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HAZARDOUS WASTE REDUCTION: AN OVERVIEW AND A CALL FOR ACTION

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EXECUTIVE SUMMARY

The conventional "end-of-pipe" approach to waste management has resulted in the annual production of millions of tons of hazardous waste, most of which has been discharged into the environment through a number of different pathways. This disposal, in turn, has given rise to serious environmental damage and public health concerns, and has underscored the need to implement a preventative approach to hazardous waste management in Canada.

Recently, many commentators have identified hazardous waste reduction as the optimum strategy to avoid or minimize environmental harm and health risks; in addition, source reduction can confer various economic benefits upon industry. However, there are several barriers to hazardous waste reduction that can only be overcome by comprehensive and coordinated initiatives by both the federal and provincial governments. Given the scope and complexity of the hazardous waste problem, it is incumbent upon the governments to immediately implement an effective and well-funded waste reduction program, particularly as industrial compliance with increasingly stringent standards becomes more difficult and costly.

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I INTRODUCTION

In 1987, the World Commission on Environment and Development, chaired by Madam Brundtland of Norway, released its final report entitled Our Common Future (1). Although best known for its cogent plea for sustainable development, the Brundtland Report also examines the significant threats to human health and the environment posed by the generation and disposal of increasing quantities of hazardous waste, particularly within industrialized nations. Accordingly, the Report concludes that "the overriding policy objective must be to reduce the amount of waste generated and to transform an increasing amount into resources for use and reuse".(2)

The Brundtland Report has been strongly endorsed in Canada by the National Task Force on Environment and Economy in a report to the Canadian Council of Resource and Environment Ministers.(3) However, the only Task Force recommendation on waste management fails to expressly recognize the need for waste reduction; in fact, this recommendation simply states that "special emphasis is required on research into and promotion of waste disposal and re-

cycling, as well as environmental clean-up and enhancement technologies."(4)

The failure of the Task Force to adopt or even mention a specific waste reduction goal is particularly unfortunate within the context of hazardous waste, and it symbolizes Canadian legislators' preoccupation with the traditional "end-of-pipe" approach to waste management. For the most part, Canadian environmental legislation and enforcement practices over the past twenty years have focused on pollutants after they have been produced by industry. As a result, government and industry have attempted to "manage" hazardous waste in various ways, such as landfilling, incinerating, or otherwise treating the waste prior to discharge or storage. In reality, however, this traditional form of "management" merely moves pollutants from one environmental medium to another; for example, scrubbers or baghouses may prevent a large portion of air emmissions, but they often produce toxic leftover material that must be disposed if it is not reusable. Similarly, incinerators or evaporation ponds may prevent certain materials or sludges from going to landfills or or sewage treatment plants, but they also release hazardous contaminants into the air.(5)

This ex post facto approach to waste management seems to be based on two questionable assumptions: that sustained hazardous waste production is inevitable, and that contemporary pollution

abatement equipment provides a panacea for hazardous waste problems. The myopic emphasis on the unlimited production of waste also appears to be ecologically unsound, given that our seemingly inexhaustible natural resources are, in fact, clearly finite; therefore, society should not be simply disposing everything that it produces.(6)

Moreover, the cost-effectiveness of the disposal-oriented approach is highly suspect, as governmental enforcement costs and industry compliance expenses continue to escalate under present and proposed regulatory regimes.(7) Finally, and most importantly, the current approach has presented Canadians with a legacy of leaking landfills, illegal dumping, air and odour pollution, contaminated groundwater and drinking water, large stockpiles of substances requiring perpetual care, and numerous other environmental problems and public health concerns.(8) Undoubtedly, these serious problems will be compounded as Canada's rate of hazardous waste generation (at least 3 million tons per year, with 1.5 million tons created in Ontario alone) continues unabated, and as existing landfills reach capacity and new landfills or other disposal facilities become increasingly difficult and expensive to locate and operate.

Not surprisingly, then, a growing number of Canadian (9) and American (10) authors have convincingly argued that the optimal solution to the hazardous waste conundrum is to greatly reduce or eliminate the production of such waste at its source. Similarly,

legislators in several North American (11) and European (12) jurisdictions have now embraced the waste reduction ethos, and have implemented various programs to facilitate source reduction of hazardous waste. Certain pioneering companies, both large and small, have also developed innovative waste reduction practices and technologies that have proven to be practical and profitable. The purpose of this paper is to provide an overview of these developments by examining the benefits of waste reduction, the present barriers to waste reduction, and the legislative and regulatory initiatives that are necessary to make hazardous waste reduction a reality in Canada.

II BENEFITS OF WASTE REDUCTION

Although different definitions are possible, "waste reduction" may be defined as any industrial practice or policy that is intended to reduce or avoid the generation of waste, and includes methods used to recover, recycle or reuse waste material on-site or elsewhere. The initial reaction of most corporate managers to the source reduction concept is that while it may be a laudable ideal, it cannot be implemented at his or her plant for various technological reasons. While it is beyond the scope of this paper to address the technical aspects of hazardous waste reduction, it is instructive to briefly review the different ways in which source reduction has been achieved by some Canadian and American companies.(13)

A) Product Substitution

Secondary manufacturers often utilize hazardous chemicals at various stages of production; however, upon further examination, these companies may find that it is possible to substitute non-toxic or less toxic products for such chemicals. In 1986, for example, Cleo Wrap of Tennessee, a large producer of gift wrapping paper, converted from organic solvent-based printing ink to water-based ink in all its operations. This change has eliminated the generation of hazardous waste from the company, and has saved the firm $35,000 per year in waste disposal costs. In addition, the conversion has obviated the company's need for underground storage tanks (which are federally regulated), and also negated the fire hazard associated with solvents.(14)

B) Product Reformulation

Where it is not practical or possible to convert to a non-toxic substance, hazardous waste generation may still be reduced if the primary product can be reformulated so as to minimize environmental problems. For example, the polyester resins used by plastics processors in producing contact moulded items (such as bathtubs) can release toxic styrene monomer into the air, which may necessitate an expensive ventilation or emission control system. In response, some primary chemical producers have developed a new styrene-suppressed resin that reduces styrene loss into the air by 70%.(15)

C) Equipment Changes

In light of escalating energy costs and increasingly stringent environmental regulations, it may be economically advisable for a company to install updated or high-efficiency processing equipment rather than attempt to retro-fit the plant with "add-on" waste treatment equipment. In some situations, even relatively simple equipment changes or modifications may significantly reduce hazardous waste problems. For example, a 3M plant in Missouri used to clean copper sheets by spraying the metal with various acidic sprays, thereby creating a regulated hazardous waste. In the mid-1970's, the company started cleaning the metal with pumice in a machine containing rotating brushes; as the resultant sludge was not hazardous, the firm reduced its hazardous waste generation by 40,000 pounds per year. More importantly, the cost of the new machine was recovered within three years.(16)

Similarly, an Exxon facility in New Jersey installed "floating roofs" on 16 of 200 storage tanks containing volatile materials. These roofs have produced a 90% reduction in evaporative losses, and have resulted in savings of $200,000 per year.(17)

D) Process Redesign

During the initial design phase of a particular plant, it is often possible for process engineers to identify and incorporate

processing techniques or equipment that reduce the generation of hazardous waste. For example, a Peterborough electroplating firm installed a sophisticated in-line recovery system to reclaim the copper and chromium in its waste stream. Within three years, the company recovered the equivalent of the $400,000 capital cost of the equipment, and slashed its anticipated waste disposal costs from an expected $30,000 to $600 per year.(18)

Even after a company has commenced operations, it may be possible to implement straightforward process changes that reduce waste and result in significant savings for the company. For example, a Borden Chemical Company resin plant in California sent its phenol waste stream to a sewage treatment plant for over twenty years. In 1981, after adopting simple procedural changes with respect to filter rinsing, vat cleaning and chemical handling, the company saved hundreds of thousands of dollars in raw material losses and waste disposal costs; in addition, the company was able to discontinue use of an on-site evaporation pond for its wastewater.(19)

E) Process Control

Significant hazardous waste reduction can also result from conscientious housekeeping activities and low-cost process controls and monitors to ensure that all equipment is operating at peak efficiency.

It is clear from the foregoing discussion that hazardous waste reduction can confer numerous economic benefits upon a company, such as lowering compliance costs, reducing raw material losses, enhancing production efficiency, and improving profitability and cash flow. Within large corporations, the bottom line for waste reduction can be impressive: 3M's comprehensive "Pollution Prevention Pays" program, for example, has reportedly prevented the creation of millions of tons of air and water pollutants over the past decade, and has saved the company over $300 million in manufacturing and waste disposal costs.(20) In smaller companies, the savings attributable to waste reduction may be more modest, but they can nevertheless have an important effect on the balance sheet, and represent dollars that can be put to use against competitors.

Effective hazardous waste reduction programs are also beneficial to governments in that monitoring and enforcement costs can be reduced or rechannelled into financial or technical assistance to encourage further waste reduction. In fact, a recent American study suggests that governments can save approximately three dollars in enforcement costs for every dollar invested in technical assistance programs for waste reduction.(21) Taxpaying members of the public are also beneficiaries of reduced enforcement costs; as well, the public benefits from hazardous waste reduction in that this approach provides a firmer safeguard against future health risks, environmental harm and

resource depletion.

In light of these multiple benefits, and given the present consensus among industry and government that source reduction is generally desirable, why has widespread hazardous waste reduction failed to occur throughout Canada? The answer is readily apparent: despite some progress in this area, there are still several significant barriers to hazardous waste reduction that can only be removed by concerted governmental action.

III BARRIERS TO HAZARDOUS WASTE REDUCTION

Several authors (22) have identified various economic, regulatory, technological and attitudinal obstacles to hazardous waste reduction. These barriers may be briefly described as follows:

A) Economic Barriers

The labour and capital costs associated with waste reduction technology, and the corresponding lack of strong financial support from government for hazardous waste reduction, are well-recognized as a serious problem, particularly for smaller companies that lack the capital or research facilities to develop source reduction. But while some source reduction technology may initially require a high capital outlay, it has been properly pointed out that when the various savings and the payback period

are taken into account, an investment in such equipment is not only sound but financially rewarding.(23)

The financial barrier posed by these start-up costs could be overcome by various governmental incentives (such as tax breaks, grants or low or no-interest loans) and disincentives (such as smaller depreciation rates or surcharges on waste disposal equipment). Government funding programs that are specifically geared to hazardous waste reduction do exist at this time, but they remain chronically underfunded and largely unknown to industry. The federal D-RECT (Development and Demonstration of Resource and Energy Conservation Technology) program and Ontario's CFP (Comprehensive Funding Program) for the Industrial 4R's Program have underwritten many worthy reduction projects, but these funding programs have not received the fiscal support that they warrant, particularly in comparison to the much larger monitoring and enforcement budgets of environmental ministries. For example, while the CFP budget has doubled for 1988-89, only $300,000 has been made available for hazardous waste reduction development/ demonstration projects, and $600,000 for capital projects.(24)

B) Legislative and Regulatory Barriers

It has been argued that the absence of comprehensive federal and provincial legislation promoting source reduction has prevented industry from meeting or even recognizing its potential in this area. In fact, a close examination of the Canadian Environ-

mental Protection Act (CEPA) and Ontario's Environmental Protection Act (EPA) and Regulation 309 reveals that all three lack a specific waste reduction goal, policy or incentive. This silence is to be contrasted with the U.S. Resource Conservation and Recovery Act (RCRA), which expressly provides that "the Congress hereby declares it to be the national policy of the United States that, wherever feasible, the generation of hazardous waste is to be reduced or eliminated as expeditiously as possible."(25) In addition, the State of Washington has declared that "management and regulation of hazardous waste disposal should encourage practices which result in the least amount of waste produced"; therefore, Washington law lists reduction, recycling, treatment, incineration, solidification and landfilling in descending order of priority.(26)

Because of this legislative vacuum in Canada, current regulatory pressures in Canada tend to direct industrial attention on simply meeting compliance deadlines and targets rather than on undertaking meaningful hazardous waste reduction. This is especially true where the regulators largely rely on negotiated compliance agreements, ad hoc remedial orders, and occasional prosecutions, as opposed to a truly preventative approach to environmental protection. Even as some regulatory standards and programs such as MISA become stricter, it has been suggested that companies will simply install additional "end-of-pipe" technology or change disposal methods,

and will likely pass the costs on to consumers; the waste reduction option will generally be ignored despite its compelling economic benefits.(27)

This regulatory misdirection is compounded by the continuing reluctance of governments to force industry to pay the true social, economic and environmental costs of traditional waste disposal methods. Not surprisingly, industry will generally attempt to "manage" waste in the least expensive manner within the confines of the law (28); accordingly, since landfilling or more complex waste disposal facilities are usually subsidized by government and the public, the artificially low and unrealistic costs of waste disposal methods continues to present a major impediment to widespread waste reduction.

C) Technological Barriers

The main technological barrier to hazardous waste reduction appears to be a function of the lack of efficient and widely disseminated research and development in this area.(29) Few companies possess the capital, time or research capability to conduct or commission waste audits or to design and install the necessary reduction or recovery equipment. As well, successful R & D projects in the academic or private spheres have not been broadly advertised or commercially applied. Similarly, refinement of existing technology towards compact, less expensive equipment for smaller or less valuable waste streams has been

slow and sporadic to date. These problems are clearly related to the economic and legislative barriers described above, as there is inadequate financial support or other incentives for extensive R & D, and both levels of government lack a coordinating agency to oversee, integrate and publicize R & D initiatives.

D) Attitudinal Barriers

It has been suggested that within large and small companies, there is frequently greater managerial familiarity with traditional forms of waste management and pollution control, as opposed to newer waste reduction strategies and practices.(30) Undoubtedly, this is largely due to the current regulatory regime's "end-of-pipe" focus, and to the dearth of credible and usable information about waste reduction technology, the necessity and benefits of waste reduction, and the financial and technical assistance that may be available to implement hazardous waste reduction. With a few exceptions (31), governmental information efforts have been infrequent and uncoordinated; moreover, this information has not been industry-specific, and has not contained a sufficient level of detail to be helpful. It should also be noted that while waste management information is often conveyed in trade journals, industry associations and informal communication, much of this information is of limited utility and tends to reinforce prevailing opinions on waste management.(32)

IV RECOMMENDATIONS FOR REFORM

The American and Canadian experience has clearly demonstrated that hazardous waste reduction is practical, economically beneficial, and environmentally sound. But while there are marketplace incentives and certain assistance programs in existence today to promote source reduction, Canadian governments must act quickly and decisively to accelerate hazardous waste reduction.

In fact, the next few years may be crucial if the federal and provincial governments hope to chart a new direction for environmental protection in Canada. Indeed, the timing of a serious waste reduction program is critical from both an industrial and environmental perspective, largely because companies will soon be be investing considerable capital into costly treatment and disposal equipment in order to comply with new regulations under MISA and CAP.(33) Once this equipment has been installed, industry will be extremely reluctant to move away from conventional pollution control, and the generation of hazardous waste will likely continue unabated.

Any comprehensive waste reduction program initiated by the governments must, of necessity, be founded on a number of legislative and regulatory reforms. It has been suggested, however, that additional statutory and regulatory requirements in this area are undesirable and even counter-productive, as companies

presently have sufficient financial incentives to reduce waste, and they are already overwhelmed by regulations and other "red tape". In response, it should be noted that voluntary hazardous waste reduction has not been widely practiced by industry to date; for example, the previously described "floating roofs" installed by Exxon were developed at the insistence of state officials, and the process changes employed by the Borden Chemical Company were implemented only after the sewage treatment plant threatened to stop receiving the phenol waste stream. In addition, it is clear that many of the above-noted barriers to waste reduction can only be overcome through regulations and other forms of governmental intervention. Indeed, most industry representatives appear to agree that regulations are important and necessary tools within the environmental context, provide that these regulations are understandable to industry and consistently applied by government.(34)

Accordingly, a comprehensive governmental program intended to expedite hazardous waste reduction must, at a minimum, include the following elements:

A) Federal Initiatives

First and foremost, the federal government must overcome its long-standing inertia in the waste management field, and must exercise a firm leadership role in the development of a national hazardous waste reduction program. Unconvincing constitutional

arguments from federal legislators that their environmental jurisdiction is limited should not be used to rationalize the clear abdication of federal responsibilities in this area. In fact, given the gravity and national (and international) scope of this matter, a national hazardous waste program can likely be upheld under various heads of federal power, including the "peace, order and good government" residual power.(35)

The federal government must start by substantially overhauling CEPA, or, preferably, by enacting a separate waste reduction statute.(36) As noted earlier, CEPA does not emphasize or even recognize hazardous waste reduction as a desirable goal, nor does it provide any incentives for source reduction activities. Although the Act has been hailed by its drafters as "cradle to grave" legislation, its regulatory powers, if used at all, will likely be limited to the storage or disposal of the most toxic wastes. Admittedly, this approach may be necessary for the millions of tons of hazardous waste already in existence, but it does little to prevent or minimize the future generation of such waste.

A federal hazardous waste reduction statute will necessarily contain a variety of detailed provisions, but there are at least four essential elements that must be included in this legislation. Firstly, there must be an explicit recognition of the waste reduction hierarchy:(37)

i) Non-generation of waste as the highest priority;

ii) Recovery, recycling and reuse wherever possible; and

iii) Treatment, storage and disposal as a last resort.

Secondly, there must be comprehensive national definitions of "hazardous waste" and "hazardous waste reduction".(38) These definitions must clearly mandate a significant and quantifiable reduction in the initial generation of hazardous waste, as opposed to an ex post facto decrease in the mass, volume or toxicity of hazardous waste prior to disposal. Thirdly, the federal government should set industry-specific reduction targets and timetables for action; the State of Minnesota, for example, has adopted a plan that calls for a 31% reduction of hazardous waste generation by the year 2000.(39)

Fourthly, the federal legislation must confer broad regulatory powers upon the government to ensure that regulations are made with respect to the following objectives.(40) It should be noted that some of these initiatives are already underway (41), but are included here as part of an overall package of suggested reforms.

i) Establish a separate Waste Reduction Office (WRO) within Environment Canada. This high-level department must be properly funded and fully staffed with knowledgeable personnel, and must be solely responsible for designing and administering the national hazardous waste reduction program.

ii) Empower the WRO to oversee and greatly expand federal technical and financial assistance programs geared to waste reduction research, development and application.

iii) Create a national clearinghouse for legal, technical and financial information relating to hazardous waste reduction.

iv) Establish a national advisory council consisting of government, industry and public interest groups to discuss, develop and promote waste reduction strategy, technology and regulations.

v) Entrench the Canadian Waste Materials Exchange on a statutory basis, and expand federal funding for this program. Industry membership in this exchange should be mandatory, and registration fees should be required.

vi) Expand the manifest system under the Transportation of Dangerous Goods Act to identify and segregate waste deemed recyclable by the WRO. There must be a general prohibition on the disposal of deemed recyclable wastes, and generators must justify why other types of waste have been disposed rather than sent to the Exchange. Companies that generate hazardous waste that is sent off-site must file annual reports certifying that they have waste reduction programs in place, and describing the particulars and results of such programs.

vii) Promulgate strong national standards for hazardous waste incineration, landfilling and physical/chemical treat-

ment.

viii) Coordinate with Revenue Canada to develop taxation policies that favour waste reduction, such as extending the accelerated capital cost allowance from conventional abatement devices to source reduction/recycling equipment.

ix) Expand funding to regional or provincial technical or financial assistance programs, and to regional or provincial waste exchanges.

x) Integrate the national program with similar programs in other jurisdictions, including the United States.

B) Provincial Initiatives

For the most part, provincial hazardous waste programs have perpetuated the traditional disposal-oriented approach rather than promote significant waste reduction.(42) While the following suggested reforms are made with respect to Ontario's existing hazardous waste program, they nevertheless could be applied with necessary modifications to other jurisdictions.

As previously discussed, there is a pressing need to entrench the above-noted waste management hierarchy in both federal and provincial legislation. Accordingly, Ontario's environmental protection statutes in general, or Regulation 309 in particular, must be amended to make waste reduction the highest priority. Alternatively, the province could enact a separate waste reduc-

tion statute that supplements the above-noted elements of the federal legislation necessary in this area.

While provincial actions must be coordinated with federal initiatives to avoid unnecessary duplication or conflict, it is still open to Ontario to set and pursue its own priorities. There are, for example, a number of important reforms that Ontario may be in a position to implement immediately so as to accelerate hazardous waste reduction. Some of these initiatives are similar to those proposed for the federal government, while others are already underway, but are included here as part of an overall waste reduction strategy for Ontario:

i) Establish a separate WRO within Environment Ontario to develop and administer the hazardous waste reduction program. The WRO should work with its federal counterpart, and should assume the OWMC's role in promoting waste reduction.

ii) Expand the Regulation 309 manifest system to identify and segregate recyclable hazardous waste; the annual federal reporting requirements described above should also be implemented.

iii) Require the periodic preparation of waste audits to identify opportunities for waste reduction. Such audits should be a necessary precondition to the issuance of a Certificate of Approval under the EPA, and should be carried out at low or no cost by government personnel.

If private consultants are to be used, the cost to smaller firms should be subsidized by governmental grants or loans.

iv) Greatly expand and advertise the CFP within industry, and coordinate funding with federal financial programs to minimize unnecessary duplication.

v) Expand the funding for the Ontario Waste Exchange, and make industry membership compulsory.

vi) Prohibit the landfilling of particularly hazardous wastes at all sites, and ban the disposal of any waste deemed recyclable by the WRO.

vi) Greatly increase landfill tipping fees and impose additional fees or surcharges per ton of hazardous waste that is disposed of by any means.

viii) Conduct industry-specific studies to assess the technical and financial feasibility of waste reduction, and to identify each industry's potential for waste reduction. This information should be widely circulated among industry and the national clearinghouse described above.

V CONCLUSIONS

Within the past few years, there has been a growing recognition that hazardous waste reduction is a laudable objective, and that it should be implemented as soon as possible. But while there have been several industrial success stories and

worthy assistance programs in this area, governmental and industrial attention remains largely focused on waste "management" rather than waste prevention. Accordingly, hazardous waste reduction programs remain underdeveloped and underfunded, despite the ever-increasing generation of such waste and the resultant risks to the environment and public health.

The Brundtland Report recognized this situation as a serious threat to the global environment, and recommended that governments exercise leadership in promoting the reduction or elimination of hazardous waste at the source. Given the gravity of the hazardous waste threat, Canadian governments can no longer afford to merely pay lip service to the Brundtland Report. Instead, the governments must jointly develop a comprehensive waste reduction program, and must commit the necessary resources to ensure that such program is quickly and effectively implemented.

END NOTES

1. World Commission on Environment and Development, Our Common Future (1987, Oxford University Press).

2. Ibid., p.227.

3. National Task Force on Environment and Economy, Report to the Canadian Council of Resource and Environment Ministers (1987, CCREM).

4. Ibid., Recommendation 1.6, p.5.

5. J.D. Underwood, "Managing Waste is Not Enough", (1988) 11 Industry and Environment 29.

6. R.G. Gordon, "Legal Incentives for Reduction, Reuse and Recycling: A New Approach to Hazardous Waste Management" (1986), 95 Yale L.R. 810, pp. 810 and 817.

7. Enforcement and compliance costs will undoubtedly increase under "zero discharge" programs such as Ontario's MISA and CAP initiatives. However, a 1987 Environment Ontario report suggests that industry is experiencing considerable difficulty in meeting the less onerous requirements of the current regulatory regime; see, for example, Report on the 1986 Industrial Direct Discharges in Ontario (October, 1987), where it is reported that 101 of 154 surveyed companies did not meet governmental requirements during one or more months in 1986.

8. J.F. Castrilli, "Hazardous Wastes Laws in Canada and Ontario: At the Skull and Crossroads" (1980), 9 C.E.L.R. 152.

9. See, for example, F. Giorno, "Response of the Canadian Environmental Law Association to the Ministry of the Environment's Blueprint for Waste Management" (1983, CELA); M.E. Campbell and W.M. Glenn, Profit from Pollution Prevention (1982, Pollution Probe Foundation); G. Munroe, "Where is Industrial Waste Reduction Taking Us?" (1986), 9 Probe Post 2:15; J.F. Castrilli, supra, note 8.

10. See, for example, J.D. Underwood, supra, note 5; R.G. Gordon, supra, note 6; J. Biden, "A New Direction for Environmental Policy: Hazardous Waste Prevention, not Disposal" (1987), 17 E.L.R. 10400; K.U. Oldenberg and J.S. Hirschorn, "Waste Reduction: A New Strategy to Avoid Pollution" (1987), 29 Environment 2:16; Environmental Defence Fund, Approaches to Source Reduction (1986, EDF); W. Muir and J. Underwood, Promoting Hazardous Waste Reduction: Six Steps States Can Take (1987, INFORM, Inc.); D.J. Sarokin et al., Cutting

Chemical Waste (1985, INFORM, Inc.); D. Huisingh et al., Proven Profits from Pollution (1985, Institute for Local Self-Reliance). See also R.W. Hahn, "An Evaluation of Options for Reducing Hazardous Waste" (1988), 12 Harv. Env. L.R. 201.

11. See, for example, the Ontario Ministry of the Environment, Blueprint for Waste Management in Ontario (1983, MOE); B. Balfour, "Provincial Initiatives in the Industrial 4R's in Ontario", in Proceedings of the 8th Canadian Waste Management Conference, (1986, Minister of Supply and Services); J.W. Giles, "Canadian Council of Resource and Energy Ministers and Hazardous Waste Action Plan", and N.R. Ahlberg, "Municipal/Industrial Waste Reduction Program", in Proceedings of the 34th Ontario Industrial Waste Conference (1987, MOE). For an American perspective on hazardous waste reduction, see U.S. Office of Technology, Serious Reduction of Hazardous Waste (1986, U.S. Government Printing Office); Environmental Protection Agency, Report to Congress: Minimization of Hazardous Wastes (1986, EPA); U.S. Office of Technology, From Pollution to Prevention: A Progress Report on Waste Reduction (1987, U.S. Government Printing Office).

12. See, for example, A.C. Williams, "A Study of Hazardous Waste Minimization in Europe" (1987), 14 B.C. Env. Affairs 165; G. Hager, "Waste Control under German Law" (1988), 25 Hous. L.R. 963; Munroe, supra, note 9.

13. M. Campbell, supra, note 9, pp. 5 - 6; see also J. Underwood, supra, note 5, p.30.

14. K. Oldenberg, supra, note 10.

15. M. Campbell, supra, note 9, p.5.

16. K. Oldenberg, supra, note 10, p. 16.

17. J. Underwood, supra, note 5, p.30.

18. M. Campbell, in Roundtable Discussion of Hazardous Law and Policy, Appendix D (1983, CELA/CELRF)

19. K. Oldenberg, supra, note 10, p. 16.

20. J. Biden, supra, note 10, p.10401.

21. Ibid., p.10403.

22. V. Adamson, Breaking the Barriers: A Study of the Legislative and Economic Barriers to Industrial Waste Reduction and Recycling (1984, CELRF/Pollution Probe Foundation); Victor &

Burrell et al., Barriers to Reduction, Recycling, Exchange and Recovery of Special Wastes in Ontario (1984, OWMC); J. Biden, supra, note 10; M. Campbell, supra, note 9.

23. V. Adamson, supra, note 22, p.18.

24. Eco-Log Week (September 23, 1988) p.1.

25. RCRA, s.1003(b). It has been noted that RCRA's lofty goal has not been supported by effective implementing legislation and programs: see J. Biden, supra, note 10, p.10402.

26. Wash. Rev. Code Ann., s.70.105.150-160 (Supp. 1986).

27. Victor & Burrell, supra, note 22, pp. 33-34.

28. Ibid., p.30.

29. V. Adamson, supra, note 22, p. 48.

30. J. Biden, supra, note 10, p. 10401.

31. See, for example, Regional Municipality of Peel, Industrial Waste Reduction Manual (1987, Peel Region); OWMC, Industrial Waste Audit and Reduction Manual (1987, OWMC).

32. Victor & Burrell, supra, note 22, pp.27-28.

33. Ibid., pp. 55-56.

34. Ibid., p.50.

35. See C.S. Alexander, "The Need for Federal Environmental Legislation" (1973), 4 C.B.A.J. 4:8; P. Emond, "The Case for a Greater Federal Role in the Environmental Protection Field" (1972), 10 Osg. H.L.J. 646; Dale Gibson, "Constitutional Jurisdiction and Environmental Management in Canada" (1973), 23 U.of T.L.J. 54. See also R. v. Crown Zellerbach Canada Ltd. [1988] S.C.J. No. 23 (SCC).

36. Such a bill was recently proposed in the U.S. Senate; see S.1331 (1987), as described in 17 E.L.R. 10334.

37. V. Adamson, supra, note 22, p.9; J. Underwood, supra, note 5, p.31.

38. J.F. Castrilli, supra, note 8, pp. 154-55.

39. R.G. Gordon, supra, note 6, p.822, f.n. 80.

40. For a detailed review of these and other options, see V. Adamson, supra, note 22.

41. See J. Giles, supra, note 11.

42. Quebec, however, is presently reforming its hazardous waste program in order to foster greater recycling; see Eco-Log Week (April 15, 1988).