



CANADIAN INSTITUTE FOR ENVIRONMENTAL LAW AND POLICY

L'INSTITUT CANADIEN DU DROIT ET DE LA POLITIQUE DE L'ENVIRONNEMENT

Est. 1970

**HAZARDOUS WASTE GENERATION AND MANAGEMENT IN ONTARIO
A PRELIMINARY OVERVIEW**

Prepare by:

Mark S. Winfield, Ph.D
Director of Research

Contract No. KW405-6-1217

CIELAP Shelf:
Winfield, Mark S.; Canadian Institute for
Environmental Law and Policy
Hazardous Waste Generation And Management
in Ontario : A Preliminary Overview

RN 27190

Canadian Institute for Environmental Law and Policy
March 31, 1997

Table of Contents

I.	INTRODUCTION	1
II.	HOUSEHOLD HAZARDOUS WASTES	2
	1) Introduction	2
	2) Household Hazardous Waste Generation	2
	3) Household Hazardous Waste Stream Composition	2
	i) Household Batteries	4
	ii) Vehicle (Lead-Acid) Batteries	6
	iii) Used Oils	6
	iv) Pesticides	6
	4) Household Hazardous Waste Collection Programs	6
	i) Municipal Programs	6
	ii) Industry Sponsored Programs	7
	5) Fate of Materials Collected Through HHW Programs	7
	6) Environmental Impacts of Fate of Collected Materials	9
	i) Automotive Batteries	9
	7) Recent Policy Initiatives	10
	8) Conclusions	10
III.	COMMERCIAL/AGRICULTURAL PESTICIDES	11
	1) Introduction	11
	2) Commercial Pesticides	11
	3) Agricultural Pesticides	11
	4) Pesticide Containers	12
	5) Recent Regulatory Initiatives	12
	6) Conclusions	12
IV.	BIOMEDICAL WASTES	13
	1) Introduction	13
	2) Generation and Composition	13
	3) Disposal/Fate	15
	4) Recent Policy Initiatives	15
	5) Conclusions	16
V.	INDUSTRIAL HAZARDOUS AND LIQUID INDUSTRIAL WASTE	17
	1) Introduction	17
	2) Waste Generation and Composition	17
	3) Fate of Generated Wastes	22
	i) On-Site Disposal	22
	ii) Off-Site Disposal	23
	4) Waste Import/Export	25

5)	Spills	26
6)	Recent Policy Initiatives	26
7)	Conclusions	27
VI.	PCB WASTES	28
1)	Introduction	28
2)	Current Status of PCB De-Commissioning, Storage and Disposal in Ontario	28
3)	Recent Developments	29
4)	Conclusions	29
VII.	CONCLUSIONS	30
	ENDNOTES	31

HAZARDOUS WASTE GENERATION AND MANAGEMENT IN ONTARIO A PRELIMINARY OVERVIEW

I. INTRODUCTION

This report is intended to provide a preliminary overview of the generation, composition, and fate of hazardous and liquid industrial wastes produced by the residential, agricultural, industrial, commercial and institutional sectors in Ontario. In particular, it reviews the available data in the areas of household hazardous waste, waste/banned/de-registered pesticides, biomedical wastes, industrial hazardous and liquid industrial wastes, PCB's and used oil.

The report is limited to the data which could be obtained from publicly accessible sources within the time frame available for the project. In many cases more detailed analysis and research is required. The Institute intends to undertake this work over the next few months, particularly the analysis of the data available through the Ontario Waste Generator and Waste Manifest Databases.

This preliminary review has revealed some very serious gaps in the existing data sources. No data appears to exist at all, for example, regarding the generation and disposal of waste pesticides. Similarly, only crude, and widely varying, estimates exist regarding the generation of household hazardous wastes. No data appears to be available at all regarding trends in HHW generation and waste stream composition.

Serious flaws have also been identified with the data available through the Ontario Waste Generator Database. In fact, according to some estimates, only half of the wastes reported as generated actually exist. At the same time, the Provincial Auditor has identified potential failures to report certain types of waste generation.

The National Pollutant Release Inventory provide some additional data on industrial waste generation. However, as data is only available for two years, it is difficult to identify any trends in the NPRI results. The usefulness of the NPRI data is further compromised by the decision to make the reporting of shipments of NPRI substances off-site for "recycling" voluntary for the 1994 and 1995 reporting years.

Within these limitations, this preliminary review is intended to highlight problem areas for further investigation in the Institute's broader review of hazardous waste management in Ontario.

II. HOUSEHOLD HAZARDOUS WASTES

1) Introduction

Household hazardous waste (HHW) is the residual of products used in the home which are toxic, combustible, explosive, and/or flammable.¹ This includes such materials as waste paints, solvents, pesticides, used motor oil, fuels, batteries and chemicals. Although HHW represents only a small portion of the residential waste stream, it poses significant environmental and human health threats. In addition to the immediate dangers associated with its handling and storage in the home, HHW has been implicated as a major source of toxic components of leachate from landfills.

2) Household Hazardous Waste Generation

Few figures are available regarding the generation of household hazardous wastes in the province of Ontario. The only figure published by the Ministry of Environment and Energy is 20,000 tonnes/yr. This was provided in the Ministry's 1992 Status Report on Ontario's Air, Water and Waste.² This is roughly consistent with an estimate developed in 1990 by the Québec Commission d'enquête sur les déchets dangereux of 2.5kg per person per year.³

However, the MoEE's figure is significantly lower than the 1986 estimate developed for the Ontario Waste Management Corporation of 86,000 tonnes/yr. This included estimates of 17,000 tonnes of paint, 3,170 tonnes of solvents, 40,937 tonnes of used oils, 14,255 tonnes of antifreeze, 5,649 tonnes of pesticides, and 5,490 tonnes of other wastes.⁴

No data or estimates are available regarding trends in household hazardous waste generation. In the absence of any specific information, it may be assumed that generation is stable or increasing slowly as levels of economic activity and population expand.

3) Household Hazardous Waste Stream Composition

A detailed study of the composition of the Ontario household hazardous waste stream was completed by the Association of Municipal Recycling Coordinators (AMRC) in 1996. The study involved household hazardous waste collected by the Region of Peel, the Region of Halton, the Kingston Area Recycling Corporation, Centre and South Hastings Recycling Board, City of Stratford and the Essex-Windsor Solid Waste Authority beginning in May 1995. The results of the AMRC study are outlined in **Table 1**.⁵

Table 1: Ontario HHW Stream Composition (Six Municipalities - 1996)

HHW Category	Percent of Overall Composition	Top 3 Product Types	Top 3 Brand Owners
Paint	40.7%	Latex Paint Alkyd Paint Enamel Paint	Colour Your World (18.7%) St.Clair (12.4%) Sears (8.2%)
Flammables (includes stains, cleaners, driveway sealers, fuel, rust/metal paint, adhesive, paint remover/thinner, liquid plastic).	22.4%	Unknown Stain Cleaners	Unknown (23.6%) Canadian Tire (9.2%) Beaver Lumber (4.5%)
Oils	17.1%	Motor Oil Oil Filters	Unknown (54%) Canadian Tire (21%) Quaker State (12.6%)
Vehicle Batteries	11.4%	N/A	Canadian Tire (30.1%) unknown (24.9%) AC Delco (16.9%)
Gas Cylinders	4.5%	Large Propane Small Propane other	<u>Large Propane</u> unknown (51.5%) Wolfdale Engineering (31.9%) Engineering Products (6.5%) <u>Small Propane</u> Coleman Canada (42.3%) Canadian Tire (30.1%) Unknown (9.3%)

Bases	1.0%	other cleaners wax strippers	Canadian Gypsum (32.3%) unknown (12.0%) Domtar Gypsum (7.2%)
Antifreeze	1.6%	N/A	unknown (47.8%) Canadian Tire (30.7%) First Brands (6.5%)
Pesticides	0.5%	Insecticide Herbicide Other	Unknown (16.2%) S.C. Johnson Wax (11.6%) CIBA-Geigy (9.2%)
Oxidizers	0.5%	Fertilizer Pool Chemicals Disinfectant	Co-op (14.4%) Unknown (12.4%) Olin Corporation (10.9%)
Acids	0.3%	Muriatic Acid other cleaners	unknown (22.6%) Sheffield Bronze Power (9.8%) Ecolab (5.9%)
Pharmaceuticals	0.1%	Prescription Medication Non-Prescription Medication Unknown	N/A
Household Batteries	0.0%	Alkaline Button Nickel-Cadmium	Not recorded.

i) Household Batteries

Household batteries contain a wide range of hazardous materials. These include Mercury, Cadmium, and Nickel, all of which have been placed on the List of Toxic Substances under the *Canadian Environmental Protection Act* (CEPA), or assessed as "toxic" for the purposes of the Act.⁶

The composition of the household battery stream assessed in the AMRC study

was by weight 98.6% alkaline, and 1.4% button, Lithium and Nickel-Cadmium (Ni-Cad) combined.⁷

The only available estimate of numbers of household batteries sold in Canada is 153,000,000 (1992). Composition was estimated at 65% alkaline, 29% carbon zinc, 5% Ni-Cad.⁸ As of 1992, batteries were estimated to account for 35% of the mercury and 33% of the Cadmium in the Municipal Solid Waste Stream.⁹

It was estimated that 6.6 Million Ni-Cad batteries were imported into Canada in 1988. None are manufactured in Canada.¹⁰ It is important to note that sales of Ni-Cad batteries on a cell or pack basis only account for 15% to 20% of total Ni-Cad battery sales. The remaining 80%-85% of the market are units sealed within consumer or industrial products.¹¹ U.S. estimates of total Ni-Cad sales are 300-400 million units/yr.¹² This would suggest sales of 30-40 million units/yr in Canada.

An estimate of the consumer button battery market in the United States is provided in **Table 2**.¹³ No estimates appear to be available for the Canadian market.

Table 2: Consumer Button Battery Market in the United States

Type	Estimated Share of Button Cell Market	Uses
Zinc-Air	60% (increasing)	Hearing Aids
Mercuric Oxide	20%	Hearing Aids, watches, cameras, medical devices
Silver Oxide	5%	Calculators, watches, cameras.
Alkaline & Lithium	15%	cameras, computers, other devices

Mercury use in batteries in the United States is required to be phased out under federal legislation passed in May 1996.¹⁴ The *Mercury Containing and Rechargeable Battery Management Act* also provides for the collection and recycling or disposal of used Ni-Cad batteries, small sealed lead-acid batteries, and certain other batteries.

Canadian trade in mercury cell batteries has decreased from 3 million units in 1990 to 700,000 units in 1995.¹⁵ The Canadian battery industry has made a voluntary commitment to the elimination of Mercury in household batteries by the end of 1996.¹⁶

ii) Vehicle (Lead-Acid) Batteries

A 1991 estimate gives the figure of 7,119,882 lead-acid batteries disguardred in Canada.¹⁷ It is estimated in the U.S. that roughly 80% of all lead consumed today goes into lead acid batteries.¹⁸

iii) Used Oils

To be Developed

iv) Pesticides

It has been noted that small amounts (i.e.<2 kg.) of de-registered or banned pesticides, including DDT and Chlordane have been collected during municipal household hazardous waste collection days.¹⁹

4) Household Hazardous Waste Collection Programs

i) Municipal Programs

The numbers of household hazardous waste collection programs in Ontario has expanded significantly over the last decade. This growth is shown in **Table 3.**²⁰

Table 3: HHW Collection Programs in Ontario

Year	Number of Municipalities Offering Programs	Number of Households Participating	Total HHW collected (Tonnes)
1986	5	1338	34.871
1987	14	2958	100.51
1988	25	4923	188.003
1989	33	19,384	966.326
1990	41	33,505	1,345.821
1991-92	N/A	N/A	>1,200 ²¹

1992-93	83	N/A	1,867.742 (MoEE Funded Programs only)
1993-94	27	N/A	507.891 (MoEE Funded Programs only)
1994-95	23	N/A	294.134 (MoEE funded programs only)
1995-96	43	N/A	483.463 (MoEE funded programs only)

The Ministry of Environment and Energy significantly reduced its funding for municipal HHW programs in its 1993-94 budget. This appears to have resulted in a decline in the number of programs being offered, particularly by smaller municipalities. Provincial funding for municipal HHW programs was eliminated entirely in November 1995. A number of larger municipalities, including Metropolitan Toronto, have operated HHW collection programs without provincial support.

ii) Industry Sponsored Programs

A number industry sectors have initiated programs in Ontario to collect waste products which may become HHW. These include a Home Hardware Pilot Program for paint in City of London for their brand name of paint,²² a voluntary used oil collection program for retailers,²³ voluntary return programs for vehicle batteries by some larger retailers,²⁴ voluntary return to vendor programs for specialized batteries (e.g. Bell Mobility for Nickel-Metal Halide, Ni-Cad and Alkaline).²⁵ Voluntary return to vendor programs for pharmaceuticals have been established in some cases as well.²⁶

5) Fate of Materials Collected Through HHW Programs

Specific information on the fate of materials collected through HHW programs is difficult to obtain, as arrangements for disposal are made by each individual sponsoring municipality. The MoEE prescribes the waste management procedures for the major HHW streams as outlined in **Table 4.**²⁷

Table 4: HHW Disposal Options

HHW Category	Reuse/Recycle Possibilities	Disposal Options
--------------	-----------------------------	------------------

Acids and Bases	None.	Disposal at secure landfill. ²⁸
Oxidizers	None.	Disposal at secure landfill. ²⁹
Solvents	Recycling through distillation possible depending on quantity & number of different solvents collected.	Incineration at licensed facility.
Paint	Reuse, or lab-packed or bulked for recycling. ³⁰	Incineration or use as secondary fuel.
Oil	Can be sent to recycler.	Incineration or use as secondary fuel.
Pesticides	None.	Disposal at secure landfill or incineration. ³¹
Household Batteries	None.	Secure landfill.
Lead-Acid Batteries	Can be sent to recycler. Industry estimates 90% of lead-acid batteries disposed of in Canada are recycled. ³²	Dispose at licenced treatment, storage or disposal facility (TSD) (i.e. landfill).
Aerosols	None.	Dispose at licenced TSD facility.
Propane Cylinders	Can be sent to supplier to shredded	Dispose at licenced TSD facility.
Pharmaceutical Wastes	None.	Secure Landfill or incineration.
Antifreeze	Bulk and send to be re-refined.	
Miscellaneous Chemicals	Unknown.	Dispose at licenced TSD facility.

The Metropolitan Toronto Works Department gives the figures outlined in **Table 5** for the fate of HHW collected in 1995.³³

Table 5: HHW Disposal by Metropolitan Toronto

Material	Method	Volume (Kg)
Paints (Latex and Alkyd/Oil based).	Fuel blending in cement kilns.	85,171
Paints (Latex and Alkyd/Oil based).	Reused/Recycled	329,338
Flammable Materials (e.g. solvents, stains)	Fuel blending/cement kilns	178,368
Motor Oils	Fuels Blending/Re-refining	195,488
Propane Cylinders	Refurbished/Metal Recovery	45,070
Automotive Batteries	Metals and Plastics Recycling/Chemical Treatment	129,789
Antifreeze	Chemical Treatment	13,175

These fates accounted for 76.2% of the HHW collected in 1995 by Metro Toronto. The remainder of the wastes collected were incinerated or landfilled.³⁴

6) Environmental Impacts of Fate of Collected Materials

Significant environmental impacts have been associated with the fate of some materials collected through HHW programs.

i) Automotive Batteries

Serious environmental problems have emerged in relation to Lead-Acid battery recycling operations. There have been incidents of lead contamination documented at all three secondary lead smelter sites in Ontario, the Tonolli Canada facility in Mississauga, Canada Metal Co in Toronto, and the now decommissioned Toronto Refiners and Smelters plant in Toronto.³⁵ There have also been incidents of illegal disposal of sulphuric acid at battery breaking facilities in Ontario.³⁶

No specific information is available on the fate of lead-acid batteries in Ontario in terms of export or the portions of the waste stream received by individual recyclers. This is due to the fact that Lead-Acid battery recycling activities have been granted an "administrative" exemption from requirements of Regulation 347 by MoEE.³⁷ This means that they have not been subject to generator registration and manifesting requirements

or EPA Part V approvals. Consequently, there are no records of the movement of fate of Lead-Acid batteries sent for recycling.

7) Recent Policy Initiatives

MoEE funding assistance for municipal household hazardous waste collection programs was terminated on November 29, 1995. Between 1992-1993 and 1996-96 MoEE grants provided between 22% and 49% (proportion varied year to year) of the funding for municipal HHW programs.³⁸ The impact of this change on municipal programs needs to be investigated.³⁹ It is likely to be particularly severe on small, rural municipalities, which have related heavily on MoEE funding for their HHW collection programs.

In contrast to many U.S. states, and British Columbia, Ontario has relied entirely on voluntary measures by industry, rather than establishing mandatory recycling programs for batteries, paints and other HHW waste stream components. In addition, in July 1996 the Ministry proposed to expand the "administrative" exemption granted to Lead-Acid battery recycling operations from the requirements of Regulation 347 to include other types of batteries.⁴⁰

8) Conclusions

Estimates of waste generation vary by a factor of four, and no data appears to be available regarding trends. It appears however, that only a small portion (<10%) of the household hazardous waste generated in the province is captured by existing municipal programs. Furthermore, the continuation of many HHW programs, particularly in small, rural communities is in serious doubt due to the withdrawal of provincial funding.

III. COMMERCIAL/AGRICULTURAL PESTICIDES

1) Introduction

Information on waste generation and disposal in relation to pesticides in Ontario, particularly with respect to agricultural applications, is extremely limited.

2) Commercial Pesticides

The MoEE indicates that its inspections and surveys indicate that outstanding stocks of banned pesticides identified under the *1994 Canada-Ontario Agreement on the Great Lakes Basin Ecosystem* within commercial distribution and application sectors were collected and disposed of by contract at a secure landfill prior to the provincial regulatory ban in 1994.⁴¹ No other information appears to be available regarding the disposal of other waste pesticides from the commercial distribution and application sector.

3) Agricultural Pesticides

The information available regarding the disposal of de-registered, banned or expired, or otherwise waste pesticides, particularly from agricultural operations, is extremely limited. A province-wide Ontario Waste Agricultural Pesticide Program was conducted by the Ministry of Agriculture and Food in 1991 and 1992 to collect pesticide products with banned ingredients, which had become ineffective due to changing pest populations or inappropriate due to changes in crops, or which had become outdated or unusable. Under the program, farmers could turn in their stocks of such pesticides at one of 29 sites for disposal without charge.⁴²

35,000 kg and 55,000 litres of waste pesticides were collected from the 960 farmers who participated in the program. The substances collected included the banned or de-registered pesticides outlined in **Table 6**.

Table 6: Banned or De-register Pesticides Collected Through the Ontario Waste Agricultural Pesticide Program

Active Ingredient	Quantity Collected (kg)
Aldrin	153.0 kg.
Chlordane	293.3 kg.
DDT	1,189.0 kg.

Dieldrin	69.1 kg.
----------	----------

The only program established to collect de-registered or waste pesticides since the completion of the Waste Agricultural Pesticide Collection Program in 1992 is a single site pilot project set up by Laidlaw Environmental Services Ltd. in London Ontario in August 1995. The site charges \$1.50/kg for dry formulations, and \$2.75/L for liquids.⁴³ Since its opening, the site has collected a total of 180 litres of pesticides, primarily lindane and atrazine, and smaller amounts of other older pesticides from three individuals. There have been no deposits since July 1996.⁴⁴

4) Pesticide Containers

A pesticide container recycling program was established by the Crop Protection Institute, a pesticide industry association, in 1992. The program permits the return of clean (triple rinsed) containers. As of the end of 1995 nearly 1 million empty containers had been collected and recycled. Plastics are recycled into agricultural products such as fence posts, and metal containers are turned into reinforcement bars for use in construction. In 1996, over 150 pesticide vendors participated in the collection of empty pesticide containers from farmers and licenced exterminators.⁴⁵ The container recovery rate for Ontario in 1995 was 62.5%.⁴⁶

5) Recent Regulatory Initiatives

Existing regulations require the burying of empty agricultural pesticide containers. In July 1996, the MoEE proposed amendments to require the recycling of empty pesticide containers.⁴⁷

6) Conclusions

Virtually no information is available on the amounts or fate of waste, expired or de-registered agricultural pesticides in Ontario. The availability of estimates of generation of waste pesticides in the agricultural sector in other provinces is under investigation.

IV. BIOMEDICAL WASTES

1) Introduction

Biomedical wastes are classified as hazardous wastes under Ontario Regulation 374. In particular, "pathological waste" is defined as follows:

- "i) any part of the human body, including tissues and bodily fluids, but excluding fluids, extracted teeth, hair, nailclippings, and the like, that are not infectious,
- ii) any part of the carcass of an animal infected with a communicable disease or suspected by a licenced veterinary practitioner to be infected with a communicable disease, or
- iii) non-anatomical waste infected with a communicable disease."

Interprovincial and international movements of biomedical wastes are regulated under the federal *Transportation of Dangerous Goods Act*.

Biomedical wastes are generally estimated to constitute less than 10% of the total wastes generated by health care facilities in Ontario.⁴⁸ Furthermore, it has been estimated that only 60% of the wastes disposed of as biomedical waste by health care facilities actually require special handling.⁴⁹

2) Generation and Composition

A detailed study on the generation of biomedical wastes in Ontario was completed by Ortech International in December 1992.⁵⁰ It estimated that 14,556 tonnes of waste were disposed of as biomedical waste each year in Ontario. The waste stream composition described in that report is outlined in **Table 7**.

Table 7: Ontario Biomedical Waste Stream Composition

Waste Category	Tonnes/yr	% of Total
----------------	-----------	------------

Biomedical:		
Human Anatomical Waste:	184	
Animal Wastes:	30	
Microbiological Waste:	1,717	
Liquid Blood Waste:	1,388	
Blood Contaminated Biomedical Waste:	981	
Other Body Fluids Waste:	381	
Sharps:	1,966	
Total:	6,650.042	45.5%
Animal Carcasses	1,530	10.5%
Pharmaceuticals	265	2.0%
Continuous: Blood Contaminated (wastes contaminated with blood but not to the degree of being considered biomedical wastes)	421	3.0%
Non-Biomedical	5,690	39.0%
Total	14,556	100%

The definition of biomedical waste used in this study was that proposed by the MoEE in May 1992, based on the February 1992 CCME definition.

The 1992 ORTECH study indicated that Hospitals accounted for the generation of approximately 67% of the biomedical waste in the province.⁵¹ An earlier (1991) Ministry of Environment study suggested that hospitals accounted for 60%, veterinary clinics 14%, medical and research laboratories 13%, doctors' offices 7%, dentists' offices 3%, funeral homes 2% and special homes 1%.⁵²

No data appears to be available regarding trends in waste generation and composition. Generation was thought to have increased significantly in late 1980's and early 1990's due to "universal precautions" adopted in light of AIDS epidemic.⁵³ The generation of biomedical wastes could be expected to increase as the population of the

province grows, and its age profile rises. Further analysis will be conducted on the Ontario Waste Generator and Waste Manifest Databases to determine if any trends with respect to biomedical wastes can be identified.

3) Disposal/Fate

No commercial biomedical waste incinerators exist in Ontario.⁵⁴ The Ministry of Environment and Energy's 1992 Status Report on Ontario's Air, Water and Waste indicates that approximately 60 per cent of Ontario's biomedical wastes are being exported, either to Quebec, or to the United States, for disposal.⁵⁵ In the past serious concerns have been raised regarding the operation of these facilities, particularly in relation to emissions, incomplete incineration of wastes, leaking trucks and the presence of vermin.⁵⁶

In 1991 charges were laid by the Ontario and Quebec Ministries of the Environment against DECOM Group, the major biomedical waste hauler in Ontario. DECOM Group was subsequently purchased by Laidlaw Waste Systems, which is now the only biomedical waste hauler in the province.⁵⁷

The remaining 40% of the biomedical waste generated in Ontario is disposed of in 106 local hospital incinerators around the province.⁵⁸ Ministry of Environment and Energy staff have raised serious concerns regarding the disposal of wastes in hospital incinerators as, with one exception,⁵⁹ these facilities operate without air pollution control systems.⁶⁰ Hospital incinerators operational before December 31, 1985 are exempted from Part V of the *Environmental Protection Act*, permitting them to accept off-site wastes from other hospitals for incineration, in addition to waste generated on site.

It is also important to note that some elements of the biomedical waste stream are not captured in the above figures. The ORTECH study noted, for example, that several sites, such as funeral homes, veterinarians' and coroners' offices and some hospitals reported managing blood disposal by draining it directly to the sewers.⁶¹ There were also reports of sewerage of pharmaceutical wastes.⁶²

4) Recent Policy Initiatives

The Ministry of Environment and Energy proposed new a definition of "biomedical waste" in 1992. This would distinguish between the portion of the waste stream which requires special management, and the portion that can be appropriately managed as municipal solid waste. A proposal for the establishment of new regional facilities for disposal of biomedical waste also released by the Ministry in 1992.⁶³ However, no further action has been taken to taken to date on these initiatives.

In 1993 a proposal was made by Environment Canada for a Biomedical Waste Management Regulation under CEPA, which would apply to all federal facilities. However, no such regulation has been made under the Act to date.

5) Conclusions

There is evidence of continuing serious problems in the area of biomedical waste management, particularly with the disposal of wastes in hospital incinerators which lack any air pollution control equipment. Trends in biomedical waste generation and the fate of wastes shipped out of province for disposal require further investigation.

V. INDUSTRIAL HAZARDOUS AND LIQUID INDUSTRIAL WASTE

1) Introduction

Data on the generation of hazardous and liquid industrial wastes in Ontario is available from several sources. Since 1986 the generators of approximately 300 substances listed in the regulation as hazardous wastes, and "liquid industrial waste" have been required to register with the Ministry of Environment and Energy, and report annually on their waste generation. In addition, movements of wastes classified as hazardous wastes and liquid industrial wastes off the site of their generation for disposal, recycling or reuse are subject to a "manifesting" system to track these movements.⁶⁴

Furthermore, waste generators must report their releases or transfers off-site of 178 designated substances to the federal government under the National Pollutant Release Inventory Program (NPRI).⁶⁵ The data is then made available to the public. In the 1993 reporting year generators were also required to report shipments of NPRI substances off-site for recycling or reuse. However, this requirement was made voluntary for the 1994 reporting year. The federal government has recently proposed to re-establish mandatory reporting of transfers of NPRI substances off-site for recycling.⁶⁶

Finally, under the *Export and Import of Hazardous Wastes Regulations*, made under CEPA in 1992, Canadian exporters of hazardous wastes must obtain prior consent from the receiving country, through Environment Canada, before exporting wastes. In the case of imports, consent must be obtained by the Canadian importer, through Environment Canada, from the receiving province. These requirements are intended to implement Canada's obligations under the *Basel Convention on the Transboundary Movement of Hazardous Wastes*. Section 45 of CEPA requires the publication of notices of proposed exports, imports and transits of hazardous wastes received by Environment Canada.

Some voluntary industry reporting programs are also potential sources of information. However, the leading program sponsored by the federal government, Accelerated Reduction/Elimination of Toxics (ARETS) only requires reporting of releases of substances to the air and water. There are no reporting requirements for transfers of substances off-site for disposal, recycling or reuse.

2) Waste Generation and Composition

The Ministry of Environment and Energy Waste Generator Data Base gives the figures for total waste generation in the period 1986 -1995 Outlined in **Table 8**

Table 8: Hazardous and Liquid Industrial Waste Generation in Ontario

Year	Reported Waste Generation (Tonnes)
1986	3,326,106
1987	4,734,119
1988	5,463,724
1989	5,589,018
1990	4,222,757
1991	4,817,844
1992	
1992	
1993	
1994	
1995	
1996	

However, it is important to note that serious concerns have been raised regarding the reliability of the Waste Generator Database figures. In its decision regarding the Environmental Assessment of the Ontario Waste Management Corporation's (OWMC) proposed hazardous waste treatment and disposal facility, the Joint Board concluded that only between 50% and 60% of the registered wastes reported as generated under the Waste Generator Database actually existed.⁶⁷ For its part, in its 1992 Status Report on Ontario's Air, Water and Waste, the Ministry of Environment and Energy gave a total figure for 1991 of 2 million tonnes a year. This estimate appears to include a correction factor along the lines of that accepted during the OWMC assessment.

More recently, in his 1996 Annual Report, the Provincial Auditor expressed concern over Ministry estimates that over half of the generators registered had never reported any disposal of hazardous wastes. The Ministry was reported as not having any information regarding whether these generators had gone out of business, were no longer producing hazardous waste, were simply not reporting their waste generation, or were disposing of waste illegally.⁶⁸

Given these considerations, it is difficult to draw clear conclusions from the Waste Generator Database data. However, in its decision regarding the OWMC project, the

Environmental Assessment Board accepted an estimate that hazardous and liquid industrial waste generation in the province would increase by approximately 3% per year.⁶⁹ This is consistent with recent conclusions regarding hazardous waste generation in the United States.⁷⁰

Data from the Waste Manifest Database, which is generally regarded as being more reliable than the Generator Database, indicates that the amount of waste being shipped off-site for disposal is increasing. This could also suggest an overall increase in waste generation. These figures are outlined in **Table 9**.

Table 9: Off-Site Hazardous and Liquid Industrial Waste Disposal in Ontario

Receiver type	1993 (Figures in G&M November 24, 1994, citing MoEE Figures)	1995 (MoEE, Distribution of Hazardous & Liquid Industrial Waste in Ontario)
Landfill (Commercial)	90,000	64,473
Private Landfill/Sludge Farm	30,000	42,931
WPCP (Water Pollution Control (Sewage Treatment) Plant)	530,000	481,990
Transfer Station		233,277
Transfer Station & Processing	200,000	285,358
Export	190,000	180,666
Incineration	60,000	54,172
Reclaimer	110,000	69,561

Dust Suppression ⁷¹	55,000	17,310
Total	1,265,000	1,428,874

The rates of waste generation also appear to be related to the overall level of activity in the economy. Ministry figures from the period 1987-1990 show a significant increase in the shipment of wastes off-site for disposal, from 840,000 tonnes in 1986 to 1.5 million tonnes in 1990.⁷² The rate of waste generation then fell off to 1.265 million tonnes by 1993 as economic activity declined.

3) Waste Sources and Composition

In its 1992 Status Report on Ontario's Air, Water and Waste, the Ministry of Environment and Energy provided the estimates outlined in **Table 10** of the composition the hazardous and liquid industrial waste stream in Ontario. The same report indicated that the bulk of the wastes originated with the manufacturing sector (**Table 11**)

Table 10: Hazardous and Liquid Industrial Waste Stream Composition 1992 (MoEE)

Waste Type	Percentage of Total Generation
Salts and Sludges	40%
Alkalines	13%
Acids	10%
Oily Wastes	10%
Solvents and Fuels	8%
Halogenated Substances	5%
Plastics and Resins	4%

Processed Organics	2%
Other Organics	8

Table 11: Waste Generation/Sector (MoEE)

Sector	Percentage of Total
Manufacturing	34%
Transportation	7%
Government	6%
Wholesale trade	6%
Education	5%
Construction	5%
Retail Trade	4%
Utilities	4%
Others (includes forestry, mining, health and social services)	29%

More recent (1995) figures from the MoEE Waste Manifest Database indicated the composition of the off-site waste stream presented in **Table 12**.

Table 12: Wastes Sent Off-site for Disposal - Leading Categories

Waste Class	Description	Total (Tonnes)
149	Landfill Leachates	429,575
254	Transfer Station Oil Wastes	191,468
146	Other Specified Organics	83,559
251	Oil Skimmings and Sludges	70,571
143	Steel Making Residues	66,806

253	Emulsified Oils	66,145
122	Alkaline Waste - other (non-heavy) metals	56,285
252	Waste Oils and Lubricants	55,512
270	Other Specified Organics	48,806
211	Aromatic Solvents	46,198
111	Spent Pickle Liquor	42,877
145	Paint/Pigment/Coating Residues	27,224
121	Alkaline Waste - heavy metals	25,551
212	Aliphatic Solvents	25,361
131	Neutralized Waste - heavy metals	24,337
281	Non-Halogenated Rich Organics	20,856
112	Acid Waste - heavy metals	20,502
Total		1,301,636 (91% of total of 1,428,874)

3) Fate of Generated Wastes

i) On-Site Disposal

In its 1992 Status Report on Ontario's Air, Land and Waste, the Ministry of Environment and Energy estimated that 40% of the hazardous wastes generated in the province were disposed of On-site.⁷³ However, the OWMC Environmental Assessment suggested that a much higher portion of hazardous wastes are disposed of on-site than are shipped off-site, although the OWMC figures do appear to include liquid industrial wastes or registerable solid wastes.⁷⁴

On-site disposal tends to be favoured by larger facilities that generate substantial volumes of waste and can operate disposal facilities cost effectively. Off-site disposal tends to be favoured by smaller companies or small volumes of wastes that require expensive handling facilities.⁷⁵

The fate of hazardous wastes disposed of on-site reported in the OWMC decision for 1991 are outlined in **Table 13**.

Table 13: Fate of Wastes Disposed of On-Site

Method of Disposal	Quantity (Tonnes)	Percentage of Total
Sanitary Sewer	383,300	38%
Water Pollution Control Plant	266,500	27%
Landfill/Landfarm	260,600	26%
Other Treatment	122,600	12%
Incineration	35,800	3.5%
Dust Suppression	1,600	1.6%
Waste-Derived Fuel	100	.1%
Total	1,070,500	100%

The National pollutant Release Inventory includes a smaller number of substances than the Ontario Waste Generator Database. The NPRI figures for 1994 indicate that 46,733 tonnes of NPRI Substances were released directly to Air from Ontario facilities. The leading substances included Xylene (6,305 tonnes), Toluene (5,630 tonnes), Ammonia (4,605 tonnes), Methanal (3,819 tonnes), Methyl Ethyl Ketone (3,497 tonnes), Sulphuric Acid, (2,900 tonnes), Cyclohexane (2,529 tonnes), and Benzene (1,029 tonnes).⁷⁶

4,232 tonnes of NPRI substances were released by Ontario facilities directly to water in 1994. This included 2,865 tonnes of Methanol, 948 tonnes of Ammonia, and 244 tonnes of Sulphuric Acid.⁷⁷ Finally, 5,860 tonnes of NPRI substances were released to land in Ontario in 1994. The leading substances were Managese (1,906 tonnes), Ethylene Glycol (1,282 tonnes), Zinc (965 tonnes) and Copper (912 tonnes).⁷⁸

ii) Off-Site Disposal

The fate of Ontario Waste Manifest System waste sent off-site for disposal is outlined in **Table 9** above. With respect to NPRI substances 27,393 tonnes of NPRI substances were transferred off-site for disposal in Ontario in 1994. The leading types and fates of these substances is outlined in **Table 14**.

Table 14 Off-Site Disposal of NPRI Substances in Ontario (1994)

Disposal Method	Total (Tonnes)	Leading Substances	Percent of Total
Landfill	14,251	<i>bis</i> (2-ethylhexyl) phthalate, Zinc, Managese.	52%
Incineration	4,147	Toluene, Xylene.	15%
Chemical Treatment	1,153	Managese, Sulphuric Acid.	12%
Physical Treatment	2,544	Zinc, Lead, Toluene.	9%
Sewage Treatment Plants	1,613	Hydrochloric Acid, Ethylene Glycol, Sulphuric Acid	6%
Underground Injection	810	Sulphuric Acid	3%
Biological Treatment	590	Ethylene Glycol	2%
Storage	284	Hydrochloric Acid, Xylene, Toluene.	1%
Total	27,393		100%

In addition, in 1994 112,755 tonnes of NPRI substances were sent off-site for recycling or reuse. This included 36,000 tonnes of Managese (and its compounds), 20,000 tonnes of di-*n*-octyl phthalate, 10,000 tonnes of Lead, nearly 10,000 tonnes of Copper, and 8,700 tonnes of Sulphuric Acid.⁷⁹

In the same year, 1,471 tonnes of NPRI substances were sent to energy recovery. This included 533 tonnes of Xylene, 262 tonnes of Toluene, 104 tonnes of Methyl ethyl Ketone, and 101 tonnes of Isopropyl Alcohol.⁸⁰

Ontario has only one hazardous waste incineration facility, operated by Laidlaw Environmental Services in Sarnia Ontario. However, the facility cannot handle solids, sludges, or chlorinated organic chemicals, which the Ministry of Environment and Energy has noted make up an increasing portion of the hazardous waste stream.⁸¹ The Laidlaw facility also includes Ontario's only commercial landfill authorized to handle hazardous and solidified liquid industrial wastes.

In its November 1994 decision, the Joint Board concluded that by 1996 there would be between 75,000 and 89,000 tonnes of hazardous wastes generated in Ontario for which adequate treatment and disposal options did not exist.⁸²

4) Waste Import/Export

The Ministry of Environment and Energy's 1992 Status Report on Ontario's Air Water and Waste, noted that between 1987 and 1992 the portion of Ontario hazardous and liquid industrial waste being exported for disposal rose significantly, from 5% to 17% or 166,000 tonnes. Approximately one third of this total was waste oil exported to processors and reclaimers. The remainder was largely chlorinated organic wastes, organic sludges, and other wastes for which Ontario has no disposal facilities.⁸³

The upward trend in Ontario waste exports appears to be continuing, peaking at 190,000 tonnes in 1993, and falling back slightly to 180,000 tonnes in 1995, as shown in **Table 9**. Environment Canada's figures for 1991 and 1994, the most recent year for which statistics are available, appear to confirm this trend.⁸⁴

With respect to imports, the Ministry's 1992 report indicated a slight decline in imports. Approximately half of Ontario's hazardous and liquid industrial waste imports are reported as coming from the U.S., and the remainder from other provinces. 54% of the import total for 1992 was waste oil destined for recycling.⁸⁵ However, Environment Canada's figures, provided in **Table 16**, suggest a significant increase in imports between 1991 and 1994, the most recent year for which statistics are available.⁸⁶ Surprisingly, the Environment Canada figures are reported as being based on figures provided by the province.

Table 15: Ontario Hazardous Waste Exports to Other Jurisdictions

Year	Exports to Other Provinces	Exports to Other Countries	Total
1991	20,490	133,177	153,667
1994	43,065	118,853	161,918

Table 16: Ontario Hazardous Waste Imports from Other Jurisdictions

Year	Imports from Other Provinces	Imports from Other Countries	Total
1991	119,850	52,510	172,360
1994	84,258	129,188	213,446

5) Spills

Number of spills of hazardous materials reported to the Ministry of Environment and Energy is reported to have been "roughly static," at a rate of 5,000/yr over the period 1990-1995, the most recent period for which statistics are available.⁸⁷ The Ministry has been reported as stating that 69% of spills are significant enough to have either a possible or confirmed impact on the environment.⁸⁸

6) Recent Policy Initiatives

In July 1996, the Ministry of Environment and Energy released a series of proposal for the reform of environmental regulation in the province.⁸⁹ Hazardous and Liquid Industrial Waste management was the area most heavily affected by the Ministry's proposals. The Ministry's proposals included the following measures:

- * the complete de-regulation of activities related to the handling of "recyclable materials," including hazardous wastes such as batteries, photochemical wastes, and metal bearing sludges. This is despite the province's long history of illegal solid and hazardous waste disposal activities operated under the guise of "recycling."
- * the removal of "liquid industrial wastes" from the province's definition of "subject" (i.e. hazardous) wastes; and
- * the weakening of Ministry oversight on the establishment and operation of on-site hazardous waste storage sites and hazardous waste transfer stations, the burning of hazardous wastes as "fuel," and the use of hazardous and liquid industrial wastes for dust suppression.⁹⁰

Many of these proposals were subsequently reiterated by the province's "Red Tape Review Commission" in its January 1997 report.⁹¹ As of March 1997, none the government's proposals for the "reform" of the regulation of hazardous and liquid industrial waste management had been implemented. However, major reductions in the budgetary and personnel resources have raised serious questions regarding the

province's capacity to enforce the existing regulatory framework.⁹²

7) Conclusions

It is difficult to draw clear conclusions regarding the status of hazardous and liquid industrial waste generation and disposal in Ontario, given the unreliability of some of the key data sources, particularly the Ontario Waste Generator Database, and the incompatibility of definitions and scope of reporting requirements under different programs, such as the NPRI and the *CEPA Hazardous Waste/Import Export Regulations*.

The information available regarding on-site disposal practices and trends is especially difficult to obtain. The NPRI provides some indications of the fate of wastes, but it does not cover all substances or sources in Ontario Waste Generator System.

It can be concluded that at least two million tonnes of hazardous and liquid industrial waste continue to be generated within the province each year. There is also evidence of a gradual upward trend in waste generation. There is certainly no basis on which it could be concluded that hazardous and liquid industrial waste generation is declining.

Transboundary traffic, both in terms of imports and exports of hazardous wastes appears to be increasing, as well. Exports to other provinces, and imports of waste from other countries have shown particular growth. Imports from other provinces, on the other hand, appear to have declined significantly.

No significant changes appear to be emerging in terms of the rates of spills of hazardous and liquid industrial wastes. These remain stable at a rate of approximately 5,000 per year. The Ministry has stated that 69% of spills have the potential to have a significant impact on the environment.

VI. PCB WASTES

1) Introduction

PCBs are synthetic chlorinated compounds that were used in electrical and heat transfer equipment since the 1930's. In the 1960's and 70's scientific evidence emerged that PCB's were harmful to human health and toxic to some aquatic species, accumulated in animal tissues, and were persistent in the environment.⁹³ More recently, PCB's have been associated with the disruption of endocrine systems in humans and animals.⁹⁴

The manufacture, importation and most non-electrical uses of PCB's were banned in Canada in 1977 through regulations made under the federal *Environmental Contaminants Act*. These regulations were subsequently amended to prohibit the use of PCB's as a constituent of prescribed electrical equipment manufactured or imported into Canada after July 1, 1980. The sale of any type of equipment containing greater than 50 parts per million by weight of PCBs waste was banned in 1985.⁹⁵

In 1990, PCB waste export regulations were made under the *Canadian Environmental Protection Act (CEPA)* prohibiting the export on any PCB waste, except to the United States, where there is a requirement for the prior consent of the United States Environmental Protection Agency. Regulations governing the storage of PCB's were made under CEPA in 1992.⁹⁶ Both regulations followed Interim Orders issued in 1988 after a fire at a PCB storage site in Quebec.⁹⁷

2) Current Status of PCB De-Commissioning, Storage and Disposal in Ontario

Ontario has lacked adequate destruction facilities for PCB's, and the United States banned the import of PCB's in 1982. Consequently, since the early 1980's, growing amounts of PCBs have been held in storage in the province as electrical and other equipment containing PCBs reached the end of its service life. As of April 1995,⁹⁸ the Ministry of Environment and Energy reported that there were 1,723 active PCB storage sites in Ontario, containing 13,360.655 tonnes of high level PCB's⁹⁹ and 92,859.146 tonnes of low level PCBs.¹⁰⁰

The low level (<1000 ppm) PCB's in storage included 80,000 tonnes of soil, 9,000 tonnes of soil in 23,087 drums, 2,400 tonnes of bulk liquids, 720 tonnes of other materials in 5,002 drums, 186 tonnes of liquid in 2,875 transformers, 103 tonnes of other materials not in drums.¹⁰¹ All of these wastes are stored on the property of their owners, as there are no approved commercial storage sites in the province.¹⁰²

More recently, a November 1996 report under the *Canada-Ontario Agreement on The Great Lakes Ecosystem* gives a total baseline estimate of 144,200 tonnes of PCB's in the province, consisting of 29,200 tonnes of high level PCB's in service or storage, and

115,000 tonnes of low level PCB's in storage.¹⁰³ The total amounts of PCB's requiring destruction is expected to rise as old transformers and other equipment and materials containing PCB's are taken out of service.¹⁰⁴

As of December 31, 1995, 42% of high level PCBs in service had been decommissioned and 7% of a baseline total of 18,600 tonnes of high level PCB's in storage, largely through shipment to the Alberta Special Waste Management Corporation facility at Swan Hills Alberta.¹⁰⁵ In addition, 15% of the low-level PCB's in storage had been destroyed,¹⁰⁶ largely by mobile incinerators, although some have been shipped to the Swan Hills facility for destruction as well.¹⁰⁷

3) Recent Developments

In October 1995, the United States instituted an interim relaxation of its ban on PCB imports. This was followed by a permanent amendment in March 1996. In response, in November 1995 the federal Minister of the Environment made an Interim Order under the CEPA prohibiting PCB waste exports to the United States. This Interim Order was extended in February 1996.¹⁰⁸ However, it was withdrawn in February 1997, and replaced with a regulation permitting exports for incineration or chemical destruction.¹⁰⁹

In the meantime, a mobile PCB destruction process developed by Eli Eco Logic International was approved for use in the destruction of both high and low level PCB wastes by the Ontario Environmental Assessment Board in November 1996.¹¹⁰

In July 1996, the Ministry proposed a number of changes to the regulatory framework for PCB's. These included eliminating requirements for mandatory public hearings prior to the approval of non-incineration mobile PCB waste destruction systems and sites, place approvals for PCB consolidation and transfer sites on a "permit by rule" system, and eliminate certain categories of PCB's from the current Ontario definition.¹¹¹ As of March 1997, none of these proposals had been implemented.

4) Conclusions

The export of PCB wastes to the U.S. and Alberta for destruction can be expected to increase in light of the removal of the CEPA PCB Interim Export order and the opening the Alberta boarder to out of province wastes. However, serious concerns remain regarding the adequacy and safety of the Swan Hills facility¹¹² and many U.S. facilities. Concerns have also been raised regarding the risks associated with the long-distance transport of PCB's.¹¹³

VII. CONCLUSIONS

The quality of information available regarding hazardous waste generation and disposal in Ontario is mixed. With respect to household hazardous waste, estimates of waste generation vary by a factor of four, and no data appears to be available regarding trends. It appears however that, at best, only a small portion (<10%) of the household hazardous waste generated in the province is captured by existing municipal programs. Furthermore, the continuation of many HHW programs, particularly in small, rural communities, is in serious doubt due to the withdrawal of provincial funding.

No data appears to exist at all regarding the presence, generation or disposal of waste or banned agricultural pesticides. Programs to collect such pesticides are virtually non-existent.

There is evidence of continuing serious problems in the area of biomedical waste management, particularly with the disposal of wastes in hospital incinerators which lack any air pollution control equipment.

The situation with respect to industrial hazardous and liquid waste management is difficult to assess due to the poor quality of much of the available data and the incompatibility of different reporting programs. However, it is apparent at least 2 million tonnes of hazardous and liquid industrial waste are generated in Ontario each year. There is also evidence that the total amount of waste generated is rising slowly. There continues to be an upwards trend in both the import and export of hazardous wastes from Ontario as well.

Very little data is available regarding the types of waste disposed of on-site. There continue to be significant releases to municipal sewer systems, and direct discharges to air and water. In its November 1994 decision regarding the OWMC, the Joint Board concluded that there are between 75,000 and 89,000 tonnes of waste currently being managed on and off-site for which adequate disposal facilities did not exist.

Progress is beginning to be made on the destruction of PCB wastes in storage in Ontario, both as a result of the approval of new destruction technologies in Ontario, and the availability of the possibility of export to the United States and Alberta. However, serious concerns have been raised regarding the adequacy and safety of the disposal facilities at both export destinations.

The Institute will be undertaking further investigations of the available data in these areas over the next few months.

ENDNOTES

1. Association of Municipal Recycling Coordinators, Analysis of Household Hazardous Waste: Reduction and Management Study Project Two: Municipal HHW Composition, Cost Analysis & Management Options Study/Final Report (Guelph: AMRC and National Household Hazardous Waste Task Force, February 1996), pg.1.
2. Ministry of Environment and Energy, 1992 Status Report on Ontario's Air, Water and Waste (Toronto: MoEE, unpublished, released to the public in January 1997), p.91.
3. Cited in Environment Canada, The State of Canada's Environment, (Ottawa: Supply and Services Canada, 1991) pg.25-16.
4. Report on Special Waste Generation by the Non-Industrial Sector in Ontario (Toronto: Ontario Waste Management Corporation, 1988), Table 1.
5. Association of Municipal Recycling Coordinators (AMRC) Analysis of Household Hazardous Waste: Reduction & Management Study Project Two: Municipal HHW Composition, Cost Analysis & Management Options Study/Final Report (Guelph: Association of Municipal Recycling Coordinators, February 1996), Table 7a.
6. Environment Canada and Health Canada, Canadian Environmental Protection Act Priority Substances List Assessment Report: Cadmium and its Compounds, (Ottawa: Government of Canada, 1994) and Environment Canada and Health Canada, Canadian Environmental Protection Act: Priority Substances List Assessment Report: Nickel and Its Compounds (Ottawa, Government of Canada, 1994).
7. AMRC, Municipal HHW Composition, Cost Analysis & Management Options Study: Final Report, Table 4.2.k.
8. Recycling Council of Ontario (RCO), Fact Sheet on Household Batteries July 30, 1992.
9. Ibid.
10. Environment Canada and Health Canada, CEPA PSL Assessment Report: Cadmium and its Compounds, pg.6.
11. S.Cohen "Recycling nickel-cadmium batteries," Resource Recycling, April 1993.
12. Ibid.
13. N.Reutlinger and Dan de Grassi, "Household battery recycling: numerous obstacles, few solutions," Resource Recycling, April 1991.
14. Mercury-Containing and Rechargeable Battery Act (Pub. L. No. 104-142, 110 Stat. 1329)

15. North American Task Force on Mercury Draft North American Regional Action Plan on Mercury (Ottawa, Washington, Mexico City, North American Commission for Environmental Cooperation, September 1996), pg.6.

16. Ibid.

17. RCO, Fact Sheet on Automotive Batteries, August 20, 1992.

18. S. Apotheker, "Get the Lead Out," Resource Recycling (April 1991).

19. The Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem, 1994: Stream 2 Progress Report (July 1995-August 1996) (Toronto: Environment Canada and Ontario Ministry of Environment and Energy, November 1996) pg.43.

20. MoEE, Household Hazardous Waste Collection Programs in Ontario for 1987-1990 and MoEE HHW Collection Program Summaries 1992-93 - 1995-96.

21. MoEE, 1992 Status Report on Ontario's Air, Water and Waste, pg.91.

22. AMRC, Analysis of HHW: Composition & Management Study, pg.59.

23. Ibid., pg.66.

24. Ibid., pg.80.

25. Ibid., pg.82.

26. Ibid., pg.85.

27. Ministry of Environment and Energy, Household Hazardous Waste Collection and Facility Guidelines, (May 1993) Table 5-1.

28. AMRC, Analysis of HHW: Composition and Management Study, pp.68 and 72.

29. Ibid., pp.68 and 72.

30. Ibid., pg.59. See also figure 4.2.b.

31. Ibid., pg.78.

32. RCO, Fact Sheet on Automotive Batteries, August 20, 1992. This is consistent with figures for U.S. given in Apotheker, "Get the Lead Out," Resource Recycling, April 1991.

33. Metroworks, Household Hazardous Waste Program Operations Summary From 1991 to 1995 Table 8.2.

34. Ibid.

- 35.RCO, Fact Sheet on Automotive Batteries, August 20, 1992.
- 36.See, for example, *R.v.Erie Battery Inc.*, 1992 (MoEE file #91-0304).
- 37.MoEE, Responsive Environmental Protection: Technical Annex (Toronto: MoEE, August 1996), pg.77.
- 38.MoEE, HHW Collection Program Summaries 1992-93 - 1995-96.
- 39.NOTE: CONTACT AMRC HHW Coordinator (Heather Kepran) Re: Impact of Program Termination on HHW Programs (Tel: 1-519-823-1990)**
- 40.MoEE, Responsive Environmental Protection: Technical Annex.
- 41.COA Stream 2 Progress Report (July-August 1996), pg.43. The substances in question were Aldrin,/Dieldrin, Chlordane, DDT, MIREX and Toxaphene.
- 42.MoEE, Ontario Waste Pesticide Program.
- 43.Personal communication Doug Marrow, Environment Canada, Ontario Region, London Office, March 5, 1997.
- 44.Personal communication, Mark Rombough, Site Manager, London Transfer Station, Laidlaw Environmental Services, March 5, 1997.
- 45.MoEE, Responsive Environmental Protection: Technical Annex, pg.57.
- 46.Container Management Program: 1995 Report (Etobicoke, Crop Protection Institute, May 31, 1996).
- 47.MoEE, Responsive Environmental Protection: Technical Annex.
- 48.G.Kirby, ed., Protecting Community Health: 3R's solutions to Health Care Waste (Toronto: Recycling Council of Ontario, May 1992).pg.xi.
- 49.Ellen Mead and Bill Longley, Evaluation of Quantities of Biomedical Waste Generated in Ontario (Mississauga: ORTECH, December 1992).
- 50.Ibid.
- 51.Ibid., pg.1.
- 52.Waste Management Branch, Biomedical Waste Generation, Treatment and Disposal (Toronto: Ministry of the Environment, 1991). An earlier Proctor and Redfern study suggested that hospitals accounted for 46% of waste generation, laboratories 24%, animal care 16.8%, dentists's offices 4.6%, doctors' offices, 3.5%, long-term care 2.2%,

funeral homes 1.3% and home care 1.2%. P.Moon, "Misconception fuels crisis," Globe and Mail, June 15, 1990.

53.Moon, "Misconception fuels crisis."

54.ORTECH, Biomedical Waste Generation in Ontario, pg.6.

55.MoEE, 1992 Status Report, pg. 89.

56.See, for example, P.Moon, "Volume of medical waste grows as options for disposal shrink," The Globe and Mail, June 14, 1990.

57.See P.Moon, "Biomedical waste facility raided," The Globe and Mail June 22, 1990. See also Globe and Mail, September 7, 1991.

58.MoEE, Backgrounder: Biomedical Waste Management in Ontario, June 1992.

59.The Royal Victoria Hospital in London, Ontario.

60.MoEE, Backgrounder: Biomedical Waste Management in Ontario. See also MoEE Regulation Review: Regulation 347 - General Waste Management, Existing Hospital Incinerators, Sections 1 and 29 and ORTECH, Evaluation of Quantities of Biomedical Waste Generated in Ontario, pg.6.

61.ORTECH, Biomedical Waste Generation Study, pgs. 65 and 70.

62.Ibid., pg.73.

63.A Strategy for the Development of New Biomedical Waste Management Facilities in Ontario (Toronto: Ministry of Environment and Ministry of Health, June 1992).

64.For a detailed history of the development of the waste "manifesting" system in Ontario see M.Winfield, The Ultimate Horizontal Issue: Environmental Politics and Policy in Ontario and Alberta: 1970-1992 (Toronto: Ph.D. Thesis, Department of Political Science, University of Toronto, 1992), esp. Ch. II, III and IV.

65.For a brief summary of the NPRI see Industrial Releases Within the Great Lakes Basin: An Evaluation of NPRI and TRI Data (Toronto: Environment Canada, November 1995), pp.3-5.

66.National Office of Pollution Prevention, Proposed Modifications to the National Pollutant Release Inventory (NPRI): Outcome of Stakeholder Consultations and Environment Canada's Proposed Response (Ottawa: Environment Canada, November 1994).

67.Joint Board, Ontario Waste Management Corporation Applications: Reasons for Decision and Decision (Toronto, November 1994), esp.Ch.3.

68. Office of the Provincial Auditor, 1996 Annual Report (Toronto: Queen's Printer, October 1996), pg.120.

69. Joint Board, OWMC Reasons of Decision and Decision, pg.3-51 - 3-52.

70. Working Notes on Community Right to Know (U.S.PIRG), January-February 1997, citing New Jersey Department of Environmental Protection, Industrial Pollution Prevention Trends in New Jersey.

71. The use of used oil for dust suppression in Ontario was banned in 1992. The materials currently disposed of through use for dust suppression include ammonium lignosulphonate, spent pulping liquor sodium carbonate) and "line flush" or "line wash" oils from petroleum refineries. CH2M HILL ENGINEERING LTD. A Study of Dust Suppressants in Ontario (Volume 3) (Toronto: Ministry of Environment and Energy, August 1993).

72. MoEE, 1992 Status Report on Ontario's Air, Land and Waste, pg.89.

73. Ibid., pg.87.

74. Joint Board, OWMC Decision, pg.3-25.

75. MoEE, 1992 Status Report, pg.87.

76. 1994 NPRI Summary Report, Table 38.

77. Ibid.

78. Ibid.

79. Ibid., Table 40.

80. Ibid., Table 41.

81. MoEE, 1992 Status Report, pg. 89.

82. Joint Board, OWMC Decision, pp. 3-42 and 3-52.

83. MoEE, 1992 Status Report, pg.90.

84. Office of Waste Management, Movements of Hazardous Waste International and Interprovincial Annual Report 1991 (Ottawa: Environment Canada, April 1992) and Office of Waste Management, Movements of Hazardous Waste International and Interprovincial Annual Report 1994 (Ottawa: Environment Canada, 1995).

85. MoEE, 1992 Status Report, pg.90.

86. Office of Waste Management, Movements of Hazardous Waste International and Interprovincial Annual Report 1991 and Office of Waste Management, Movements of Hazardous Waste International and Interprovincial Annual Report 1994.

87. Canada Ontario Agreement Respecting the Great Lakes Basin Ecosystem 1994: Stream 2 Progress Report (Toronto: Environment Canada, MoEE, November 1996), pg.30.

88. "No Progress on Spills," The Globe and Mail, March 27, 1997.

89. Responsive Environmental Protection: A Consultation Paper (Toronto: Ministry of Environment and Energy, July 1996).

90. For a detailed review of these proposals, see M. Winfield and G. Jenish, Comments on Responsive Environmental Protection (Toronto: Canadian Institute for Environmental Law and Policy, October 1996).

91. Red Tape Review Commission, Cutting Red Tape Barriers to Jobs and Better Government: Final Report of the Red Tape Commission (Toronto: Cabinet Office, January 1997).

92. See, for example, Nothing Left to Cut: A Field Report on the Activities of the Ontario Ministry of Environment and Energy (Toronto: Ontario Public Service Employees Union, January 1997).

93. Environmental Protection Regulatory Review Discussion Document (Ottawa: Environment Canada, November 1993), pg.83.

94. For an overview of this issue, see T. Colbourn, D. Dumanoski, J. Peterson Myers, Our Stolen Future (New York: Penguin Books, 1996).

95. Environment Canada, Regulatory Review Discussion Document, pp.83-84.

96. Ibid., pp.83-84.

97. CP and Staff, "Toxic fire forces 3,000 from homes," The Globe and Mail, August 25, 1988.

98. Ontario Inventory of PCB Storage Sites (Toronto: Ministry of Environment and Energy, October 1995), pg.29.

99. Defined as waste materials with >10,000 ppm PCBs.

100. Defined as 50-10,000 ppm PCBs.

101. MoEE Quantities of Low Level (<1000 ppm) PCB's Stored in Ontario (1995).

102. MoEE, 1992 Status Report on Ontario's Air, Land and Water, pg.90.
103. COA Stream 2 Progress Report (July 1995 - August 1996), pg.22.
104. MoEE, 1992 Status Report on Ontario's Air, Land and Water, pg.90.
105. The Alberta facility has been permitted to receive wastes from outside of Alberta since February 1995. COA Stream 2 Progress Report (November 1996), pg.25.
106. COA Stream 2 Progress Report, November 1996, pg.23.
107. COA Stream 2 Progress Report (November 1996), pg. 15.
108. "Ban on PCB waste exports extended," The Globe and Mail, February 28, 1996.
109. COA Stream 2 Report (November 1996), pg.25, and CP, "PCB-export ban lifted," The Globe and Mail, February 7, 1997.
110. Environmental Assessment Board General Electric Canada Inc./Eli Eco Logic International Inc.: Destroying and Decontaminating PCB Waste Using ECO LOGIC's Mobile PCB Destructor/Reasons for Decision and Decision (Toronto: Environmental Assessment Board, November 25, 1996).
111. Responsive Environmental Protection: Technical Annex. See also, Winfield and Jenish, Comments on Responsive Environmental Protection.
112. See, for example, B.Laghi, "Toxic leak near hunting grounds brings charges," The Globe and Mail, December 21, 1996.
113. D.Westell, "Trans-Canada faces more toxic traffic," The Globe and Mail November 24, 1994.