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HAZARDOUS WASTE MANAGEMENT: CANADIAN DIRECTIONS

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HAZARDOUS WASTE MANAGEMENT: CANADIAN DIRECTIONS

INTRODUCTION

Nobody seems to know for sure! This response pervades the field of hazardous waste management, not only in Canada but throughout the world. The questions it answers range from how much of any hazardous waste is generated each year and what is its long-term toxicological effect at sub-lethal concentration, to how to define a hazardous waste.

Fortunately, the importance of safe management of hazardous wastes has become widely recognized in the past few years. In Canada, a resurgence of public and government concern - initiated by a dramatic but small-scale spillage of PCBs across northwestern Ontario and spurred on by the 1988 PCB warehouse fire in Saint-Basil-le-Grand - has focused attention on this problem.

The management of hazardous wastes is a relatively recent concern, resulting from the rapid generation of new chemical substances concurrent with industrial expansion since the 1940s. If the welfare of society depends on the constant expansion of production, society will be forced to deal with an increase in waste, particularly hazardous waste. Improper management of the large quantities and varieties of wastes produced has disastrous implications for the environment and human health.

Canadians generate over 30 million tonnes of non-hazardous waste annually, more than a tonne of garbage for every man, woman and child. We recycle on average 10% of our garbage and send most of the remainder to rapidly filling landfill sites. We produce 8 million tonnes a year of hazardous waste, only 40% of which is treated. The rest goes to landfill sites or is discharged into municipal sewers.(1)

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(1) M. Dowling, "Defining and Classifying Hazardous Wastes," *Environment*, Vol. 27, April 1985, p. 19.

Managing wastes inefficiently imposes an economic burden on Canadians; waste collection and disposal costs exceed $1.5 billion every year. A reduction in waste generation, through reduction, re-use and recycling programs, would save taxpayers money. By not recycling, Canadians are wasting valuable resources and missing profitable economic opportunities. For example, if we were to recycle 50% of our waste paper, almost 50 million trees would be saved each year and new investment opportunities and jobs in the paper recycling industry would be created.(2)

HAZARDOUS WASTE

A. Definitions and Classification

Generators and shippers of waste materials and owners of treatment and disposal facilities must increasingly decide whether a waste is considered "hazardous" and, if so, how it should be classified. With the recent emphasis on regulatory control, schemes for defining hazardous wastes and separating them from non-hazardous wastes have been evolving. Further demand for uniformity of classification has also arisen since shipment across provincial and international boundaries has become an important issue.(3)

What might appear to be a simple process at the outset (i.e., a uniform definition and classification scheme for hazardous wastes) has not yet been achieved in Canada, despite an indirect attempt by Canada's *Transportation of Dangerous Goods Act* (1980) (TDGA) and its Regulations (1985). Most provinces are willing to use the TDGA classification system but also cling to their own provincial transport regulations and manifest systems. The lack of a national system is still cited as the reason for delay in the implementing of hazardous waste management regulations.

Although definitions generally accompany specific pieces of legislation, there is not a single comprehensive definition of a hazardous waste that is universally acceptable for all circumstances. In Canada, the Federal Task Force on Hazardous Waste Definition agreed on the following general definitions:

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(2) ECO/LOG, *Hazardous Waste Management Handbook 1985*, Corpus Information Services Ltd., Don Mills, Ontario, 1985, p. 125.

(3) Environment Canada, "New Federal Regulations to Control Movement of Hazardous Waste," News Release, PR-HQ-92-37.

> Waste is any substance for which the owner/generator has no further use and which he discards.
>
> Hazardous wastes are those wastes which, due to their nature and quantity, are potentially hazardous to human health and/or the environment and which require special disposal techniques to eliminate or reduce the hazard.(4)

Of more recent note is the definition of "Dangerous Goods" as defined in the TDGA:

> any product, substance or organism included by its nature or by the regulations in any of the classes listed in the schedule.(5)

The definition of hazardous waste is being expanded under the *Canadian Environmental Protection Act* (CEPA) to reflect:

- the Basel Convention list of hazardous wastes, such as hazardous household garbage, wastes contaminated with CFCs, wastes contaminated with dioxins or furans and hazardous ash from the incineration of household wastes. These wastes are in addition to the lists of hazardous wastes covered by the *Transportation of Dangerous Goods Act*;
- hazardous recyclable wastes in the OECD decision (p. 28).

The *Canadian Environmental Protection Act* of 30 June 1988 (CEPA) includes the Priority Substances List (see p. 27). There are an estimated 30,000-40,000 chemicals manufactured in or imported into Canada, as well as hundreds of effluent streams and emissions, and all are candidates for assessment. As it would be impossible to check all substances simultaneously for their potential impact on human health and the environment, it is the responsibility of the CEPA Priority Substance List to identify those compounds requiring immediate assessment.(6)

B. Sources

Industrial: Industries are by far the largest sources of hazardous wastes; 8 million tonnes were produced from this source in 1986.(7)

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(4) ECO/LOG (1985), p. 127.

(5) *Ibid*.

(6) Environment Canada, *Assessing and Controlling Toxic Substances*, July 1990.

(7) Government of Canada, *The State of Canada's Environment*, Chapter 14:12, 1991.

Petroleum: In 1989 there were 29 refineries producing an average of 248,000 m^3 of crude oil daily.(8) The principal contaminants in refinery discharges are oil, grease, suspended solids, phenols, sulphides and ammonia nitrogen. Currently, 81% of Canadian refineries apply secondary or tertiary treatment to their effluent. Sludge from filtration processes may contain volatile compounds such as benzene, as well as phenols and poly-aromatic-hydrocarbons (PAHs). Trace metals, including iron, chromium, lead, mercury, zinc, copper, and vanadium, may also be present. Approximately 30% of these wastes are recycled, 36% are disposed of in landfill sites, 18% are spread on land, 7% are incinerated, 1% are injected into deep wells, and the remainder are disposed of by a variety of other methods.(9)

Chemical: Canada manufactures or imports 21,400 chemicals, 60% being petrochemicals, of which 50% are produced in Alberta and 35% in Ontario.(10) The compounds found in the wastestreams of this industry are usually complex and of variable composition. Compounds include both conventional and persistent toxic contaminants originating from the raw materials used, reactants, the end products and bi-products and occur in varying concentrations. Conventional pollutants include acids, bases, suspended solids, oil and grease, organic carbon and nitrogen. Toxic pollutants may include metals, phenols, chlorinated hydrocarbons and PAHs. Substantial improvement in these facilities since the 1960s has reduced concentrations entering the environment; however, more improvements are necessary, such as adoption of stricter legislation and standards.(11)

Pulp and Paper: Pulp and paper is one of Canada's largest industries, with mills located in every province but P.E.I. Each tonne of paper requires approximately 100 m^3 of water (this may vary depending on the process). The waste water produced in pulp and paper mills may contain wood fibres, finely divided solids, and a complex mixture of chemicals and compounds derived from wood and the chemicals used in the production process. Chemicals such as dioxins and furans produced from the chlorine used in the bleaching process are quite toxic even in very low concentrations and have therefore been heavily regulated. The environmental standards for the pulp

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(8) L. Losier, *Environmental Status Report for the Canadian Petroleum Refining Industry*, Ottawa, Environment Canada, 1990.

(9) Government of Canada, *The State of Canada's Environment*, Chapter 14:15 and 17, 1991.

(10) *Ibid.*, p. 17.

(11) *Ibid.*

and paper industry, set by the provinces and federally under CEPA, are some of the strictest of all industries.

Consumers: Consumers also generate hazardous wastes whenever they discard paint, solvents, old batteries, pesticides, cleaners and a number of other household products. It has been estimated that the average consumer generates 2.5 kg of hazardous waste a year, amounting to 1% of the national production totalling 60,000 tonnes a year.(12)

Biomedical: Approximately 0.5% of all hazardous wastes produced are of biomedical origin, amounting to 8,300-31,000 tonnes a year.

C. Storage

"Storage" as discussed here refers to temporary containment of a hazardous waste for transport, or while awaiting treatment and/or disposal. Environmental and health hazards can arise during such storage, as has been amply demonstrated by the large number of reported spills and leakages of PCBs in recent years.

Detailed guidelines for the storage of hazardous wastes in Canada have been presented in federal and provincial codes or guidelines.(13)(14) As well, guidelines for storage building designs and container designs for specific substances are outlined and include information on the proper handling of these substances. Recognition of the incompatibility of some wastes is important for proper storage in order to avoid violent, explosive reactions and/or toxic fumes. Various systems to ensure compatible storage have been set up, for example the "Hazardous Waste Compatibility Chart" of the U.S. Environmental Protection Agency or a similar system found in California.(15) These systems also require appropriate recognition and classification.

Monitoring at storage facilities should involve in-plant surveillance and inspection, together with thorough record-keeping that can account for all qualities and quantities of wastes being stored. Leak detectors or systems that can identify corrosion should be installed in

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(12) *Commission d'enquête sur les déchets dangereux. Les déchets dangereux au Québec, Les Publications du Québec*, Quebec City, 1990.

(13) Canada, Environment Canada, EPS, *Code of Good Practice for Management of Hazardous and Toxic Wastes at Federal Establishments*, Ottawa, January 1977.

(14) Ontario, Ministry of the Environment, Waste Management Branch, *Guidelines for Environmental Protection Measures at Chemical Storage Facilities*, Toronto, October 1978.

(15) ECO/LOG (1985), p. 191-194.

underground storage facilities and tanks, such as those frequently used for petroleum products. The installation of leak detectors would have reduced the problem in Prince Edward Island where there is groundwater contamination due to leaking underground petroleum storage tanks. It appears that appropriate legislation is necessary to ensure that adequate storage guidelines are met[16] and in fact regulatory programs are being developed in some jurisdictions.[17][18]

D. Treatment

Current practices are moving toward best use technology, which attempts to reduce the amount of hazardous waste produced in the first place. Any that is produced is most commonly destroyed or detoxified by a number of methods with the resulting residues then disposed of.[19] Hazardous wastes may be treated to minimize their volume and make disposal easier, to render the waste less toxic or hazardous, or to enhance or facilitate the recovery and re-use of the waste components of a solution.

Treatments can be classified as physical, chemical, biological or thermal. Physical treatments are used to separate solids from liquids through the use of physical forces and mechanical devices. Chemical treatments are used to neutralize (e.g., by mixing acids and bases), precipitate, oxidize or reduce chemical components, or to cause a chemical alteration of a liquid phase to produce a solid, vapour or altered liquid phase. Biological treatments are used to biodegrade diluted organic wastes, while thermal treatments are used to cause the vaporization, oxidation or other destruction of liquid or solid phase components.

The following list shows the large number of specific unit treatment operations. A short description of each treatment can be found in:

> ECO/LOG, *Hazardous Waste Management Handbook 1985*, Corpus Information Services Ltd., Don Mills, Ontario, 1984, p. 210-240.

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(16) ECO/LOG (1984), p. 124-135.

(17) ECO/LOG (1985), p. 197-202.

(18) Environment Canada, Press Release, "McMillan Announces Joint PEI/Federal/Industry Project on Underground Storage Tanks," Ottawa, 19 June 1986, 2 p.

(19) *The State of Canada's Environment* (1991).

Environment Canada, "Economic Profile of the Hazardous Waste Management Service Industry Subsector in Canada," Fenco Newfoundland Ltd., July 1988.

Generally, more than one process is used for waste treatment, with some physical/chemical process often applied first to reduce the volume of dilute aqueous solutions. No single process is suitable for all categories of hazardous wastes and frequently several processes are linked in a series or in a parallel configuration to form a waste-specific treatment. At present, many of these treatments are well established in industrial operations, where on-site treatment or partial treatment in order to reduce bulk for transport is often desirable. Many of the methods for waste treatment are listed below.

Physical:
air stripping
carbon adsorption
centrifugation
dialysis
distillation
evaporation
pond filtration
flocculation and precipitation
flotation
freeze crystallization
high gradient magnetic separation
liquid-liquid extraction
resin adsorption
reverse osmosis
sedimentation
steam distillation
steam stripping
ultrafiltration

Thermal:
calcination
incineration
molten salt
plasma destruction
pyrolysis
supercritical fluid oxidation

Chemical:
catalysis
chemical dechlorination
chlorinolysis
dissolution
electrolysis
electrodialysis
hydrolysis
ion exchange
microwave discharge
neutralization
oxidation
ozonation
photolysis
reduction

Biological:
activated sludge
aerated lagoon
anaerobic digestion
enzyme treatment
trickling filter
waste stabilization

Implementation of these treatments appears to be increasing, together with an increase in the application of the "four-Rs" (reducing, recovering, reusing and recycling). There is a decrease in the quantities of high Btu wastes, oily wastes, solvents and dilute watery wastes being received by waste disposal facilities and an increase in more concentrated sludges and solids.

Considerable research is underway to develop new processes for the treatment of hazardous wastes and to refine existing treatments. Included are: waste solidification studies in Alberta; ultraviolet treatment, reverse osmosis, ultrafiltration and plasma pyrolysis research in Ontario; and reverse osmosis, fluidized bed combustion, chemical oxidation and high-rate filtration and land farming in other parts of the country. A great deal of this research is being conducted by the private sector through federal contracts.

E. Alternative Hazardous Waste Treatment and Management Methods

Currently, a number of technologies are available for managing, treating and destroying a wide range of hazardous wastes; they continue to be tested and evaluated. These technologies include low temperature oxidation (supercritical water), chlorine removal, pyrolysis, extraction and concentration, vitrification, and biodegradation.

1. Hazardous Waste Exchange, Recycling and Reduction

Hazardous wastes make up to 20% of Canada's waste management problem. Complementary federal and provincial regulations and cooperative agreements are in place to control the handling, storage, disposal and destruction of these wastes in Canada. Full implementation of these control measures, however, is awaiting decisions by the provinces on the location of new hazardous waste destruction facilities. In the meantime, existing treatment and destruction facilities are handling larger amounts of wastes, and new facilities have been brought on line for the safe elimination of such compounds as PCBs.

The federal government will take further action to reduce the generation of hazardous wastes and ensure their safe transportation and disposal in Canada. These measures will include:

- the development of a computerized tracking system to monitor the movement of hazardous wastes in and out of Canada; this will allow Canadian industry to participate more easily in international market opportunities to recycle these products;

- by 1996, destroying all PCBs under federal jurisdiction and establishing mobile incinerators in Atlantic Canada, Quebec and Ontario;

- by 1996, in co-operation with the provinces, completing regulations and guidelines for the safe management of hazardous waste streams, including reduction, re-use, recovery, recycling, transportation, storage and disposal; and

- supporting technology aimed at reducing, recycling and re-using hazardous wastes, or at their safe destruction.

We could avoid many problems by reducing our output of hazardous waste in the first place. Reduction of all hazardous wastes could be achieved by: use of more efficient manufacturing processes, use of alternative compounds, and the re-use as is, or the reprocessing, of waste streams. Environment Canada estimates that up to one-half of all hazardous wastes are recyclable. It is the Canadian government's goal, outlined in the Green Plan, to reduce the volume of hazardous wastes by 50% of the 1988 amounts by the end of the century.

Environment Canada policy has been that re-use and recycling should be encouraged as part of a comprehensive approach to managing hazardous waste. This general view is supported by international organizations, including the International Joint Commission (IJC), the European Community, WHO, UNEP and NATO.(20) The concept and practice of the "four-R's" are slowly being incorporated into hazardous waste management schemes by Canadian, British and European chemical industries.(21) In Ontario, less than 15% of the wastes managed off-site are being reclaimed or recycled. In Alberta, the volume of hazardous waste reclaimed or recycled increased by 350% from 1989-1991. One practice that holds promise for improving the recycling of hazardous wastes is the transfer of wastes from companies generating them to companies that can use them in their operations. The federal and provincial governments assist in matching the needs of potential users with supplies available from the producers.

In Canada, the largest active hazardous waste exchange program has been the Canadian Waste Materials Exchange (CWME) operating out of the Ontario Research Foundation. In 1984, the Ontario Waste Exchange (OWE) was instituted as a joint project with the Ontario

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(20) J.F. Castrilli, *Hazardous Waste Management in Canada: The Legal and Regulatory Response*, Canadian Environmental Law Association, Toronto, Ontario, September 1982, p. 26.

(21) "The Four-R's, Communications are Key Elements of Waste Checklist," *ECO/LOG WEEK*, Vol. 13, No. 49, 13 December 1985.

Waste Management Corporation and the Ontario Research Foundation to increase the effectiveness of the CWME program. It appears that once the process of exchange has been initiated most waste is exchanged continuously, at a rate of approximately 200,000 tonnes per year and an estimated value of $6 million per year.

In 1981, Alberta also launched an active exchange program called the Alberta Waste Materials Exchange, modelled after the one in Ontario. Manitoba has a passive waste exchange program in which the province acts as a coordinator but does not handle wastes directly.

Many hazardous wastes can be captured and detoxified at the source through simple procedures such as filtration and the addition of neutralizing with acids to produce a salt and water. Recycling of materials within an industry (e.g., using closed-loop systems for cyanide recovery in the electroplating industry and re-purifying solvents) can significantly reduce the quantities of hazardous waste generated. Additionally, process changes in industry can significantly reduce the amount of pollutants generated(22) and at the same time make considerable net savings. An example can be found at Bud Automotive, Kitchener, where installing a reverse osmosis system has allowed the reclaiming of industrial oil. Savings were also made through the reduction in sewage charges, normally proportional to the company's waste loading. This company reclaimed its $100,000 expenditure on the reverse osmosis system in six months.(23)

A 1986 "Report to Congress on Minimization of Hazardous Waste" said:

> A survey of 22 industrial processes concluded that if existing techniques and new waste reduction technologies are fully used, hazardous wastes could be reduced by one-third or more.(24)

The report cited as examples a paper products plant that saved U.S. $1.8 million a year by recovering vaporized solvent, and a chemical facility that saved U.S. $72,000 by reprocessing its spent solvent.

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(22) J. Jackson *et al*., *Chemical Nightmare*, Waterloo Public Interest Research Group, Between the Lines, 1982, p. 18.

(23) Robert Milko, *Reverse Osmosis and Its Application to Water Purification*, Background Paper 146E, Research Branch, Library of Parliament, 9 April 1986, p. 12.

(24) "Report Urges Processing to Cut Toxic Wastes," *The Citizen* (Ottawa), 31 October 1986.

In general, it appears that the greatest deterrents to such innovations have been the cheaper costs of landfills and the improper disposal methods sanctioned until lately. These made the prospect of recycling seem too expensive and troublesome.

2. Off-Site Management: "The Not in My Backyard Syndrome" (NIMBY)

In 1986, approximately 65% of hazardous wastes in Canada were managed on site (where generated). Increasingly, companies are now going off site for their waste reduction or disposal, especially smaller companies and companies with wastes requiring very expensive disposal methods. Such management is a practical method of treatment since there is one efficient state of the art facility, rather than a number of small facilities. It, however, also raises concerns: the danger of accident or leakage during transportation; storage of large quantities awaiting disposal; and where to locate the hazardous waste treatment facility, a facility that no municipality wants.

At present, we are generating hazardous wastes faster than we can dispose of them, with the result that untreated wastes are accumulating in storage locations in increasing quantities. The main problem is the lack of permanent off-site treatment facilities capable of handling the most difficult to manage wastes. Both industries and society in general have been slow to recognize and respond to this need. Indeed, Canada's first comprehensive, integrated hazardous waste treatment facility, at Swan Hills, Alberta, was not opened until September 1987.

Similar facilities are planned for other areas in Canada, but the choice of sites has frequently been complicated and delayed by local opposition. Although the actual hazards posed by these facilities may be small, citizens fear the occurrence of toxic disasters in their neighbourhoods and are reluctant to live with the perceived risks, even though they acknowledge that the facility itself may be of benefit to society.(25)

Typically, disposal sites have been chosen primarily on the basis of technical considerations, such as proximity to industrial centres and environmental soundness. Although citizens are invited to express their concerns once a suitable site has been identified, the decision to build the facility on the chosen site is usually seen as a *fait accompli*. In these circumstances,

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(25) D.M. Connor, *Managing NIMBY in the 1990's: Principles and Cases for Waste Managers*, Proceedings: 12th Canadian Waste Management Conference, 1990, p. 1-8.

citizens often become distrustful of public officials and see a vigorous campaign of opposition as their only hope of affecting the outcome.(26)

A more successful approach to site selection has been developed in Alberta and was used by the Alberta Waste Management Corporation in choosing the Swan Hills site. With this approach, unsuitable areas are first eliminated on the basis of technical and environmental standards. Town councils in the remaining areas are then asked if they would like further assessments to take place within their jurisdictions. After these assessments are completed, councils are invited to make proposals for the siting of the facility in their area. In the case of the Swan Hills facility, five communities expressed an interest, and all sought public reaction to the proposal. The advantage of this approach is that it leaves the communities free to decide if they want the facility and results in a faster and less combative selection process.(27)

The expansion of existing private facilities provides another means of increasing our capacity for treating hazardous wastes. Because these facilities are already in existence, their expansion creates less opposition than the construction of new facilities in communities without previous experience of hazardous waste operations.

While debates over the siting of permanent facilities go on, the federal government has turned to mobile incinerators as a way of dealing with the problem of the PCB wastes that are now in storage in some 3,000 sites across the country. These incinerators will be moved to various locations in the country where the volume of PCB wastes warrants their operation. Taking the incinerator to the wastes minimizes the risk of transportation mishaps. Moreover, because the incinerator remains in one locality for only a matter of months, public reaction to its presence is more favourable.(28)

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(26) A. Armour, *Facility Siting: A No-Win Situation?*, Part III, Canadian Environmental Mediation Newsletter 3(2): 1-6, 1988.

(27) J.P. Champion, *Yes, In My Backyard*, Constructive Citizen Participation 18(2): 3-6, 1990.

(28) *The State of Canada's Environment* (1991).

3. Problem Sites and Remedial Action

In October 1989, the five-year, $250-million National Contaminated Sites Remediation Program (NCSRP) was initiated by the Canadian Council of Ministers of the Environment (CCME) to deal with properties across the country that have been polluted with hazardous materials. Such contamination may originate from abandoned landfills, byproducts of industrial activity, leaks from underground storage tanks, transportation spills and remnants of industrial plants improperly shut down. Whatever the pollution source, the NCSRP's focus is to ensure the appropriate cleanup of sites where contamination is a serious threat to human health or environmental quality.(29)

The government will work with the provinces to:

- have agreements with participating provinces for the implementation of the program;
- clean up 30 high-risk contaminated hazardous waste sites by 1995; and
- support new technologies for site cleanup.

Across Canada, an estimated 1,000 sites are contaminated with hazardous waste materials. These include coal tar pits, leaky landfills, old plant sites and storage facilities. When a polluter cannot be charged with the task of remediation, the program's "orphan" sites component comes into play. The federal government has entered into agreements with individual provincial and territorial governments to clean up high-risk properties for which a responsible party cannot be found, or where the owner is unable or unwilling to finance a remediation project. The costs are divided equally between Environment Canada and the respective provincial and territorial environment departments. Collectively, the governments have agreed to commit a total of $200 million to orphan sites over the program's five-year life.(30) Depending on the nature of the contamination and the cleanup method used (along with several other factors) costs can vary from several hundred thousand dollars to tens of millions. At present some of the more visible sites are being cleaned up. The Canadian Council of Ministers of the Environment has initiated a program to

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(29) Canadian Council of Ministers of the Environment, *Annual Report 1991-1992, The National Contaminated Sites Remediation Program*, Winnipeg, 1992, p. 1.

(30) *Ibid*.

set guidelines for these activities and to fund the cleanup of sites where the parties legally responsible for the problem cannot be identified (see Appendix 1).(31)

One of today's largest concerns in hazardous waste management in Canada and globally is how to deal with "problem" sites (inactive dumpsites containing hazardous wastes). The OECD addressed the problem under three main headings:(32)

- site identification and preliminary risk assessment;
- in-depth environmental and health impact assessment; and
- remedial measures.

Many difficulties are found in these three areas; some of them are outlined below, with Organization for Economic Co-operation and Development (OECD) recommendations for overcoming them.

Identifying all problem sites has been difficult. Some former waste-generating industries are now closed, there are few records, and some generators of waste are reluctant to cooperate because of fear of liability. Good industry-authority relations can help to reduce this last problem. In Canada, cooperation between industries and authorities has been improving to some degree.

Consistent site assessment on a national level, as attempted by the Environmental Protection Service (EPS) of Environment Canada appears necessary to expedite remedial action at the more dangerous problem sites. Following identification of these sites, their potential health effects should be scientifically evaluated. Such comprehensive evaluation is, however, difficult and time-consuming, and should not delay remedial action.

In order to improve assessment of environmental and health impacts, more on-site analyses of leachates and further development of equipment appropriate to such analyses are needed. To assist in more exact analyses of leachate composition, the OECD has recommended maintaining the anoxic condition of the collected leachate for the analyses, avoiding cross-contamination of layers from sampling bore holes, and the use of inert sampling equipment to

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(31) Energy Pathways Inc., *Contaminated Sites Issue Briefing Paper. Final Report on the Contaminated Sites Consultation*, Canadian Council of Ministers of the Environment, 1990.

(32) Organization for Economic Co-operation and Development (OECD), *Hazardous Waste "Problem" Sites*, Report of an Expert Seminar, Paris, 1983.

reduce adsorption/desorption effects.[33] These precautions would help in dealing with some of the problems in carrying out impact assessments of leachates. Good techniques exist for the control of many surface water contaminants, but subsurface or groundwater remedial measures need a great deal of research.

Proper preventive management costs only a fraction of remedial actions. For example, in the United States between 1981 and 1985, two-thirds of the U.S. $1.35 billion Superfund was used on only 30% of the 538 sites of the National Priorities List. While the U.S. EPA estimated 2,000 more sites would reach the list, the U.S. Office of Technology Assessment estimated that 10,000 sites (or more) would require cleanup by Superfund. The number of problem sites discovered in the U.S. and Canada continues to grow.

QUANTITIES OF HAZARDOUS WASTES IN CANADA

A. Hazardous Waste Inventories

A national inventory of hazardous and toxic wastes estimated that some 3,280,863 wet tonnes a year[34] were produced across Canada in 1982;[35] by 1992, the estimate is 6.5 million tonnes. These estimates were generated by computing production factors for each of the manufacturing industry types of Canada (based on Standard Industrial Code identification numbers). Nearly half of the total quantity generated in Canada is from Ontario and approximately 29% is from Quebec. Of the remaining 22%, 17% is from Western Canada, with British Columbia and Alberta as the main contributors, and 5% comes from the Maritimes (see Appendix 2).

In Canada, the chemical industry generates 47% of the total of hazardous wastes, while the metal industries contribute approximately 38%. The remaining industries together contribute only 15% (see Appendix 2).

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(33) Leachate: Solution containing dissolved or suspended materials in water that has percolated through solids such as soils, solid wastes, and rock layers.

(34) Note: Estimate of total U.S. wet and dry weights of hazardous wastes give a 2.5:1 wet to dry ratio, a ratio also used in Canada.

(35) Gorre and Storrie Ltd., *Canadian National Inventory of Hazardous and Toxic Wastes*, Vol. 3, prepared for the Environmental Protection Service (EPS), Environment Canada, Ottawa, January 1982, p. 8.

B. Hazardous Waste Disposal Sites

Given the large quantities of hazardous wastes generated, one must wonder where they have been disposed of. According to the former Economic Council of Canada, the lack of adequate treatment and disposal facilities in Canada has led to dubious and illegal dumping practices.(36) It is estimated that approximately 85% of the national total production of hazardous wastes is dealt with improperly,(37) and, more often than not, with costly and destructive repercussions. Lack of regulations or lack of their enforcement, rather than cost, has been the major reason for improper disposal. Proper disposal would have incurred only a fraction of the costs of remedial actions required subsequent to improper disposal.

THE MANAGEMENT PROCESS IN CANADA: EXISTING AND POTENTIAL PROGRAMS AND LEGISLATION

The regulation of appropriate hazardous waste management is the responsibility of the provincial and territorial governments. In instances where provincial regulations do not exist for adequate management of hazardous wastes (i.e., storage, disposal, treatment or transportation), federal regulations are used. Provincially, however, the definition of a hazardous (or special) waste, the extent of the regulations, and the degree to which these regulations are enforced, vary. Although the role of the federal government has been principally advisory, recent developments, such as adoption of the TDG Regulations, and CEPA, have encouraged a more active role.

The requirements for good management of hazardous wastes, some of which were outlined above, need some incentive for their development and application. Existing laws, policies and programs at all levels of government offer only a patchwork of approaches to the difficult issues presented.(38) The overall picture is of a major national problem to which the regulatory and legal system is still evolving its response.(39)(40)

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(36) Castrilli (1982), p. 3.

(37) *Ibid*.

(38) Tom McMillan, Minister of Environment, Notes for an Address to the Fourth Environmental Government Affairs Seminar, Ottawa, 20 October 1986, p. 6.

(39) *Ibid*.

(40) Castrilli (1982), p. 13.

The possibility of "hazardous waste havens" in a province with less stringent standards, regulations or enforcement could best be avoided through national legislation for disposal standards. Such standards have previously been regarded as a provincial or local concern, and any legislative intervention should not intrude upon provincial powers. One possibility is that the administration and implementation of national regulations could be delegated to the provinces.(41) This might reassure the public and increase its willingness to accept disposal facilities. As well, recycling, reduction and exchange of wastes might become more attractive to industries, in view of increasing costs for proper dumping and penalties for improper dumping.

The establishment of a trust fund for cleanup and victim compensation is most feasible under provincial authority for "property and civil rights within a province."(42) In Ontario, for example, a $10-million Environmental Security Fund has been set up to compensate victims and to deal quickly with spill cleanup costs. This system was implemented so that cleanups would not be delayed by the need to negotiate responsibility and funding. It has been suggested that such funds could be supported, like workmen's compensation, by special contributions from industries, or, like the U.S. Superfund, by a direct tax on industries.

The same legal analysis that supports the feasibility of a trust fund suggests it might be possible to impose a mandatory recycling scheme at the provincial level. It appears that such a system would be less likely to be upheld if based on the federal criminal law power. A system of mandatory recycling is now in effect in California,(43) and there is mandatory membership by industries in a waste exchange program in Germany.(44)

Provincial governments have the strongest constitutional authority to deal with hazardous waste disposal and related matters, whereas the municipal authorities can address the problems from three traditional types of provincial enabling legislation: enacting by-laws, protecting health under local boards of health, and developing zoning by-laws (Appendix 3). It appears that the evolution of local powers has not always resulted in actions compatible with provincial government initiatives and municipal attempts to restrict industrial burning could

(41) *Ibid*., p. 81-91.

(42) *Ibid*., p. 91-92.

(43) ECO/LOG (1984).

(44) Castrilli (1982), p. 28.

frustrate a national policy on the elimination of selected chemicals.(45) Recent studies indicating that incinerators emit toxic compounds such as dioxins and furans have lent credence to such concerns. In Canada, this has led to the development of a National Incinerator Testing and Evaluation Program (NITEP).

These questions of jurisdiction and the need for national standards are coming to the fore with respect to most of the previously mentioned issues. In the 1986 CCREM meetings, agreement was reached on an action plan aimed at fostering uniform legislation, policies and programs for hazardous wastes. Studied were the feasibility of a national contingency fund for cleanups of hazardous waste sites posing imminent danger to the environment or human health, and an action plan to implement life-cycle management of chemical products, including problems of incineration, landfilling and physio-chemical treatment. The respective roles and responsibilities of the various levels of government in these areas will continue to be addressed in future discussions.

Public involvement in the decision-making process has rapidly evolved and in most provinces there is now provision for such involvement in both the drafting of policy and legislation.(46) In general, it appears that, at a provincial level, the more recently a province has ventured into the creation of a management plan, the stronger the public involvement. An increase in public involvement is also found at the federal level, where two related consultative programs have been quite successful. In all public consultation, care must be taken to ensure the public is well informed, so as to avoid delays in the process and to ensure rational decisions.

A. Federal Legislation and Programs

At the federal level, 24 Departments have responsibility under some 30 statutes over different aspects of controlling toxic substances; added to these are provincial and municipal regulations. The federal government's approach to waste management is an integrated one based on the 4Rs: reduce, reuse, recycle and recovery.

In December 1989, a Waste Management Branch was created within Environment Canada to coordinate the growing involvement of the federal government in waste management activities. This was in direct response to rising public concerns and awareness about the state of our

(45) *Ibid*., p. 68-69.

(46) ECO/LOG (1985), p. 1-123.

environment, especially waste generation. The Branch's activities are focused around four main areas of responsibility:

- the Hazardous Waste Management Division;
- the Office of Waste Management;
- the Contaminated Sites Program; and
- the Federal PCB Destruction Program.(47)

In the past, due to perceived or actual constitutional constraints of the *Constitution Act (1867)*, the role of the Department of Environment in hazardous waste management was principally advisory rather than regulatory.(48) Its mandate with respect to this subject has three major components:(49)

- the control of the international and interprovincial movement of hazardous wastes (under the legislative authority of the *Transportation of Dangerous Goods Act*);
- the management of hazardous wastes generated by federal facilities and the disposal of wastes on federal lands; and
- the control of dumping of materials into the ocean (under the legislative authority of the *Ocean Dumping Control Act*).

1. Green Plan (11 December 1990)

Throughout the Green Plan consultations, Canadians strongly supported the need to increase controls over toxic chemicals. In addition, they want those toxic chemicals already present in the environment removed and toxic dump sites cleaned up and restored. Governments, industry, labour and the public have been taking direct action to reduce and control toxic chemicals. For example, the Workplace Hazardous Materials Information System (WHMIS) was a cooperative effort to protect workers from toxic substances.

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(47) Environment Canada, *Proceedings*, Twelfth Canadian Waste Management Conference, St. John's, October 1990.

(48) Castrilli (1982), p. 14.

(49) ECO/LOG (1985), p. 2.

2. National Cleanup Programs Under the Green Plan

A national plan to destroy stocks of PCBs held by the federal government is well underway, with regulations enacted in 1989 governing the operation of PCB treatment centres within federal jurisdiction. Since 1989, 40% of the federal government's stock of PCBs has been safely destroyed.

The cleanup of the Sydney Tar Ponds chemical dump site, one of the largest cleanups of its kind in North America, is proceeding. The Canadian Council of Ministers of the Environment has undertaken a $250-million cost-shared program to clean up other contaminated sites. This program will enable immediate action to be taken where the responsible party cannot be found or is unwilling to carry out a cleanup program. Cost recovery will be pursued through court action (see Appendix 2, p. iii).

Co-operative cleanup of the Great Lakes and St. Lawrence River has begun. Action under the St. Lawrence Action Plan has already resulted in a significant reduction in liquid toxic waste discharged by the 50 chief polluters along the St. Lawrence River. The target is 90% reduction by 1993.

Over the past 20 years, scientists have learned much about the detrimental effects of toxic chemicals. We know that barely detectable amounts of some chemicals have the ability to remain and build up in the tissue of the animals we rely on for food. These "persistent" toxic substances accumulate to a point where they represent a danger to our health.

The Great Lakes and St. Lawrence River basin is one of the most intensively studied areas in the world with respect to toxic chemicals. Over 350 persistent toxic chemical compounds have been found in the Great Lakes alone. The process of regulating these substances has begun on such chemicals as mercury, mirex and polychlorinated biphenyls (PCBs). But our scientific understanding of the environment and health effects of many of these substances is not sufficient to establish appropriate discharge and ambient concentration levels for each substance, let alone for the complex mixtures that are now found in the environment. Faced with this situation in the Great Lakes, the governments of Canada and the United States concluded that the only prudent course was to set a long-term goal of virtual elimination of discharges of persistent toxic chemicals. This objective was established in the Great Lakes Water Quality Agreement signed by the two governments in 1978 and amended in 1987.

The virtual elimination of persistent toxic substances, however, is a long-term goal that will require ongoing co-operative efforts at all levels of government and by industry. The Green Plan will further these efforts by:

- regulating the discharge of individual chemicals where the toxicological evidence already exists;
- accelerating toxicology research; and
- promoting full life-cycle management of chemicals to reduce discharges beyond regulated amounts.

Industry has taken an important initiative. The Responsible Care Program of the Canadian Chemical Producers Association is a good example. It establishes codes of conduct that commit chemical companies to managing toxic chemicals and preventing their release into the environment. Some Canadian companies have demonstrated international leadership by committing themselves to the goal of virtual elimination of toxic discharges from their manufacturing operations. The *Canadian Environmental Protection Act* encourages non-regulatory measures, including environmental codes of practice and guidelines, as means of managing toxic chemicals.

Perhaps the major environmental initiative of the past few years has been the creation of a unifying piece of legislation to assist in safeguarding the environment and human health from polluting substances, particularly those recognized as toxic. To this effect, the *Canadian Environmental Protection Act* (CEPA) was proclaimed on 30 June 1988.

In essence, CEPA was a major revision of the old *Environmental Contaminants Act* (ECA), which had failed to be effective in providing the legislative authority to regulate toxic substances. Additionally, CEPA incorporates the *Clean Air Act* (CAA), the *Canada Water Act* (Part III), the *Ocean Dumping Control Act*, and the *Department of the Environment Act*, subsection 6(2). As in ECA, both the Minister of the Environment and the Minister of National Health and Welfare are responsible for administering this new legislation.

There are provisions in CEPA whereby the federal government and the provincial governments may enter into agreements that would allow the provinces to regulate specific toxic substances. This is only possible, however, where the Minister and the government of a province agree that the province has in force provisions equivalent to the federal regulations applying to the toxic substance. To date, no such so-called “equivalency agreements” have been signed regarding

any regulation, but it is expected that some will be signed within the next year. These would most likely be regulations relating to industrial emissions, specifically those that had been regulated under CAA, rather than those relating to product control.

The first action taken under CEPA was the 19 September 1988 establishment of an Interim Order Respecting the Storage of Wastes Containing Chlorobiphenyls (PCBs) following the fire at Saint-Basil-le-Grand in the summer of 1988. Consequently, all provinces, except Prince Edward Island and the Territories, have either created or changed their storage regulations to conform to the Order and have assumed provincial responsibility for the regulation of storage for PCB wastes. The second initiative under CEPA is the Contaminated Fuel Interim Order established 12 May 1989. This prohibits the import or export of contaminated fuel unless specific conditions are met.

Since the conception of CEPA, a panel of experts involving stakeholders from various sectors had been drawing up a Priority Substances List of chemicals that could be toxic and might therefore need regulating. This list was published in the *Canada Gazette* in February 1989. A period of five years (1994 completion date) is allowed for the evaluation of the toxicity of the 44 Priority Substances. A substance assessed as toxic would be expected (but not required by the Act) to be regulated in some way (see p. 27).

Several other legislative mechanisms are employed to limit and control the release of hazardous substances into the environment:

Arctic Waters Pollution Prevention Act (1970)
Fisheries Act (1970)
Atomic Energy Control Act and Regulations (1978)
Canada Shipping Act, Oil Pollution Prevention Regulations (1978)
Ocean Dumping Control Act (1974)

3. Hazardous Waste Export/Import Regulations

The *Transportation of Dangerous Goods Act*, developed and implemented cooperatively by the federal and provincial governments, is designed to protect the environment and Canadians from the dangers posed by spills of toxic and hazardous substances while in transit. An integral component of a hazardous waste management program is controlling the transport of dangerous goods such as wastes.

The federal government made a commitment under the Green Plan to regulate and control the export and import of hazardous wastes at border points. A number of incidents in Canada, such as the shipment of Canadian PCB waste to the U.K., allegations of contaminated fuel exports and imports, and exports of lead-contaminated wastes to Brazil, required government action. In response to these events, Environment Canada began to draft the Hazardous Waste Export/Import Regulations in 1989. Environment Minister Jean Charest on 16 November 1992 announced that the hazardous waste export and import regulatory package had received final approval and was now in force. It was published in *Canada Gazette* Part II on 2 December 1992.(50) The regulations also provide the measures necessary to implement the provisions of the United Nations' *Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal*, which Canada signed on 22 March 1989 and ratified August 1992. That Convention states that countries should take necessary measures to ensure that the management of hazardous wastes destined for disposal or recycling, including any Transboundary movement, is consistent with the protection of human health and the environment. Canada has had some of these requirements in place since 1985, under the Transportation of Dangerous Goods Regulations. Development of the proposed Export/Import Regulations began in 1989, shortly after the signing of the Convention, to enhance the existing controls. Extensive consultations have been ongoing with industry, environmental groups, the provinces and other federal government departments, and workshops were held in 1990 and 1991, where all interested parties were able to contribute their views.

On 30 March 1992, the Council of the Organisation for Economic Co-operation and Development (OECD) adopted a Decision on the Transboundary movement of hazardous wastes destined for recycling operations within the OECD area, based on a three-tier system. This decision, which is consistent with the Basel convention, ensures that shipments of hazardous wastes destined for recycling receive the proper degree of control required by the overall risk, to protect the environment and human health without unnecessarily disrupting recycling. The proposed regulations incorporate the provisions of the OECD decision (see p. 28).

(50) Environment Canada, Press Release, "New Federal Regulations to Control Hazardous Waste Now in Force," Ottawa, 26 November 1992.

4. Federal Waste Reduction Plan (CCME)

The main components of the proposed regulations are:

- a simplified procedure for controlling the export and import of hazardous waste destined for recycling operations based on the OECD Decision on the Transboundary movement of hazardous waste recyclables;
- mandatory prior written notification and consent of the importing country;
- the prohibition of exports to those countries that have banned imports;
- a tracking system to ensure that shipped hazardous wastes arrive at the authorized facility and are disposed of or recycled in accordance with the notice;
- the requirement for every importer or exporter to obtain insurance to cover environmental damage and cleanup for any accident occurring during the Transboundary movement of hazardous wastes;
- controls over hazardous wastes shipped through Canada to another country; and
- the obligation to find alternative arrangements, with the consent of countries concerned, or to bring the hazardous wastes back to Canada if disposal or recycling arrangements cannot be completed as first specified.

Some federal programs of note are:

Guidelines for the Management of PCB Wastes

Reports of PCB spills resulted in public attention and consequent requests for assistance in establishing provincial regulatory licenses and permits. Emphasis has therefore been on these guidelines, which deal with the handling, storage and disposal of PCBs as these are retired from service. The manual was released in January 1987. The *Environmental Contaminants Act* prohibits the use of PCBs in new equipment or products.

Guidelines for the Secure Landfilling of Hazardous Wastes (1987)

Pre-empted by the PCB guidelines, this publication has been reduced in strength to a technical manual of practice.

Federal-Provincial Waste Disposal Site Program

The program was restricted to federal lands after a reduction in funds in the November 1984 Economic Statement.

Institutional Waste Guidelines

This technical manual provides management procedures and criteria for laboratory waste chemicals.

Canadian Waste Materials Exchange (CWME)

Initiated in 1978 and originally funded by the Department of the Environment (DOE), this program is managed through the Ontario Research Foundation. In the 1983-1984 fiscal year, the CWME program facilitated the industrial exchange and hence recycling of over 210,00 tonnes of waste with a value of $6 million. At present, the federal and provincial environment ministries and private industry jointly fund the CWME.

Priority Substance Assessment (1988)

A Green Plan initiative was the Priority Substances List. Environment Canada and Health and Welfare Canada in cooperation assess potentially toxic substances and undertake regulatory action or other control measures when appropriate. The Plan announced that the federal government would assess 100 priority substances, including the 44 potentially hazardous substances on the Priority Substances List that it was to assess by 1994. Assessments of dioxins, furans as well as pulp mill effluents were released earlier. Assessments of toluene, methyl tertiary-butyl ether, and benzene will be released over the next few months.(51) The Priority Substances List is to be reviewed by a multi-stakeholder panel, which will recommend whether other substances should be added. The revised list is due to be published in 1994, and every three years thereafter. The full list of 100 substances is expected to have been assessed and regulated by this process by the year 2000.(52)

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(51) Government of Canada, Press Release, "Third Priority Substances Assessment Report Released," Ottawa, 19 November 1992.

(52) Kristen Douglas and David Johansen, *Toxic Substances: Federal-Provincial Control*, Current Issue Review 88-11E, Research Branch, Library of Parliament, Ottawa, 8 October 1992.

Aret (Accelerated Reduction/Elimination of Toxins)

The Aret program is to produce by January 1993 a candidate substance list with targets and schedules for reduction or elimination by the end of 1993.

Sunset Chemical Project

In September 1991, Federal Environment Minister Jean Charest announced that the government would sponsor a multi-stakeholder process to identify the worst toxic chemicals and develop appropriate strategies to eliminate or reduce them.

B. Enforcement

Penalties under (CEPA) for non-compliance will apply. Those penalties include fines of up to $1 million and jail terms of up to three years. Environment Canada and Revenue Canada Customs are preparing a training program for both CEPA inspectors and Revenue Canada Customs officers who will enforce the regulations.

C. Bilateral/Multilateral Agreements

1. Basel Convention

The Basel Convention is a global convention, which now has 53 signatory countries, including Canada. The Convention entered into force on 5 May 1992 for the 33 countries that had ratified it as of that date. The Convention sets procedures to encourage the disposal of waste in the country of origin, cooperate with technology transfer and information exchange, ensure the reduction of hazardous waste, and inform countries and secure their consent before shipping hazardous wastes. The proposed export/import regulations will allow Canada to ratify the Convention.

2. OECD Decision

The OECD Decision on Hazardous Recyclables was adopted in March 1992. The Decision established a three-tier system (Green, Amber, Red) to ensure that shipments of hazardous wastes destined for recycling receive the proper degree of control required, based on the overall risk

of the waste. The goal is to protect the environment and human health without disrupting recycling operations. The proposed regulations incorporate the provisions in the OECD Decision.

3. Canada-U.S. Bilateral Agreement

This agreement was signed in October 1986, one year after regulations came into effect under the *Transportation of Dangerous Goods Act*. It sets out specific conditions for the export and import of hazardous wastes between the two countries, including the prior notification provision. Canada and the U.S. both realize the environmental benefits of sharing environmentally acceptable disposal facilities on both sides of the border close to the point of generation, thus minimizing the distances that hazardous wastes travel. In 1991, Canada imported 135,000 tonnes of hazardous wastes while 223,000 tonnes were exported to the United States. In both cases, approximately 50% were destined for recycling or recovery operations. Both countries agree to review this agreement to ensure it conforms to the Basel Convention and any new relevant domestic legislation. In Canada, hazardous waste Transboundary shipments will be covered by the new export/import regulations.(53)

4. Agenda 21

In June 1992, Canada was a key player in the United Nations Conference on Environment and Development in Rio de Janeiro. One of the main documents to come out of this conference was Agenda 21, a 700-page document intended to be an action plan for environmental issues.

Chapters 19 and 20 address the issues of management of toxic chemicals and hazardous wastes.

- Chapter 19, "Environmentally Sound Management of Toxic Chemicals Including Prevention of Illegal International Traffic in Toxic and Dangerous Products": A substantial use of chemicals is essential to meet the social and economic goals of the world community and today's best practice demonstrates that they can be used widely in a cost-effective manner and with a high degree of safety. However, a great deal remains to be done to ensure the environmentally sound management of toxic chemicals, within the principles of sustainable development and improved quality of life for humankind. Two of the major problems, particularly in developing countries, are (a) lack of sufficient scientific information for the assessment of risks entailed by the use of

(53) Environment Canada, New Federal Regulations to Control Movement of Hazardous Wastes, News Release, PR-HQ-92-37, 15 June 1992.

a great number of chemicals, and (b) lack of resources for assessment of chemicals for which data are at hand.(54)

- Chapter 20, "Environmentally Sound Management of Hazardous Wastes Including Prevention of Illegal International Traffic in Hazardous Wastes": Effective control of the generation, storage, treatment, recycling and reuse, transport, recovery and disposal of hazardous wastes is of paramount importance for proper health, environmental protection and natural resource management, and sustainable development. This will require the active cooperation and participation of the international community, governments and industry.(55)

DISCUSSION

One of the greatest challenges that Canadians face on the road to a sustainable future is reducing the volume of waste that they generate. Waste management is indeed an urgent and pressing problem in Canada.

Canadians realize that this situation is unacceptable and they are demanding that their governments take action. The success of community-based blue box recycling programs is evidence of the willingness of individual Canadians to choose and to support a sustainable future. Similar efforts have been initiated in the industrial and commercial sectors of our economy. For example, the Canadian Waste Exchange in Toronto encourages trade of materials among industries to reduce the amount of wastes for disposal.(56)

As the basic concept and initial stages of hazardous waste management in Canada evolve, so does the decision-making process. Involvement of the public, primarily due to a concern generated by the media, will continue to grow. A common theme stressed at the Toxics and Environment Conference in Ottawa in May 1985 and reiterated at the October 1990 Twelfth Canadian Waste Management Conference(57) was the need for truth to instill trust. Particularly at a provincial level, people's faith and trust in government and industry had by then reached an all-time low, which is requiring both time and care to rebuild. As well, the federal government,(58) many

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(54) United Nations Conference on Environment and Development, Agenda 21, 1992.

(55) *Ibid*.

(56) Environment Canada, "Twelfth Canadian Waste Management Conference Proceedings," St. John's, October 1990.

(57) *Ibid*.

(58) J. Buccinni, "Environmental Contaminants Acts Revision," Toxics and the Environment Conference, Ottawa, 12-13 June 1985.

provinces, and industry understand that the public is more scientifically aware now than in the past and requires more complete explanations and answers to its questions.

Jurisdiction for most aspects of hazardous waste management in Canada rests with the provinces, which show wide variation in their hazardous waste regulatory practices. However, Ontario has adopted a hazardous waste regulatory framework similar to the federal U.S. model and it is widely expected that other provinces will follow suit.

Problems, however, still abound. The industries involved would like to see an end to the provincial-federal struggle - which only tends to erode any progress - and recognize that there must be mutual trust and credibility. In some respects, the provinces also feel they are in a disadvantaged position. Although they still feel they should control management, their major complaint is the lack of adequate information. For example, the federal government is said to have access to proprietary information from pesticide industries that the provinces are lacking, although they are responsible for provincial regulation.(59)

The national scope of the problem should be evident. Most industrialized countries recognize the need for uniformity and centralized control of hazardous waste management, as well as international cooperation. The TDGA was a step in the right direction for Canada. As public pressure develops, the provinces may turn even more to the federal government as an advocate, if consensus is difficult to achieve. Governments can help to develop the infrastructure to manage hazardous wastes and ensure better enforcement of disposal regulations.

Research and development are required at most stages of management. Although industry may be capable of conducting research, some direction and incentives directly related to toxics and the environment are needed. Uniformity in inventories and non-partisan evaluation of chemical toxicities (as previously conducted by the Environmental Secretariat of the NRC) could only help us in deciphering this complex issue, which we are just beginning to understand.

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(59) W. Solodzuk, “Provincial Perspectives on Managing Chemicals,” Toxics and the Environment Conference, Ottawa, 12-13 June 1985. Note: Solodzuk has made a disclaimer and now attributes these statements to his personal view.

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APPENDIX 1
ORPHAN SITE REMEDIATION PROJECTS

At the end of the 1991-92 fiscal year, eight provinces and one territory had signed agreements with the federal government to participate in the National Contaminated Sites Remediation Program (NCSRP). The latest to join were Newfoundland and Labrador, Prince Edward Island, and the Northwest Territories. In the program's first year, bilateral agreements were put into place between the Government of Canada and British Columbia, Alberta, Ontario, Quebec, New Brunswick and Nova Scotia. While Saskatchewan, Manitoba and the Yukon Territory had not signed bilateral agreements with the federal government as of 31 March 1992, all three jurisdictions have participated actively in other areas of the program, with a view to signing agreements in the near future.

As jointly agreed within the CCME, each province has access to a percentage of the federal contribution based on the size of its population.

The bilateral agreements that have been signed to date commit the following amounts to orphan sites remediation and technology demonstration over the life of the program:

Prince Edward Island	$ 1.25 million
Newfoundland and Labrador	$ 5.50 million
Northwest Territories	$ .50 million
British Columbia	$ 29.25 million
Alberta	$ 23.25 million
Ontario	$ 91.25 million
Quebec	$ 63.75 million
New Brunswick	$ 6.75 million
Nova Scotia	$ 8.50 million
Total	$230.00 million

In 1992, the CCME in its annual report also included those sites in the process or under evaluation for remediation. These sites are presented below.

Newfoundland:

- Makinsons Scrapyard Site, Hodgewater Line
  - PCB and heavy metal contamination
  - assessment complete
  - cleanup to begin 1992-93

New Brunswick:

- Crude Oil Separation Site, Weldon
  - hydrocarbon contamination
  - remediation in progress

- Petroleum Contaminated Site, Drummond
  - gasoline contamination
  - remediation to begin 1992-93

- Furnace Oil Spill, Rogersville
  - fuel tank spill
  - remediation to be complete 1992-93

- Petroleum Contaminated Site, Haute Aboujagane
  - petroleum contamination
  - remediation complete

- Petroleum Contaminated Site, Harvey Station
  - petroleum contamination
  - remediation to begin 1992-93

- Petroleum Contaminated Site, Trois Ruisseaux
  - fuel oil contamination
  - assessment of remedial actions began March 1992

Nova Scotia:

- Associated Electronics and Metal Salvage Ltd. Site, Five Island Lake
  - PCB and heavy metal contamination
  - remediation complete 1992

Quebec:

- Tire Fire Site, Saint-Amable
  - oil and heavy metal contamination
  - remediation complete

- Le Vidangeur de Montréal Ltée, Montréal
  - petroleum byproducts and hazardous industrial waste contamination
  - remediation scheduled for 1993-94

- Ruisseaux Bouchard et Bertrand, Dorval
  - heavy metal, oil and grease contamination
  - site was assessed and determined to be of no risk

- Hazardous Waste Disposal Site, Ville Mercier
  - waste oil and solvent contamination
  - remediation in progress

- Weedon Mine, Fontainbleau
  - acid water and heavy metal contamination
  - remediation to begin 1992-93

- Industrial Waste Disposal Site, Saint-Marie Salomé
  - refinery and other industrial waste contamination
  - final assessment due 1992-93

Ontario:

- Tyre King Fire Site, Hagersville
  - oil and chemical byproducts of burning rubber contamination
  - remediation complete 1992

- Canadian Waste Management Ltd. PCB Spill Site, Smithville
  - PCB contamination
  - remediation ongoing

- Blackbird Holdings Site, Rednersville
  - solvents and other hazardous waste contamination
  - remediation ongoing

- Deloro Mine Site, Deloro
  - arsenic contamination
  - remediation ongoing

Alberta:

- Canada Creosote, Calgary
  - creosote contamination
  - remediation ongoing

- Peerless Wood Preserves, Cayley
  - pentachlorophenol (PCP) contamination
  - to be completed 1992-93

APPENDIX 2

PROVINCIAL WASTE DISPOSAL SITES AND WASTE MANAGEMENT ACTIVITIES

The quantities and qualities of hazardous wastes vary depending on the province, the region and often the site-specific circumstances (e.g., leaking PCBs from the B.C. Hydro storage site at Mackenzie, B.C.). The findings of provincial waste inventory studies up to 1982 were included in "Data on Hazardous Wastes, Rubber Wastes and Oil Wastes in Canada - 1983," a report (Proctor and Redfern *et al*., 1984).

Given the large quantities of hazardous wastes generated, one cannot help wondering where they have been disposed of. According to the former Economic Council of Canada, the lack of adequate treatment and disposal facilities in Canada has led to dubious and illegal dumping practices. It is estimated that approximately 85% of the national total production of hazardous wastes is dealt with improperly, and, more often than not, with costly and destructive repercussions. Lack of regulations or lack of their enforcement, rather than cost, has been the major reason for improper disposal. Proper disposal costs, however, would have been only a fraction of those of remedial actions required subsequent to improper disposal.

In Canada, as in the rest of the world, landfilling has been the primary method of disposing of municipal, institutional, commercial, industrial and hazardous wastes. To date, there is no complete inventory of hazardous waste dumpsites in Canada and it may be that every municipal landfill has the potential to demonstrate some problems associated with improperly constructed hazardous waste disposal sites. In fact, as inventories of potential problem sites continue to be conducted, the condition of most municipal sites is being investigated. Of course, some sites are already known to possess greater than average quantities of hazardous wastes or to be located in more environmentally sensitive areas.

In the past few years, inventories have been completed by most of the provinces and/or by the Waste Management Division of the Commercial Chemicals Branch, Environment Canada.[60] This EPS study, which began in 1981, was a joint federal-provincial project involving all the provinces except Quebec, Ontario and British Columbia. Quebec has completed and

(60) Formerly known as the Waste Management Branch in the Environment Protection Service (EPS). The study will be referred to as the EPS study.

published its own inventory, Ontario is still conducting one, and British Columbia has no plan to conduct such an inventory at this time. In these three provinces, only those sites located on federal Crown land were examined.

The project initially had three phases, but all jointly funded aspects of the project had to be discontinued, due to reduced financial resources as a result of the November 1984 Economic Statement. By that time, however, Phase I (initial cataloguing of abandoned sites) had been completed and in some locations Phase II and Phase III (preliminary on-site assessment and extensive testing, respectively) had also been completed or initiated. The cost of the project had been approximately $300,000/year since 1981.

In the study, all sites investigated were ranked as Priority 1, 2, or 3, according to their potential for adverse health and/or environmental impacts. This involved the scoring of sites against various criteria (e.g., type of waste, proximity to a water supply or groundwater, population, etc.). Priority 1 sites are those which could present a high-risk potential and which should be immediately assessed.

In July 1988, Fenco Newfoundland Limited under contract to Environment Canada produced the document, "Economic Profile of the Hazardous Waste Management Service Industry Subsector in Canada." Environment Canada is currently updating this report with the publication date of summer 1993. Presented below are inventories contained in the 1988 report and the EPS.

Newfoundland: Little hazardous waste has been identified by the EPS study in this relatively industry-free province. Of the 236 sites identified, only one site was Priority 1, 95 sites were Priority 2, and 140 were Priority 3. But there are also about 15 PCB storage sites in the province and recent observations indicate PCB contamination in Cartwright and Mellville in Labrador. A number of as-yet unknown sites may, of course, subsequently be discovered.

New Brunswick: No priority ranking of the 245 active landfill sites was made in the EPS study, but a ranking was completed for the 191 inactive sites. Phase II studies of six of the nine Priority 1 sites showed that leachate was being released to both ground and surface waters at five of them. In general, closed sites had few major problems since the wastes deposited were characteristically "mild" and good closing procedures had been used. In 1985, a survey of more than 220 waste-

generating companies and institutions was undertaken to estimate the volume, sources and nature of hazardous wastes generated in New Brunswick. This survey indicated that approximately 1,814 tonnes of hazardous material are produced in the province annually. It was also noted that a comprehensive waste inventory should be undertaken including detailed information on the volume of used lubricating oil generated in New Brunswick each year.

Prince Edward Island: Of the 471 sites surveyed in the EPS study, 21 were classified as Priority 1. It was noted that only three of 40 active dumpsites had been "approved" for use and that many sites contained agricultural chemical containers, animal carcasses and unauthorized sewage. The high population density of P.E.I. and its dependence on groundwater may soon present difficulties as herbicides, pesticides, nitrate and petroleum products are being found locally in groundwater. Although not listed (probably because of its location on private land), there is at least one PCB storage site on the island.

Nova Scotia: The EPS study indicates 15 Priority 1, 123 Priority 2, and 34 Priority 3 sites, in addition to 29 unclassified sites that were not identified until after the study's completion. Of the Priority 1 sites, six are abandoned coal mines with problems of leachate from the tailings containing PAH and acid. One site is a lead/zinc mine and five are domestic dumpsites, one of which has been certified as containing 117, 45-gallon drums which are leaking or have leaked PCBs, trichlorethylene and trichlorbenzenes. Two other sites are suspected of containing PCBs.

A federal-provincial agreement was signed 6 November 1986 to clean up the Sydney Tar Ponds, a large chemical waste site containing an estimated 3,400 tonnes of polynuclear aromatic hydrocarbons (PAH). The cleanup was scheduled to take 10 years at a cost of $34.4 million, split between the federal and provincial governments on a 70/30% basis. The main generator of the waste, Sydney Steel Co. (SYSCO) coke ovens, remained functioning until 1988. At 25% capacity, they were loading 3.5 tonnes/year PAH into Muggah Creek. The federal commitment expired in November 1992, at which time the province assumed financial responsibility under the terms of the agreement. The estimated date of completion is 1999-2000.

Quebec: The EPS study, restricted to federal land sites, shows that eight out of the 11 Priority 1 sites are in the Montreal and Quebec administrative regions. Phase II investigations indicated problems ranging from bacteriologically affected surface water to significant levels of phenols,

arsenic and methane gas production. In addition to remedial action, further study was recommended at two sites.

Quebec's provincial inventory investigated 1,078 sites, rejecting 761 as representing no risk, and classifying 62 sites as Priority 1. Of these 62 Priority 1 sites, 23 are deemed a direct health risk because of their proximity to either a private or domestic water source.

Outside Ontario, Quebec is the only province that at present has licensed hazardous waste treatment plants. There is a large Stablex fixation/solidification (inorganic) facility at Blaineville, which processes 60% of Quebec's liquid industrial wastes, and a Tricil Ltd. liquid-organics incinerator in Ville Mercier. Additionally, plans exist for the construction of a large 50,000 tonnes/year high-temperature, rotary kiln incinerator for liquid, solid and semi-solid organic wastes.

Ontario: The province of Ontario is continuing to identify and classify active and inactive landfill sites. To date, 1,339 active sites and 1,990 inactive sites have been listed; that is, their existence is known, but the nature of the wastes they contain has not yet been investigated in all cases. The purpose of the project is to ensure that all sites have a good data base to help to predict and prevent problems such as leachate migration or groundwater contamination, and to deal with existing problem sites.

Ontario does house two licensed waste treatment and incineration facilities: Tricil Limited's liquid injection incinerator (capacity of 160 million litres liquid waste/year) near Sarnia and Syntah Limited's small treatment centre and incinerator near St. Catharines. Although plans are to phase out the use of municipal landfills for the disposal of hazardous wastes, six landfills in Ontario are still licensed to accept liquid industrial wastes (LIW). These are located in Hamilton, Brantford, Guelph, Paris, Welland and Lambton.

The Ontario Waste Management Corporation (OWMC) is a Crown agency established in 1981 to design, own and operate the province's waste management facilities. After a three-and-a-half-year detailed site selection process costing $10 million, in September 1985 a site for the facilities was selected in Lincoln Township in the Golden Horseshoe, the area which produces 70% of the province's hazardous wastes. Its initial capacity is expected to be 30,000 tonnes of organic wastes and 120,000 tonnes of inorganic wastes per year, with provision for a future doubling of this capacity. These amounts are only 15% of the inorganic and 7.5% of the organic waste production of Ontario, low amounts set to avoid having a facility with too large a

capacity. As of December 1992, the facility proposal was in stage 6 of 6 in the environmental assessment process. Final arguments are expected to be heard by April 1993. At this time, the decision will be made to proceed with construction as planned, with modification or abandoned.

In February 1988, the Ontario Waste Management Corporation (OWMC) published a draft document entitled *The OWMC Undertaking*; this is the first of six volumes of OWMC's Environmental Assessment. Chapter 4 of the document examines the quantity and characteristics of waste currently generated in Ontario. Chapter 6 presents estimates of Ontario's generated waste quantities potentially seeking off-site treatment and disposal in 1992 and 1997. Ontario currently generates over 50% of the total volume of hazardous wastes in Canada and as a result influences the magnitude of the industrial and waste management capacity.

Of the on-site and off-site reported waste, approximately half (45.8%) falls into the "hazardous industrial" category, with "liquid industrial" (22.5%), "registerable solids" (13.5%) and "corrosive" (11.6%) being the other major contributors. Few wastes were classified as "acutely hazardous" or "hazardous chemical." No "severely toxic" or "PCB wastes" were reported in the database. The industries most prominent in waste generation are metals and machinery, resource-based industries and petroleum and chemicals.

PCB wastes are currently stored and awaiting treatment at various facilities around the province. The Ministry maintains a separate database recording the type and location of PCB wastes for every site reporting under this regulation. Waste generated by decommissioning and site cleanups would be manifested (documented and registered) for all subject waste categories if shipped off-site for treatment, disposal or storage. However, a fairly large quantity of PCB-related wastes generated by these decommissioned activities is not manifested. This waste is currently being stored on-site. On average, approximately 45,000 tonnes of PCB-contaminated soil were generated and stored in 1986 and 1987.

For most waste streams, the estimated waste quantities for 1992 and 1997 were derived by applying the economic growth rates, on a standard industrial classification (SIC) basis, with the projected gross domestic product (GDP) growth rates cut in half.

The quantities of waste potentially seeking off-site treatment and disposal in the years 1992 and 1997 range between approximately 800,000 and 1,100,000 for 1992 and from approximately 900,000 to 1,200,000 for 1997.

The enhanced regulatory scenario assumes that Ontario will adopt a landfill ban similar to that in the U.S. 1984 Hazardous and Solid Wastes Amendments to the *Resource Conservation and Recovery Act*, in addition to the regulations implemented in the current scenario.

Manitoba: In the past, most disposal was by open dumping with only occasional compaction of the wastes and limited capping with cover material. Concern has arisen over the large number of sites close to many of the numerous water bodies in the province. Additionally, buildings constructed on old landfills may be subject to high (potentially explosive) concentrations of methane gas produced from the refuse. Phase II studies of 17 sites indicated that at five of them leaching into groundwater and/or gas production was an immediate problem. Preventive recommendations were also made for the other sites. A hazardous waste Assessment Report that examines the quantities, qualities and disposal of waste material generated in the province has been produced. At present, most hazardous wastes are stored and then shipped to Ontario. The identified amount of hazardous waste generated in Manitoba was 20,325 tonnes/year (not including air emissions and recycled wastes), produced by at least 293 companies.

Saskatchewan: A large number of sites have been ranked at the top two priority levels; however, little on-site investigation has taken place. The major problems encountered are pesticide contamination of surface water and, less frequently, groundwater contamination.

Alberta: Approximately 14% of the 1,152 sites investigated in Phase I of a large study were designated as Priority 1 sites. Of the known inactive sites, approximately one-third have been rehabilitated under a Heritage Trust Fund Program; however, some known industrial sites are still missing from the inventory.

A Crown corporation, the Alberta Special Waste Management Corporation (1982) (ASWMC), coordinated the construction of an integrated hazardous waste treatment plant by a subsidiary of Bow Valley Resources Services Ltd. (BVRS; Chem-Security). Situated near Swan Hills, 200 km northwest of Edmonton, the site is in a good position to serve Edmonton's industry, which produces 68% of the province's hazardous wastes. The facility opened on 17 September 1987. The treatment centre is jointly owned by industry and government and is the exclusive off-site facility for the treatment of special wastes in Alberta until at least 1994. The Alberta Special Waste Management System's second step is the creation of transfer stations in major cities for

special waste identification and sorting. The third stage involves strategic placement of smaller collection stations for consumer drop-off in subsidiary areas.

Unlike the situation in Ontario, where the OWMC is 100% Crown-owned, the cost is split 60-40 between BVRS and the province. Under the Joint Venture Agreement, BVRS will be guaranteed a rate of return based on the original capital investment; the rate base will decline at 10% per year plus a formula-derived rate, based on the prime interest rate. Such an agreement was necessary to secure private sector involvement when the actual volumes and types of wastes BVRS will be handling are not yet known. The ASWMC and BVRS will have equal representation on a board that will lay down policies and restrictions, audit financial returns and help set rates. BVRS's subsidiary, Chem-Security, will run day-to-day operations.

Methods of deep well injection for waste disposal are unique to Alberta. In this case, hazardous industrial wastes are stored in rock strata at depths of between 300 and 2,000 metres and in materials which it is hoped will protect groundwater supplies.

British Columbia: Except for the EPS inventory of sites on Crown land, no inventory has been or is planned to be conducted in British Columbia. Initial research, involving a year and a half and $1.5 million, identified sites for a hazardous landfill in the Fraser Canyon, but no further action is planned. The original study, conducted by a private company, reported that such action was not economically feasible.

APPENDIX 3
PROVINCIAL LEGISLATION AND PROGRAMS

The provincial governments have substantial constitutional authority to deal with hazardous waste disposal and related matters. With few exceptions, however, provincial legislation, like federal law, has focused primarily on general air and water discharges. The recognized inadequacy of this approach has recently prompted some provincial initiatives that more directly address hazardous waste disposal.

Newfoundland: The major piece of legislation, the *Waste Material (Disposal) Act* (1973), sets out provisions governing waste management systems and disposal sites and empowers the Lieutenant Governor to make regulations designating hazardous substances. To date this has not been done and no other direct hazardous waste legislation or program is in effect. Hazardous wastes have not been recognized as a serious problem because of their relatively small quantities.

After three years on the shelf, the province's *Dangerous Goods Transportation Act* was proclaimed in force on 20 December 1985 and its first regulations, which generally adopt the federal TDG Regulations, were brought into effect. A more recent initiative has been the licensing of 12-15 interim storage sites for PCB wastes awaiting further disposal.

Other regulations and legislation bearing on hazardous waste management are:

Environmental Assessment Act (1983-84)
Pesticides Control Act (1970)
Storage and Handling of Gasoline and Associated Products Regulations (1982)
Department of the Environment Act (1981)
The Department of Health Act (1970)
Dangerous Goods Transportation Act (1982)

New Brunswick: Two developments of note in New Brunswick involve hazardous substances and wastes. In August 1986, a public consultation report concerning waste and, in particular, hazardous waste management, was presented to the legislature by the Environmental Council of New Brunswick. The report was originally commissioned by the Minister and contains three statements of principles and 18 recommendations. There is, however, no obligation for response.

The explosions and fires caused by underground gasoline storage tank leakages in the city of Saint John in April 1986 prompted a ministerial order to register all underground and above ground storage tanks capable of containing 2,000 litres or more, or 200 litres in the case of

marine storage tanks. The deadline for registration was 10 December 1986. This appears to be the first step towards legislation concerning storage tanks. The enormity of the problem surfaced when documentation was presented in June 1986 indicating that about 5 million litres of gasoline had leached into groundwater between 1965 and 1980 throughout the province, generally through the negligence of major oil companies.

Under the *Clean Environment Act* (1973), the Minister of the Department of the Environment (now the Department of Municipal Affairs and Environment) has broad powers regarding the discharge of wastes or contaminants into the environment. Within the Act, water and air quality regulations and permit requirements have recently been passed, but low financial support has restricted their application to non-hazardous wastes. Also, as of 1983, amendments have provided a legislative framework for environmental impact assessments. These assessments, carried out by the proponent, involve public consultation on both ecological and socio-economic issues and involve a substantial review process. There are no regulations specific to the transport of hazardous substances within the province.

Other legislation, which is of less significance but can be employed:

Public Health Act (1973) and Regulations
Pesticides Control Act (1973) and Regulations

Prince Edward Island: In this province there is no legislation or plan for legislation dealing strictly with hazardous wastes, although the *Environment Protection Act* (1975) does set out general pollution provisions which could include hazardous wastes. The Department of Transportation did, however, adopt those federal TDG Regulations that did not duplicate areas addressed by their own regulations. Since all drinking water in P.E.I. comes from groundwater, drinking water quality is inevitably linked to groundwater quality and small amounts of hazardous wastes can have serious effects. Recently passed regulations require the registration of all underground petroleum storage tanks and specify the quality of their construction with respect to corrosion resistance. Domestic and municipal waste and pesticides also threaten groundwater in P.E.I.

Other legislation:

Pesticides Control Act (1984)
Dangerous Goods Transportation Act (1981)

Nova Scotia: Nova Scotia has no legislation specifically dealing with hazardous waste management, although the *Environment Protection Act* (1973), which prevails over all Acts, including municipal by-laws, does set out procedures for licensing and standards for waste management systems and pollution abatement programs. Standards of compliance and penalties for non-compliance are detailed. The province adopted the TDGA Regulations in February 1986 for interprovincial transportation and passed a *Dangerous Goods and Hazardous Wastes Management Act* in July 1986.

Other legislation:

Water Act (1973)
Dangerous Goods Transportation Act (1982)

Quebec: The Hazardous Waste Regulation under the *Environment Quality Act* (1977), came into force on 15 October 1985 and is the most comprehensive set of regulations governing hazardous waste management in Quebec. The regulations incorporate requirements for a previously tested manifest system, and the prenotification of waste shipments, and address waste definition, classification, storage, transport and disposal. Prior to these regulations, the *Environmental Quality Act* had few specific provisions governing the disposal of hazardous wastes, although Division VII of the Act does set out provisions for issuing licenses and permits for waste management systems and imposes standards of compliance which must be met before the operations are approved by the Minister. Some provisions relating to certain industrial sectors, however, have been delayed.

Other regulations:

Quality of the Atmosphere Regulation (1981)
Regulation Respecting Liquid Waste (1983)
Regulation Respecting the Transport of Waste (1981) R.R.Q. 1981, c. T-12, r. 16
Hazardous Waste Regulation (1985)
Regulation Respecting Solid Waste (1981)
Highway Safety Code (R.S.Q., c. C-24.1)
Transportation of Dangerous Substances Regulation

Ontario: It can readily be seen that policy regulations and legislation in some provinces, but particularly in Ontario, are rapidly changing and are being strengthened. This can be expected to continue as the problems involved in controlling and regulating hazardous substances and wastes unfold. The most recent evidence of such a trend was legislation to strengthen the enforcement provisions of three existing Acts: (*Environmental Protection Act* (1980), *Ontario Water Resources Act* (1980) and the *Pesticides Act* (1980)). The legislation provides for jail sentences, fines increased from two to five times their present amounts, and "gives the courts the power to strip polluters of ill-gotten gains"; that is, if, after paying the fines, polluters still make net gain from polluting rather than using proper treatment and/or disposal, additional fines can be imposed "to deprive lawbreakers of any financial gain achieved by polluting Ontario's environment."

The principal statute governing waste management in Ontario is the aforementioned *Environmental Protection Act* (1980). Part V of the Act provides definitions, requirements and procedures for acquiring certificates of approval for operating and altering existing waste management systems and disposal sites, as well as proposed systems and sites. The Act also specifies when public hearings must be held with regard to issuing certificates of approval. The Act provides the Director responsible with considerable power over waste management in general and establishes a Waste Disposal Security Fund to pay for compensation claims. Amendments in 1983 permitted a greater "preventive" stance to be taken by monitoring and controlling waste problems on private land that eventually may threaten others.

The main regulation of the *Environmental Protection Act* is the Environmental Protection (General-Waste Management) Regulation 309. This defines, classifies, and sets standards for wastes, management systems, disposal sites and transfer vehicles. The second major regulation was the "Way-Bill" or Transfer of Liquid Industrial Waste Regulation 313, in essence a manifest system, which has effectively been replaced by the amended Regulation 309. in 1983, an in-depth review had produced a document called the "Blueprint for Waste Management", which set forth policy and legislative and regulatory proposals relating to virtually every phase of waste management. The amended Regulation 309, based on this policy paper, was announced 17 June 1985 and came into effect 17 September 1985.

> Under the regulation, companies producing hazardous waste must register all wastes within 12 months of production, fill out a manifest

for shipments of waste, and ensure the wastes are recycled, treated or disposed of properly.

As well, the controversial "Spills Bill," Part IX of the *Environmental Protection Act*, was proclaimed in force 29 November 1985. This bill places onerous financial responsibilities on those who own or use toxic materials, particularly in the event of a spill.

In June 1987, the Ontario Ministry of Environment, Waste Management Branch, initiated a program to reduce industrial waste generation in Ontario. The program provides grants to support industrial waste reduction initiatives on a project-specific basis the Industrial Waste Diversion Program.

The Ontario Waste Management Corporation (OWMC) is a Crown agency established in 1981. Its primary responsibility is to design, construct and operate a province-wide system for the treatment and disposal of liquid industrial and hazardous wastes along with the development of a long-term program to encourage and assist in greater waste reduction, reuse, recycling, recovery and exchange. In its 1988 draft report, *OWMC Undertaking*, it identified the demand for such a treatment and disposal facility in the province taking into consideration the commercial services available provincially. The OWMC's philosophy is to fill the gap in the provincial supply-demand scenario for provision of commercial hazardous waste management services. The OWMC is not a regulatory agency responsible for monitoring the industry; this responsibility lies with the provincial Ministry of the Environment. The OWMC has published several documents on waste management. It also publishes an irregular, informal newsletter, *OWMC Exchange*, which updates its programs and contains details on general waste management literature, technologies and conferences.

Other legislation and regulations:

Waste Management: PCB Regulation (1980)
Dangerous Goods Transportation Act (1981)
Environmental Assessment Act (1980)
Consolidated Hearings Act (1981)
Municipal Act (1980)
Planning Act (1980)
Ontario Waste Management Corporation Act (1981)

Manitoba: A three-phase waste management strategy for Manitoba is being carefully constructed with substantial public consultation and review. It includes various pieces of legislation to manage hazardous wastes in particular and, on a broader scale, all environmental impacts. A *Hazardous Waste Management Corporation Act*, proclaimed on 15 November 1986, provides a mandate to establish an appropriate collection, treatment and disposal system for the province.

As well, a discussion paper for a new Environment Act was tabled in September 1986. This replaces the *Clean Environment Act (1972)* and is much broader in scope, as any social-environmental impact will be considered under it. Additionally, several municipalities in the province maintain a collection program for chemical pesticide containers, similar to those in Alberta and Saskatchewan. These municipalities, with the assistance of federal and provincial governments, have programs to separate pesticide containers from the rest of the wastes being taken to municipal landfills. The cans are crushed and the liquid pesticide residues collected and shipped out of the province for disposal.

Other legislation concerning hazardous wastes, the *Dangerous Goods Handling and Transportation Act*, was passed in the summer of 1984.

Other legislation and regulations:

Clean Environment Act (1972)
Public Health Act (Sanitation Regulations: 1971)
Pesticide and Fertilizer Control Act (1976)
Waste Disposal Grounds Regulations (1976)
Regulation Respecting the Designation of Certain Substances As Hazardous Materials (1981)
Pesticides Regulation (Man. Reg. 98/85)
Classification Criteria for Products, Substances and Organisms Regulation (Man. Reg. 282/87)
Regulations Respecting the Handling, Offering for Transport and Transporting of Dangerous Goods (Man. Reg. 141/87)
Generator Registration and Carrier Licensing Regulation (Man. Reg. 140/88)
Manifest Regulation (Man. Reg. 139/88)
Environmental Accident Reporting Regulation (Man. Reg. 439/87)

Saskatchewan: Saskatchewan restructured its Environment Department through the *Department of Environment Act* (1984) with details of its mandate in the *Environmental Management and Protection Act* (1984). Regulations for this Act control the designation, transportation, storage,

processing, disposal and recycling of hazardous wastes (Environmental Spill Control Regulations (R.R.S. 1981, c. D-14, Reg. 1)).

Additionally, Saskatchewan has a pesticide container disposal program, which has been successful in accounting for the return of at least 50% of the agricultural containers sold. Saskatchewan was the first province in Canada to license a low-level PCB waste treatment facility, opened in 1985, to decontaminate low-level PCB (500 ppm) contaminated oil from the province. Other waste management programs include waste minimization through a provincial waste exchange program, a pesticide container disposal program similar to the programs ongoing in Alberta and Manitoba since 1983; collection each year of derelict vehicles and delivery to a provincial steel mill; and, since 1985, provision of emergency response services in the event of a waste spill.

Other legislation and regulations:

Environmental Spill Control Regulations (1983)
Mineral Resources Act, Pollution Prevention Regulations for the Mineral Industry (1969)
Pest Control Products (Saskatchewan) Act (1976)
Public Health Act (1972) - Waste Management Regulations
Municipal Refuse Management Regulations (Sask. Reg. 701/86)
Dangerous Goods Transportation Act (S.S. 1984-85, c. D-1.2)
Dangerous Goods Transportation Regulations Vehicles Act
PCB Transportation Regulations (Sask. Reg. 521/85)

Alberta: Within the Alberta Department of Environment, the Environmental Protection Service is the main branch responsible for controlling and prevention pollution, while the Alberta Special Waste Management Corporation (ASWMC) is chiefly responsible for control of waste management facilities. The major enabling statute for the formation of a comprehensive legislative framework to control hazardous wastes is the *Department of Environment Act*, under which regulations may be made prescribing disposal methods for any substances detrimental to the environment.

The Acts predominantly responsible for the management of hazardous wastes are the *Hazardous Chemicals Act* (1978) and the *Special Waste Management Corporation Act* (1982). As of 13 March 1984, both were updated and amended to provide a more complete set of regulations. The *Hazardous Chemicals Act* now provides regulations for a manifest system similar to that of the TDGA although Alberta's more recently proclaimed *Transportation of Dangerous*

Goods Control Act (1986) is more specifically designed to control the movement of both special wastes and dangerous goods. The *Hazardous Chemicals Act* also gives power to the Director responsible to ensure wastes are properly managed and it assigns responsibility for remedial action "to the person responsible for the chemical." The same regulations formalized the power of the ASWMC for controlling waste management facilities in the province.

The Swan Hills Central Treatment Facility officially opened 11 September 1987. The treatment centre is jointly owned and operated by industry and government and is the exclusive off-site facility for the treatment of special wastes in Alberta until at least 1994.

The extensive development of the oil and gas industry in Alberta has provided special advantages in waste management but has also given rise to special problems. Special regulations, the Oil and Gas Conservation Regulations (1971), were amended in 1983 to ensure proper handling and disposal of wastes from oil and gas exploration and production activities. A necessary emphasis is placed on disposal of large-scale liquid and solid waste generated by the oil sands plants. Licensing and approval of deep well injection disposal facilities must be obtained from the Energy Resources Conservation Board, which permits their use only in suitable geological conditions.

The Alberta Waste Materials Exchange (AWME) was established in 1984 as a project of the Alberta Research Council with funding from Alberta Environment. It operates in conjunction with the Canadian Waste Materials Exchange (CWME) as an information clearinghouse designed to put potential users of waste material in contact with waste producers. A bi-monthly bulletin is published and distributed, without charge, to industries that may be able to recycle or reuse the available materials.

The Recycling Council of Alberta was established in 1987 to promote increased recycling of all types in the province through four main activities. These are: (1) organizing and operating a public education program to make people aware of the benefits of recycling; (2) to act as an interface between industries, collectors and consumers involved in recycling by, for example, the publication of a newsletter, the operation of information services and/or the organization of conferences; (3) to act as an interface between the recycling industry and government by making recommendations on recycling and providing provincial recycling statistics; and (4) to encourage

market development for recycled materials through research and development of new uses for recycled materials.

Other legislation and regulations:

Agricultural Chemicals Act (1970) R.S.A. 1980, c. A-6
Pesticides Sales Use and Handling Regulations (1980)
Clean Air Act (1971) R.S.A. 1980, c. C-12
Clean Water Act (1971) R.S.A. 1980, c. C-13
Department of the Environment Act (1971) R.S.A. 1980, c. D-19
Oil and Gas Conservation Act (1970) and Regulations (1971)
Energy and Gas Conservation Act (1971)
Energy Resources Conservation Act R.S.A. 1980, E-11
Public Health Act (1971) and Regulations Respecting the Control of Refuse Disposal Systems
Hazardous Waste Regulation (Alta. Reg. 505/87)
Transportation of Dangerous Goods Control Regulation (Alta. Reg. 383/85)

British Columbia: In this province, the *Waste Management Act* (1982) (WMA) and its supplements give authority to the Waste Management Branch concerning the regulation of hazardous wastes. In general, the WMA allows participation by the province in the development of waste management plans for municipalities, and in the control and storage of hazardous wastes. It also regulates the permitting of discharges into the environment and gives the Ministry the authority to require spill prevention, assessment and contingency plans. The provincial *Transportation of Dangerous Goods Act* (1985) adopted the federal TDG regulations, but no regulatory controls explicitly cover the registration of special waste generators, nor the handling, treatment and disposal of hazardous wastes. In February 1988, the Special Waste Regulation was issued under the WMA. This regulation addresses the handling and transportation of special wastes, and details the waste transfer manifest system to be used, licensing, packaging and identification requirements, and sets out the criteria and test protocols for determining what constitutes a special waste and what materials and quantities are exempt. Additionally, under this Regulation, British Columbia is one of two provinces in Canada with legislation specific to biomedical waste management; biomedical wastes are listed as special wastes.

Other legislation and regulations:

Pesticide Control Act (1979) and Regulation

British Columbia Health Act (1979)
Waste Management Regulation (1983)

YUKON TERRITORY AND NORTHWEST TERRITORIES

No specific territorial legislation exists to govern hazardous waste management. Federal legislation such as the *Fisheries Act*, the *Environmental Contaminants Act*, the *TDG Act* and the *Northland Water Act* are used. The territorial governments are, however, developing environmental legislation and addressing the need for hazardous waste facilities.