designate one of the members representing workers to inspect the physical condition of the work place, not more often than once a month or at such intervals as a Director may direct, and it is the duty of the employer and the workers to afford that member such information and assistance as may be required for the purpose of carrying out the inspection."

107. *E.g.*, *The Workplace Safety and Health Act*, S.M. 1976, c. 63, C.C.S.M., c. W210, as amended, s. 41.

108. *Canada Labour Code*, s. 93.

109. An exception is the case of Québec, where health and safety representatives must be designated by employees where there is a joint committee, and where the powers of the representative are distinct from those of the committee; these include accompanying inspectors and "assist[ing] workers in the exercise of their rights under this act and the regulations." *An Act Respecting Occupational Health and Safety*, R.S.Q., c. S-2.1, s. 90.

110. *The Occupational Health and Safety Act*, R.S.S. 1978, c. O-1, as amended, ss. 24(4), 26(1).

111. *E.g.*, *Occupational Health and Safety Act*, R.S.O. 1980, c. 321, ss. 23(4) and (7).

112. *An Act Respecting Occupational Health and Safety*, R.S.Q., c. S-2.1, s. 78 (see also s. 90 on the role of health and safety representatives in identification of hazardous substances).

113. See *infra*, pp. 29-30.

"prevention programmes" under the Act.[114] However, these limited exceptions highlight the generally advisory and consultative role of the committees; therein, as we shall see, lies a major weakness of the concept of internal responsibility.

B. The Right to Refuse Unsafe Work

When legislation recently passed in Prince Edward Island[115] is proclaimed, every Canadian jurisdiction will give employees a statutory right to refuse unsafe work under certain conditions, in addition to the right to refuse such work which employees may enjoy by virtue of the common law, arbitral jurisprudence, or specific provisions in a collective agreement.[116] A detailed examination of the statutory right to refuse cannot be undertaken here. However, the general pattern is for this right to be provided when a worker has reason to believe or reasonable cause to believe that the work in question is dangerous (sometimes "unusually dangerous"[117]) to health and safety. Until recently, the *Canada Labour Code* restricted the right to refuse to situations involving "imminent danger," excluding from this category situations in which the use of a particular machine or device, or exposure to particular working conditions, was "normal" for employees having a particular occupation or for employees in the normal course of their employment. Recent amendments define the dangers which justify refusal in a way which is arguably no less restrictive; they exclude dangers which are "inherent in the employee's work" or are a "normal condition of employment."[118] Employees are generally entitled to pay for time they would normally have worked as long as the proper procedures for reporting a refusal are followed.[119]

In general, disputes over the legitimacy of a work refusal are first reported to the supervisor or other employer representative.[120] If they cannot be resolved in this fashion, an inspector must be called in to investigate, sometimes with the involvement of an employee member of the joint committee or another employee representative.[121] Some jurisdictions also specify that other employees may only be assigned to do the same job or work under the same conditions if first advised that another employee has

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114. See *infra*, pp. 30 and 56-7.

115. *Occupational Health and Safety Act*, S.P.E.I. 1985, c. 36.

116. For a general overview of the law of refusals of unsafe work, see R. Brown, "The Right to Refuse Unsafe Work" (1983), 17:1 *University of British Columbia Law Review* 1.

117. *The Occupational Health and Safety Act*, R.S.S. 1978, c. O-1, as amended, s. 26(1).

118. *Canada Labour Code*, s. 85(2). The definition of an "inherent" danger amounts to a form of standard setting, and therefore raises the same contentious issues about the degree of danger to which employees should be permitted to expose workers: see *supra*, pp. 15-21 and *infra*, pp. 42-5.

119. *E.g.*, *Canada Labour Code*, s. 104(*a*). These procedures may include remaining at the workplace and being available for other work that is assigned. *E.g.*, *Canada Labour Code*, s. 86(3)(*a*).

120. *Canada Labour Code*, s. 85(6).

121. *E.g.*, *Canada Labour Code*, ss. 86(1) and (2).

refused the job.[122] Decisions by investigating inspectors that a refusal to work is not justified terminate the existence of the right purportedly to refuse unsafe work.[123] In some jurisdictions, the inspector's ruling may be appealed — for instance, in the federal jurisdiction to the Canada Labour Relations Board.[124] In Québec, where the Commission de la santé et de la sécurité du travail (CSST) is responsible both for enforcement of prevention-oriented legislation and regulations and for the administration of workers' compensation, appeals can be made in the first instance to regional "review offices"[125] whose members are appointed by the CSST and include one representative each of employees and employers, along with a chairman chosen from among the members of the CSST.[126] As a last resort, the decision of review offices may be reviewed by the Board of Appeal which is also responsible for ruling on appeals from CSST decisions related to workers' compensation.[127]

The right to refuse unsafe work has been a particular bone of contention with employers. During parliamentary committee hearings on the recent amendments to the *Canada Labour Code*, industry spokespeople expressed considerable concern about the possible abuse of a broadened right to refuse, but could not cite instances of such abuse in response to questions.[128] Indeed, it is surprising how infrequently refusals to work by employees in major industrial jurisdictions have remained unresolved for long enough to require intervention by officials. In 1984, refusals to work in Québec resulted in the calling in of inspectors for 278 cases, and in 1983 for 208 cases.[129] In Ontario, inspectors investigated 140 refusals in 1983/84, and 136 in 1982/83[130] — this in a province with a workforce of more than three million. It must also be stressed that the failure of an inspector or a labour board ultimately to uphold an employee's refusal does *not* indicate in itself that the right has been "abused."

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122. *E.g.*, *Occupational Health and Safety Act*, R.S.O. 1980, c. 321, s. 23(11); more extensive restrictions on asking another employee to do work which has been refused are contained in *An Act Respecting Occupational Health and Safety*, R.S.Q., c. S-2.1, s. 14. The *Canada Labour Code* now allows employers to assign other employees to such work only if they have been told of the refusal (s. 86(3)(*b*)).

123. *E.g.*, *Canada Labour Code*, s. 86(5).

124. *Canada Labour Code*, ss. 86(5), 87.

125. *An Act Respecting Occupational Health and Safety*, R.S.Q., c. S-2.1, ss. 20, 191.1, as amended by *An Act Respecting Industrial Accidents and Occupational Diseases*, S.Q. 1985, c. 6.

126. *Id.*, ss. 176.1, 176.2. Procedures for the establishment and operation of review offices are set forth in ss. 176.3 to 176.20 inclusive.

127. *Id.*, ss. 1, 193.

128. Canada, House of Commons Standing Committee on Labour, Manpower and Immigration, *Minutes of Proceedings and Evidence*, June 18, 1984, pp. 8:28, 8:36 (Canadian Manufacturers' Association).

129. CSST, *Annual Report 1984*, (Québec: CSST, 1985), p. 41.

130. Ontario Ministry of Labour, *Annual Report* 1983-84 (Toronto: Government of Ontario, 1985), pp. 30, 34, 38.

C. The Right to Know

Employees' right to information about hazards in the workplace varies considerably among Canadian jurisdictions. The *Canada Labour Code* does not provide any specific right to information beyond the "full access to all government and employer reports relating to the safety and health of the employees" accorded to joint committees,[131] and the duty imposed on the employer to "ensure that each of his employees is made aware of every known or foreseeable safety or health hazard in the area where that employee works."[132] Notably absent, as they are in many other jurisdictions, are specific rights to information about the actual chemical identity of substances in use in the workplace, and about the potential hazards of such substances.

The importance of the latter right is self-evident. Incomplete information cripples employees' ability to assess the hazards of the job; yet economic analysis suggests that employers may be motivated not to provide such information, or to minimize its significance, wherever it might lead to demands for higher wages *or* to demands for unprofitable expenditures on reducing hazards.[133] It is partly for this reason, and partly because employers themselves may be using trade-named products about whose composition and effects they know little, that labour representatives have pressed for regulations requiring the disclosure of chemical identities.[134] In the final report of its regulation reference study, the Economic Council of Canada supported "the right of workers to be informed fully about the generic names of ingredients of all substances used in the workplace."[135] It may also be that only requiring disclosure of chemical identities will give employees and their representatives a way of discovering that little or no reliable information is available about the health effects of substances to which employers are exposing them.

In response to these concerns, some jurisdictions (once again, not the federal) require employers to compile and update inventories of all hazardous substances in use in their establishments.[136] Ontario does not at present have such an inventory requirement, but amendments to its legislation providing for such a requirement and for disclosure of the inventory to employees were proposed by its Minister of Labour in

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131. *Canada Labour Code*, s. 92(6)(*k*).

132. *Canada Labour Code*, s. 82(*s*).

133. G. Reschenthaler, *Occupational Health and Safety in Canada: The Economics and Three Case Studies* (Montreal: Institute for Research on Public Policy, 1979), pp. 11, 13.

134. See, *e.g.*, comments of Ray Denison and Margaret Seminario, of the AFL-CIO staff, in *OSHA Oversight Hearings on Proposed Rules on Hazard Identification*, Hearings before Subcommittee on Health and Safety, Committee on Education and Labour, U.S. House of Representatives (Washington, D.C.: U.S. Government Printing Office, 1981), pp. 18-40; Ontario Federation of Labour, "Towards a More Comprehensive Approach to Regulating Workplace Health Hazards," mimeographed (Toronto: OFL, February 1984), pp. 19-21.

135. *Reforming Regulation*, *supra*, note 87, pp. 106-7.

136. *E.g.*, *Occupational Health and General Regulations*, R.R.S., c. O-1, Reg. 1, s. 67.

January 1986.[137] Saskatchewan law (for example) further requires employers to find out and record information about the chemical identity and potential hazards of these substances if it is not already in their possession.[138] Nash[139] notes several weaknesses in existing inventory requirements. For example, there is no automatic reporting to governments;[140] enforcement of such regulations therefore relies on the receipt of employee complaints about incomplete or outdated inventories. Yet such inventories, *if* reasonably accurate, can provide a valuable source of information for employees and a useful starting point for the enforcement of exposure limits where these exist.

Less specifically, several jurisdictions impose a general duty on employers to keep employees informed of all hazards,[141] and/or empower joint committees to request such information.[142] Québec law both requires employers to keep an inventory of "contaminants and dangerous substances connected with certain jobs" and to make this information available to joint committees and health and safety representatives,[143] and states that participation in the preparation of this inventory is among the functions of health and safety committees and representatives.[144] In Ontario, with no specific right to know embodied in legislation, some unions have succeeded in arguing to the Ministry of Labour that such provisions in the province's legislation, and the legal duty imposed on an employer to co-operate with members of the joint committee,[145] provide a basis for directing employers to disclose the identity of chemicals used in particular workplaces.[146] However, according to Swinton, "the inspectors' reports to which employees have a right do not include air quality assessments taken by the industrial

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137. Bill 101, "An Act to Amend the Occupational Health and Safety Act," 1st Session, 33rd Legislature, Ontario; First Reading, January 31, 1986.

138. *Occupational Health and General Regulations*, R.R.S., c. O-1, Reg. 1, s. 67.

139. M. Nash, "Trade Secrets in Occupational Health and Safety Law," in *Hazardous Substances and the Right to Know: A One-Day Symposium* (Toronto: Canadian Environmental Law Research Foundation, 1983).

140. Except in Québec, where employers are required to communicate hazardous substance inventories to the CSST. *An Act Respecting Occupational Health and Safety*, R.S.Q., c. S-2.1, s. 51(13). The proposed amendments to Ontario legislation would impose a similar requirement in that province. Bill 101, *supra*, note 137, s. 2.

141. *E.g.*, *Occupational Health and Safety Act.*, R.S.O. 1980, c. 321, s. 14(2)(*a*) and (*c*); *The Workplace Safety and Health Act*, S.M. 1976, c. 63, C.C.S.M., c. W210, as amended, s. 4(2)(c).

142. *E.g.*, *Occupational Health and Safety Act*, R.S.O. 1980, c. 321 , s. 8(6)(*d*); *Canada Labour Code*, s. 92(6)(*j*).

143. *An Act Respecting Occupational Health and Safety*, R.S.Q., c. S-2.1, s. 52.

144. *Id.*, ss. 78(6), 90(9).

145. *Occupational Health and Safety Act*, R.S.O. 1980, c. 321, s. 14(2)(*d*).

146. A. Robinson (Assistant Deputy Minister, Occupational Health and Safety, Ontario Ministry of Labour) to J. Gill (Director, Citizenship and Legislation, U.A.W. Canada), September 29, 1982; reproduced in Ontario Federation of Labour (OFL), "Legislation Interpretations," mimeographed (Toronto: OFL Occupational Health and Safety Training Centre, 1983).

hygienists of the Ministry,"[147] although employers do receive this information. Without a guarantee of access to such information, it is hard to see how employee members of joint health and safety committees can function effectively.

Negotiations have recently been completed among federal authorities and representatives of provincial governments, labour, and industry on a proposal for the establishment of a nation-wide Workplace Hazardous Materials Information System (WHMIS).[148] WHMIS would establish minimum labelling, disclosure and hazard-warning requirements (the last satisfied through a standard Material Safety Data Sheet) for a broad range of chemical substances. If and when WHMIS is implemented, which will require action by both federal and provincial governments,[149] WHMIS will represent a substantial advance in providing employees with information about workplace hazards. Mention should also be made in this connection of the Trade Names data base, an inventory of information on the constituents of proprietary chemicals maintained by the Canadian Centre for Occupational Health and Safety. Information included in the data base is made available on a voluntary basis by Canadian employers for dissemination via the inquiry services of the Centre.[150]

D. Protection against Reprisals

Whereas some jurisdictions provide specific statutory protection from reprisals resulting from employee refusals to do unsafe work (without which protection the right would be largely meaningless), other jurisdictions extend this prohibition against reprisals further, along with an associated presumption in favour of the affected employee. Saskatchewan prohibits reprisals for any activity associated with the joint committee, as well as for work refusals;[151] and Ontario prohibits dismissal, threats of dismissal, discipline, suspension, intimidation or coercion "because the worker has acted in compliance with this Act or the regulations or an order made thereunder or has sought the enforcement of this Act or the regulations."[152] However, remedies can be imposed in Saskatchewan only following conviction of the employer by a provincial magistrate. In Alberta, remedies can be imposed by inspectors, who are empowered to direct employers to cease disciplinary action against employees resulting from their activities on joint health and safety committees or refusals of unsafe work, to reinstate employees, and/or to reimburse them for any wages lost as a result of such disciplinary

147. K. Swinton, "Enforcement of Occupational Health and Safety Legislation: The Role of the Internal Responsibility System," in *Studies in Labour Law*, ed. K. Swan and K. Swinton (Toronto: Butterworths, 1983), pp. 169-70.

148. *Workplace Hazardous Materials Information System: Report of the Project Steering Committee* (Ottawa: Labour Canada, April 1985).

149. *Id.*, pp. 30-3.

150. G.R.C. Atherley (Chairman and CEO, Canadian Centre for Occupational Health and Safety) to E.W. Keyserlingk, Law Reform Commission of Canada, August 29, 1985.

151. *The Occupational Health and Safety Act*, R.S.S. 1978, c. O-1, as amended, ss. 25, 26.

152. *Occupational Health and Safety Act*, R.S.O. 1980, c. 321, s. 24(1).

action.[153] In Ontario, employees may direct complaints of reprisals either to binding arbitration (where a collective agreement exists) or to the Ontario Labour Relations Board.

The *Canada Labour Code* prohibits employers from discharging or otherwise discriminating against an employee for giving inspectors information, testifying in a proceeding or inquiry, or otherwise acting in accordance with or seeking the enforcement of any of the provisions of Part IV.[154] However, only reprisals resulting from refusal to do work believed to constitute a danger can be dealt with by the Canada Labour Relations Board;[155] the prohibition against reprisals of other types appears to be enforceable only through prosecution or injunction proceedings instituted by Labour Canada.[156]

E. The Limits of Internal Responsibility

Evaluating the effectiveness of the internal responsibility system in reducing pollution dangers in the workplace confronts the same difficulties as the attempt to [illegible]ate other policy responses. However, several inherent limitations can and should be [illegible]d. The underlying implicit assumption of the joint committee system is that co-operation (presumably on the basis of common interests) is possible on a sustained basis between labour and management. In many situations, the economic interests of management will be served by measures to protect health or safety and to improve working conditions. At the same time, there are clear economic limits to the extent of such common interests:

> Industrial *safety* is profitable only when the direct and indirect costs associated with accidents (such as production shut-downs, damaged equipment and materials, increased workers' compensation assessments) exceed the cost of eliminating these accidents.[157] [Emphasis added]

A widely used technical handbook makes a similar observation:

> Even in so obviously desirable an activity as accident prevention, some proposed measures must be accepted or rejected on the basis of their probable effects on profits.
>
> Although most executives want to make their company a safe place in which to work, they also feel a responsibility for running their business profitably. Consequently, they may be

153. *Occupational Health and Safety Act*, R.S.A. 1980, c. O-2, as amended, ss. 7(3), 25(6), 28.

154. *Canada Labour Code*, s. 104(*a*).

155. *Canada Labour Code*, ss. 90, 91.

156. *Canada Labour Code*, s. 105.4.

157. R. Sass, "The Underdevelopment of Occupational Health and Safety in Canada," in *Ecology versus Politics in Canada*, ed. W. Leiss (Toronto: University of Toronto Press, 1979), p. 73.

> reluctant to spend money for accident prevention unless they can see a prospect for saving at least as much as they spend.[158]

These problems are arguably even more serious in the case of workplace pollution, because of the length of time it can take for health effects to manifest themselves. Investing money to prevent employee health problems whose costs the firm will have to meet, if at all, only years in the future is even less appealing in economic terms than investment in safety improvements.[159]

Generally, employees or their representatives have no guarantee of access to formal procedures for resolving disputes over health or safety hazards which cannot be satisfactorily settled at the joint committee level. Although government inspectors may be (and very often are) asked by employee members to take action to improve working conditions, no legal barrier appears to exist to a concern's remaining unresolved almost indefinitely.[160] Management need not respond even to those joint committee recommendations in which its own representatives have concurred. As Swinton has noted in examining Ontario's *Occupational Health and Safety Act*:

> [T]he legislation's commitment is to consultation, but no more. There is a strongly held belief that health and safety come within management's prerogative, unless bargained away, and [the Act] was not meant to shift the balance of power in the workplace to the worker side, either by granting actual decision-making power to joint health and safety committees or by turning government inspectors into interest arbitrators.[161]

A further limitation is created by the fact that the legal protections which exist for employees exercising their rights under the internal responsibility system are no practical substitute for the resources provided by union membership. In a recent study of occupational safety and health policy in Ontario

> [a]ll inspectors and regional managers interviewed agreed that the internal responsibility system works most effectively in unionized worksites. ... [A]ll agreed that the job of the inspector in the small unorganized establishment is made particularly difficult by the tenuous position of the employee. It is almost trite to point out that the internal responsibility system cannot operate effectively where a worker thinks or fears that he jeopardizes his job every time he lodges a complaint. Prohibition of reprisals notwithstanding, an employer can almost always find some excuse to dismiss an "obstreperous" employee.[162]

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158. National Safety Council, *Accident Prevention Manual*, 7th ed. (Washington, D.C.: National Safety Council, 1979).

159. See *infra*, pp. 47-8.

160. Cf. comments of E. Martel, MPP, in debate in the Estimates, Ministry of Labour, *Legislature of Ontario Debates*, Standing Committee on Resources Development, January 27, 1983, pp. R1332-R1333.

161. Swinton, *supra*, note 147, p. 153. This article provides a much more detailed critique of the operations of the internal responsibility system in one jurisdiction than can be provided here.

162. G.B. Doern *et al.*, *Living with Contradictions: Health and Safety Regulation and Implementation in Ontario*, study prepared for the Royal Commission on Matters of Health and Safety Arising from the Use of Asbestos in Ontario (Toronto: Government of Ontario, 1982), p. 3.76.

In a similar vein, an official from another province commented on an earlier draft of this Working Paper to the effect that:"Experience has shown that for a committee to be successful, there must be a balance of power which exists, usually, only in unionized operations."

Given the lack of formal access to remedies on the part of employee members of joint committees, another important determinant of their effectiveness may be the extent to which government inspectors are willing to back up the legitimacy of employee members' concerns by issuing corrective orders. In one recent episode, a provincial official responded to persistent demands for such action on the part of employee members of the joint committee by threatening to have them dismissed and replaced with more co-operative individuals — something he had no legal authority to do.[163]

This admittedly extreme case is cited in order to underscore the degree to which joint committees, even in a unionized workplace, ultimately depend on external dispute resolution and sanctioning mechanisms. Relatedly, there may be a temptation for regulatory agencies to view their role as "facilitator" of the operation of joint committees,[164] and to avoid direct conflicts with business by leaving workplace pollution hazards to be resolved at that level even when it is unrealistic (because of the limited powers and resources of employees) to expect this to happen in a way which will provide the protection to which employees are entitled by law.

Union membership may be even more important in securing the *effective* right to refuse unsafe work; available evidence suggests that the right is very seldom used in non-union shops,[165] although at least one employee in such a shop has successfully defended a refusal before the Ontario Labour Relations Board.[166] Unions are much more likely than individual employees to have the resources both to defend work refusals and to defend employees against possible subsequent reprisals. Even union members face a major constraint on the exercise of the right to refuse: their refusal may result in the unavailability of work for other employees (for example, on an assembly line). Only in Québec does the law entitle workers thus idled, as well as the

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163. *Re Stanley Gray and L.J. Bergie*, Ontario Labour Relations Board File No. 1713-82-U, Decision of the Board, February 2, 1984. The case came before the Board because Gray, the complainant, argued that the inspector's action violated provisions in the province's *Labour Relations Act*, R.S.O. 1980, c. 228, prohibiting intimidation or coercion of union members.

164. Cf. the following statement from the *Operations Manual* of the Industrial Health and Safety Branch, Ontario Ministry of Labour, as cited by Doern *et al.*, *supra*, note 162, p. 3.42:

> As an Internal Responsibility System improves, the level of compliance will move from enforced compliance through self-compliance to ethical compliance. To encourage this Internal Responsibility System to develop, the role of facilitator has been given to the inspector, who will identify, evaluate and review the actions of labour and management on a regular basis.

165. Between 1977 and 1980, "in every year, 93 per cent or more of the cases" of refusals requiring the calling in of an inspector "were in unionized workplaces" in Ontario. Swinton, *supra*, note 147, p. 168.

166. *Robert Zizek and Wilco Canada Inc.* (1983), 5 C.L.R.B.R. (N.S.) 248 (Ont.).

worker refusing to work, to pay for time spent idle or at other work while the dispute is being resolved.[167] Elsewhere a work refusal, however well justified, may be the cause of uncompensated wage losses to other employees.

The Canada Labour Relations Board has held that no reasonable cause existed for a pregnant woman to refuse work with video display terminals (VDTs) because of the Department of National Health and Welfare's belief, "presumed to be authoritative," that no hazard exists from radiation emissions from VDTs.[168] The Board has also rejected the use of the right to refuse unsafe work by an employee who had been using for many years a compound whose possibly carcinogenic effects had only recently come to his attention. The argument was both that the use of the compound constituted a "normal work practice" and that the available scientific evidence did not justify an apprehension of imminent danger.[169]

The law, and thus the Board, are in these cases firmly rooted in the reactive problem definition. As Brown points out, the "long latency period of cancer and the possible incremental harm of continued exposure" are ignored[170] in the *LaBarge* decision. Although the legal right to refuse unsafe work is an essential element of worker protection, its current usefulness in the context of workplace pollution is limited by institutional factors, by the restrictive wording of most statutes, and by the reluctance of arbitrators and labour boards to consider apprehensions about controversial or long-term health effects as reasonable grounds for refusing particular tasks.[171]

II. Regulatory Controls on Workplace Pollutants

The preceding discussion should not be taken to minimize the usefulness of internal responsibility as a way of creating a process of ongoing internal inspection of the workplace. At the same time, internal responsibility cannot be expected to replace a more conventional regime of externally imposed and enforced regulatory controls on workplace pollutants, or to function effectively without support from such a system.

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167. *An Act Respecting Occupational Health and Safety*, R.S.Q., c. S-2.1, ss. 28, 30.

168. *Jean M. Sibley and Atomic Energy of Canada* (1983), 52 di 137, p. 144 (Canada Labour Relations Board), File 950-19, Reasons for Decision, August 25, 1983.

169. *Ernest L. LaBarge and Bell Canada* (1981), 47 di 18 (Canada Labour Relations Board), File 950-9, Reasons for Decision, December 10, 1981. The Board's decision also indicates that it does not view as legitimate the use of work refusal as a "last resort" to bring existing disputes to a head.

170. Brown, *supra*, note 116, p. 23.

171. Cf. the arbitrators' decision in *Steel Company of Canada and United Steelworkers, Local 1005* (1975), 8 L.A.C. (2d) 375 (Ontario), p. 378 where it was held that "employees may only validly refuse to do work when they may subject themselves to serious injury not normal with their work."

A. Numerical Exposure Limits

In most Canadian jurisdictions, including the federal,[172] maximum limits for employee exposure to toxic substances have been based on a set of threshold limit values, or TLVs, promulgated on an annual basis by a non-governmental organization known as the American Conference of Governmental Industrial Hygienists (ACGIH). Federal regulations also specifically require employers to carry out atmospheric sampling and testing "where there is a likelihood" that these exposure limits may be exceeded.[173]

As applied to workplace pollution the term TLV "refer[s] to airborne concentrations of substances" which represent "conditions under which it is believed [by the ACGIH] that nearly all workers may be repeatedly exposed day after day without adverse effects."[174] Most TLVs are stated in terms of a time-weighted average (TWA) atmospheric concentration over an eight-hour working day. However, for some substances the ACGIH has also put forward short-term exposure limits (STELs), which represent maximum average concentrations over a 15-minute period and are alleged to protect workers from serious short-term health effects, and ceiling (C) values, which represent concentrations which should not be exceeded even instantaneously.[175]

Two issues of obvious concern are the *adequacy* of the exposure standards which are used in Canada, and their *enforceability*. No Canadian regulatory authority appears to have undertaken and published a detailed analysis of the adequacy of the TLVs. Only a few points can be made in the present Paper. TLVs have been assigned only for approximately 550 of the chemical substances to which employees may be exposed — a reflection, at least in part, of the paucity of information about the health dangers of industrial chemicals. More seriously, not all the information which is available is necessarily considered in the setting of TLVs. Two Swedish occupational toxicologists concluded flatly in 1976 that the documentation for TLVs "cannot be regarded as satisfactory."[176] The Canadian Union of Public Employees (CUPE) argued in 1982 that:

> In a substantial number of cases, the exposure limits are based on data that renders them virtually useless. The TLV for welding fumes is based on an updated NIOSH [National Institute for Occupational Safety and Health] reference and a 1974 Welding Society publication. Numerous publications since 1974 have analyzed welding fumes and welders appear to be at a high risk for cancer ... The latest reference for asphalt fumes is 1970 although substantial newer material is available. For malathion, only 5 studies from the

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172. *Canada Occupational Safety and Health Regulations*, SOR/86-304 (March 13, 1986), s. 10.21(1).

173. *Id.*, s. 10.21(2).

174. American Conference of Governmental Industrial Hygienists, *TLVs: Threshold Limit Values for Chemical Substances and Physical Agents in the Work Environment, with Intended Changes for 1983-84* (Cincinnati, Ohio: ACGIH, 1983), p. 2.

175. *Id.*, pp. 3-4.

176. B. Holmberg and M. Winell, "Occupational Health Standards: An International Comparison" (1977), 3 *Scandinavian Journal of Work, Environment and Health* 1, p. 9.

> 1950s are available. The exposure limit for 2,4,5-T is based on two animal experiments carried out in 1953 and 1954. During the past two decades, extensive studies have been published on the health effects of 2,4,5-T. Several have suggested that the substance may be a carcinogen ...[177]

and the IARC now regards occupational exposure to phenoxy herbicides (of which 2,4,5-T is one) as probably carcinogenic.[178] These and other observations[179] about the TLV documentation suggest that the process of gathering and evaluating information which underlies the TLVs (and, by implication, the exposure limits set in many Canadian jurisdictions) may be highly unsystematic.

The scientific basis of the TLV concept is open to question in at least two respects. First, a recent review suggests that little evidence is available to support the use of time-weighted average (TWA) exposures as the basis for predicting the occurrence or absence of health effects.[180] Second, exposure to workplace pollutants frequently involves simultaneous exposure to a number of potentially hazardous contaminants.[181] The ACGIH deals with combined exposures by way of an algebraic formula in which the concentrations of all substances present in the work environment, expressed as a fraction of the TLV, are added together. If the result exceeds unity, the exposure is presumed to be excessive.[182] A special variant of this formula is used where the source of the contaminants is a liquid, but the underlying principle remains the same: the effects of the multiple contaminants are assumed to be additive, not multiplicative or (alternatively) self-cancelling. This assumption appears indefensible[183] in view of evidence such as that from a recent Swedish study, which found significant evidence of damage to the nervous systems of spray painters exposed to a combination of solvents at an airborne concentration which, calculated on this algebraic basis, was well below the allowable Swedish exposure limit. That limit was, in turn, substantially lower than that which would have been indicated on the basis of the ACGIH's TLVs.[184]

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177. Canadian Union of Public Employees, "A Submission to the Ontario Ministry of Labour on the Document: 'Exposure Criteria for Potentially Harmful Agents and Substances in the Workplace'," mimeographed (Ottawa: CUPE, 1982), p. 13.

178. IARC, *supra*, note 21, p. 16.

179. *E.g.*, D. Henschler, "Exposure Limits: History, Philosophy, Future Developments" (1984), 28:1 *Annals of Occupational Hygiene* 79, pp. 83-5; W. Louch, "The Regulation of Chemical Exposure," document D82-5E (Hamilton, Ontario: Canadian Centre for Occupational Health and Safety, October 1982).

180. G.R.C. Atherley, "A Critical Review of Time-Weighted Average As an Index of Exposure and Dose, and of Its Key Elements" (September 1985), 46:9 *American Industrial Hygiene Association Journal* 481.

181. See *supra*, note 57, and pp. 14-5.

182. ACGIH, *supra*, note 174, p. 50.

183. It is also unverifiable, since it is impossible to test even a small fraction of the possible, or even likely combinations of chemical exposures, and since any number of examples of combinations of exposures which do not conform to this assumption can be dismissed merely as exceptions to a general rule!

184. S.-A. Elofsson *et al.*, "A Cross-Sectional Epidemiologic Investigation on Occupationally Exposed Car and Industrial Spray Painters with Special Reference to the Nervous System" (1980), 6 *Scandinavian Journal of Work, Environment and Health* 239.

The ACGIH's treatment of carcinogens also is cause for concern. For some substances whose carcinogenicity the ACGIH considers to have been demonstrated in human beings or in experimental animals, the ACGIH has assigned TLVs; for others, no TLV has been set and the ACGIH suggests that "no exposure or contact by any route ... shall be permitted."[185] The issue of whether or not "safe" or threshold exposure levels exist for carcinogenic substances is a highly contentious one;[186] unlike Herbert Stokinger, for many years chairman of the ACGIH's TLV Committee,[187] many scientists strongly question the wisdom of assuming that such levels exist.[188] "Negative" results in animal experiments and epidemiological studies which appear to demonstrate the existence of levels of exposure to suspect carcinogens below which no excess cancer risk exists may, in fact, be functions of the statistical limitations of experimental designs rather than indications of an actual absence of risk.[189] Relatedly, the ACGIH also discounts evidence from animal tests for carcinogenicity when the experiment involved administration of the suspect substance at a dose considered excessively high.[190] The ACGIH thus appears to accept the hypothesis that metabolic defence mechanisms against carcinogenic effects which are broken down by the high doses used in animal tests, effectively guard against carcinogenic risks at lower exposures.[191]

Controversies both over thresholds and over the choice of model for extrapolating results from high to low doses are rooted in competing models of cancer causation;[192] they obviously cannot be resolved here. Indeed, they represent what Weinberg has called "trans-scientific" questions[193] whose conclusive resolution by experimental methods is theoretically possible, but completely impractical. The point being made here is simply that in dealing with scientific uncertainty on this point for purposes of

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185. *Supra*, note 174, pp. 41-7.

186. See *supra*, notes 65 to 67, and p. 17.

187. H. Stokinger, "Genetic Screening of Employees: Resistance and Responsibility" (September/October 1981), 2:1 *Dangerous Properties of Industrial Materials Report* 7.

188. Rall, *supra*, note 66; M. Schneiderman *et al.*, "Thresholds for Environmental Cancer: Biologic and Statistical Considerations" (1979), 329 *Annals of the New York Academy of Sciences* 92.

189. *Supra*, notes 53 to 55 (on epidemiological studies); J. Farmer *et al.*, "Dose and Time Response Models for the Incidence of Bladder and Liver Neoplasms in Mice Fed 2-Acetylaminofluorene Continuously" (1979), 3 *Journal of Environmental Pathology and Toxicology* 55; and D. Gaylor, "The ED Study: Summary and Conclusions" (1979), 3 *Journal of Environmental Pathology and Toxicology* 179 (on a laboratory study of exposure to a known carcinogen involving much larger numbers of test animals, and much lower exposure levels, than are normally used in such studies).

190. See *supra*, note 64.

191. A claim frequently made by industry as part of the argument for the existence of thresholds; see *e.g.*, Dow Chemical Canada Inc., comments in response to "Discussion Paper on the Control of Workplace Carcinogens," in Advisory Council on Occupational Health and Occupational Safety, *Fifth Annual Report*, Vol. 2 (Toronto: Government of Ontario, 1983), p. 150.

192. Stokinger, *supra*, note 187; L. Tomatis *et al.*, "Experimental Studies in the Assessment of Human Risk," in *Cancer Epidemiology and Prevention*, ed. D. Schottenfeld and J. Fraumeni (Philadelphia: Saunders, 1982), pp. 66-71.

193. A. Weinberg, "Science and Trans-Science" (April 1972), 10 *Minerva* 209. The importance of the concept of trans-scientific questions in determining allowable exposure to carcinogens is provided by McGarity, *supra*, note 73, pp. 733-6.

recommending exposure levels, the ACGIH has adhered firmly to the reactive paradigm, implicitly attaching greater weight to the consequences to employers of overcontrolling exposures than to employees of undercontrolling.[194] The implications of the ACGIH's caution in this respect dramatize the inseparability of science and values in the enterprise of standard setting.

A few jurisdictions have departed from the TLV-based approach, to some degree at least. In addition to a list of concentrations based on the TLVs (with some modifications), Saskatchewan requires employers to obtain permission before using any substance on a short list of carcinogens,[195] and provides a somewhat longer list of "hazardous chemicals" for which employers must provide "adequate engineering controls and suitable personal protective equipment ... to prevent intake of the chemical substance into the body."[196] The province's regulations also specify particular measures which must be taken to control worker exposure to silica dust and asbestos fibres in workplaces where these present hazards.[197] And Manitoba has circulated for comment a draft of a proposed regulation which, in addition to adopting the TLVs, would specify approximately 300 suspected carcinogens for which especially strict protective measures would be required.[198]

Ontario uses the ACGIH's TLV values as guidelines for inspectors and hygienists; however, they have no legal status.[199] The only exposure standards which have the force of law in Ontario are those contained in regulations for nine "designated substances."[200] These regulations contain exposure limits, stated as an average over a 40-hour week, which reflect trade-offs between avoidance of health effects and technical/economic feasibility.[201] In addition to setting exposure standards, the regulations also require employers to: prepare hazard assessments and control programmes for designated substances used in their workplaces; specify the kinds of personal protective equipment which will be considered acceptable as an alternative to engineering controls; state in detail the procedures to be used for sampling and sample analysis; and state requirements for periodic medical surveillance of exposed workers. The designated substance regulations are promulgated only after an extensive process

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194. Cf. Stokinger's reference to the ACGIH's "dealing with occupational carcinogens in a manner industry can live with." H. Stokinger, "Threshold Limit Values" (May/June 1981), 1:5 *Dangerous Properties of Industrial Materials Report* 8.

195. *Occupational Health and General Regulations*, R.R.S., c. O-1, Reg. 1, s. 70 and Appendix IV.

196. *Id.*, s. 71 and Appendix V.

197. *Id.*, ss. 91 to 119 inclusive.

198. "The Workplace Health Regulation," Draft #1 (Winnipeg: Manitoba Department of Environment and Workplace Safety and Health, February 1984).

199. Doern *et al.*, *supra*, note 162, p. 3.23.

200. O.Reg. 733/84 (Acrylonitrile); O.Reg. 732/84 (Benzene); O.Reg. 570/82 (Asbestos); O.Reg. 517/82 (Coke Oven Emissions); O.Reg. 455/83 (Isocyanates); O.Reg. 536/81 (Lead); O.Reg. 141/82 (Mercury); O.Reg. 769/83 (Silica); O.Reg. 516/82 (Vinyl Chloride).

201. See, *e.g.*, "Advisory Memorandum 82-II to the Minister of Labour" in Advisory Council on Occupational Health and Occupational Safety, *Fifth Annual Report*, Vol. 1 (Toronto: Government of Ontario, 1983), p. 50.

of informal consultation with industry and labour. As a result, only a handful of substances have been designated. The delays have come in for stinging, and understandable, criticism from labour.[202]

Regardless of the source of the numbers, enforcing exposure limits based on 8-hour or 40-hour TWAs poses obvious difficulties. In order to determine the existence of a violation the air in a workplace must be sampled for an 8-hour period, ideally using personal sampling devices attached to the employee's body to measure as accurately as possible the employee's actual exposure, and the sample then subjected to laboratory analysis to determine contaminant levels.[203] The amount of manpower and money which would be required for consistent monitoring of compliance with TWA-based exposure limits is therefore immense; this problem is exacerbated by the large number of contaminants, requiring a variety of sampling and analytical techniques, which may be of concern in the workplace.

Partly for these reasons, the simple fact that TLVs have legal status says little or nothing in itself about the actual degree of protection provided to employees. Indeed, numerical exposure limits are probably less important by virtue of their legal status than by virtue of the extremely high degree of reliance which regulators and occupational health professionals appear to place on TLVs.[204] In one case, provincial inspectors used the TWA recommended by the ACGIH for a group of materials generically referred to as Stoddard solvents as the basis of a decision not to order the employer to institute control measures even though the manufacturer of the particular trade-named product in question had recommended a maximum allowable TWA exposure of less than half that figure.

B. General Duty Provisions

Legislation in most jurisdictions imposes a general duty on the employer to avoid endangering the health and safety of employees. For example, the *Canada Labour Code* requires that:

> Every employer shall ensure that the safety and health at work of every person employed by him is protected.[205]

In addition, regulations may complement numerical exposure limits (where applicable) with general requirements dealing with workplace pollutants. Again, fairly typical in terms of their generality are the provisions of the *Canada Occupational Safety and Health Regulations* which require employers not to use a dangerous substance (defined

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202. Ontario Federation of Labour (OFL), *supra*, note 134, pp. 1-15.

203. See J.S. Lee, "Industrial Hygiene: Measurement and Control," in Rom, ed., *supra*, note 11, p. 925.

204. This incident is described in *Re Stanley Gray and L.J. Bergie*, *supra*, note 163, pp. 13-4.

205. *Canada Labour Code*, s. 81.

as one which, "because of a property it possesses, is hazardous to the safety or health of a person exposed to it; ..."[206]) when it is "reasonably practicable" to use a less hazardous alternative,[207] or to reduce hazards resulting from the use of dangerous substances to a minimum,[208] and confine them to "as small an area as practicable."[209]

These general requirements contrast sharply with the highly specific regulations which are applied to workplace accident hazards — a contrast which is perhaps inevitable, given the range of potential contaminants and the diversity of workplace situations. But the generality of provisions such as those of the *Canada Occupational Safety and Health Regulations* creates an obvious problem: How (for example) is "reasonable practicability," a term used copiously in the regulations of many jurisdictions,[210] to be determined for purposes of deciding whether or not an employer is in compliance? In British case-law, a test has been applied to the reasonable practicability of measures to protect workers, based (a) on a comparison of "the relative quantum of risk and sacrifice"[211] and (b) on the foreseeability of the risks in question.[212] Only Saskatchewan among Canadian jurisdictions specifies a statutory definition, which borrows directly from British jurisprudence:

> ..."reasonably practicable" means practicable unless the person on whom a duty is placed can show that there is a gross disproportion between the benefit of the duty and the cost, in time, trouble, and money, of the measures to secure the duty.[213]

Many such determinations appear, in practice, to be made by inspectors at the field level in deciding whether or not to issue improvement orders, and by higher-level agency officials in making more general decisions about how to deal with potentially hazardous workplace situations.

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206. *Canada Occupational Safety and Health Regulations*, SOR/86-304 (March 13, 1986), s. 1.2.

207. *Id.*, s. 10.5.

208. *Id.*, s. 10.8.

209. *Id.*, s. 10.9.

210. Saskatchewan, for instance, requires employers to substitute less for more hazardous substances insofar as it is reasonably practicable, keep the workplace free from contamination by chemical substances insofar as it is reasonably practicable, and take all reasonably practicable steps to minimize the danger to workers from chemical substances. *Occupational Health and General Regulations*, R.R.S., c. O-1, Reg. 1, ss. 66, 72.

211. *Edwards* v. *National Coal Board* (1949), 65 *The Times L.R.* 430, p. 432 (opinion of Asquith L.J.).

212. *Marshall* v. *Gotham Co. Ltd.* (1952), 2 *The Times L.R.* 941; (1954), 2 W.L.R. 812. The application in the contemporary context of British jurisprudence dealing with the concept of reasonable practicability is discussed in C.D. Drake and F.B. Wright, *Law of Health and Safety at Work: The New Approach* (London: Sweet & Maxwell, 1983), pp. 62-9.

213. *Occupational Health and General Regulations*, R.R.S., c. O-1, Reg. 1, s. 2(2). Cf. the opinion of Asquith L.J. in *Edwards* v. *National Coal Board*, *supra*, note 211, p. 432:

> "Reasonably practicable" ... seems to me to imply that a computation must be made by the owner in which the quantum of risk is placed in one scale, and the sacrifice involved in the measures necessary for averting the risk (whether in money, time or trouble) is placed in the other; and that if it be shown that there is a gross disproportion between them — the risk being insignificant in relation to the sacrifice — the defendants discharge the onus on them.

III. Principles for Standard Setting[214]

Whether decisions about the degree of protection from workplace pollution to which employees are entitled are made at the level of regulation setting or at the level of general enforcement policy and specific enforcement decisions, at least three sets of substantive issues come up.

A. "Acceptable Risk"

The standard-setting enterprise can and perhaps must be viewed as one of determining the acceptability of risk. Very often, judgment of acceptability is implicit: for example, a decision not to treat a substance as carcinogenic for regulatory purposes because of the limited or inconclusive nature of the available evidence, represents implicit acceptance on behalf of the exposed individuals of the risk of continued exposure to the substance should it subsequently be confirmed as carcinogenic on the basis of stronger or more extensive evidence.

Less often, acceptable risk is used as an explicit criterion for policy formulation. For example, Ontario's Ministry of Labour determined the province's vinyl chloride standard on the basis of the number of cancers which might be expected to result, based on extrapolations from animal experiments, if workers in the relevant industries were exposed at the allowable maximum. This number was derived from a standard of "acceptable risk" promulgated by the International Commission on Radiological Protection (ICRP), based on the risk of death run by workers in relatively safe industries.[215] Ontario's Royal Commission on Asbestos took a similar approach to evaluating proposed standards for workplace asbestos exposure, inferring the acceptability of the calculated number of cancer deaths associated with exposure at the maximum level allowed by the standard on the basis of comparison with accident fatality rates in manufacturing, construction and mining.[216]

Such crude inferences of acceptability from comparisons with current risk levels have been severely, and rightly, criticized by many commentators,[217] as have more sophisticated approaches which involve variants of cost-benefit analysis.[218] Among other weaknesses, both sets of approaches ignore or discard the possibility that life and

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214. These are dealt with in greater detail in T. Schrecker, *The Pitfalls of Standards*, P86-4E (Hamilton, Ont.: Canadian Centre for Occupational Health and Safety, 1986), pp. 6-18, 22-24.

215. See *Fifth Annual Report*, Vol. 1, *supra*, note 201, pp. 23-6.

216. *Report of the Royal Commission on Matters of Health and Safety Arising from the Use of Asbestos in Ontario*, Vol. 2 (Toronto: Government of Ontario, 1984), pp. 426-41.

217. L. McGinty and G. Atherley, "Acceptability versus Democracy" (May 12, 1977), *New Scientist* 323.

218. *E.g.*, K. Bogen, "Public Policy and Technological Risk" (1980), 21:1 *IDEA: the Journal of Law and Technology* 37; A. Lovins, "Cost-Risk-Benefit Assessments in Energy Policy" (August 1977), 45:5 *George Washington Law Review* 911; Schrecker, *supra*, note 86, pp. 46-54.

freedom from unwanted infliction of injury in the particular context being dealt with may be *rights* whose existence derives from a source other than statistical comparability with existing risks of unrelated origin.

This Paper cannot examine in any detail the philosophical issues underlying conflicts over acceptable risk decisions in the area of occupational health. It can, however, illustrate the fundamental nature of those conflicts by way of two quotations from recent writing on the subject. Schneiderman reacts to a set of calculations suggesting that 15-year-old Britons are five times as likely to die before age 65 if they work with amosite asbestos or beta-naphthylamine as if they become teachers by saying:

> I suggest that we attempt to set as our standard for all male workers the level of survival reached by school teachers. ... That might be a little difficult to achieve and therefore, perhaps if the teacher standard is too high, we should aim to ensure that industrial workers have survival rates as good as that of managers, public officials, and so on.[219]

Economist W. K. Viscusi, on the other hand, contends that:

> We cannot provide jobs of equal safety for all any more easily than we can ensure that all individuals will be productive on a particular job irrespective of their strength, diligence or intelligence. Indeed, attempts to promote such equalization undermine a beneficial feature of all market allocations.[220]

It should be emphasized that in *practical* terms, decisions about the risk to employees which will be considered "acceptable" are made by employers, regulators and (to some extent) employees themselves in a context which reflects the contrasting nature of the choices available to employees and employers.[221] Policy decisions in this area can also be expected to reflect, to a greater or lesser extent, the privileged position of business within the political system as a whole[222] and its resistance to costs which will have adverse effects on employment costs, productivity, and competitiveness.[223]

B. Feasibility and Practicability

One approach to the issue of acceptability of risk would distinguish between intrinsic hazards (those which are built into the nature of the job) and casual hazards

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219. M. Schneiderman, "Cost-Benefit, Social Values and the Setting of Occupational Health Standards," in *Legal and Ethical Dilemmas in Occupational Health*, ed. J. Lee and W. Rom (Ann Arbor, Mich.: Ann Arbor Science, 1982), pp. 195-6.

220. Viscusi, *supra*, note 86, p. 976.

221. See *supra*, pp. 21-2.

222. C. Lindblom, *Politics and Markets* (New York: Basic Books, 1977), pp. 170-221; C. Offe, *Contradictions of the Welfare State* (Cambridge, Mass.: MIT Press, 1984), pp. 119-29, 147-61.

223. Comments of the Canadian Manufacturers' Association in *Minutes of Proceedings and Evidence*, *supra*, note 128, p. 8:22.

(those which are not inherent, and could be eliminated).[224] For example, it is (given the present and near-future state of the technological art) an intrinsic hazard of fire fighting that people in that occupation have to spend time near and sometimes in burning buildings, although that hazard can and must be minimized. On the other hand, it is *not* an intrinsic hazard of working as a welder that the employee be exposed to fumes because of the absence of proper local exhaust ventilation. Similarly, *if* a less hazardous substitute for asbestos cannot be found as an ingredient of a particular caulking compound, it is *not* an intrinsic hazard of working in the plant that produces the compound that employees be exposed to any greater asbestos concentration than that achievable by state-of-the-art engineering controls.[225] It should also be emphasized as strongly as possible that even when intrinsic hazards are associated with a particular occupation, there exist numerous ways in which these hazards can and should be *minimized*, even if not eliminated altogether.

Superficially, this distinction would appear to be embodied in legal requirements that exposures be controlled or hazards eliminated wherever reasonably practicable. Unfortunately, the lack of definition of this concept provided in the law means that feasibility may be determined simply on the basis of current practice. For example, in the mid-1970s Ontario officials attempted to determine whether compliance with an asbestos exposure standard of 2 fibers/cm^3 of air was technologically feasible simply by reviewing sampling data to determine whether employers were already meeting the standard![226] Clearly, the fact that the standard was being complied with in many plants demonstrated its feasibility; just as clearly, much more stringent levels of control might also have been feasible, and might have resulted in a reduction of the danger to employees.

It has sometimes been proposed to resolve such problems for standard-setting purposes by requiring use of the best available control technology. This approach does not appear explicitly to have been adopted anywhere in Canada with respect to workplace pollutants. In Sweden, exposure limits have in some cases been set at levels below the current ACGIH's TLVs on the grounds that technology existed which would ensure lower levels of exposure and that the TLVs were based on incomplete data.[227] The best-available-technology (BAT) approach has both advantages and disadvantages in norm-setting terms. On the one hand, it is sensitive to the uncertainty inherent in any determination of an "acceptable" exposure level by requiring that exposures be controlled, where possible, even below performance standards such as TLVs. On the

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224. Personal communication with D. Bennett, National Health and Safety Representative for the Canadian Labour Congress.

225. See M. First and D. Love, "Engineering Control of Asbestos" (September 1982), 43 *American Industrial Hygiene Association Journal* 634.

226. G. Rajhans *et al.*, "A Review of Asbestos Exposures in Ontario" (September 1978), 39 *American Industrial Hygiene Association Journal* 767.

227. S. Kelman, *Regulating America, Regulating Sweden* (Cambridge, Mass.: MIT Press, 1981), p. 63.

other hand, in situations where current state-of-the-art technology may be inadequate to meet a given performance standard stated in terms of exposure levels, the BAT approach does not specifically provide an incentive to innovation.[228]

C. Technology Forcing

If we assume that economic motivations are the major factor in the development and adoption of new technology by employers, the incomplete and imperfect internalization of the costs of work-related illness means that reduction of employee exposure to workplace pollution is unlikely in and of itself to be a driving force behind the development of new technology. This is the rationale behind technology forcing, a regulatory strategy which explicitly adopts performance standards which cannot be achieved using current technology as a way of "giving signals to the industrial community"[229] about the need to consider factors other than return on investment in its technological development priorities.

The example of successful technology forcing most frequently cited is that of the United States occupational exposure standard for vinyl chloride: industry initially protested that the standard of control demanded would result in the destruction of the vinyl chloride industry in the United States, yet the standard was ultimately complied with at relatively minor cost.[230] Industry spokesmen point out with considerable justification that the technological problems of controlling other kinds of hazards may be much more difficult than those of controlling vinyl chloride.[231] (Some may, of course, also be less difficult.) At the same time, it is hard to get away from the fact that any norm-setting approach which does not include a technology-forcing element implicitly accepts the level of employee protection provided by current technology as adequate.

The preceding paragraphs sketch out several approaches to the same kinds of choices: decisions (whether implicit or explicit) about the level of work-related risk which society is prepared to accept on behalf of those exposed. All such acceptable risk decisions should be based on extensive public discussion in which two particularly important aspects of such decisions are highlighted: conflicts in the weighting of

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228. On problems in assessing the control capabilities of current technologies, see H. Latin, "The Feasibility of Occupational Health Standards: An Essay on Legal Decisionmaking under Uncertainty" (1983), 78 *Northwestern University Law Review* 583, pp. 613-30.

229. Comments of N. Ashford in *The Use of Cost-Benefit Analysis by Regulatory Agencies*, Joint Hearings before the Subcommittee on Oversight and Investigations and the Subcommittee on Consumer Protection and Finance of the Committee on Interstate and Foreign Commerce, U.S. House of Representatives, Serial 96-137 (Washington, D.C.: U.S. Government Printing Office, 1980), p. 70.

230. See Doniger, *supra*, note 46. A revealing articulation of the industry point of view at the time (1974) that occupational vinyl chloride exposure became a major public issue is provided by P. Weaver, "On the Horns of the Vinyl Chloride Dilemma" (October 1974), *Fortune* 150.

231. K. Nelson (of ASARCO, Inc.), "The Future Approach of the Occupational Safety and Health Administration to Standard-Setting," in Lee and Rom, eds., *supra*, note 219, p. 179.

scientific uncertainty (the problem definitions referred to in Chapter One) and the economic element which is inescapable in standard setting. Economics must enter into even such frameworks as the distinction between intrinsic and casual hazards: complete enclosure or automation of many industrial processes — although technologically achievable — would often be economically prohibitive. And the extensive litigation which has accompanied the promulgation of national workplace health standards in the United States illustrates that the concept of technological feasibility is inseparable from at least some degree of consideration of economic feasibility.[232]

This Paper unequivocally favours the primacy of employee health and safety considerations over economic considerations. However, both in the process of standard setting and in the course of implementation and enforcement, it is important that the economic dislocation (and associated health effects) created by potential loss of employment be weighed against the potential damage caused by the hazard itself. This equation must always be formulated from the employee's perspective, rather than that of the owners or operators of the enterprise. Nevertheless, in the most obvious examples of such a situation, standards, compliance with which would compel the closure of entire industries, are unlikely to be in the best interests of those whom they are designed to protect. This issue was succinctly summarized by the District of Columbia Circuit Court in its decision on a standard promulgated under United States legislation: "Congress," the court said, "does not appear to have intended to protect employees by putting their employers out of business ... by making financial viability generally impossible." At the same time: "Standards may be economically feasible even though, from the standpoint of employers, they are financially burdensome and affect profit margins adversely."[233]

The rationale for dealing with standard setting for workplace pollution in a rather cursory fashion here is best expressed by asking a rhetorical question: How much of an improvement in the protection afforded the potential victims of workplace pollution would be achieved if numerical exposure limits were set by regulation for, say, 900 substances instead of 550 or so? Or if the values generally considered allowable in Canada were derived not from the ACGIH's list, but from its Swedish counterpart which sometimes sets considerably lower maximum allowable exposures?[234] For reasons discussed in Chapters Three and Four, reforming the mechanisms of implementation and enforcement is likely to have a much greater impact on the *effective* level of protection from workplace pollutants.

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232. Latin, *supra*, note 228, pp. 588-623; J.L. Berger and S.D. Riskin, "Economic and Technological Feasibility in Regulating Toxic Substances under Occupational Safety and Health Act" (1978), 7 *Ecology Law Quarterly* 285.

233. *Industrial Union Department, AFL-CIO* v. *Hodgson*, 499 F. 2d 467 (D.C. Circuit, 1974), p. 478.

234. Elofsson *et al.*, *supra*, note 184.

IV. Civil Liability and Workers' Compensation

Workers' compensation is an insurance system, financed by employer premiums, which reimburses workers in those industries covered by compensation for medical expenses, losses of earnings, retraining and rehabilitation costs resulting from work-related injuries and illness.[235] Workers' compensation was introduced by the government of Canada's various provinces, beginning early in the twentieth century, with two basic aims about whose relative importance commentators differ widely. On the one hand, "the unholy trinity of common law defences — contributory negligence, voluntary assumption of risk and the fellow employment rule — made it virtually impossible for a workman to recover tort damages from his employer, even where the latter was negligent."[236] On the other, workers' compensation also benefited (and benefits) employers by insulating them from the possible financial consequences of work-related illness and injury in return for the payment of (relatively) predictable premiums.[237]

This Paper cannot attempt a detailed examination of workers' compensation schemes and the ethical and political issues they raise, although such an examination is desperately needed. All that can be done here is to ask whether it is reasonable, or desirable, to expect workers' compensation to play a preventive, rather than compensatory role by forcing employers to internalize the costs of damage done to workers by workplace pollutants. In this context, compensation has several drawbacks.

Compensation normally reimburses workers only for a percentage of lost earnings, up to a ceiling which varies widely from province to province, as well as for medical and related expenses.[238] The clear implication is that workers have consented to at least a small portion of the risk of future-earnings deprivation by working in the jobs they hold. No specific awards are made for pain and suffering, nor are punitive damages awarded against employers, although both these possibilities would exist in the context of recovery of tort damages. Indeed, a fundamental characteristic of workers' compensation, in Canada at least, is the exclusiveness of the remedy it provides: with very minor exceptions, workers in covered industries do not have the right to sue employers as a result of work-related illness or injury.[239]

The effects of many workplace pollutants only become noticeable many years after the beginning of exposure. Even if the individual employer could expect the direct

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235. A general introduction to Canadian workers' compensation systems is provided by T. Ison, *Workers' Compensation in Canada* (Toronto: Butterworths, 1983).

236. A. Linden, "Public Law and Private Law: The Frontier from the Perspective of a Tort Lawyer" (1976), 17 *Cahiers de droit* 831, p. 837.

237. Reasons *et al.*, *supra*, note 3, pp. 160-77.

238. Ison, *supra*, note 235, pp. 49-94.

239. *Id.*, pp. 101-3. In the United States, the exclusiveness of the workers' compensation remedy appears to be under attack; see F. Lancianese, "Is Exclusive Remedy in Jeopardy?" (December 1983), 45:12 *Occupational Hazards* 45.

costs of employee illness eventually to be reflected in compensation premiums, the relevant economic comparison from the employer's point of view would be the discounted present value of future damages versus the present cost of controlling hazards. (This is an observation which would apply to suits for damages as well.) In this context

> [C]onsider the decision faced by a businessman who would need $200,000 to "design-in" engineering controls to prevent carcinogenic exposure to workers at a particular worksite. Given a current [1981] discount rate in the private economy of at least 12 percent, if the businessman put only $11,800 into an investment opportunity affording 12 percent interest, at the end of 25 years there would be a cheque for $200,000 waiting for him. So, for the businessman, clearly the preference would not be to spend $200,000 now in prevention, but to bank $11,800 now for compensation and after-the-fact expenditures.[240]

This hypothetical example fails to account for the possibility that employers would subsequently become liable for damages considerably in excess of the present value of the cost of preventive measures. Any economically "rational" employer would take this possibility into account in decisions about limiting exposure to hazards. On the other hand, present practice generally is to set workers' compensation premiums on the basis of average claims experience for a particular kind of establishment or industry, rather than on the basis of the claims record of individual employers. This fact, coupled with the evidentiary uncertainties facing any compensation claim for work-related illness, further limits the preventive significance of workers' compensation in this context.

Most importantly, setting compensation assessments and benefit levels is ultimately a political decision in which factors unrelated to employees' health and safety may play a major role. The chairman of Ontario's Workers' Compensation Board noted in 1984 that the level of benefits "is a political decision the government will have to look at in terms of its mandate. As you know, we pay what the government dictates we should pay."[241] He elaborated on the role played in setting assessment levels (and therefore, of course, the amount of money available for benefits) of the "strain on management with respect to profits and with respect to the competitive aspect of their business."[242] In other words, it may be much cheaper for employers to limit their compensation costs by putting political pressure on governments than by controlling hazards to the life and health of employees.

Perhaps because of this strong pressure to keep down assessments, compensation boards are often highly reluctant to accept individual injuries and (especially) illnesses as work-related.[243] At the same time, major problems may be created by trying to

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240. R. Ruttenberg and E. Bingham, "A Comprehensive Occupational Carcinogen Policy As a Framework for Regulatory Activity" (1981), 363 *Annals of the New York Academy of Sciences* 13, p. 18.

241. L. Alexander, in *Legislature of Ontario Debates*, Standing Committee on Resources Development (Annual Report, Workers' Compensation Board, 1982), March 6, 1984, p. R-37.

242. *Id.*, p. R-39.

243. See Reasons *et al.*, *supra*, note 3, pp. 195-8.

expand the deterrent or preventive role of workers' compensation costs. Despite its shortcomings, workers' compensation does provide a remedy that would be available only unpredictably, with much delay, and at great cost through the courts. Trying to expand the preventive role of workers' compensation, either by increasing assessments or through experience rating (determining premiums on the basis of an individual firm's claims record), would reduce the accessibility of recompense for lost earnings and medical expenses, by giving employers an even stronger economic incentive to contest individual claims and to prevent general increases in benefit levels.[244]

V. Collective Bargaining

The collective bargaining process has the potential to achieve major reductions in health hazards for the unionized portion of the workforce. Of particular attractiveness is the fact that the process of standard setting is in the first instance carried out by the two parties involved rather than a third party. Further, including health- and safety-related provisions within the collective agreement provides valuable access to a mechanism for dispute resolution (grievance arbitration) which is not otherwise available.

In the United States, a major focus of collective bargaining efforts has been the establishment of joint health and safety committees[245] — committees which are now required by law in much of Canada. Such committees were established in some Canadian workplaces under the terms of collective agreements before the law required them, and collective agreements have continued to expand the powers and terms of reference of health and safety committees or health and safety representatives. A striking example is the collective agreement between Denison Mines Limited and Rio Algom Limited and the United Steelworkers of America, which provides for full-time, paid health and safety inspectors appointed by the union who will have the power to order a section of the workplace closed down if a health and safety problem exists, until the problem is reported to the employer.[246]

Contracts could give a union health and safety committee a similar power, and may also allow individual workers to "tag out" defective equipment as not to be used until repaired.[247] They can also establish or strengthen employees' rights to information

244. This analysis was presented by a labour leader contacted during research for the preparation of this Working Paper.

245. J. Bertinuson, "Workplace Health and Safety Committees: Minimum Criteria for Maximum Benefits" (Spring 1981), 6:1 *Labor Studies Journal* 62.

246. A. Moses, "Union-Picked Inspectors Will Have the Authority to Close Uranium Mines," *The Globe and Mail*, September 7, 1981, p. 4.

247. Clause in contract between International Brotherhood of Electrical Workers, Local 424, and Imperial Esso Ltd., cited in Alberta Federation of Labour, *Bargaining for Health and Safety: A Manual for Union Negotiators* (Edmonton: AFL, 1984), pp. 11-2.

about hazardous substances used in the workplace;[248] establish or strengthen the right of employee representatives to inspect the workplace or to take samples for airborne or other contaminants;[249] specify procedures for use in dealing with special hazards (such as limits to the number of hours a day an employee may be assigned to use a video display terminal);[250] require provision of paid time off for health and safety training for employees or their representatives;[251] require employers to pay for necessary protective equipment;[252] and otherwise entrench or strengthen employee rights which may be provided in other jurisdictions, but not in the one where the contract applies. More generally, as noted previously,[253] union membership is an important resource for employees in defending their rights of access to information, participation, and refusal of unsafe work even where specific contract provisions are not involved.

The collective bargaining process itself, however, has two major inherent limitations as a way of providing protection from workplace pollution. First, and most obviously, it is applicable only to the roughly 35 per cent of the non-agricultural workforce who are unionized,[254] although negotiated protections for employees may have an indirect influence on conditions in non-unionized workplaces, and indeed on the development of regulations protecting employees' health. Second, the process of negotiating a collective agreement is one of making trade-offs. Most enterprises exist, to a greater or lesser extent, in a competitive environment within which their viability may be endangered if the "unproductive" costs of protecting employees' health and safety are sufficiently high. However, although the end result of the collective bargaining process is a set of trade-offs agreed to by both parties, the bargaining strength of the parties may be far from equal. More fundamentally, and despite the imperatives imposed on employers by a competitive environment, the question remains: Are we comfortable with the notion that the level of health and safety protection to which employees are entitled should *have* to be traded off against other considerations? Without reaching a conclusion on this issue, we can nevertheless conclude that collective bargaining cannot *substitute* for, although it may well complement, the existence of other legal approaches relating to exposure to workplace pollutants.

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248. *Id.*, pp. 15-6.

249. *Id.*, pp. 16-7.

250. "West Germany: Workplace Agreements on New Technology" (July 1981), No. 90 *European Industrial Relations Review* 7.

251. Alberta Federation of Labour, *supra*, note 247, pp. 18-9.

252. *Id.*, p. 23. Appallingly, only in Québec does the law require that employers pay for protective equipment, even when it may be necessary to meet a legally specified standard of protection. *An Act Respecting Occupational Health and Safety*, R.S.Q., c. S-2.1, as amended, s. 51(11).

253. See *supra*, p. 32.

254. *Corporations and Labour Unions Returns Act, Report for 1984 — Part II: Labour Unions*, Statistics Canada 71-202 (Ottawa: Supply and Services, 1985).

CHAPTER THREE

Compliance and Enforcement

I. The Importance of Compliance: An Overview

Regulatory officials with inspection and enforcement responsibilities are generally given a broad range of investigative powers; in the federal jurisdiction, which is more or less typical, these include examining and copying books and records; taking oral or written statements from employers and employees; requiring production of documents; and taking samples of materials used in the workplace.[255] Related powers include the right of entry to premises and the right to the assistance of supervisors and employees in the carrying out of inspectors' duties.[256]

Yet perhaps the highest-profile function of inspectors is not directly related to investigative or enforcement duties. Rather, it involves the issuance of orders (referred to variously as directions, improvement orders and so forth, depending on the jurisdiction) to employers to correct a specific condition which contravenes legislation or regulation, when such a situation is discovered during the course of an inspection.[257] Inspectors' orders may be issued in extremely large numbers: inspectors with the Ontario Ministry of Labour issued more than 78,000 such orders in 1983-84.[258] (Some orders are complied with immediately, in the course of the inspection.[259]) In some jurisdictions, such as Saskatchewan, inspectors' orders are automatically accompanied by a deadline date for compliance;[260] Ontario, where time-limits had not previously been automatically specified in inspectors' orders, has recently announced an internal policy of increased emphasis on specifying time-limits in inspectors' orders.[261]

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255. *Canada Labour Code*, s. 98(1).

256. *Canada Labour Code*, ss. 98(1), 99.

257. *E.g.*, *Canada Labour Code*, ss. 102(1) and (2); *Occupational Health and Safety Act*, R.S.O. 1980, c. 321, s. 29; *The Occupational Health and Safety Act*, R.S.S. 1978, c. O-1, as amended, ss. 18(1), 19(1) and (2).

258. *Supra*, note 130, p. 32.

259. Doern *et al.*, *supra*, note 162, p. 3.73.

260. *The Occupational Health and Safety Act*, R.S.S. 1978, c. O-1, as amended, s. 18(1); the form, "Notice of Contravention," used by the province's Department of Labour, includes a section where deadline dates for remedying each infraction noted in an inspection must be specified.

261. Ontario Ministry of Labour, "Policy re: Orders Issued under the Occupational Health and Safety Act" (Toronto: Ontario Ministry of Labour, November 21, 1985).

As a rule breakdowns are not available of how many orders are issued, or how much of inspectors' time is spent, with respect to workplace pollution as distinct from more immediate, safety-related concerns. An exception is the case of Ontario, where in one recent year (1980/81), of more than 40,000 orders issued by Industrial Health and Safety Branch inspectors, 1,333 orders (fewer than four per cent) were issued with respect to contraventions of section 145 of the province's Industrial Establishments Regulation, which deals with exposure to toxic substances.[262] Section 145 is not the only section which does this, but since the figure was quoted by Ministry spokespeople as an indication of compliance activity in the health field, it is defensible to use it for that purpose.

Several reasons may account for emphasis on safety at the level of compliance or enforcement. Compliance with regulations about matters such as the proper shoring of trenches on construction sites or the type of guard which must be part of a particular machine tool tends to be immediately observable. Results, too, tend to be relatively easy to assess by observing trends in accident rates and the number of lost-time injuries. It is likely to take far more time to document instances of non-compliance with regulations or guidelines based on time-weighted exposure limits. This process is inherently time-consuming and requires at least a modicum of special training on the part of the inspector. Samples once taken must then undergo laboratory analysis, which demands access to a body of highly specialized (and not inexpensive) expertise and equipment.[263] Compliance with pollutant exposure standards, even when properly monitored, is much more difficult to link with rapidly observable results, because of the problem of clinical latency and the difficulty of distinguishing work-related from non-work-related disease. Alternatively, the issuance of orders or directives based on general provisions of Acts or regulations (for example, requiring proper ventilation or the substitution of less for more hazardous substances where reasonably practicable) implies a substantial interpretative role for inspectors in "translating" the general norms stated by statute or regulation into terms appropriate for the particular workplace. This role may be considerably less important with respect to safety-related hazards.

The role of inspectors is, however, even more complex than indicated by the preceding discussion. A rapidly growing body of literature and research has focussed on the ways in which governments attempt to achieve compliance with regulations, particularly those whose objective is the protection of health, safety or environmental quality. One of the central findings of such research is the importance of negotiations between inspectors, or their administrative superiors, and the regulated firm. Reviews of the process of enforcing Canadian environmental law suggest that:

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262. Comments of T. Armstrong, Deputy Minister of Labour, in *Legislature of Ontario Debates*, Standing Committee on Resource Development (Estimates, Ministry of Labour), January 27, 1983, p. R1344.

263. In *Re Stanley Gray and L.J. Bergie, supra*, note 163, a member of the regional staff of the Ontario Ministry of Labour's Occupational Hygiene Service is quoted as saying that "the staff of the Industrial Health and Safety Branch [*i.e.* the inspectors] would not have the expertise to interpret the results of the Occupational Hygiene service reports, and that their role is limited to setting up the appointments ..." (p. 12; the words are those of the Ontario Labour Relations Board, not the staff member).

> *[B]argaining* is the essence of the environmental regulatory process as it is practised in Canada. ... [T]he rules of environmental regulation are never clearly stated or certain, except in a purely symbolic sense. Instead the norms of conduct are the subject of negotiation and renegotiation between the regulator and the regulated right down to the moment of compliance or non-compliance.[264]

Bardach and Kagan[265] and Hawkins[266] suggest that the activities of enforcement personnel can be described in terms of "trading forebearance for ... compliance." Thus, a great deal of the norm setting which determines the *effective* level of protection provided by regulation takes place at the level of enforcement. Bardach and Kagan describe forebearance as:

> (1) overlooking violations that pose no serious risk under the circumstances; (2) not enforcing regulatory requirements that would be especially costly or disruptive in relation to the additional degree of protection they would provide; (3) granting reasonable time to come into compliance and accepting measures that would provide substantial if not literal compliance; and (4) making allowance for good faith efforts on the part of the regulated enterprise.[267]

In contexts such as this, regulators play what amounts to a *licensing* role: by declining to invoke sanctions, they are in effect issuing permits for activities which may endanger employees' health or environmental quality. There is good reason to think that this process represents the rule, rather than the exception, with respect to enforcing laws protecting employees from workplace hazards in Canada.[268] But this is not the only way in which norm setting with respect to workplace hazards takes place at the level of implementation and enforcement. Inspectors in most Canadian jurisdictions also become involved in resolving disputes which arise from exercises of the right to refuse unsafe work and (in some cases) from the operations of joint health and safety committees.[269]

Because of the importance of inspection and enforcement in determining the actual level of protection from workplace hazards which is enjoyed by employees, further research on the functioning of these processes in Canadian workplaces is urgently needed. It is nevertheless useful to focus attention on two sets of factors which almost undoubtedly have an important impact on the norms which result. First, there are strikingly few inspectors. In Ontario, 360 inspectors and 20 hygienists in 1983/84 were responsible for the health and safety of some three million employees; of these

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264. A. Thompson, *Environmental Regulation in Canada* (Vancouver: Westwater Research Centre, University of British Columbia, 1981), p. 33. See also R. Gibson, *Control Orders and Industrial Pollution Abatement in Ontario* (Toronto: Canadian Environmental Law Research Foundation, 1983).

265. E. Bardach and R.A. Kagan, *Going by the Book: The Problem of Regulatory Inefficiency* (Philadelphia: Temple University Press, 1982), p. 140. See generally Chapter 5, "The Good Inspector," pp. 123-51.

266. K. Hawkins, "Bargain and Bluff: Compliance Strategy and Deterrence in the Enforcement of Regulation" (1983), 5 *Law and Policy Quarterly* 35.

267. Bardach and Kagan, *supra*, note 265, p. 134.

268. See, for example, *infra*, pp. 59-60.

269. See *supra*, pp. 27-8, 32, and 34.

inspectors, 193 were responsible for construction and mining safety, and therefore had little, if any, role in policing workplace pollution.[270] Within the federal jurisdiction, roughly 175 officers are charged with enforcement not only of Part IV of the *Canada Labour Code* (the Part which deals with health and safety) but also of other Parts of the *Code*. In situations involving workplace pollution, inspectors can and sometimes must draw on more specialized agency expertise, whose availability is to some extent a function of the size of the jurisdiction involved. Manpower constraints therefore serve as an important initial determinant of the regulators' ability to provide employees with protection which corresponds with the norms embodied in law.

Second, the outcome of the process of trading forebearance for compliance surely depends, to a substantial extent, on the credibility and severity of the sanctions which can be invoked in response to non-compliance on the part of a regulated firm — in other words, on what inspectors and their administrative superiors have to trade. Yet the discussion which follows suggests that the range of sanctions which can be invoked in response to violations of occupational health safety law is limited, and regulatory agencies face considerable difficulty in invoking them systematically or reliably. In this context, forebearance may not constitute a "resource" for compliance personnel, as Hawkins claims,[271] but rather an acknowledgement of the limitations which legal frameworks and departmental budgets impose on regulatory enforcement.

II. Administrative Compliance Mechanisms

A. Stop-Work Orders

With few exceptions, failure to comply with an inspector's order does not carry any special, distinct or automatic sanctions. At best, failure to notify the regulatory agency of compliance will prompt a reinspection.[272] One of the few penalties available to officials in most jurisdictions as a way of encouraging compliance without recourse to prosecution is the stop-work order. The provisions of the *Canada Labour Code* are fairly typical. When "... the use or operation of a machine or thing or a condition in any place constitutes a danger to an employee while at work" and where "the danger cannot otherwise be guarded or protected against immediately," the inspector may "issue a direction in writing to the employer directing that the place, machine or thing

270. Ontario Ministry of Labour, *supra*, note 130, pp. 29, 32, 34.

271. Hawkins, *supra*, note 266, p. 49.

272. Cf. the description of the process of following up on inspectors' orders in Ontario provided by Doern *et al.*, *supra*, note 162, p. 3.73.

in respect of which the direction is made shall not be used or operated until his directions are complied with, ...''[273] Manitoba is among the jurisdictions which provide more scope for the use of stop-work orders to achieve compliance. They are allowed both in cases involving ''imminent risk of serious physical or health injury'' and in response to failure to comply with an inspector's order. In the latter case, ''serious risk to safety or health'' of employees must be involved, and the employer must be warned when the improvement order is issued that a stop-work order will be the response to failure to comply within the time period specified.[274]

The stop-work order or warning is clearly a powerful sanction, and one which does not require a major expenditure of resources on the part of a regulatory agency. Manitoba uses these orders relatively sparingly, with 79 orders and 197 warnings issued in 1983.[275] Inspectors in Ontario issued 840 stop-work orders in the industrial sector, and 563 in construction, in 1983/84.[276] Québec inspectors issued stop-work orders in 427 cases during 1983.[277] Unfortunately, breakdowns of the use of such orders in cases involving workplace pollution as opposed to safety hazards are unavailable, but at least two factors can be expected to limit the use of stop-work orders in the former context.

First, remedying a workplace pollution problem may be a relatively simple matter of equipment repair or material substitution (for example, of cadmium-free solders for solders containing cadmium).[278] In other cases, however, it may require weeks or months of engineering and installation work on a ventilating system or a new process. Stopping or threatening to stop work pending the completion of such major modifications clearly creates a powerful incentive for rapid compliance, and might not create a major financial burden for large firms. Smaller employers, however, could well be put out of business. Despite the possible seriousness of the hazards involved, this remains an outcome to be avoided because the employees whose protection is the object of the entire exercise will be worst affected.

Even when the long-term survival of the enterprise is not in question, stopping work may also mean putting people out of work. Only British Columbia and Québec[279] among Canadian jurisdictions provide for payment of salary and benefits to workers when they cannot work because a stop-work order is in effect. The effect is to create a powerful disincentive for officials in other jurisdictions to impose a stop-work order for

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273. *Canada Labour Code*, s. 102(2).

274. *The Workplace Safety and Health Act*, S.M. 1976, c. 63, C.C.S.M., c. W210, as amended, ss. 26(2), 36, 37.

275. Personal communication from C.A. Younger, Manitoba Department of Environment and Workplace Safety and Health.

276. Ontario Ministry of Labour, *supra*, note 130, pp. 30, 34.

277. CSST, *Annual Report 1983* (Québec: CSST, 1984), p. 39.

278. ''UE Members at Aerofin Elated after Winning Cadmium Battle,'' *UE News*, August 29, 1983, p. 1.

279. *Workers Compensation Act*, R.S.B.C. 1979, c. 437, as amended, s. 74(2); *An Act Respecting Occupational Health and Safety*, R.S.Q., c. S-2.1, s. 187.

any length of time: it may simply force employees to trade one form of victimization (the endangerment of their health) for another (lost wages and lay-offs).[280]

B. Prevention Programmes

Québec legislation empowers the Commission de la santé et de la sécurité du travail (CSST) to require employers to submit "prevention programmes" for establishments identified by regulation, and to update these programmes periodically. Programmes must include proposals for compliance with regulations "respecting the layout of workplaces, work organization, equipment, material, contaminants, dangerous substances, processes and collective safety measures and equipment"; "measures of supervision of the quality of the work environment"; and proposals for personal protective equipment and training and information programmes.[281] They must also specify "conditions and deadlines for implementing preventive measures" required by all applicable regulations, including those dealing with workplace pollutants.[282]

The CSST has been requiring the preparation of prevention programmes on a sector-by-sector basis; although all employers in a designated sector must have programmes in place, only programmes applying to establishments with more than 20 employees must be submitted to the Commission.[283] Compliance with this requirement has improved substantially, but is still not complete. Roughly 18 months after the deadline for submission of prevention programmes by firms in the first five "priority sectors," 10 per cent of the programmes expected from those sectors had yet to be received.[284]

The use of prevention programmes being made in Québec has a number of attractive features, including the combination of flexibility (in leaving technological choices up to individual employers) and consistency (by approaching compliance strategy on an industry-by-industry, rather than firm-by-firm basis). In addition, the

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280. For example, in May 1979, Manitoba officials issued a stop-work order against a Winnipeg foundry in response to excessive concentrations of airborne lead. As a result, 66 workers were laid off for almost a month until the plant was allowed to reopen after preparing a plan to reduce lead emissions, and were unable to recover lost wages. See B. Cheshire, "Foundry Closed for Excessive Lead-in-Air Levels," *Winnipeg Free Press*, May 17, 1979, p. 1; "Polluted Foundry to Reopen," *Winnipeg Free Press*, June 2, 1979, p. 13; "Foundry Workers' Claim Rejected," *Winnipeg Free Press*, June 15, 1979, p. 5. A spokesman for the employer was quoted as saying workers could use the shutdown as "an opportunity to take their holidays."[!] "Lead Levels Close Foundry," *Winnipeg Tribune*, May 17, 1979, p. 1.

281. *An Act Respecting Occupational Health and Safety*, R.S.Q., c. S-2.1, s. 59.

282. *Regulation Respecting Prevention Programmes*, R.R.Q. 1981, c. S-2.1, r. 13.1, as amended, s. 5.

283. *Id.*, ss. 6, 7. As of this writing (November 1985) the deadline has passed for initial submission of programmes by the following sectors: buildings and public works; chemical industry; forestry and sawmills; mines, quarries and oil wells; manufacturing of metal products; wood industry; rubber and plastics industry; transportation equipment; primary metals processing; and manufacture of non-metallic mineral products. CSST, *supra*, note 129, pp. 38-9.

284. CSST, *supra*, note 129, pp. 37-8.

process of developing prevention programmes may have the indirect effect of expanding the scope of employees' right to participate in decisions related to health and safety. The law requires that joint committees "take cognizance of" prevention programmes,[285] which does not necessarily mean very much, but it also gives committees duties involving the establishment of employee training and information programmes,[286] the selection of the physician in charge of health services in the establishment, and approval of the health programme he/she prepares.[287] This last provision could provide a powerful lever for employee members of a joint committee, since health programmes must be included as one component of all prevention programmes.[288]

The preparation and enforcement of prevention programmes is a major task, to say the least: at the end of 1984, approximately 1,900 such programmes had been prepared and submitted to the CSST. It is clearly too soon to arrive at any judgment about the relative success or failure of the use of prevention programmes. However, one important problem which could well arise involves the legal status of the programmes themselves. Failure to submit a programme could presumably lead to a prosecution, as could failure to comply with the regulations compliance with which is to take place as specified in the programme. And the CSST may order amendments to a programme when first submitted (for example, one may speculate, to compliance deadlines).[289] But the programmes themselves may be toothless tigers, in that no special sanctions appear to attach to non-compliance with a programme once submitted and approved by the CSST.

C. Continuing Financial Penalties

Many workers' compensation boards have the authority to impose penalty assessments above and beyond normal premiums.[290] In general, where boards have used this power at all, the use of penalty assessments or surcharges has been confined to the reduction of accident hazards. Managements in Ontario have noted the effectiveness of such penalties in getting them to improve in-plant safety.[291] However, the use of penalty assessments assumes particular importance in British Columbia, where (unlike the

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285. *An Act Respecting Occupational Health and Safety*, R.S.Q., c. S-2.1, ss. 60, 78(5).

286. *Id.*, ss. 59(6), 78(3).

287. *Id.*, ss. 78(1), 112. Health programmes must include measures to identify occupational health risks; monitor the quality of the work environment; inform employees of the nature of the risks; provide necessary medical examinations before and during employment; and maintenance of lists of employees exposed to particular contaminants (*id.*, s. 113). The arrangements under which the community health departments of regional hospitals may provide health services and facilities needed to implement health programmes are outlined in ss. 109 to 111 and 115 to 119 inclusive.

288. *Regulation Respecting Prevention Programme*, R.R.Q. 1981, c. S-2.1, r. 13.1, as amended, s. 5.

289. *Id.*, s. 60.

290. Ison, *supra*, note 235, p. 144.

291. "Double Assessments by WCB Brought Fast Results" (May 16, 1983), 56:1561 *CLV Health and Safety Forum* 4.

situation in other jurisdictions) the Workers' Compensation Board is also the agency with principal responsibility for enforcing regulations protecting occupational health and safety. However, the Board has used penalty assessments principally with respect to situations which present safety or accident, rather than health, hazards. For example, in 1984 the Board imposed 55 penalty assessments related to safety hazards, with a total value of roughly $148,000. Only six such assessments were imposed by the Board's Industrial Hygiene Department, with an approximate value of just $16,000.[292] This is part of a general trend of reduced imposition of penalty assessments which began in 1981: the value of penalty assessments imposed for safety violations in 1984, even in current dollar terms (that is, without accounting for inflation) is substantially less than their value in 1979. And penalty assessments for health-related hazards declined from a value of $326,000 in 1980 to $63,000 in 1981, and (as mentioned) to $16,000 in 1984.[293]

The precipitous decline between 1980 and 1981 involves a penalty assessment of roughly $30,000 a month imposed in 1974 on the Cominco Limited lead-zinc smelter complex in Trail, British Columbia for continued non-compliance with exposure limits for airborne lead and other contaminants.[294] The penalty assessment was drastically reduced early in 1977,[295] but was restored at the end of that year as an incentive for expeditious completion of an eight-year modernization programme which would result in major improvements in working conditions. Consideration was to be given periodically to rebating the penalty assessment to the firm if modernization remained on schedule.[296] In 1981, the penalty assessment was cancelled and 80 per cent of the penalties paid from 1978 through 1980 was repaid to Cominco, although permissible exposure limits for lead and other contaminants were still often being exceeded.[297] The firm subsequently shelved the major portion of its modernization plans which remained to be completed.[298]

It is difficult to say whether the discontinuation of the penalties was a major factor, as opposed to the general weakness of lead markets. Union representatives at the plant state that a major increase in lead levels has occurred since the assessments

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292. *Statistics '84* (Victoria: B.C. Workers' Compensation Board, 1985), pp. 9, 10.

293. Figures for years 1979 through 1981 are taken from the *Annual Reports* of the B.C. Workers' Compensation Board for those years. Figures for more recent years are drawn from *Statistics '83* (Victoria: B.C. Workers' Compensation Board, 1984) and *Statistics '84*, *supra*, note 292.

    The B.C. Federation of Labour recently argued for the more extensive and systematic use of penalty assessments, noting that they are currently "not used sufficiently, consistently, or with high enough dollar amounts to be of value," partly because "the use of penalty assessments is entirely at the initiation of the inspectors." *Report* of the B.C. Federation of Labour's Public Inquiry into the B.C. Workers' Compensation System (Burnaby, B.C., 1985), p. 24.

294. *Re Industrial Hygiene* (April 25), Decision No. 36 (1974), 1 W.C.R. 139.

295. *Re Industrial Hygiene and Cominco Ltd.* (March 18), Decision No. 234 (1977), 3 W.C.R. 94.

296. *Re Industrial Hygiene and Cominco Ltd.* (December 15), Decision No. 268 (1977), 3 W.C.R. 194.

297. *Re Industrial Hygiene and Cominco Ltd.* (September 28), Item No. 341 (1981), 6 W.C.R. 114.

298. "Trail Steelworkers Take on WCB" (December 1982), 47:5 *SteeLabour* 16; interview with John Weir, United Steelworkers of America Local 480 (Trail, B.C.), January 1985.

were discontinued.[299] Ironically, an epidemiological study published in 1983 showed that in 1975, smelter workers' average blood lead levels were three times those of a control group, and many exhibited symptoms associated with lead intoxication, including insomnia, weakness, indigestion, shakes, and pain in bones and joints.[300]

III. Prosecutions: The Last and Only Resort?

The preceding list of administrative mechanisms for imposing penalties is a strikingly short one. For the most part, Canadian occupational safety and health legislation is structured on a command–penalty model, in which regulators can impose sanctions only by initiating prosecutions. Yet prosecution appears to be regarded as a last resort in enforcement of occupational safety and health legislation and regulations. For example, inspectors with the Industrial Health and Safety Branch of Ontario's Ministry of Labour issued 48,881 orders to correct unhealthy or unsafe conditions in 1983-84, including 4,876 repeat orders, but the Branch undertook only 88 prosecutions. In the previous year, 56,435 orders were issued, including 8,057 repeat orders, but only 73 prosecutions were launched.[301]

Figures from Québec illustrate a similar pattern: in 1984 inspectors noted a total of 37,720 instances of non-compliance with the Act and regulations, but fewer than 900 "preliminary notices" were issued, and just 459 legal proceedings were begun.[302] A "preliminary notice" is a notice of violation specifying a minimum fine, payment of which within thirty days precludes prosecution. Such notices must be mailed to violators before any legal action may be taken for a first contravention of Québec's Act or regulations.[303] Québec's lack of resort to preliminary notices is especially striking in view of the minimal fines involved (for corporate violators, $500 to $1,000 on a first offence).[304] Some other jurisdictions have been even more sparing in their use of prosecutions: Labour Canada undertook only six prosecutions in 1981, and only two in 1983.

The last-resort status of prosecutions is a matter, in some jurisdictions at least, of stated policy. Labour Canada has expressed a preference for "voluntary compliance, self-regulation and early co-operative resolution of problems," with enforcement

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299. Weir, *supra*, note 298.

300. L. Neri *et al.*, "Health Effects of Low Level Occupational Exposure to Lead: The Trail, British Columbia Study" (May/June 1983), 38:3 *Archives of Environmental Health* 180.

301. Ontario Ministry of Labour, *supra*, note 130, p. 34. These figures do not include orders issued or prosecutions begun by the Construction or Mining Safety Branches, with little direct responsibility in the area of workplace pollution.

302. CSST, *supra*, note 129, pp. 42-3.

303. *An Act Respecting Occupational Health and Safety*, R.S.Q., c. S-2.1, ss. 236, 243.

304. *Id.*, s. 236.

provisions of the law being used only when other means prove ineffective.[305] Similarly, Ontario's policy has until recently been to *consider* prosecution only in situations of: fatal or critical injury; high risk of such injury; and persistent or flagrant disregard of regulations or inspectors' orders.[306] The Province's Ministry of Labour announced in late 1985 a policy of initiating prosecutions for non-compliance with inspectors' orders "*except* in the limited circumstance that an inspector is satisfied on reasonable grounds that the contravener has made every reasonable effort to comply."[307] This policy, although aggressive in some respects, nevertheless highlights the importance of the *de facto* licensing role played by inspectors. Although breakdowns of prosecutions into those involving safety-related offences and those involving workplace pollution are not available, it is a general impression that extremely few prosecutions are undertaken for violations which could be expected to result in long-term damage to employee health, at least when an immediate and serious short-term effect is not also observable.

An example of the non-aggressiveness of enforcement policy at the federal level is provided by the recent history of attempts to control grain dust levels in grain handling facilities, which come under the federal jurisdiction. Grain dust is a serious health hazard; at high enough atmospheric concentrations it presents a major explosion hazard, and at lower concentrations it can cause impaired lung function, chronic bronchitis, pulmonary fibrosis, and allergic reactions among the workers who breathe it.[308]

A study of Canadian grain-handling facilities published in 1978 indicated that dust concentrations were high enough in some locations to present an explosion hazard, and that employee exposures in some locations in grain elevators *averaged* several times the TLV for total grain dust of 10 milligrams per cubic metre of air.[309] In 1978, Labour Canada issued a directive and guideline to all employers in this sector indicating that by October 1, 1981, all grain elevators should be equipped with ventilation systems

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305. "Part IV Amendments (Occupational Safety and Health)," background information accompanying Bill C-34, "An Act to Amend the Canada Labour Code and the Financial Administration Act" (Ottawa: Communication Services Directorate, Labour Canada, May 15, 1984).

306. "Occupational Health and Safety Division Policy on Prosecution," mimeographed (Toronto: Ontario Ministry of Labour, October 1983), p. 102. Cf. the statement of a former Ontario Minster of Labour that

> [P]rosecution is an admission of failure in problem solving. It is an admission that the matrix of shared responsibility in a collaborative setting has broken down. ... I continue to believe that in the majority of instances the educative effect of a strongly worded directive is to be preferred where possible to the quasi-criminal route of the provincial court. I happen to believe ... that in most matters relating to the work place and to labour relations we must strive to avoid actions which polarize people and jeopardize relationships.

Comments of the Hon. R. Elgie, *Legislature of Ontario Debates*, Standing Committee on Social Development (Estimates, Ministry of Labour), December 14, 1981, p. S1001.

307. Ontario Ministry of Labour, *supra*, note 261.

308. C.P.W. Warren, "Health and Safety in the Grain Industry," in Rom, ed., *supra*, note 11, p. 221.

309. J.-P. Farant and C. Moore, "Dust Exposures in the Canadian Grain Industry" (March 1978), 39 *American Industrial Hygiene Association Journal* 177.

able to keep dust levels below the TLV.[310] By November 1982, a year *after* the three-year deadline, roughly 30 per cent of the affected facilities had not installed the necessary ventilating systems.[311] Meanwhile, significant damage to lung function had been documented in a study of some 400 grain handlers.[312] The then Minister of Labour was quoted in February 1983, as being "not prepared to accept excuses any longer."[313]

One may well ask why it should have been necessary, or permissible, to accept excuses at all. The impotence of enforcement illustrated by this case-study is, in part at least, a function of the limited range of sanctions available to regulators. The latter, even in instances of persistent non-compliance, are often faced (not to put too fine a point on the observation) with the choice between initiating prosecution or going away and shutting up. Yet, many factors work against the use of prosecutions even in cases of persistent non-compliance.

Prosecutions are inherently time-consuming and expensive; "the procedures are cumbersome and require a tedious attention to documentary formalities."[314] Even when prosecutions are undertaken following fatal accidents, gathering and presenting the evidence necessary to demonstrate the existence of a violation may require considerable staff time and specialized expertise. This is even more true of prosecutions for contraventions of time-weighted contaminant exposure standards, where it must be proved not only that the violation existed, but also that the sampling and analysis techniques were appropriate for the contaminant in question and that the cumulative margin of error in sampling and analysis is less than that by which the standard was exceeded. These difficulties may be compounded by the hesitation of regulatory officials "to recognize as criminal, and the reluctance to label as criminal, anything done in the course of business, or in the course of production."[315] A further problem is the inexperience of Crown attorneys (and judges) in this relatively specialized area. Manga *et al.* note in a study of Saskatchewan, where very few prosecutions are undertaken, that "[a] typical prosecutor will have only one of these cases in five

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310. Labour Canada, "Status Report on Labour Canada Environmental and Medical Surveillance Program in the Grain Industry," mimeographed (Ottawa: Occupational Safety and Health Branch, Labour Canada, December 17, 1982), p. 1.

311. *Id.*, p. 2.

312. "Report: Assessment of the Health Surveillance Program in the Cereal Grain Industry in Canada," June 10, 1982, Appendix E to Labour Canada, *supra*, note 310.

313. "'I Am Not Satisfied': Caccia" (February 21, 1983), 6:7 *Canadian Occupational Health and Safety News* 1.

314. T.G. Ison, "*Re* the Uses and Limitations of Sanctions in Industrial Health and Safety," Item 158 (1975), 1 W.C.R. (B.C.) 203, p. 209. Ison was chairman of the British Columbia Workers' Compensation Board when this article was written; it comprises a strong argument for the more extensive use of penalty assessments as opposed to quasi-criminal proceedings in enforcing protections of employees' health and safety. The recent history of B.C.'s use of penalty assessments is discussed *supra*, pp. 57-9.

315. *Id.*, p. 207. See also the comments of Elgie, *supra*, note 306; Reschenthaler, *supra*, note 133, pp. 82-3 (quoting an Alberta enforcement official).

years," and that "the judiciary ... are accustomed to cases involving the criminal law where there typically is a victim."[316]

In some cases, the law adds to this latter difficulty by appearing to demand proof of individual injury — a particularly serious obstacle in cases where health hazards are involved. In a recent case involving such hazards, the Windsor Board of Education was charged under the general duties section of Ontario's *Occupational Health and Safety Act*.[317] It was alleged that a worker assigned to inspect school buildings for asbestos was not warned of the hazard, or provided with the necessary protective equipment. The need to prove harm arose because there were, at that point, no specific regulations dealing with asbestos in force in Ontario, and consequently no specific regulatory violations could be documented. Although asbestos is perhaps the workplace pollutant whose devastating effects on health are most exhaustively and conclusively documented,[318] Nosanchuk Prov. Ct. J. found that:

> There was no medical evidence called at the hearing indicating any ill effects actually suffered by Mr. Milburn, although it was generally conceded that asbestos-related diseases, if they are contracted, would not develop for a period of 10 to 15 years.
>
> ...
>
> [T]he evidence fails to establish beyond a reasonable doubt that, given the contradictory medical evidence and the evidence of controversy in the medical and scientific fields, that Mr. Milburn's health in the circumstances in which he worked was actually or potentially in danger ... [T]he court is not prepared to find that, having regard to the duration and intensity of exposure that a risk to health has been demonstrated *beyond a reasonable doubt*.[319] [Emphasis added]

No criticism of the court or its decision is intended. The decision is cited in order to show that demonstrating damage or endangerment may be a formidable challenge when long latency periods are involved or when the "proof" of a relationship between exposure and diseases is probabilistic in nature, even in the case of a widely recognized health hazard such as asbestos. This discussion also suggests a more general problem with prosecution-based approaches to achieving compliance which has been elaborated upon by Ison:

> To be most effective, the regulations must be explanatory as well as regulatory. They must explain to ordinary people what needs to be done; yet they must define for a lawyer in the role of judge exactly what is punishable. To some extent, these are conflicting objectives.

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316. P. Manga *et al.*, *Occupational Health and Safety: Issues and Alternatives*, Technical Report No. 6 (Ottawa: Economic Council of Canada, 1981), p. 215. Cf. the comment of Ison, *supra*, note 314, p. 210, that courts may impose sanctions based on "the gravity of the consequences in the particular case rather than the hazard level of the behaviour leading to the violation."

317. *R.* v. *Windsor Board of Education and Eric Laub*, unreported decision, Provincial Court (Criminal Division), Essex County, Ontario, June 11, 1982, Nos. 5429, 8919/82, 8920/82.

318. *A Review of Four Major Reports on the Health Hazards of Asbestos* (Hamilton, Ont.: Canadian Centre for Occupational Health and Safety, July 1981).

319. *R.* v. *Windsor Board of Education and Eric Laub*, *supra*, note 317.

> One aspect of this problem is the degree of precision and detail that should be contained in the regulations. If they are drawn in broad and general terms, the application to particular circumstances is left to be determined by someone who is normally untrained in industrial health and safety matters .... Yet to cover every potentially hazardous situation with detailed regulations would be an impossible task.[320]

Further problems arise from the applicability of the defence of due diligence, entrenched in law by the Supreme Court of Canada in *R.* v. *City of Sault Ste. Marie* when it defined strict liability offences as those where "the doing of the prohibited act *prima facie* imports the offence, leaving it open to the accused to avoid liability by proving that he took all reasonable care. This involves consideration of what a reasonable man would have done in the circumstances."[321] It can be argued that in fact the principal effect of *Sault Ste. Marie* involved "simply bringing the law into line with practice" since "those entrusted with enforcement are extremely reluctant to prosecute without there being some degree of fault on the part of the offender."[322] At the same time, in at least two subsequent Ontario cases defendants have successfully invoked the defence of due diligence against charges of violations of workplace health and safety legislation.[323] Intriguingly, in one of these cases the failure of inspectors to issue corrective orders with respect to the situation which ultimately resulted in a fatal accident was accepted as support for the defence of due diligence.[324] The importance of this discussion is that, wherever an offence is defined by statute or construed by the courts as one of strict liability, "[t]he onus of proof is on the Crown, throughout, to establish that the employer failed to take every reasonable precaution for the protection of the employee";[325] it is not sufficient merely to document, however conclusively, a violation of the relevant Act or regulation.

IV. When Prosecution Is Successful, Are Sanctions Appropriate?

In terms of achieving compliance, a major determinant of the usefulness of prosecutions is the nature of the sanctions which result. Are they sufficient to deter either the convicted offender (specific deterrence) or others contemplating similar acts (general deterrence)? Without far more detailed and systematic data than are available, it is impossible to answer this question on an empirical basis, but some preliminary observations can be made.

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320. Ison, *supra*, note 314, p. 210.

321. *R.* v. *City of Sault Ste. Marie* (1978), 40 C.C.C. (2d) 353, p. 374.

322. A.C. Hutchinson, "*Sault Ste. Marie, Mens Rea* and the Halfway House: Public Welfare Offences Get a Home of Their Own" (1979), 17:2 *Osgoode Hall Law Journal* 415, p. 416 (note 8).

323. *R.* v. *Z-H Paper Products Limited* (1979), 27 O.R. (2d) 570; *R.* v. *United Ceramics Limited* (1979), 52 C.C.C. (2d) 19.

324. *R.* v. *United Ceramics Limited, id.*, p. 31.

325. *R.* v. *Z-H Paper Products Limited, supra*, note 323, p. 576 (Trainor J., for the majority).

First of all, fines or imprisonment (the latter being almost unheard-of as a penalty for endangering workers) are "one-shot" sanctions. Once the time-consuming and costly process of prosecution is over, a conviction registered, and a sentence imposed, the regulatory agency has no further leverage against the violator unless it is willing to begin the process all over again. This may help to explain the reluctance of regulators to prosecute: the *threat* of the imposition of sanctions has considerably greater value than the sanction itself, in terms of a regulatory agency's relationship with a specific violator.

This is not to say, however, that the possibility of substantial sanctions may not serve as a deterrent to other employers in similar situations. In this context, much depends on the size of the penalties. Maximum penalties vary among jurisdictions; under the *Canada Labour Code* the maximum fine is set at $5,000, $15,000 or $25,000, depending on the particular section of the *Code* which is contravened.[326] In the case of contraventions "the direct result of which is the death of or serious injury to an employee," the maximum fine is increased to $100,000;[327] and wilful contravention with the knowledge "that the contravention is likely to cause the death of or serious injury to an employee" is punishable by a fine of up to $25,000 on summary conviction, or by imprisonment for up to two years following conviction on indictment.[328] Several jurisdictions set higher maximum penalties for repeat offences than for first offences.[329]

Maximum penalties are of limited relevance in the context of deterrence; more important are the penalties which an offender might reasonably anticipate. In Ontario, where the maximum fine for a violation of the *Occupational Health and Safety Act* is $25,000, the average fine in 1983/84 for contraventions of the Act and the Industrial Establishments Regulations was $3,125.[330] Courts have shown themselves increasingly willing, in that jurisdiction at least, to impose maximum or near-maximum fines.[331] On the other hand, one Ontario employer was recently fined just $2,000 for removing the guard from a mixing machine in whose rotating blades an employee was subsequently fatally injured.[332] Thus high fines are by no means universal even in cases where an employer is convicted of a violation which has directly resulted in death or serious injury.

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326. *Canada Labour Code*, ss. 105(1), (2), and (3).

327. *Canada Labour Code*, s. 105(4).

328. *Canada Labour Code*, s. 105(5).

329. *E.g.*, *The Workplace Safety and Health Act*, S.M. 1976, c. 63, C.C.S.M., c. W210, as amended, s. 54; *The Occupational Health and Safety Act*, R.S.S. 1978, c. O-1, as amended, s. 33; *An Act Respecting Occupational Health and Safety*, R.S.Q., c. S-2.1, ss. 236, 237.

330. A. Gladstone (Occupational Health and Safety Division, Ontario Ministry of Labour) to E.W. Keyserlingk, Co-ordinator, Protection of Life Project, Law Reform Commission of Canada, December 31, 1984.

331. *E.g.*, *R.* v. *Cotton Felts Ltd.* (1982), 2 C.C.C. (3d) 287 (sentence of $12,000 upheld on appeal); see generally "Token Fines Passé for Safety Offenders" (April 18, 1983), 56:1553 *CLV Health and Safety Forum* 3.

332. *R.* v. *Ontario Gypsum Co., George Popik, Nancy Jukes*, Provincial Court (Criminal Division), Region of Durham, Ontario, July 28, 1982.

When reducing exposure to dangerous workplace pollutants involves process redesigns, installations of ventilating systems, or other forms of engineering controls, costs may run into the millions of dollars for large plants.[333] Even the maximum penalties now available in Canadian jurisdictions are trivial in comparison with the savings which may accrue to employers in such situations as the result of non-compliance. Further, in terms of sentencing, the impact of diminished peripheral nerve conduction velocity or even the statistical greater probability of dying of cancer some time in the future is likely to be less than that of an amputated limb or a grieving widow, making courts less inclined to impose maximum penalties precisely where they may be most needed for deterrent purposes.

Coffee points out that even if offenders can expect to be assessed the maximum fine on conviction, "the expected penalty must be discounted by the likelihood of apprehension and conviction in order to yield the expected punishment cost."[334] He goes on to argue that where the risk of apprehension and conviction is relatively low, there may be *no* fine within the financial resources of a corporate offender that would be large enough to serve as a deterrent.[335] Fines for offences such as those involving workplace pollution are not, of course, the only penalties involved: the costs of mounting a defence can themselves be substantial, and the stigmatization of "being treated like a criminal" *may*, in some cases, be a powerful additional disincentive to offenders in management positions. On the other hand, sanctions directed at a large corporation may fail to have the desired effect because they can be passed on to consumers in price increases, or because the relevant decision-makers within the corporation (for example, plant or division managers) do not anticipate that they will be personally affected by fines or other sanctions directed against the corporation as a unit.[336]

The effectiveness of prosecution as an enforcement strategy, then, is limited largely to situations where violations can be reliably detected, where the agency responsible for enforcement has the resources to undertake prosecutions based on that information with some consistency, and where the sanctions imposed on conviction are likely to have a substantial deterrent effect. Their role may thus be limited even for the most aggressive enforcement agency in the world simply by limits to the agency's resources. The complexities of sanctioning the corporation introduce a further set of problems. Yet in most Canadian jurisdictions (including the federal) prosecutions represent one of the few ways in which a penalty or other economic disincentive can be imposed on an employer, even if the employer has persistently disregarded health and safety standards or inspectors' orders.

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333. K. Nelson, "Government Regulations — Environmental and Occupational Health" (September 1981), 42 *American Industrial Hygiene Association Journal* 633, p. 635; "Winds of Change a Trifle Blustery" (March 21, 1983), 56:1546 *CLV Health and Safety Forum* 2 (on costs of dust control systems for grain elevators).

334. J. Coffee, "'No Soul to Damn, No Body to Kick': An Unscandalized Inquiry into the Problem of Corporate Punishment" (January 1981), 79 *Michigan Law Review* 386, p. 389.

335. *Id.*, pp. 390-1.

336. *Id.*, pp. 397-402.

V. Criminal Negligence: Can It Be Proved? Should We Try?

In addition to the problems posed by relying on prosecution as a step in imposing sanctions on employers who violate laws dealing specifically with employees' health and safety, using the criminal law in this context means confronting a number of further difficulties. At the same time, there is a powerful intuitive attractiveness to the notion that conduct which results in damage to life and health of the sort which could lead to criminal charges, if it involved the effects of one individual's actions on another individual, should be treated similarly by society when the conduct involved is that of a corporate employer and the victims are his employees. Glasbeek and Rowland have argued, in an extensive review of potential applications of the *Criminal Code* in this context, that criminal negligence is "the most useful of all the serious criminal charges"[337] which might be used in dealing with creators of hazards to employees' health. It is therefore worth examining a few recent cases in which charges of criminal negligence were laid as a result of fatal injuries to workers, to get an idea of how useful or defensible the change of criminal negligence has proved in practice.

In *R.B.C. Construction Inc.* v. *R.*, the Québec Court of Appeal allowed the employer's appeal from a 1977 Provincial Court conviction of criminal negligence causing the death of three construction workers buried in the collapse of an excavation. Kaufman J.A. found that:

> [T]he criteria prescribed by the [Criminal] *Code* are not ignorance, incompetence, or "insouciance," but rather "wanton or reckless disregard for the lives or safety of other persons". This is *not* necessarily found in the non-observance of governmental regulations (though, on occasion, that may suffice) .... And certainly, it is not incompetence or ignorance.[338]

He went on to

> ... underline the distinction which must be made between civil and criminal negligence. It is right that this should be so: causing death by criminal negligence is not an offence of strict liability. It is not sufficient that an undertaking — one might even say an undertaking which is dangerous by its very nature — resulted in tragedy. It is the wanton or reckless disregard which counts ....[339]

This line of reasoning is somewhat more restrictive than that followed in the earlier decision of the Québec Court of Appeal to allow the appeal of the International Paper Company of Canada from its conviction on a similar charge. The case involved a worker who had fallen to his death from one of two gangways beside a conveyor used to carry logs across a river. Dubé J.A. concluded that:

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337. H. Glasbeek and S. Rowland, "Are Injuring and Killing at Work Crimes?" (1979), 17 *Osgoode Hall Law Journal* 506, pp. 524-50.

338. *R.B.C. Construction Inc.* v. *R.* (August 22, 1979), Québec Court of Appeal, District of Montréal, No. 500-10-00316-776, opinion of Kaufman J.A.

339. *Ibid.*

[F]or there to be criminal negligence, there must be added to civil negligence a factor of criminality; in other words, the act or the omission for which the accused is blamed must indicate a wanton or reckless carelessness with respect to the safety of others: with respect for any contrary opinion, I do not find, in the acts, or rather in the omissions for which the appellant is blamed that factor of criminality which differentiates civil negligence from criminal negligence.

If the accident had occurred as a result of negligence in maintaining the eastern gangway, without any doubt the appellant would be guilty of criminal negligence, because the gangway in question was intended for the use of the factory employees and was accessible for this purpose; it would be the same as well if the appellant had been informed that the western gangway was used and represented a danger.

But, in the instant case, the gangway which collapsed, *i.e.*, the western gangway, was in no way intended for the use of employees and, moreover, was inaccessible; ... and no one, from the director of the factory to the most junior worker was under the impression that this gangway was for the use of workers; moreover, the gangway in question was practically inaccessible at one end and access was very difficult at the other end.[340] [Emphasis added]

A case more interesting in part because it involved the effects of a workplace pollutant is that of *R.* v. *Canadian Copper Refiners Ltd.*[341] Workers in the defendant's plant were cleaning out one particular set of vats used in the electrolytic refining of copper — normally a routine operation. However, under certain conditions the process could result in the generation of highly toxic arsine gas. Over the period of approximately two years before the incident, the technician in charge of the environmental control programme at the plant and his immediate superior had become aware of this possibility and had carried out various experiments aimed at detecting hazardous levels of arsine emissions and improving ventilation systems. Work had begun 18 months before the incident on the design of local exhaust ventilating hoods for the vats, but the hoods had not yet been installed. On this particular day, smoke coming from the vats first irritated the eyes and throats of workers in the area. There followed headaches, stomach cramps, nausea and vomiting. Some employees had to leave the plant and go home; others stayed on. One of those affected later became so sick he could not return to work for two and a half months. Two of the victims were less fortunate: they died within a week of what was successfully argued by the Crown to be arsine gas poisoning.

After reviewing earlier jurisprudence, Tarasofsky J.C.S.P. specifically expressed agreement with the views of the court in *R.B.C. Construction*.[342] He went on to

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340. *R.* v. *International Paper Company of Canada* (1979), 50 C.C.C. (2d) 231, pp. 232-3.

341. *R.* v. *Canadian Copper Refiners Ltd.* (February 16, 1982), Cour des Sessions de la Paix, Judicial District of Montréal, No. 01-007907-758, Reasons for Judgment, Tarasofsky J.C.S.P. See also "Coroner's Report ... concerning the Death of Two Persons [Paul-Emile Dorval and Joao Da Costa] in Montreal on January 7th and January 9th, 1975" (Montreal, June 27, 1975), which reports the findings of the coroner's inquest into the events which led to the laying of charges.

342. *R.* v. *Canadian Copper Refiners Ltd.*, *id.*, p. 49.

indicate that: "The existence of criminal negligence always resides in the minds of the accused prior to the accident having been committed"[343] and that:

> [C]riminal negligence is essentially ... a crime of attitude. It is the crime of having so improperly evaluated a risk, or so frivolously, so unseriously approached the evaluation of a risk, of having so manifestly inadequately to have begun to evaluate a risk in the light of what one could have known, knew and should have known, that it can be fairly said that the negligent attitude towards the evaluation of the risk, the indifference to the responsibility to evaluate the risk, the devil-may-care attitude that characterized the approach to the evaluation of the risk was such that the negligence was wanton and reckless and therefore criminal; but it is more. Not only must the evaluation of the risk be approached in the manner that I have just stated, but equally the attitude of reaction to that risk must be of a like attitude. The approach to the risk, the attitude towards it, the *mens rea* must be such that it can be reasonably said that it was so cavalier, so insufficient, so lacking in reasonable seriousness, so bereft of healthy care and concern, so inappropriate, so wanting on a reasonable test, so puny, so callous, so capricious that it constitutes negligence which goes beyond civil negligence and becomes criminal negligence.[344]

On the responses of management to the potential hazard from arsine gas, he had this to say:

> Clearly, when they reacted to the risk their reaction was inappropriate. It was insufficient. Their reaction did not take into account or could not have taken into account and was inadequate to take into account the abnormality that occurred on January the third. To that extent, one can make a value judgment on their actions and say yes, their actions were inappropriate, were unsufficient, were incomplete, were unsuccessful, but beyond that one cannot go, one cannot attribute blameworthiness to them when they made those decisions, and when one notes that their actions were incomplete and insufficient, et cetera, one is doing so with the advantage and the twenty-twenty vision that hindsight provides, because when one places oneself in the position of these people ... nothing in the evidence that I saw indicates that they should have known or could have known, that they should have foreseen or could have foreseen that which occurred.[345]

He concluded that "while the prosecution has proven negligence in the company ... it has failed to prove beyond a reasonable doubt *criminal* negligence as defined in section 202 of the *Criminal Code* and as further defined by the jurisprudence ..." and acquitted the defendant.[346]

The preceding discussion, admittedly, deals only with cases in a single province, and one in which the judge in *Canadian Copper Refiners Ltd.* was bound by the earlier decision of the Québec Court of Appeal. It is nevertheless important in theoretical terms, and suggests the problems with application of today's criminal law to workplace pollution. Was the conduct of defendants in cases such as these merely dangerously misguided, rather than truly blameworthy? And is the problem one of the lack of mechanisms outside the criminal law for deterring such conduct? Or is the problem one

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343. *Id.*, p. 59.

344. *Id.*, p. 60.

345. *Id.*, pp. 67-8.

346. *Id.*, p. 68.

associated with existing legal conceptions of culpability? To the outside observer, it would appear that the fact that the employer allowed work to go on while workers were getting sick and having to go home would constitute "wanton and reckless disregard" for human health on the part of the company, even without prior knowledge of the potentially lethal effects of gas emissions from the operation in question. This was not, however, the view of the court; nor is it clear that this interpretation could be sustained on the basis of a statute and a body of jurisprudence which very strongly emphasizes the elements of wantonness and recklessness, as distinct from "mere" negligence, carelessness or indifference to duty.

The restriction of criminal liability only to those cases where conduct is truly blameworthy in a manner that cannot adequately be condemned merely by imposition of civil liability is consistent with the doctrine of restraint articulated by this Commission in Report 3, *Our Criminal Law*. However, as the foregoing discussion indicates, our present criminal law may not be adequate to deal with cases where workers are exposed in the workplace to patently unacceptable risks to their health and safety. The problem of workplace pollution must be dealt with at a variety of levels. As our standards respecting health and safety become more strict, our regulatory regimes and our capacity to ensure compliance with stricter regulations will have to be enhanced. And in those extreme cases where workers are exposed to unacceptable risks in callous disregard of regulations, criminal sanctions may have to be invoked.

CHAPTER FOUR

General Conclusions and Recommendations

I. Workplace Pollution As Crime?

The tests which have been applied to determining the criminality of acts or omissions which endanger workers, in cases such as *R.B.C. Construction Inc.* and *Canadian Copper Refiners Ltd.*, are extremely restrictive ones. It is argued here that the conception of criminality, or of culpability, which they reflect is indeed indefensibly strict, for a number of reasons.

As applied to situations which result in the injury or death of workers, how should we distinguish between civil and criminal negligence? The argument that criminal negligence should be defined in terms of an action which goes beyond a matter of compensation between the parties[347] has a long history in the jurisprudence,[348] and sounds very much like the interpretation articulated in *Canadian Copper Refiners Ltd.* However, a less restrictive approach can also be defended at a theoretical level. There are many instances of acts or omissions by employers which result in harm to workers which might not meet the tests for criminal negligence cited in the previous chapter, yet which we would almost certainly think are too serious to be left to the civil law. Such acts are definable, in Stone's words, as "behaviour ... [which] is viewed as so objectionable that we do not wish to provide an actor the option of doing it merely on condition that he purchase the damages."[349] These observations suggest that it is worthwhile to re-examine the definition of criminality, and of the criteria for determining culpability which are an essential element of that definition. It is perhaps even more important to explore ways in which employees could be provided with expanded access to preventive remedies, in contexts which do not require demonstration of blameworthiness in order to eliminate life- or health-threatening situations which may exist in the workplace.

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347. Law Reform Commission of Canada, *Omissions, Negligence and Endangering* [Working Paper 46] (Ottawa: LRCC, 1985), p. 39.

348. *E.g.*, *R.* v. *Bateman* (1925), 19 Cr. App. R. 8 (C.C.A.).

349. C. Stone, "The Place of Enterprise Liability in the Control of Corporate Conduct" (November 1980), 90:1 *Yale Law Journal* 1, p. 14.

In discussions of tests for the existence of criminal negligence, it is often implied or assumed that civil remedies are available as an alternative. For many injured employees, they are not; in the case of work-related illness, employers may have to "purchase the damages," if at all,[350] only at a cut-rate price which makes no explicit allowance for pain, suffering, the delay between exposure and the appearance of clinical symptoms of the resulting illness, or "the *unwantedness* of involuntary, unjustified deprivations of well-being at the hands of another."[351]

In striking contrast to the view of criminal negligence as "essentially ... a crime of attitude,"[352] Baker has focussed on contexts and potential consequences in challenging the equation of culpability with intention:

> It is wrong to think that any case of negligent (or culpably ignorant) law breaking behaviour must be less seriously at fault than any case of intentional or knowing law breaking behaviour. Carelessly handling loaded firearms in a crowded area, or speeding through a school zone at lunch hour oblivious to the dangers of others because one is absorbed in an interesting conversation, is more culpable *ceteris paribus* than deliberately taking a 50 cent store item without payment or than many other knowing offences against property.[353]

Why, though, do we think such behaviour culpable? One aspect involves the harm that could be done as a result, which represents the infringement of "a *right* to freedom from injury by others' negligence."[354] [Emphasis added] But although the behaviour in question does not always result in harm, we would think it culpable regardless. "Could be" is the operative phrase here, and can provide the basis of a persuasive argument for creating a criminal offence of reckless endangerment. As noted in the Commission's Working Paper 46:

> [R]eckless endangerment is penalized at present when it results in death or injury but not when it does not. However, where is the logic or justification for this when the result is usually quite fortuitous from the endangerer's standpoint?[355]

Working Paper 46 points out that this is the rationale behind "dangerous activity" offences like dangerous or impaired driving,[356] and behind similar offences such as those involving careless use or possession of explosives or dangerous weapons.[357] It is here suggested that a further element is involved, as well: the element of *assumed control*. Certain kinds of activities involve the control of technology (cars, explosives,

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350. See discussion of workers' compensation, *supra*, pp. 47-9.

351. B. Fisse, "The Retributive Punishment of Corporations" (unpublished, 1981), p. 32. MS on file with the Protection of Life Project, Law Reform Commission of Canada.

352. See *supra*, p. 68.

353. B. Baker, "*Mens Rea*, Negligence and Criminal Law Reform," mimeographed (Calgary: University of Calgary, April 1984), p. 28. MS on file with the Law Reform Commission of Canada.

354. Law Reform Commission of Canada, *supra*, note 347, p. 24.

355. *Id.*, p. 36.

356. *Id.*, p. 33.

357. *Id.*, pp. 33-4.

firearms) with the inherent potential to do such serious damage to life and limb that the law is justified in paying special attention to the individuals in control. Failing to act in a way which indicates respect for the inherent potential for harm of those technologies, after having voluntarily assumed control of them (no one *has* to drive, use explosives, or keep guns) is legitimately regarded as criminal.

Working Paper 46 argues for the entrenchment in the *Criminal Code* of a general offence of endangerment applicable to acts causing risk of death or serious bodily harm, the requisite degree of culpability for which should be criminal negligence as distinct from the more restrictive criterion of recklessness.[358] The inclusion of such an offence in the *Criminal Code* would go a long way toward remedying some of the deficiencies in the applicability of criminal law in the workplace identified in the preceding paragraphs. Creative application of such an offence section to situations involving workplace health and safety should take into account the breadth of managerial prerogatives and, consequently, the degree of control possessed by employers over conditions in the workplace. This control, coupled with the damage that can be done by workplace hazards and the lack of recourse to civil remedies on the part of many victims, is an additional point in favour of the entrenchment in criminal law of an offence comparable to those associated with the control of dangerous technology in other contexts.

An important complication is introduced by the corporate nature of most employers. Particularly in the case of large corporations, it may prove extremely difficult to document criminal negligence on the part of individual actors in positions of responsibility.[359] Nor is it clear that trying to do so will necessarily get at the broader implications of "corporate policy" for the life and health of employees. Cases do exist of clear relationships between corporate policy decisions and subsequent deaths as a result of workplace hazards,[360] but they are very much the exception.

It could be argued that these exceptions are the only cases in which the criminal law should be used to deal with workplace hazards. It could also be pointed out that sanctions directed against the corporation can be extremely effective and do not require (or at least need not require) the use of the criminal law. And the difficulty of assigning responsibility to individuals, even very powerful individuals, within the corporation is hardly a problem unique to occupational health and safety offences. At the same time,

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358. *Id.*, pp. 35-40.

359. See Stone, *supra*, note 349, pp. 26, 31-32.

360. As in the case of a corporate decision not to invest $33,000 for a dust control system, which was followed by an explosion which killed six employees and injured 48 others. S.P. Sethi, *Up Against the Corporate Wall*, 4th ed. (Englewood Cliffs, N.J.: Prentice-Hall, 1982), pp. 99-117. The ultimate dismissal by the New York Court of Appeals of indictments for criminally negligent homicide and manslaughter in the second degree against the corporation and four senior executives has generated a number of critical articles on the limitations of the criminal law in addressing the causing of death by corporate policy. See S. Weinfeld, "Criminal Liability of Corporate Managers for Deaths of Their Employees: *People* v. *Warner-Lambert Co.*" (1982), 46 *Albany Law Review* 655; S. Radin, "Corporate Criminal Liability for Employee-Endangering Activities" (1983), 18 *Columbia Journal of Law and Social Problems* 39.

we are uncomfortable, for reasons of fairness and not because of a desire for retribution, with the idea that individuals should be relieved of any part of the responsibility for harm which results from their actions because those actions (or omissions) are part of the individuals' exercise of power within a complex organizational structure rather than on a street corner.

The nature of the kinds of harm which may be done by workplace pollution creates another complication. As noted, much of the evidence concerning the relationship between particular workplace pollutants and illness or death is statistical in nature: it is possible to say on the basis of such evidence that a *greatly increased risk* of cancer death has been created, without being able to ascribe the death of any particular victim to the pollutant. Yet do we consider the employer action or corporate policy which allowed continued exposure to the pollutant in the face of such evidence any less reprehensible as a result?

How do the two most serious offences created by section 105 of the *Canada Labour Code* fit into this discussion? That section provides that:

> (4) Every person who contravenes any provision of this Part the *direct* result of which is the death or *serious injury* of an employee is guilty of an offence and is liable on summary conviction to a fine not exceeding one hundred thousand dollars.
>
> (5) Every person who *wilfully* contravenes any provision of this Part *knowing* that the contravention *is likely to* cause the death of or serious injury to an employee is guilty of an offence and is liable
>
> (*a*) on summary conviction, to a fine not exceeding twenty-five thousand dollars; or
>
> (*b*) on conviction on indictment, to imprisonment for a term not exceeding two years.[361] [Emphasis added]

At least two major problems emerge with these offences as defined. First, the mental element tests which must be met for conviction under subsection 105(5) (wilful rather than reckless or negligent action; the need to prove knowledge of the likelihood of resulting death or serious injury) appears to be more restrictive than that associated with the offence of endangerment proposed in Working Paper 46 — and, indeed, more restrictive than that associated with existing "dangerous activity" or "dangerous thing" offences. Implicitly, then, the *Canada Labour Code* arguably places a lower value on the life, health and bodily integrity of an individual in the workplace than on that of an individual outside it. If anything, given the inherently unequal distribution of power and authority as between employers and employees, the reverse should be the case.

Second, it is lamentable that the wording of the legislation fails specifically to address contraventions which cause or are likely to cause serious illness (for example, silicosis) or irreversible damage (for example, permanent neurological impairment). Will the courts consider such effects of workplace pollution as "serious injury"? Will

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361. *Canada Labour Code*, s. 105.

the courts be willing to accept appropriately robust statistical evidence of a substantially increased risk as evidence of causation under subsection 105(4)? If not, how much use (if at all) will these offence sections prove to be in addressing the damage done to employees' bodies by workplace pollution?

As the discussion in Chapter Three should make clear, it is not for a moment proposed that more than a few of the acts or omissions which create workplace hazards should be treated as criminal, just as we do not treat all driving offences, even those which may result in serious accidents, as criminal. Indeed, as made clear later in this chapter, the difficulties associated with prosecutions even under regulatory statutes suggest the need for alternative mechanisms of sanctioning. At the same time, the discussion in the preceding paragraphs suggests the merit of the following recommendations:

RECOMMENDATIONS

1. As a general principle, legislation should not be structured in a way which might result in treating the infliction of harm or the creation of an increased risk of harm in the workplace as in any way less culpable, or less deserving of criminal sanctions, than analogous inflictions of harm or creations of an increased risk of harm in other contexts.

2. The endangerment of employees by acts or omissions of employers which cause risk of death or serious bodily harm should be covered by the endangerment offence in the new Criminal Code, as proposed by the Commission, the requisite degree of culpability for which is criminal negligence, defined in terms of conduct which is such a marked departure from the ordinary standard of reasonable care as to call for criminal sanctions.[361a]

3. For purposes both of the offence discussed in Recommendation 2 and of *Canada Labour Code* offence sections which address acts or omissions which cause or are likely to cause death of, or serious injury to, employees, serious or irreversible illness or damage to bodily functions must be treated as serious bodily harm or injury for purposes of determining whether or not an offence has been committed.

4. It is essential to recognize the statistical nature of increased risk of death or bodily harm resulting from exposure to many workplace pollutants. The determination of whether or not an offence of endangerment has been committed should not depend on conclusive establishment of a cause-and-effect relationship between a specific workplace pollutant and the illness, injury or death of a specific, individual victim.

Some elaboration on this last recommendation is in order. Statistical evidence is ill-suited to the conclusive establishment of a cause-and-effect relationship between exposure to workplace pollutants and disease in an individual employee,[362] because of

361a. See LRCC, *Recodifying Criminal Law*, Vol. 1 [Report 30] (Ottawa: LRCC, 1986), p. 64.

362. See references cited *supra*, in notes 70-71.

multi-factor etiologies, variations in individual susceptibilities, and other factors. However, the issue for purposes of determining whether or not an offence of endangerment as proposed in Working Paper 46 has been committed is not the infliction of death or serious bodily harm, but the creation of an increased *risk* of harm. In the workplace context, endangerment should not need to be demonstrated with respect to any individual employee, but rather only with respect to the group of all employees exposed to a particular contaminant or combination of contaminants. Statistical evidence of increased risk is thoroughly appropriate in this context. In fact, if this definition of the evidence which will be considered sufficient for purposes of demonstrating endangerment is not accepted, the existence of an offence will be demonstrable only on the basis of production of conclusive proof of actual injury to a specific individual — precisely the situation at whose avoidance the creation of an offence of endangerment is aimed.[363]

II. Rights, Standards and Sanctions

Unlike criminal law, legislation specifically aimed at protecting employees' health and safety is generally a matter of provincial jurisdiction. Only with respect to the relatively small proportion of the Canadian workforce falling within federal jurisdiction does the government of Canada have the authority directly to regulate workplace health and safety. In addition, the recent package of amendments to the *Canada Labour Code* makes it unlikely that major changes will be made to the *Code* over the next few years. The observations and recommendations which comprise the remainder of this chapter are, therefore, deliberately stated not in terms of recommendations for specific statutory changes, but rather as general principles which should guide the development of legal protections for employees' health and safety in the remainder of the 1980s, and beyond.

The federal jurisdiction has played essentially a catch-up role in this respect. The amendments to Part IV of the *Canada Labour Code* which were passed by Parliament in 1984 represented a vitally important consolidation of responsibility for the health and safety of employees within the federal jurisdiction. Yet they have not advanced beyond the legislation of a number of provinces in terms of broadening the right to refuse unsafe work, of expanding the powers of the joint committees which will become mandatory when the amendments are proclaimed, or with respect to providing employees with a specific right to information about hazards.

A. Refining Internal Responsibility

In refining the various elements of the internal responsibility system, consideration should be given to the several weaknesses identified in the discussion in Chapter Two. As noted, Québec has taken some important steps in the direction of giving joint

363. See *supra*, p. 72.

committees actual, specific decision-making responsibilities. A useful guide for further efforts in this direction may be Norway's *Act ... relating to Worker Protection and Working Environment*, which requires joint committees in all workplaces where more than 50 people are employed; they may also be set up in enterprises with fewer employees at the request of employees or management or at the direction of the Directorate of Labour Inspection. The committees "shall consider," among other items, "plans that may be of material significance for the working environment, such as plans for building work, purchases of materials, rationalization, work processes, working time systems and preventive safety measures."[364] Further:

> If the working environment committee considers it necessary in order to protect the life or health of employees, it may decide that the employer shall effect concrete measures to improve the working environment, within the framework of the provisions stipulated in or by virtue of this Act. To determine whether a health hazard exists, the committee may decide that the employer shall have the working environment examined or tested. A time-limit for effectuation of the decision shall be imposed by the committee. If the employer finds that he is unable to effectuate the decision, the matter shall be submitted without undue delay to the Labour Inspection [Directorate] for decision.[365]

This statute clearly envisions a more meaningful decision-making role for joint committees than is presently provided for by statute anywhere in Canada. It is obviously difficult to base a recommendation on the Norwegian experience, because of the different patterns of employee-employer relations in Norway and Canada, and because of the absence of published research on the effectiveness of the Norwegian Act. However, conclusions are easier to reach on three other issues: the right to refuse; the right to know; and protection against reprisals. With respect to the first:

RECOMMENDATION

5. Legislative provisions governing the right to refuse unsafe work should specify that, as in the Québec legislation, no employee who is without work as a result of a refusal to perform unsafe work which imposes an immediate threat to life or health under the provisions of the law shall suffer any loss of wages or other penalty.

Superficially, this recommendation would appear to impose unjustifiably high costs on employers in cases where (for instance) correction of the hazard which has led to the work refusal requires shutting down an operation for a substantial period of time for process modifications or installation of new equipment. This apprehension is almost certainly unfounded, however. The right to refuse unsafe work as entrenched in legislation, and as interpreted by labour boards and arbitrators, represents a response to immediate threats to life and health rather than an initial response to working conditions which are perceived as hazardous by employees, or even a last resort in ongoing disputes over such conditions.[366] The recommendation does not involve broadening the

364. Norway, *Act of 4 February 1977 relating to Worker Protection and Working Environment*, s. 24.2.

365. *Ibid.*

366. See *supra*, note 169, and *supra*, p. 35.

statutory basis for exercise of the right to refuse; rather, it addresses the removal of a constraint which may have the effect of pitting employee against employee, *even* in situations of clear and immediate hazard to life or health.

On the issue of the right to know, the federal and provincial government departments involved in the development of the Workplace Hazardous Materials Information System (WHMIS) deserve the highest praise for their involvement in this initiative. But legal entrenchment of employees' right of access to information about hazardous substances nevertheless remains important.

RECOMMENDATION

6. Legislation or regulations applicable to workplace pollution should:

(a) specifically indicate that employers must inform employees about the identity and potential hazards of all substances or physical agents present in the workplace which might be dangerous to safety or health;

(b) require employers to compile and update inventories of such substances and physical agents, and of all information in their possession with respect to their potential hazards, on a periodic basis, and to make these inventories available to the regulatory agency and to employees or their representatives;

(c) specifically indicate that employees are entitled to all information from tests of workplace conditions, or reports on those conditions, whether prepared or conducted by officials of the responsible government agency or by representatives of the employer.

Compliance with the objectives of Recommendation 6(b), in particular, will be greatly facilitated by the implementation of the WHMIS. The right of access to information is essential to the effective functioning of the joint committee system and to informed exercise of the right of refusal. The specific expansion of this right to include information contained in inspectors' or hygienists' reports also reflects a more general rethinking of the role of enforcement officials and of compliance policy, discussed in more detail below.

RECOMMENDATION

7. That, as a general principle, employees should be able to appeal to labour boards any alleged discriminatory action by employers related to demands for access to information to which they are legally entitled, to refusals of work believed to be unsafe, or to other involvement in activities related to the protection of workplace health and safety such as participation in the activities of joint health and safety committees.

Since this recommendation is part of a more general consideration of access to remedies, the rationale will be discussed in more detail under that heading. Suffice it

to note here that in the federal jurisdiction, whereas employees may appeal to the Canada Labour Relations Board for redress when discriminatory action is alleged to result from a refusal to work under the provisions of the *Canada Labour Code*, prohibitions against reprisals for other kinds of discrimination, or for failure to provide a joint committee or health and safety representative with information to which it/he/she is legally entitled, appear to be enforceable only through application for an injunction or through prosecution under the offence section of the *Code*, with all the difficulties that this implies.[367] This is a needless and cumbersome restriction on employees' protection, and one not imposed by several provincial jurisdictions.

B. Standards and Compliance

In Canada, surprisingly little attention has been paid, on a public level, to the basic normative issues and principles underlying the standard-setting process in the area of occupational health. For the most part, Canadian jurisdictions have been content to adopt the norms of acceptable exposure promulgated by the ACGIH, with little reflection on their strengths and limitations. A partial exception to this general lack of reflection is the after-the-fact review of Ontario's designated substance regulations conducted by the Advisory Council on Occupational Safety and Health,[368] and the Council's solicitation of responses to a draft proposal for a policy on occupational carcinogens.[369] A much more ambitious effort to develop a carcinogen policy was undertaken by the United States Occupational Safety and Health Administration (OSHA) in the late 1970s.[370] The change of administration in the United States shortly after the policy was finalized meant a retreat from the aggressive regulatory stance embodied in the policy, which has now effectively been shelved.[371] Yet the final statement of that cancer policy,[372] based on extensive public hearings which produced a record of some 250,000 pages, remains perhaps the most sophisticated and detailed

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367. T. Armstrong (Deputy Minister of Labour, Ontario), commenting on the rationale for the provisions of the *Occupational Health and Safety Act* which allow referral of a complaint alleging reprisals either to arbitration or to the Ontario Labour Relations Board, in *Legislature of Ontario Debates*, *supra*, note 262, p. R1338:

> [I]t is not sufficient simply to prohibit reprisals and leave it to prosecution to punish those who engage in reprisals, for a couple of simple reasons. First, in a prosecution the onus of proof is a criminal one. You have to prove it beyond a reasonable doubt. Second, and more important, all that a provincial court judge can do is impose a fine. He cannot reinstate the worker, he cannot issue cease and desist orders, he does not have all the range of remedies that administrative tribunals have.

368. See, *e.g.*, the Council's *Fifth Annual Report*, Vol. 1, *supra*, note 201 (reviews of the processes and principles used to develop standards for vinyl chloride, coke oven emissions, asbestos and noise).

369. The draft proposal and responses received are reproduced in the Council's *Fifth Annual Report*, Vol. 2, *supra*, note 191.

370. Occupational Safety and Health Administration (OSHA), "Identification, Classification and Regulation of Toxic Substances Posing a Potential Occupational Carcinogenic Risk" (October 4, 1977), 2 *Federal Register* Part VI 54148; OSHA, "Identification, Classification and Regulation of Potential Occupational Carcinogens" (January 22, 1980), 45 *Federal Register* Part VII 5001. For discussion of the generic carcinogen policy, see McGarity, *supra*, note 73; Ruttenberg and Bingham, *supra*, note 240.

371. S. Crapnell, "OSHA Cancer Policy: Nearing the End or a New Beginning?" (April 1983), 45:4 *Occupational Hazards* 88.

372. OSHA, "Identification ..." (1980), *supra*, note 370.

analysis available of the extent to which regulating workplace pollutants represents an exercise in the resolution of value conflicts about the weighting of scientific uncertainty. These issues and conflicts are not unique to carcinogens, but recur with respect to the health effects of workplace pollutants more generally.

RECOMMENDATIONS

8. There is a need for a general public review of the normative principles which should be embodied in legal standards for protection from workplace pollutants, with particular reference to the basis for making decisions in cases of uncertainty, conflict among scientists, or incomplete information about long-term health effects of workplace pollutants.

9. There is a need for a systematic assessment of the adequacy of the numerical exposure limits currently adopted by regulation in protecting all workers who may be exposed to workplace pollutants, based on the most recent and comprehensive research available.

The bipartisan federal Advisory Council on Occupational Safety and Health created by the 1984 amendments to the *Canada Labour Code*[373] may well be the most appropriate body to initiate such a review within the federal jurisdiction.

The discussion provided in the preceding chapters suggests that limits on the available range of sanctions seriously inhibit society's ability to protect employees from the effects of workplace pollution. Because the institutions involved (employers, ranging from firms with only a few employees to large transnational corporations) are economic actors, there is ample reason to believe that their motivations with respect to employee protection are primarily economic ones: measures to reduce or eliminate employee exposure to workplace pollution will not be taken when they would reduce the flow of economic benefits to the employing firm,[374] unless the probable costs of failing to take such measures (in terms of fines, compensation assessment, insurance premia or other penalties) outweigh the benefits. It is not necessarily the case that the *only* relevant factors are economic ones; the firm may not be an "amoral calculator" whose only considerations are the increased profits which result from non-compliance and the probability and magnitude of the sanctions which might result from persistent non-compliance.[375] And non-compliance may be a function of other factors as well, such as lack of access to the technical expertise necessary to achieve compliance.[376] At the same time, it is reasonable to operate on the presumption that unless the sanctions which can be imposed for non-compliance (a) bear some relationship to the economic benefits from non-compliance, and (b) can be invoked with a high degree of predictability and consistency, they are unlikely to be effective in achieving compliance in more than a minority of cases.

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373. *Canada Labour Code*, s. 96.

374. See *supra*, pp. 32-3 and 48.

375. R.A. Kagan and J.T. Scholz, "The 'Criminology of the Corporation' and Regulatory Enforcement Strategies," in *Enforcing Regulation*, ed. K. Hawkins and J.M. Thomas (Boston: Kluwer-Nijhoff, 1984), pp. 69-72.

376. *Id.*, pp. 80-4; Bardach and Kagan, *supra*, note 265, pp. 143-50.

In this context, it is worthwhile to examine two innovative approaches to sanctioning which have been advanced in the area of environmental protection. The first is a proposal that firms not in compliance with environmental regulations be required to post with the regulatory agency a surety bond in an amount representing at least a substantial proportion of the estimated cost of a compliance programme. The funds thus deposited would be refunded, with interest at an appropriate rate, in stages as completion of the programme is demonstrated. The mechanism provides

> ... an up-front financial incentive to the polluter to comply with agreed-to programs or performance rules. The more that is deposited, the greater the incentive. The bond also ensures that money for the program or operation is made available against future economic downturns.[377]

In December 1985, Ontario's Minister of the Environment announced that he would "be proposing shortly that Ontario adopt this tool as a matter of policy."[378]

The second of these alternative compliance mechanisms, again as proposed in the context of environmental pollution, involves the automatic application of a financial "delay penalty." As long as a firm is in compliance with a specified or negotiated schedule of emission reductions, no penalty would be assessed. Conversely, non-compliance would be dealt with by imposition of a penalty which varies with the level of excess emissions, and which continues until compliance is achieved. Penalties can theoretically be set at any level, but should bear some relationship to the cost savings from non-compliance.[379]

During the 1970s, Connecticut legislators adopted an enforcement regime for air and water pollution regulations which empowered the state's Department of Environmental Protection to impose both civil asessments (monthly economic penalties based on estimates of the savings from non-compliance) and surety bond requirements as ways of achieving compliance in an order-based regulatory framework.[380] Drayton, in addition to providing numerous details on the workings of the mechanism, noted in 1980 that the approach had "worked well in Connecticut, cutting non-compliance rates and delay in both large and small cases. It opens the way to widespread, philosophically acceptable use of administrative civil penalties."[381] A proposal by government economists for the application of delay penalties to the Ontario pulp and paper industry in the 1970s[382] would have related the size of financial penalties both to the time during which a facility was not in compliance with effluent regulations and to the amount by which its discharges exceeded the allowable limit.

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377. Peat, Marwick and Partners and W. Sims, *Economic Incentive Policy Instruments to Implement Pollution Control Objectives in Ontario* (Toronto: Ontario Ministry of the Environment, 1983), pp. III-1 — III-2.

378. The Hon. J. Bradley, "Remarks to the Economic Council of Canada Colloquium on the Environment," mimeographed (Toronto: Ontario Ministry of the Environment, December 10, 1985), p. 15.

379. Peat, Marwick, *supra*, note 377, pp. III-21 — III-23; J. Donnan and P. Victor, *Alternative Policies for Pollution Abatement: The Ontario Pulp and Paper Industry*, Vol. 3. *Summary and Update for Discussion Purposes*, rev. ed. (Toronto: Ontario Ministry of the Environment, October 1976), pp. 68-71.

380. W. Drayton, "Economic Law Enforcement" (1980), 4 *Harvard Environmental Law Review* 1.

381. *Id.*, p. 31.

382. Donnan and Victor, *supra*, note 379.

Applying a penalty regime analogous to that proposed for Ontario's pulp and paper industry to cases of workplace pollution clearly would involve unmanageable monitoring requirements. However, a regime of automatic financial delay penalties would be ideally suited to ensuring compliance with the provisions of prevention programmes such as those now being required from some Québec employers.[383] Such programmes have two substantial advantages relative to the conventional approach of inspecting individual workplaces: they require employers to specify plans for compliance with *all* relevant legal requirements, and whereas inspections of the individual workplace may have the (unintended) effect of "picking on" some employers relative to their competitors, prevention programmes (in Québec) are required from all employers in a particular sector. At the same time, prevention programmes on the Québec model have one major weakness: application of sanctions for non-compliance would appear to face the same difficulties encountered in other jurisdictions. The availability of a system of automatic civil penalties would remedy that weakness.

RECOMMENDATION

10. As a general principle, legislation applicable to the control of workplace pollution, in conjunction with appropriate regulations, should:

(a) allow, if not oblige, regulatory authorities to require the submission, on or before deadlines specified by regulation, of prevention programmes analogous to those now being required in Québec, specifying the steps which will be taken to comply with all applicable legal requirements, and the time by which such steps will have to be taken;

(b) provide regulators with the authority to require the posting of refundable surety bonds, and/or to impose a regime of automatic financial levies analogous to pollution control delay penalties, in cases where employers have failed to meet the requirements and time-limits specified in prevention programmes or in inspectors' orders.

This is, of course, only the barest outline of an alternative approach to protecting employee health. Considerable further investigation would be needed to propose necessary additional detail, but a few important considerations should be mentioned here.

First, such a regime of prevention programmes and automatic financial penalties is *not* equivalent to a system of "first-instance sanctions" analogous to that provided for by occupational health and safety legislation in the United States. Under that legislation, inspectors are authorized (and, indeed, required) to issue citations for all violations of regulations which are observed in the course of an inspection, even when the violations are corrected immediately.[384] The result has been to stimulate a considerable degree of

383. See *supra*, pp. 56-7.

384. See G.Z. Nothstein, *The Law of Occupational Safety and Health* (New York: The Free Press, 1981), pp. 338, 347-88.

resistance and litigation on the part of employers who view this approach (with some justification) as excessively punitive.[385] The system of sanctions proposed here, in contrast, recognizes that time may be needed to achieve compliance with the norms embodied in regulation, and the sanctions in question would only be invoked in response to an employer's initial failure to meet a specified timetable for compliance. At the same time, they ensure that the costs of failure to live up to such a timetable will be difficult to avoid, thus drastically reducing the economic attractiveness of delays in compliance.[386]

Second, the idea that penalties should be based on the cost savings from non-compliance (the "recapture standard"[387]) is a superficially simple concept that hides a multitude of practical difficulties associated with making this determination. In the case of Connecticut environmental regulation, referred to above, the administrative agency involved was able to develop a set of formulae for the rapid and reasonably accurate calculation of compliance costs for the purposes of determining penalty levels.[388] Because of the multiplicity of potential workplace contaminants, it is not certain whether such a strategy could be applied to workplace pollutants. Yet control strategies for any number of pollutants may involve the same basic engineering principles, applicable (for example) to the design of exhaust ventilation.[389] A study of employee exposure to silica and metal dust in Ontario non-ferrous foundries concludes that the causes constitute, "for the most part, a litany of the obvious" engineering and housekeeping failures.[390] In such cases, estimates of compliance costs (and, consequently, of the benefits to the employer from continued violation) may be achievable without a detailed engineering study of each individual workplace. An alternative, and perhaps complementary solution would involve requiring that cost estimates for compliance be developed as part of the process of preparing prevention programmes.

Third, legitimate reasons may delay the submission of prevention programmes or compliance either with these or with specific inspectors' orders. In these cases, it should be up to the employer to show cause (before the appropriate agency officials, in the first instance) for the non-imposition of such a penalty or the extension of compliance deadlines. Relatedly, it is essential that proper appeal procedures be

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385. Bardach and Kagan, *supra*, note 265, pp. 104-16.

386. At present, in most Canadian jurisdictions, it could be argued and unless a prosecution is successfully completed, the costs of non-compliance are limited to the costs of litigation, which may be trivial in comparison with the cost savings from non-compliance. At the same time, once prosecution is successfully completed and a sanction imposed, no further costs may be associated with continued non-compliance.

387. Drayton, *supra*, note 380, pp. 2, 5-12.

388. Drayton, *supra*, note 380, pp. 2, 10-11, 32-40.

389. B. Feiner, "Industrial Air Contaminant Control," in *Dangerous Properties of Industrial Materials*, ed. N. Irving Sax, 5th ed. (New York: Van Nostrand Reinhold, 1979); G.E. Socha, "Local Exhaust Ventilation Principles" (January 1979), 40 *American Industrial Hygiene Association Journal* 1.

390. O.P. Malik *et al.*, "An Evaluation of Dust and Fume Conditions in Non-Ferrous Foundries in Ontario" (April 1984), 5 *Occupational Health in Ontario* 52, p. 61.

provided for those on whom penalties or surety requirements are imposed — a point stressed by Drayton in his discussion on the Connecticut experience.[391] For instance, surety bond requirements may impose an undue hardship on small firms which cannot (unlike their better capitalized competitors) readily absorb the cost of providing such bonds and, at the same time, expending funds on improving health and safety conditions in the workplace. High and rising product liability insurance premiums in the United States appear to have had an analogous impact, effectively barring smaller firms from a number of product markets.[392] At the same time, the standards applied in such appeal procedures must emphasize the need to restrict exemptions from such requirements to cases where the survival of the enterprise is genuinely in question. Otherwise, pleas for the reduction or waiver of economic penalties could defeat the objective of shifting the direction of investment and technological development toward a higher priority for employee protection. The need to develop and refine such criteria is one of many reasons for Recommendation 12, below.

Finally, requiring the submission and approval of prevention programmes will obviously not eliminate the need for ongoing inspections. Employees' health can be endangered by improper work practices, failure to maintain safety systems such as local exhaust ventilation, and many other types of action which can only be prevented through effort on an ongoing basis. This is one of the rationales for extending the use of civil penalties beyond failure to perform according to prevention programmes, to include cases of non-compliance with inspectors' directives to rectify these situations.

III. The Right to Workplace Protection

A theme which emerges from a number of points made in this Working Paper is the extent to which strategies for achieving compliance with regulations in areas such as environmental pollution and occupational health rely on discretionary enforcement, and implicitly entrench the process of negotiation between officials and regulated firms. To a considerable degree, this heavy reliance on official discretion is a function of the perceived "moral ambivalence"[393] or "moral ambiguity of regulatory offences."[394] However, compliance or non-compliance with prohibitions under regulatory statutes is not always a matter of moral indifference, a matter simply of the conflicting preferences of the state and the regulatee. Despite the fact that they all fall under the catch-all heading of "regulation," it is absurd to think about legal requirements such as those dealing with workplace pollution in the same terms as those specifying the units in

391. Drayton, *supra*, note 380, p. 8.

392. M. Brody, "When Products Turn into Liabilities" (March 3, 1986), 113.5 *Fortune* 20.

393. Hawkins, *supra*, note 266, p. 37.

394. R. Kagan, "On Regulatory Inspectorates and Police," in Hawkins and Thomas, eds., *supra*, note 375, p. 54.

which gasoline or salami may be sold, or the times during which parking is prohibited, for purposes of designing compliance regimes and evaluating the normative significance of compliance or non-compliance.

It is also inaccurate to argue that administrative or regulatory regimes do not necessarily defend important or fundamental rights or values. For example, consider the range of remedies available to labour boards in cases of unfair labour practices.[395] Many of us, perhaps most, would agree that prohibitions of employer actions of this sort contain at least some moral element, and that the practices in question are not wrong solely because prohibited. The same is even more true of laws which prohibit discrimination on the basis of race, religious belief, or sex.

In such cases, we are not content to leave the protection of the rights or entitlements in question to administrative discretion. The reason we do not do so can be understood by considering Sax's discussion of public rights with reference to the protection of environmental quality, in which he argues that relying on administrative discretion means that "[t]he citizen who comes to an administrative agency comes essentially as a supplicant."[396] He continues this critique of administrative discretion by way of a comparison with property rights, noting that "a society which is ready to recognize public rights can no more leave the destiny of those rights in the hands of bureaucrats than it would leave the enforcement of an individual's property rights to some bureaucrat to vindicate when, and if, he determines them to be consistent with the public interest."[397] We would argue that the same is true with respect to the rights or entitlements of employees to be protected from infliction of illness or injury at work.

The "bureaucrats" involved with the implementation of occupational health and safety law are an indispensable element of enforcement strategy. Yet we would argue that laws protecting occupational health and safety should do more than provide an enabling framework for the exercise of official discretion. They should also entrench some species of *right* of employees not to be injured or made ill in the course of employment — a right at least broadly analogous to those provided by legislation concerned with other aspects of labour-management relations, and to those provided to varying degrees (depending on the jurisdiction) by the legal provisions setting up the internal responsibility system. In this context: "It is trite to say that all rights acquire substance only insofar as they are backed by effective remedies."[398] A striking fact about Acts and regulations protecting employees from the effects of pollution in the workplace is the extremely limited range of remedies to which the employees who are supposedly being protected have access. Legal prohibitions of reprisals against employees for health- and safety-related activities often provide the opportunity for

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395. H.W. Arthurs *et al.*, *Labour Law and Industrial Relations in Canada*, 2nd ed. (Deventer, Neth.: Kluwer-Butterworths, 1984), pp. 172-3.

396. J.L. Sax, *Defending the Environment: A Strategy for Citizen Action* (New York: Knopf, 1971), p. 58.

397. *Id.*, p. 60.

398. *Radio Shack* (1979), O.L.R.B. Rep. 1220, p. 1253, as cited by G. Adams, "Labour Law Remedies," in Swan and Swinton, eds., *supra*, note 147, p. 68.

redress through labour boards.[399] In view of the importance of the issuance of inspectors' orders and the enforcement of those orders in determining the actual level of health and safety protection afforded to workers, it is surprising that only in one jurisdiction in Canada (Ontario) does the law specifically provide for appeals by employees based on the *failure* of officials to issue an order or take other action to achieve compliance.[400] Others restrict the right to appeal inspectors' orders to employers,[401] or are silent or unclear on the issue.[402] The *Canada Labour Code* extends the right of appeal to "[a]ny employer, employee or trade union that considers himself or itself aggrieved by any direction issued by a safety officer ..."[403] but does not specify whether failure to issue a direction is appealable.

Moreover, such appeals cannot as a rule be directed to an outside body, but (as in Ontario) only to more senior levels of the bureaucracy responsible for enforcement. (This is always the first level of appeal.) In other words, the opportunity of appealing an inspector's order offers a limited, if not non-existent, way for employees to achieve greater protection in cases where non-enforcement or flexible enforcement is a matter of conscious administrative choice, rather than a product of the exercise of discretion by an individual inspector. In New Brunswick, inspectors' decisions may be reviewed in the final resort by the Occupational Health and Safety Commission,[404] and in Québec, by review offices and (as a last resort) by the Board of Appeal of the CSST.[405] Manitoba[406] is alone among Canadian jurisdictions in providing for labour board review of all inspectors' orders.

The lack of ways in which the potential victims can initiate action to trigger regulatory enforcement is not, of course, unique to occupational health, although it is particularly important in this context because of the lack of alternative civil remedies. In view of this lack, and in view of the serious damage to employees' health which may result from workplace pollution, the usual discretion of administrative authorities with respect to initiating enforcement action should be tempered by the provision of mechanisms by which potential victims can seek to obtain the protection to which they are entitled by law.

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399. See *supra*, pp. 31-2. See also comments of Armstrong, *supra*, note 367, on the rationale for this approach.

400. *Occupational Health and Safety Act*, R.S.O. 1980, c. 321, s. 32.

401. *E.g.*, *The Occupational Health and Safety Act*, R.S.S. 1978, c. O-1, as amended, s. 20(1).

402. Manitoba's *Workplace Safety and Health Act*, S.M. 1976, c. 63, C.C.S.M., c. W210, as amended, for example, provides the right of appeal to "any person aggrieved by an improvement order" (s. 38(1)), but does not specifically give employees the right to make such appeals, or specify that appeals may include requests to "toughen up" an order.

403. *Canada Labour Code*, s. 103(1).

404. *Occupational Health and Safety Act*, S.N.B. 1983, c. O-0.2, s. 38.

405. *An Act Respecting Occupational Health and Safety*, R.S.Q., c. S-2.1, ss. 20, 191.1-193, as amended by *An Act Respecting Industrial Accidents and Occupational Diseases*, S.Q. 1985, c. 6.

406. *The Workplace Safety and Health Act*, S.M. 1976, c. 63, C.C.S.M., c. W210, as amended, s. 39.

When given the appropriate responsibilities by legislation, as with respect to employer actions which unfairly restrict the right to organize and bargain collectively, labour boards have developed and applied a range of remedies including cease-and-desist orders, remedial orders, and compensatory damage awards including lost earnings and reimbursement for organizing and negotiating costs. It is arguably "the availability of *expeditious* procedures before labour boards [which] provides a powerful disincentive to unlawful action and can minimize reliance on remedies."[407] [Emphasis added] Expanding the applicability of such procedures in the area of workplace pollution would provide a powerful (and currently unavailable) avenue of access to remedies for victims and potential victims, in the process making the entitlement of employees to protection of their health and safety at work at least partly independent of administrative discretion.

RECOMMENDATION

11. Legislation should provide an opportunity for employees or their representatives to initiate regulatory action by way of appeal to a labour board, or to a tribunal with analogous powers created specifically to deal with occupational health and safety issues, in cases: where orders to correct demonstrable violations of regulations have not been issued; where deadlines for the correction of violations have not been complied with; or where penalties which normally follow in instances of non-compliance have not been collected. If a labour board is the chosen body, the board should be given the necessary remedial powers, by legislative amendment, to resolve such issues.

These proposals sound radical in the context of the degree of official discretion which currently exists with respect to the enforcement of Acts and regulations controlling workplace pollution. However, it can be argued that they merely involve providing the same degree of access to remedies with respect to workplace pollution that employees now enjoy with respect to infringements of other categories of legally protected rights in their relationships with employers. Further, they reflect a strong conviction that it is no longer defensible (if it ever was) to allow regulatory agency officials the degree of largely unappealable norm-setting authority which they now enjoy.

An alternative approach, which might require less in the way of institutional redesign, would involve expanding access to injunctive relief of the sort now provided in a limited range of circumstances under the *Canada Labour Code*. At present, only the Minister may apply for a superior court injunction to halt a contravention of the *Code* or regulations.[408] If access to this remedy were broadened to all affected parties, including employees and trade unions, the victims of workplace pollution would be able to seek the assistance of the courts in obtaining protection in cases where the existence of a contravention could be proved. Problems of meeting the relevant legal standards of proof with respect to such violations would, of course, remain. Unless the

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407. G. Adams, "Labour Law Remedies," in Swan and Swinton, eds., *supra*, note 147, pp. 62-3.

408. *Canada Labour Code*, s. 105.4.

generic reforms of employees' right to know outlined in this Working Paper were implemented, employees or their representatives might also be denied access to the information needed to demonstrate the existence of regulatory violations — information available to the officials whose inaction prompted the employee initiative in the first place.

Employees are not, of course, the only parties with a legitimate claim to access to remedies in the context of workplace pollution. Were any regime allowing for the more extensive imposition of administrative sanctions to be adopted, it would be crucial to ensure effective access to remedies for employers in conflicts with agency officials over (for example) whether it is reasonably practicable to meet performance requirements or compliance deadlines specified in inspectors' orders, prevention programmes or regulations; or over *how* best to comply with official requirements.

One important advantage of the prevention programme approach is that it tries to avoid this latter problem, by requiring employers themselves (in consultation with employees, as it is proposed here) to design the most effective engineering controls. However, in addition to permitting (as the law must) comparable access to remedies for employers and employees, it is also worth considering a suggestion made by an official of a major American copper smelting firm, to the effect that:

> Disputes between employer and [the regulatory agency] over controls could be settled by a neutral, competent consulting engineer who would decide on feasibility of successful controls and whose fee would be split between [the regulatory agency] and the employer. If either party disagree with the consultant's opinion, that party could go to court ....[409]

This mechanism for dispute resolution, with some alteration in the allocation of costs, might also be applicable to cases of deadlock within joint committees (where applicable) over prevention programmes or related issues of feasibility.

The recommendations made here constitute only an extremely general outline of an innovative approach to sanctioning and access to remedies. No doubt they fail to acknowledge numerous pitfalls and problems; they may also fail to appreciate all the advantages of the proposed changes. The departures from current practice are significant, and require considerably more long-term study and discussion than do incremental changes of the sort exemplified by the 1984 amendments to Part IV of the *Canada Labour Code*.

RECOMMENDATION

12. Further research should be initiated, with the aim of drafting a model revision to the *Canada Labour Code*, incorporating Recommendations 5 to 11 and 13 of this Working Paper, for purposes of further analysis, discussion and consultation.

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409. Nelson, *supra*, note 333, p. 635.

It is in the context of access to remedies that the ever-contentious issue of private prosecutions should be considered. Just as prosecution represents one of the few ways in which sanctions for non-compliance with the law in the area of workplace pollution may be imposed, so private prosecution is one of the very few ways in which victims or their representatives may fight back under current legal regimes.

Private prosecution has been used to good effect in Ontario, in at least one case: a union representative initiated such a prosecution against an employer following a serious accident, although the province's Ministry of Labour had refused to lay charges. The prosecution resulted not only in a conviction, but in a fine of $20,000 (close to the province's maximum) against an employer with three previous convictions for similar offences.[410] Absent the option of private prosecution, there is nothing that could have been done to impose sanctions on this clearly recidivous employer by anyone outside the bureaucracy.

Prosecution, private or otherwise, is not an ideal mechanism for imposing sanctions. At the same time, private prosecutions sometimes represent one of the few ways in which what amounts to the licensing of continued non-compliance by regulatory officials can be challenged.

RECOMMENDATION

13. That at least at present, there is no justification for legislative limitations on the scope of private prosecutions for violations of the law as it applies to workplace pollution.

None of the recommendations made in this chapter is a panacea, although all involve at least the potential for substantial improvements in existing legal protections against workplace pollution. Two concluding observations should be made in this connection. First, the recommendations do not specifically address the problem of occupational health and safety in small workplaces. These problems deserve further study. Such workplaces are not likely to be unionized, meaning that one particularly important category of protection is generally unavailable to employees. It is hard to envision the relevance of such legal provisions as those establishing joint health and safety committees in such small workplaces. Yet simply because such workplaces are so numerous, effective inspection is especially difficult to provide. Second, no legal changes can substitute for a genuine commitment on the part of employers to occupational health and safety. At the same time, there is evidence to suggest (as might be expected) that a "tougher" or more aggressive compliance regime can be effective in stimulating the development of such a commitment.[411] By providing a framework within which such a compliance regime is much more likely to develop, the recommendations made here do address, if indirectly, the conditions under which managements are likely to increase their efforts to protect employees' health and safety.

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410. *R.* v. *National Steel Car Corp.* (1983), Provincial Offences Court, Judicial District of Hamilton-Wentworth, Information 4202: Reasons for Judgment, Stevely J.P., March 8, 1983.

411. Bardach and Kagan, *supra*, note 265, pp. 93-9.

APPENDIX A

Selected Chemicals and Processes Presenting Occupational Reproduction Hazards

Alkylating agents*
Anesthetic gases
Benzene
Cadmium
Carbon disulphide
Carbon monoxide*
Carbon tetrachloride*
Chloroprene
DDT
1,2-Dibromo-3-Chloropropane (DBCP)
Diethylstilbestrol (DES)
Dioxins*
Ethylene dibromide (EDB)
Ethylene oxide*
Hexachlorobenzene (HCB)
Hormones**
Kepone
Laboratory reagents (occupational exposure)
Lead
Manganese
Mercury
Occupational exposure to pesticides
Polychlorinated biphenyls (PCBs)
Polycyclic aromatic hydrocarbons (PAHs)*
Tobacco smoke
Vinyl chloride

* Only animal evidence cited in the literature reviews from which this table is synthesized.

** *E.g.*, estrogens, androgens, progestogens, synthetics such as DES.

Sources: Compiled from Nancy M. Chenier, *Reproductive Hazards at Work: Men, Women and the Fertility Gamble* (Ottawa: Canadian Advisory Council on the Status of Women, 1982); I.C.T. Nisbet and N.J. Karch, *Chemical Hazards to Human Reproduction* (Park Ridge, N.J.: Noyes Data Corp., 1983); J. Stellman, "The Effects of Toxic Agents on Reproduction," *Occupational Health and Safety* (April 1979) 36; J.A. Thomas, "Reproductive Hazards and Environmental Chemicals: A Review" (Spring 1981), 2:4 *Toxic Substances Journal* 318.

APPENDIX B

Selected Occupational Neurotoxins

Acrylamide
Arsenic
Benzene hexachloride
Carbon disulphide
DDT
Dimethylaminopropionitrile
n-Hexane
Kepone
Lead
Manganese
Mercury
Methanol
Methyl-n-butyl ketone (MBK)
Methyl chloride
Organotin compounds
Perchloroethylene
Styrene
Toluene
Trichloroethylene

Source: Edward L. Baker Jr., "Neurological Disorders," in *Environmental and Occupational Medicine*, ed. W. Rom (Boston: Little, Brown, 1983), p. 313.

APPENDIX C

Employee Exposure to Selected Hazardous Workplace Pollutants (Ontario)

Pollutant	*Individuals Exposed*
Cadmium and its compounds (a)	3,000 to 5,000 (including "very occasional exposures").
Chlorine (b)	10,700 in chlorine production; chemical manufacturing; pulp and paper facilities; and water treatment plants.
Trichloroethylene, Tetrachloroethylene, and Methyl chloroform (c)	5,940–6,935 "directly exposed" in dry cleaning, solvent distributing, formulating, manufacturing, and metal cleaning; another 57,000 or more workers "indirectly" or "occasionally" exposed in those industries.
Formaldehyde (d)	6,410 in forest products industry; production of insulating materials; textiles; electrical products; plastics fabrication; foundries; abrasives; funeral homes; and laboratories. (Note: estimates do *not* include exposure to formaldehyde as a pollutant in office air.)
Nickel and its compounds (e)	In nickel-producing industry (principally mining, milling, smelting, refining): 14,202 on a full-shift basis, another 2,292 on a partial shift or occasional basis. In the nickel-consuming industry (alloy steel, foundries, electroplanting, nickel salts manufacturing, welding with nickel alloys): 8,927 (breakdown between full-shift and occasional exposure not available).
Styrene (f)	1,000 on a full-shift basis in plastics industry; another 4,400 on a partial shift or occasional basis.
Ethylene oxide (g)	600–1,750, mostly in hospitals where the gas is used as a sterilant.
Benzene (h)	670 on a daily basis in primary production; 1,640 on a daily basis and 1,760 intermittently in secondary industries; 12,500 on a daily basis in gasoline handling.

Sources:

(a) Hatch Associates Ltd., "Cadmium and Its Compounds," report prepared for Occupational Health and Safety Division (Toronto: Ontario Ministry of Labour, 1981).

(b) IEC Beak Consultants Ltd., "Occupational Health Implications of Chlorine Use in Ontario," report prepared for Occupational Health and Safety Division (Toronto: Ontario Ministry of Labour, 1983).

(c) Concord Scientific Corp., "Occupational Exposure to Certain Chlorinated Hydrocarbons (Trichloroethylene, Tetrachloroethylene, Methyl Chloroform)," report prepared for Occupational Health and Safety Division (Toronto: Ontario Ministry of Labour, 1982).

(d) Michael Holliday & Associates, "Occupational Health Implications of the Use of Formaldehyde in Ontario," report prepared for Occupational Health and Safety Division (Toronto: Ontario Ministry of Labour, 1980).

(e) Acres Consulting Services Ltd., "Worker Exposure to Nickel and Its Compounds," report prepared for Occupational Health and Safety Division (Toronto: Ontario Ministry of Labour, 1982).

(f) Acres Consulting Services Ltd., "Worker Exposure to Styrene," report prepared for Occupational Health and Safety Division (Toronto: Ontario Ministry of Labour, 1981).

(g) Michael Holliday & Associates, "Occupational Health Aspects of Ethylene Oxide Use in Ontario," report prepared for Occupational Health and Safety Division (Toronto: Ontario Ministry of Labour, 1982).

(h) Michael Holliday & Associates, "Occupational Health Implications of Benzene in Ontario," report prepared for Occupational Health and Safety Division (Toronto: Ontario Ministry of Labour, 1979).