

A PROFILE OF 2,4-D USE AND EXPOSURE IN ONTARIO

Presented to:

THE ONTARIO MINISTRY OF THE ENVIRONMENT

Presented by:

DELOITTE HASKINS & SELLS
Guelph, Ontario

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Abstract

Report details the number and type of applicators of 2,4-D in Ontario, and all uses including volumes, formulations and locations. Details of applicators include estimates of exposure to the users and bystanders and use of protective equipment.

Report also covers alternative weed control processes to use of 2,4-D including other chemicals and mechanical and cultural techniques, their costs and comparative efficacy, as well as estimates of all short and long term primary and secondary impacts resulting from withdrawal of 2,4-D.

Sommaire

Le présent rapport traite des utilisateurs de l'herbicide 2,4-D en Ontario et des usages qui en sont faits, en précisant le volume, la formulation et le lieu d'application. Dans chaque cas, on évalue dans quelle mesure les utilisateurs et autres sont exposés au produit et dans quelle proportion ils portent des vêtements protecteurs. Par ailleurs, les auteurs se penchent sur les méthodes de désherbage qui n'emploient pas le 2,4-D, y compris les autres substances chimiques et les techniques mécaniques ou de culture. Ils comparent le coût et l'efficacité de ces méthodes et évaluent les effets primaires et secondaires à court terme et à long terme qu'entraînerait le retrait du 2,4-D.

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1.0 INTRODUCTION

Herbicides are used in significant quantities throughout the world to reduce weed competition in a variety of end uses. One family of herbicides most commonly used in Canada for these purposes is known as phenoxy herbicides, of which 2,4-D (2,4-dichlorophenoxyacetic acid) is most predominant.

2,4-D was discovered during World War II and found to be effective and selective at very low rates of application in controlling broadleaf weeds. Commercial formulations of 2,4-D may be combined with other herbicides (i.e. dicamba, mecoprop, or picloram) in final commercial products or applied alone.

The Pest Control Products Act (1978) has listed over two hundred 2,4-D products registered for use in Canada. Currently, they include three major composition categories as either manufacturing-use products or end-use products:

- (1) 2,4-D present as an acid
- (2) 2,4-D present as an amine salt
- (3) 2,4-D present as a low-volatile ester

Although no comprehensive published statistics on current 2,4-D use in Canada are available, it is known that 2,4-D is used:

- (1) extensively in cereal production, particularly in Western Canada for broadleaf weed control;
- (2) in forestry silvicultural programs;
- (3) along roadsides and ditchbanks to eliminate sources of weed reinfestation and to facilitate drainage / waterflow;
- (4) along hydro and pipeline corridors;
- (5) in cemeteries and turfs;
- (6) in recreational areas applied by municipalities, institutions, industry and federal/provincial governments; and
- (7) in residential landscapes by homeowners and commercial lawn care companies.

Some published data exists which indicates the areas treated and quantities of 2,4-D (active ingredient) used in Ontario agriculture and along roadsides (Roller, 1978¹, McGee, 1983²). Specifically, in 1978, approximately 160 tonnes of 2,4-D (alone and in mixtures) were applied on 311,000 hectares of crop land. In 1983, approximately 184 tonnes of 2,4-D were

applied on 220,000 hectares of crop land and 30,620 hectares of roadsides in Ontario.

With the mounting concerns about the health and safety of 2,4-D, the Ontario Ministry of the Environment recently appointed an expert panel to assess all information regarding its health effects. However, considerable use and exposure data was unknown. Consequently, Deloitte Haskins & Sells was contracted to gather supporting information for the panel including a quantitative assessment of the usage and exposure to 2,4-D.

1.1 OBJECTIVES

- 1) To estimate the volumes of each type of 2,4-D product (or any product containing 2,4-D such as fertilizers) sold in Ontario; the number of people exposed during the formulation, packaging and transportation steps and the number of person days involved in each step.

- 2) To estimate the volumes of each type of 2,4-D formulation applied in Ontario in 1986; the rates of application, location, and area treated, for each use including:
 - ▶ agricultural cereal production
 - ▶ forestry silvicultural programs
 - ▶ roadsides, powerlines, and pipelines
 - ▶ recreational areas
 - ▶ cemeteries
 - ▶ turf/nursery sod operations
 - ▶ aquatic areas
 - ▶ residential landscapes

¹ Roller, N. 1978. Survey of Pesticide Use in Ontario, 1978. Ontario Ministry of Agriculture and Food (OMAF). Toronto, Ontario.

² McGee, 3.1983. Survey of Pesticide Use in Ontario, 1983. Ontario Ministry of Agriculture & Food (OMAF). Toronto, Ontario.

- 3) To estimate the number of each kind of herbicide applicators (farmers, commercial applicators, homeowners, etc); the magnitude of exposure (type of application equipment, rates of application, and number of days during which herbicide is applied), the extent to which personal protective clothing and devices are used for each of the end uses outlined in 2) above.
- 4) To estimate the number of bystanders present during herbicide applications for each of the end uses outlined in 2) above.
- 5) To list and describe the available federally registered and provincially classified alternatives to 2,4-D; their costs and comparative efficacy, for each of the end uses outlined in 2) above.
- 6) To estimate in qualitative terms only, significant primary and secondary economic impacts of 2,4-D for each of the end uses outlined in 2) above, where possible.

1.2 SOURCES OF INFORMATION

Numerous sources of information were used to complete this study. They included, but were not limited to the following:

- a) Agricultural chemical manufacturers, formulators and distributors.
- b) Impregnated fertilizer manufacturers and distributors, (i.e. fertilizers impregnated with herbicide).
- c) Retailers of herbicide products and impregnated fertilizer.
- d) Cereal producers in Ontario.
- e) Ministry of Natural Resource forestry districts and private forestry companies in Ontario.
- f) Commercial lawn maintenance companies.
- g) Utility companies which control vegetation along rights-of-way and other areas.

- h) Counties, townships, cities and towns.
- i) Various provincial Ministries which either apply 2,4-D products and/or monitor and regulate their use.

2.0 Total Volume of 2,4-D (Kg ai) Sold in Ontario in 1986; and Manufacturer/ Formulator/ Distributor / Retailer Impacts

Thirty-three manufacturers, formulators, distributors and/or retailers representing the trade of 2,4-D products in Ontario were surveyed for the following information:

1. Total volume of 2,4-D products sold in Ontario in 1986;
2. End use for all 2,4-D products sold in 1986;
3. Estimates of worker exposure to 2,4-D during all phases of manufacture, distribution, transportation, and retailing in 1986; and
4. Qualitative assessments of the economic impact(s) if 2,4-D was removed from the Ontario market in 1987.

Following are the results of this survey:

2.1 Total Volume Of 2,4-D (Kg ai) Sold In Ontario In 1986

Approximately 532 thousand kilograms of 2,4-D active ingredient (ai) were sold in Ontario in 1986 (Table 2.1). Agricultural uses of 2,4-D accounted for the largest share estimated at 180 thousand Kg ai, closely followed by commercial applicators (including agriculture, rights-of-way, forestry and residential lawns) and home and garden, estimated at 108 thousand and 98 thousand Kg ai, respectively. All other end uses accounted for only a minor share of total 2,4-D sales in 1986.

Approximately 185 thousand Kg ai (35% of total volume sold in 1986) were sold to end users via distributors, 119,268 Kg ai (23%) via agricultural retailers, and 228 thousand Kg ai (42%) via other channels, including direct sales and retail outlets.

TABLE 2.1 Total Volume of 2,4-D Sold In Ontario in 1986 (kg ai).

		%
County Boards Of Education	1694	1.3
Cities	4460	0.8
Towns	2920	0.5
Counties/ Regions	11841	2.2
Townships	6561	1.2
Ontario Provincial Ministries	54264	10.2
Federal Agencies/ Departments	1040	0.2
Forestry And Timber Companies	10120	1.9
Utilities/ Rights Of Way	39237	7.4
Agriculture	179566	33.8
Commercial Applicators ¹	107840	20.3
Institutions	740	0.1
Golf Courses	4540	0.9
Turf/ Sod Operations ¹	9533	1.8
Home And Garden ²	97546	18.4
Total Volume Sold In 1986	531902	100

¹ contains product used in many other end use areas, such as: golf courses; along rights-of-way; provincial ministries; and commercially applied home use.

² volumes listed here may find use in cities, towns, townships and institutions for non-home and garden use.

SOURCE: Deloitte Haskins & Sells

2.2 Structure Of The Ontario 2,4-D Market In 1986

Five companies provide the basic 2,4-D acid in Ontario. They include: BASF; Dow; May & Baker; Marks; and Trans Bas (Figure 2.1). The basic product is then sold to other companies (which can be classified as chemical manufacturing or formulating companies), for production of herbicides and impregnated fertilizer products, or other out-of-province manufacturers/formulators which, in turn, sell finished products to Ontario distributors. At least one non-Canadian company (Scotts) sells formulated products to Ontario distributors (Figure 2.1).

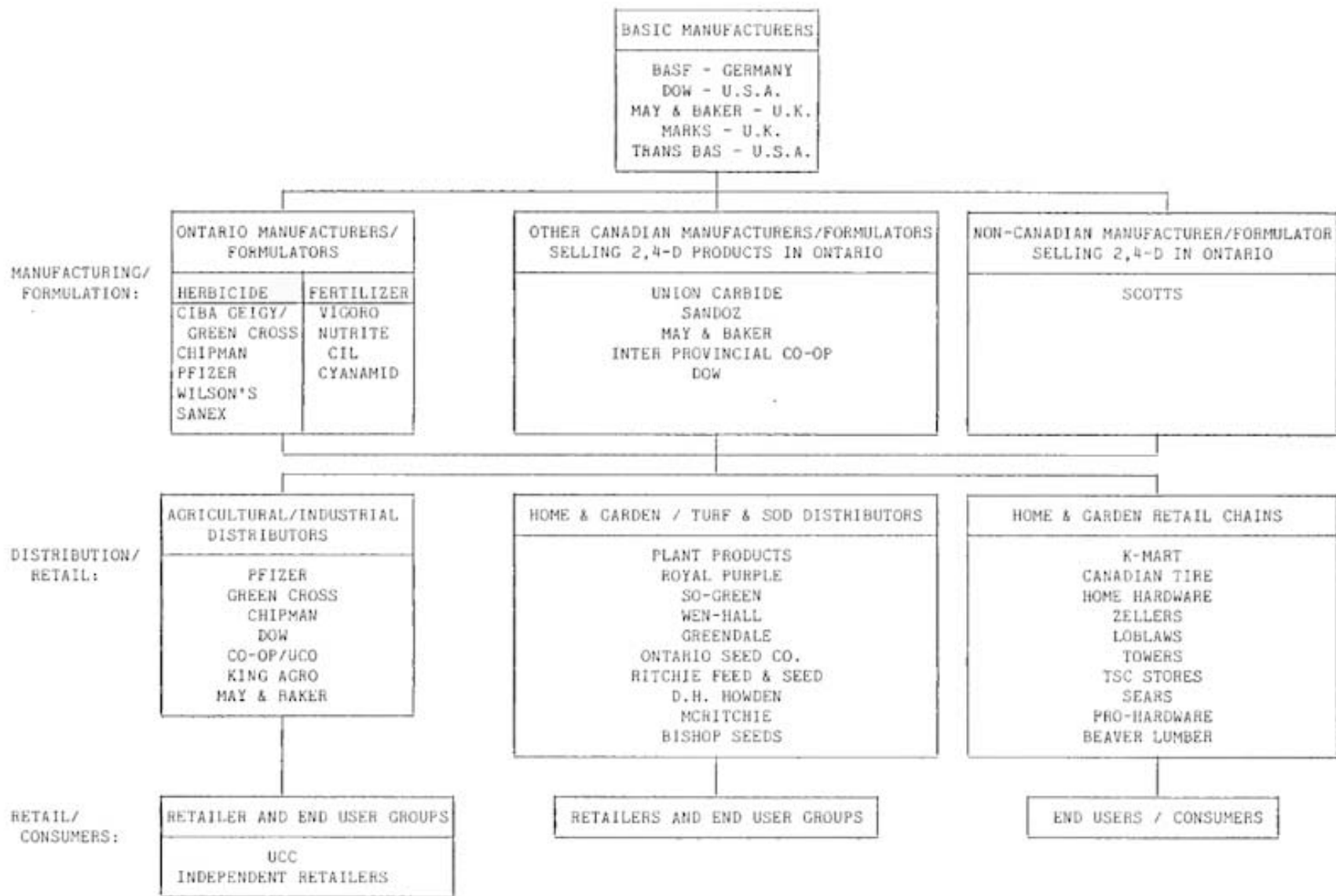
Distributors of 2,4-D products either sell directly to large volume users (i.e. Ontario Hydro, MTC) or to retailers who, in turn, sell to user groups or individual consumers (Figure 2.1).

The value of 2,4-D raw material sold to manufacturers and formulators in Ontario in 1986 is estimated at \$1.6 million. They, in turn, sold formulated products to retailers for approximately \$10.7 million. The total retail value of all herbicide and fertilizer products sold in Ontario amounted to approximately \$22 million. The breakdown of retail sales in as follows:

Agriculture	\$ 1.9
Home and Garden	16.6
Industrial/Other	<u>3.5</u>
TOTAL RETAIL VALUE OF 2,4-D	\$ 22.0 million

It is estimated that of the \$22 million retail value sold, herbicides combined with 2,4-D or 2,4-D alone sold for approximately \$13.8 million. Fertilizer combined with 2,4-D (impregnated fertilizers) sold for \$8.2 million retail in 1986.

The value added to the 2,4-D raw material (\$20.4 million) reflects the cost of labour, packaging, distribution, advertising and costs of all non-2,4-D materials.



SOURCE: Deloitte Haskins & Sells

FIGURE 2.1. Structure Of The Ontario 2,4-D Market, 1986.

2.3 2,4-D In Comparison To The Total Pesticide Market In Ontario

Following is a brief overview describing the size and general distribution of the pesticide market in Ontario in 1986:

Pest control product sales in Ontario (all pesticides) (1984/85:CPIC)	\$ 204 M
2,4-D retail sales value in Ontario: (1986: DH&S) (including weed and feed products)	\$ 22 M
2,4-D share of Ontario sales(percent of total pesticide sales)	10.8%
Value of herbicide sales in Ontario: (1984/85:CPIC)	\$ 118 M
2,4-D Share of Ontario herbicides:	18.6%

HOME AND GARDEN: (including all urban applications)	
Total Ontario pesticide sales value, (including herbicides, fungicides and insecticides) (1984/85:CPIC)	\$ 30.8 M
2,4-D Retail Sales (1986:DH&S)	\$ 16.6 M
2,4-D Share of Home and Garden Sales:	53.9%

AGRICULTURE:	
Total cash expenditure for all agricultural pesticides in Ontario (1984: Stats Can)	\$ 124 M
2,4-D product sales in Ontario: (1986:DH&S)	\$ 1.9 M
2,4-D share of agricultural pesticide sales:	1.5%
2,4-D share of agricultural herbicide sales:	1.6%

(NOTE: Source of information is provided in brackets)

SOURCE: CPIC (Crop Protection Institute of Canada)
DH&S (Deloitte Haskins & Sells - Guelph)
Stats Can (Statistics Canada, Ottawa)

2,4-D products comprise a major share of all sales in the home and garden market in Ontario. However, in all agricultural markets, 2,4-D accounts for only a minor portion of total sales in Ontario.

2.4 Worker Exposure During Manufacturing/ Formulating/ Distributing/ Retailing Activities In Ontario

Company respondents indicated that approximately 768 people came in contact with 2,4-D products on average 14.5 days in 1986. This total includes all workers in manufacturing, formulation, distribution, and retailing activities. This means that approximately 11,136 exposure days were possible in 1986 involving 2,4-D products at this step.

It is important to note that with the exception of manufacturing/ formulating operations, all workers were exposed to sealed containers and packages containing 2,4-D. Approximately 53 people were exposed in this activity for 24.5 days, or 1,299 exposure days in total. This represents only 11.7% of all reported exposure days.

Following is a summary of personal protective clothing worn during 2,4-D manufacturing/formulation activities:

Gloves/chemical resistant	8	Note: Numbers indicate a "yes" response to each category of protection clothing only. Number of companies in this category: 10
Mask	7	
Respirator	1	
Eye Cover	7	
Overalls	9	
Boots	6	
Helmet	1	
Apron	2	
None	0	

Regarding manufacturing/formulating activities, nearly all respondents indicated that their employees wore gloves (chemical resistant), masks, eye cover, coveralls, and boots. No company respondent indicated that any employees worked in 2,4-D manufacturing/formulating activities completely unprotected.

In all other operations (i.e. distribution, retailing) involved with sealed 2,4-D products and packages considerably less use of personal protective clothing was evident, particularly at the retail level. Generally, gloves (usually not chemical resistant), coveralls, and eye cover were worn by employees involved in trucking, storage and handling of 2,4-D products at least to some degree. Compliance with wearing safety clothing was never mandatory.

2.5 Alternatives To 2,4-D

There is some potential for alternative chemicals or non-chemical crop protection practices to replace 2,4-D in Ontario. Table 2.2 lists the range of broadleaf herbicide substitutes indicated by company respondents and crop protection experts as likely candidates for which federal registrations and provincial licenses are available.

It is evident that if 2,4-D is withdrawn from use, at least one registered alternative in each end use area is available (Table 2.2). However, in many cases, significant adjustments for users would be required, as outlined in subsequent sections.

2.5.1 Impacts On Manufacturing/Formulating Chemical Companies

Since chemical substitutes are available, at least in the immediate term, this qualitative analysis assumes that chemical substitutes will be the predominant alternative for 2,4-D.

Some chemical supply companies will gain while others will lose depending on the availability of alternatives to 2,4-D. Table 2.3 indicates that most of the firms that supply 2,4-D, also supply substitute products. Consequently, most of the companies will potentially remain in the broadleaf weed control market. Obviously, the degree of impact on individual companies depends greatly on what substitute products are used, where, and how in each market.

In terms of employment impacts, there is potential for minimal dislocation from the industry's perspective, given the availability of possible chemical substitutes. However, it is quite conceivable that employment may increase in one firm and/or region and decline in another firm or region.

2.5.2 Impact On Imports In Ontario

The active ingredient for 2,4-D is imported into Canada for further formulation into product. The import value of the active ingredient is estimated at \$1.6 million dollars. Since all substitutes are somewhat more expensive by as much as double or triple the price of 2,4-D, an increase in the value of imports in Ontario can be expected.

TABLE 2.2. Registered Substitutes For 2,4-D by end use.

Agriculture	Forestry	Home And Garden	Turf/ Sod (Industrial)	Municipalities & Rights-of-Way**	Aquatics
MPCA	Glyphosate	MPCA*	MPCA	Picloram	Diquat
Mecoprop	Hexazinone	Mecoprop*	Mecoprop	Chlorsulfuron	
Dicamba		Dicamba*	Dicamba	Fosamine Ammonium	
Bromoxynil					
Atrazine					
Cyanazine					

* Available to provincially licensed commercial applicators only

** Ontario Hydro, Ministry of Transportation & Communication (MTC)

SOURCE: Deloitte Haskins & Sells

TABLE 2.3. Companies Supplying 2,4-D And Substitute Products In Ontario, 1987.

Companies	2,4-D	MCPA	Mecoprop	Picloram	Bromoxynil	Glyphosate	Dicamba	Chlorsulfuron	Fosamine Ammonium	Hexazinone
Niagara (M & B)	X	X	X		X					
Pfizer	X	X	X							
Monsanto						X				
Ciba-Ceigy	X	X								
Dupont								X	X	X
Dow	X	X		X						
Velsicol / Sandoz	X						X			
Chipman	X									

SOURCE: Deloitte Haskins & Sells

3.0 2,4-D IN ONTARIO AGRICULTURE

3.1 Use Of 2,4-D In Agriculture

Results from a provincial survey of pesticide use in Ontario for 1983, indicate that use of 2,4-D is mainly used on corn and small grains, (cereals) (McGee, 1984) (Table 3.1). In addition, limited amounts of 2,4-D were applied to field beans, hay and pasture, and soybeans.

TABLE 3.1. Area Treated And Quantities Of 2,4-D Used In Ontario Agriculture, 1983.

	Area Treated (Ha)	Volume(Kg ai)
Field Corn	68,700	35,760
Soybeans	180	100
Field Beans*	4,130	15,010
Small Grains	148,000	114,150
Hay and Pasture	3,200	2,870
TOTAL	224,210	167,980

SOURCE: Bill McGee, 1984. Survey of Pesticide Use in Ontario, 1983. OMAF. Toronto.

* Applied before planting or after harvest.

Results of the Deloitte Haskins & Sells survey of all major 2,4-D manufacturers, formulators, distributors and retailers in Ontario indicate that the total volume of 2,4-D sold for agricultural purposes in 1986 was 180,000 kg active ingredient, as indicated in Section 2.0.

This study focused on 2,4-D use on cereals, including wheat, barley, oats and mixed grains. To this end, a survey of 250 cereal producers in Southern Ontario was conducted regarding their use of 2,4-D and their general safety and handling practices. Following are the results of this survey:

1. Total number of cereal producers surveyed: 250
 - ▶ All selected respondents have annual gross sales in excess of \$10,000.
 - ▶ Respondents who used 2,4-D in 1986: 116 (46.4%)
 - ▶ Respondents who did not use 2,4-D in 1986: 134 (53.4%)

2. Total cereal acreage represented in survey: 21,390 acres.
 - ▶ Total area treated with 2,4-D: 6,659 acres (31.1%)

3. Frequency of 2,4-D applications:

One:	98	(97%)
Two:	2	(2%)
Three:	1	(1%)

4. Other crops receiving 2,4-D in 1986:

	<u>YES:</u>
Corn	40
Pasture	3
Soybeans	2
Rye	1

5. 2,4-D Products Applied on Cereals in 1986:

	<u>VOLUME 2,4-D</u> (Kg ai)
2,4-D Amine 500	821
Pfizer 2,4-D Amine 500	219.5
Kilmor	61.1
Green Cross, 2,4-D Amine 500	170.1
Co-Op 2,4-D Amine 500	1,547.5
Estemine 500	97.3
King Agri-Serve 2,4-D Amine 500	41.4
Compitox Plus	6.2
Sanex 2,4-D Amine 80	147.5
Chipman 2,4-D Amine	<u>7.5</u>
	3,119.1

6. Thirteen of 116 respondents who indicated they used 2,4-D in 1986 identified the following products specifically as containing 2,4-D. However, these products do not contain 2,4-D:

	<u>No. Of Respondents</u>
MCPA	3
Banvel	1
Embutox	3
Atrazine	1
Sencor	1
Treflan	1
Roundup	1
Dicamba	1
Bladex	<u>1</u>
	13

3.2 Exposure Of 2,4-D Applicators In Agriculture

Information was collected from all 2,4-D users (including those who incorrectly identified 2,4-D products - 116 in total) regarding the use of protective clothing; estimates of the number of bystanders; storage of 2,4-D products; and container disposal practices. Following is a summary of the major findings:

1. Protective clothing used by 2,4-D applicators in 1986.

	<u>Number Of Respondents</u>	
Hat/Cap	97	
Coveralls	57	
Rubber or Neoprene Gloves	34	Number Of 2,4-D Users: 116
Rubber Boots	26	
Smock	20	
Goggles or Face shield	16	
Respirator	6	
Disposable plastic gloves	3	
Work Boots (leather)	2	
Leather gloves	1	
Raincoat with hood	1	
Nothing	7	
Refused to answer	1	

It is assumed that the use of goggles (or a face shield) and respirator would occur only during the mixing and loading operation.

Respondents were asked how many people, not directly involved in mixing, loading, or spraying of 2,4-D were in close proximity while any of the above operations were conducted. Farmers indicated that only 12 people in total were bystanders. This would imply that approximately 10% more people above the total of all 2,4-D applicators

are potentially exposed to 2,4-D.

2. Storage location for 2,4-D products and containers.

	<u>No. Of Respondents</u>
Drive shed	59
Don't store any products	14
Garage	10
Barn	10
House	8
Chemical storage building	7
Workshop	4
Empty grain bin	2
Pumphouse	1
Leave in truck	1
Grainery	1
Old house	1
Chicken Barn	1
Refused to answer	1

3. All 116 2,4-D users were asked if they had ever experienced a spill of 2,4-D products either during mixing, loading or application. Only 3 (or 2.6%) indicated a spill occurred in 1986.

4. Finally, all 116 2,4-D users were asked to describe how they disposed of their empty 2,4-D containers in 1986. Their responses are summarized as follows:

	<u>No. Of Respondents</u>	
Take them to the dump	59	
Burn them	27	
Bury them	11	Number of 2,4-D Users: 116
Garbage disposal	7	
Rinsed out (3x) then burned	6	
Garbage roadside pick-up	4	
Store on premises	4	
Rinsed (3x) then re-used	3	
Take to chemical dump site	2	
Take to local metal dealer	1	
Refused to answer	5	

It is important to note that the total number of responses will not always add up to 116, since many 2,4-D applicators may use more than one form/method of container disposal.

3.3 Potential Economic Impact Of 2,4-D Use In Agriculture

In the Ontario agricultural sector, 2,4-D is used primarily on corn and small grains, such as wheat and barley to control a broad spectrum of broadleaf weeds. At least in the very short term, there are four major alternatives to 2,4-D, which when used in right amounts and timing, provide adequate weed control compared to 2,4-D, (i.e. no crop loss would be expected with their substitution). These include, but are not limited to:

- MCPA
- Mecoprop
- Dicamba
- Bromoxynil

These four alternatives plus others vary in efficacy against many types of weeds as well as between crops (OMAF Publication 75).

If 2,4-D was no longer available to agriculture, the above herbicides, either applied alone or in combination with other herbicides, would provide effective broadleaf weed control. Indeed, MCPA which is only marginally more expensive than 2,4-D (i.e. \$1.20 per hectare more) has a similar control action as 2,4-D with some exceptions. In instances where MCPA is not as effective, other registered products listed will provide adequate control. Three cases where MCPA provides better control compared to 2,4-D include, but are not necessarily limited to:

- buttercup
- field horsetail
- hemp-nettle

If 2,4-D was no longer available for use, MCPA would be substituted almost completely on cereals and corn. The added cost of this substitution would amount to approximately \$0.5 to \$1.5 million per year. This added producer cost represents less than a 1.0% increase in total herbicide costs for the province.

Yield quantity and quality should not be affected since MCPA is such a close substitute for 2,4-D. Thus, the short-term cost to agriculture would be reflected in higher chemical cost (albeit modest).

4.0 2,4-D IN ONTARIO FORESTRY

Thirty-two Ministry of Natural Resource (MNR) districts and 11 forestry companies, currently part of the Forest Management Agreement (FMA), were surveyed for the following information:

1. Volume of 2,4-D used in all silvicultural practices in 1986;
2. Total hectares treated with 2,4-D products in 1986;
3. Age, job experience, and training of all personnel involved in 2,4-D applications;
4. Use of personal protective clothing in 1986;
5. Use and experience with alternative herbicides to 2,4-D;
6. Costs of various silvicultural practices both with and without 2,4-D, and;
7. Names and contacts of all aerial applicators involved in silvicultural practices for soliciting information on worker exposure/use of personnel protective clothing.

4.1 Use Of 2,4-D In Forestry

Herbicides are used for a number of silvicultural practices including, but not limited to, conifer release and stand tending. Two herbicides were used almost exclusively in 1986, namely: 2,4-D and glyphosate.

Approximately 36,512 hectares were treated with 2,4-D in Ontario forestry in 1986, of which 88% was treated for the purpose of conifer release¹. Survey results show that approximately 79,289 kilograms active ingredient of 2,4-D were applied in 1986. Tables 4.1 and 4.2 indicate the use and distribution of 2,4-D in Ontario in 1986. Clearly, the vast majority of 2,4-D applied was in the form of a low volatile ester, as opposed to the amine formulation widely used in agriculture and turf/sod environments (e.g. home and garden).

¹ Conifer release is the removal of, or reduction of interference by weeds (undesirable vegetation) which competes with the performance of established crop trees (i.e. conifers). Within a few years of planting, conifers are "released" from competition with hardwood species thus allowing conifers maximum growth potential.

TABLE 4.1. Use Of 2,4-D By Ministry Of Natural Resource Districts In 1986.

Region	District	Use 2,4-D*	Product Used	Vol. Product (Litre)	Vol. ai (Kg)	Rate Of Application (Kg/ai/ha)	Hectares Treated (Ha)
North-Central	Atikokan	YES	LV ESTER 600	4033	2266.5	1.7 -2.3	1126
	Geraldton	YES	LV ESTER 600	4461	2516.3	2.2 -3.3	891
	Nipigon	YES	LV ESTER 600	241.5	135.2	1.68	80.5
	Terrace Bay	YES	LV ESTER 600	1076	606.9	3.4	192
	Thunder Bay	YES	LV ESTER 600	127	71.6	2.65	27
North eastern	Blind River	YES	LV ESTER 600	3935	2219.3	3.4	700
	Espanola	NO					
	North Bay	YES	AMINE 500	390	194.9	2.24	87
	Sault Ste Marie	NO					
	Sudbury	YES	AMINE 500	1850	878.7	5.6	167
			LV ESTER 600	900	507.6	2.8	80
	Temagami	NO					
	Wawa	YES	LV ESTER 600	532	300.6	1.68	179
Northern	Chapleau	YES	LV ESTER 600	8238	4646.2	2.2 -3.36	1982
	Cochrane	NO					
	Gogama	YES	LV ESTER 600	4975	2805.97	1.6 -3.7	1053
	Hearst	YES	LV ESTER 600	12234	6900	1.68-3.4	2720
	Kapaskasing	YES	LV ESTER 600	1161	654.8	2.24	279
	Kirkland Lake	YES	LV ESTER 600	4441	2504.7	1.7 - 3.31	1330
	Timmins	NO					
North western	Dryden	YES	LV ESTER 600	3078	1736	1.68	1099
	Fort Frances	YES	LV ESTER 600	10230	5709.1	1.7-3.36	2848
	Ignace	NO					
	Kenora	YES	LV ESTER 600	3400	1914	3.3	580
	Red Lake	NO					
	Sioux Lookout	YES	LV ESTER 600	246	138.7	2.5	56
Algonquin	Bracebridge	YES	AMINE 500	16	8	1.3	6
	Parry Sound	NO					
	Pembroke	NO					
Eastern	Brockville	NO					
	Carleton Place	YES	LV ESTER 600I	772.1	435.5	5.6	147.4
	Tweed	YES	LV ESTER 600	6.4	3.6	1.8	2
	Napanee	YES	LV ESTER 600I	25	14.1	1.4	10.1
TOTAL				L.V. ESTER	36133.1		15631.9
SOURCE: Deloitte Haskins & Sells				AMINE	1081.6		

TABLE 4.2: Use Of 2,4-D y Forestry Companies : In 1986.

	Use	Product Used	Vol. Product (L)	VOL. ai (kg)	Rate Of Application (Kg/ai/ha)	Hectares Treated (ha)
Great Lakes Forest Products						
Thunder Bay	NO	--	--	--	--	--
Dryden	NO	--	--	--	--	--
E.B. Eddy Espanola	YES	ESTASOL	4814	2715	1.7	1597.3
Spruce Falls Power and Paper Company Kapuskasing	YES	ESTASOL	53197.5	30003	1.4-3.3	13560
McChesney Lumber Timmins	YES	LV ESTER 600	615	347	1.64	211
Abitibi Price Iroquois Falls	YES	LV ESTER 600	2562	1445	1.8	2608
Thunder Bay	YES	LV ESTER 600	1025	578	3.23	190
Ontario Paper Company Timmins	YES	LV ESTER 600	8030	4530	2.2-5.0	1353
Manitouwadge	NO	--	--	--	--	--
Dubreil Bros. Dubreilville	YES	LV ESTER 600 LV ESTER 600	583	328	1.64	199
Boise Cascade Fort Francis	YES	LV ESTER 600	1897	1070	2.0	586
Domtar Red Rock	YES	LV ESTER 600	1610	910	1.68 2.4	457
Kimberly Clark Longlac	YES	LV ESTER 600	262	148	1.24	119
Great West Paper Thunder Bay	License Has Been Taken Over By Buchanon Bros., Data Unavailable.					
TOTAL			42,074		20,0880	

* either alone or in combination with another product.

SOURCE: Deloitte Haskins & Sells

4.2 Exposure To 2,4-D In Ontario Forestry

A uniform pattern/system of herbicide application exists for all silvicultural practices in Ontario. Specifically, all herbicides used in silvicultural practices are purchased or paid for by the Ministry of Natural Resources (MNR). (NOTE: This includes herbicides applied by individual forestry companies so long as they are signatories to the Forest Management Agreement (FMA)). Virtually all herbicides are applied by air and the application task is contracted out to private custom applicators. The MNR and FMA forestry companies are responsible for a limited number of ground applications, ground transportation of products, storage, mixing and loading of pesticides onto aircraft, and for providing flagmen and roadblock security during aerial application activities. Consequently, exposure to 2,4-D is possible for MNR and FMA forestry employees, as well as custom applicator employees. Given this utilization, 11 custom applicators, who conducted spray applications for either the MNR or FMA companies, were surveyed for information on their employee statistics and use of personnel protective clothing.

Statistics supplied by respondents regarding the number of workers involved in 2,4-D use and handling, average age, years of experience, and exposure days are presented in Tables 4.3 to 4.5 for MNR, FMA, and custom application personnel, respectively.

Approximately 97 MNR, 44 forestry and 59 custom application employees were involved in 2,4-D use, application, and handling in 1986. Generally, MNR and FMA company employees were in the 25-35 year age range, with less than 5 years experience on the job. Where employees worked in groups, at least one person had an Ontario Ministry of the Environment (OME) license. Less than 20, eight-hour days were spent by these employees conducting 2,4-D applications.

In contrast, custom aerial applications were generally in the 30 to 45 year age group, with more than 10 years on-the-job experience. The average number of 8-hour days spent applying 2,4-D was 25-30 days per year.

TABLE 4.3 Ontario Ministry Of Natural Resources Employee Statistics.

District	No. Workers Applying	Avg Age	Jobs Involved	Avg Years Experience	Avg. No.* of Days Applying	Training Of Personnel	Application Equipment Used
Atikokan	3	33	Supervision and Monitoring	3.7	6.7	Not	Aerial
Geraldton	6	27.8	Supervisor (2) Roadblock (4)	1	15.3	1 license 5 not	Aerial
Nipigon	3	26	Supervisor and Security	2.7	12	1 license 2 not	Aerial
Terrace Bay	6	30	Supervisor (4) Weather Monitor (2)	4	11.1	5 license 1 not	Aerial
Thunder Bay	2	29	Supervisor Mixer/Loader	2	0.5	1 license 1 not	Aerial
Blind River	5	32	Supervisor Mixer Radio Oper. Security	1 1.5 1.5 1	7.6	2 license 3 not	Aerial
North Bay	1	26	Monitor	1	7	1 licensed	Ground Sprayer
Sudbury	6	23	Loaders (4)	2	3.2	3 licensed 3 not	Ground Sprayer
Wawa	6	28	Supervisor (1) Mixing & Loading (2) Weather (2) Road Control (1)	2.5	3.5	3 licensed 3 not	Aerial
Chapleau	1	34	Supervisor	11	18	licensed	Aerial
Algoma	11	30	Supervisor (2) Loader / Mixer (7) Monitor (2)	3	3.7	4 licensed 7 not	Aerial
Hearst	9	26	Application Boss (1) Mixer Loader (3) Security (3) Pilot (2)	1.4	20	3 licensed 6 not	Aerial

* All responses given in 8-hour days.

SOURCE: Deloitte Haskins & Sells

TABLE 4.3 (continued) Ontario Ministry Of Natural Resources Employee Statistics.

District	No. Workers Applying	Avg Age	Jobs Involved	Avg Years Experience	Avg. No.* of Days Applying	Training Of Personnel	Application Equipment Used
Kapuskasing	6	30	Supervisor (1) Mixer/Loader (3) Road Security (2)	7.3	2.7	3 licensed 3 not	Aerial
Kirkland Lake	13	35	Mixing/Loading	--	14	8 licensed 5 not	Aerial
Dryden	6	32	Mixing / Loading (3) Ground Sprayer (2) Skidder Operator (1)	3.7	8	1 licensed 5 not	Aerial & Ground Sprayer
Fort Frances	3	29	Loader Mixer(3)	8	21	2 licensed 1 not	Aerial
Kenora	2	30	Mixer / Loader (2)	7	4	2 licensed	Aerial
Sioux Lookout	2	29	Supervisor Security	0	3.5	1 licensed 1 not	Aerial
Bracebridge	3	30	Mixer/Loader Applicator (3)	0	2	11 licensed 2 not	Aerial
Carleton	2	35	Tractor operator Supervisor	14	5	1licensed 1not	Ground
Tweed	1	31	Mixer Loader	2	1	Not licensed	Ground
Napanee	4	34	Mixer (1) Applicators (3)	3	1	Not licensed	Ground
TOTAL	97						

* All responses given In 8-hour days.

SOURCE: Deloitte Haskins & Sells

TABLE 4.4 FMA Company Employee Statistics.

	No. Workers Applying	Avg Age	Jobs Involved	Avg Years Experience	Avg. No.* of Days Applying	Training Of Personnel	Application Equipment Used
E.B. Eddy	3	D.K.	Supervisor (1) Balloon (2) Supervisor (5)	D.K.	D.K.	NO	Airplane
Spruce Falls	10	26	Pilot (1) Mix Load (2) Road Control (2)	3	24	8 licensed 2 not licensed	Airplane
Mc Chesney Lumber Abitibi- Price	4	--	Road Block - No Contact With Chemical				
Iroquois Falls	5	23	Supervision (1)	2	1	Company Orient.	Airplane
Thunder Bay	2	27	Mixing (4) Supervision (1) Road Block (1)	2	1	Session --	Airplane
Ontario Paper Company Timmins	4	35	Monitor & Supervision	3	7	Licensed	Airplane
Dubreil Bros	5	24	Mixing (1) Monitor (1) Balloon (3)	1	2	1 licensed 4 not licensed	Airplane
Boise -Cascade	4	--	Supervisors (2) Mixers (2)	2	3	1 licensed	Airplane
DOMTAR	2		Supervisors	--	2	Not licensed	Airplane
Kimberly-Clark Longlac	4	--	Pilot (1) Mixers (3)	2	1	1 licensed orientation session	Airplane
TOTAL	44						

* All responses given in 8-hour days.

SOURCE: Deloitte Haskins & Sells

TABLE 4.5 Custom Applicator Employee Statistics.

	No. Workers Applying	Avg Age	Jobs Involved	Avg Years Experience	Avg. No.* of Days Applying	Training Of Personnel	Application Equipment Used
Canadian Ag. Air Services	3	D.K.	Pilots	D.K.	12	Licensed	Aircraft
Candu Air	8	34	Pilots (4) Mixers (4)	D.K.	45	Licensed	Aircraft
Dominion Pegasus	3	36	Pilot (1) mixer (1) loader (1)	11	10	Licensed	Aircraft
General Air Spray	6	41	Pilots (4) Mixer/ Loader (2)	12	10	Licensed	Aircraft
Hicks & Lawrence	9	40-55	Pilots (7) Loaders (2)	D.K. 15	27 40	Licensed Not Licensed	Aircraft Aircraft
Oxford Air Services	9	D.K.	Pilots (7) Loaders (2)	D.K.	6	Licensed (7) Not Licensed (2)	Aircraft Aircraft
Zimmer Air Services	6	D.K.	Pilots (3) Loaders (3)	D.K.	17	Licensed (3) Firm Train (3)	Aircraft
Jim's Flying Services	4	D.K. 27	Pilots (2) Mixer/ Loader (2)	D.K. 5	25	Licensed (2)	Aircraft
Agric Air	2	34	Pilots (2)	2	15	Licensed	Aircraft
Sturgeon Falls Brushing	3	D.K.	Driver (1) Sprayer (2)	5	25	Licensed (2)	Ground Sprayers
Asplundh Utilities Services	6	30	Driver (3) Sprayer (3)	25	25	Licensed (6)	Ground Sprayers
TOTAL	59						

¹ Includes a sample of commercial applicators (aerial and ground) in forestry, agriculture, and along rights-of-way.

* All responses given in 8-hour day. D.K. = Don't Know

SOURCE: Deloitte Haskins & Sells

Finally, all respondents were asked to indicate what protective clothing was worn by all personnel in 1986. Results of this survey are presented in Tables 4.6 to 4.8, for the MNR, FMA companies, and custom applicators, respectively. Respondents indicated that during 2,4-D application and handling activities, most employees wore disposable coveralls, rubber boots, gloves (generally chemical resistant) and faceshields or respirators as standard items. Mentions of other protective clothing include washable coveralls, hat, rubber gloves and neoprene gloves.

4.3 Economic Impacts Of 2,4-D In Forestry

The value of all 2,4-D products used in silvicultural practices in Ontario in 1986 amounted to approximately \$468 thousand (R.A. Campbell, 1987)¹.

Currently, glyphosate is the only federally registered and provincially licensed alternative to 2,4-D which can be applied by air. Hexazinone can only be used in ground application. Triclopyr has been tested on an experimental basis and has proven to be very efficacious compared to 2,4-D. However, it has not received full registration.

Since greater than 80% of all herbicides used in forestry were applied for conifer release in 1986, the following economic impact analysis is based on this silvicultural practice only.

Information provided by R.A. Campbell (MNR, 1987) indicates that, on average, the cost of aerial application with 2,4-D and glyphosate is as follows:

2,4-D plus application cost	= \$ 40/ha
glyphosate plus application cost	= \$135/ha

The cost of all herbicides used plus their application in conifer release, whether applied by MNR districts or FMA companies, are paid for by the Ministry. Consequently, if 2,4-D was not available for use, glyphosate would be immediately substituted, without any loss of efficacy or stand development. The only major consequence would be increased costs for herbicides estimated at between \$2.5 M and \$2.8 M annually.

¹ R.A. Campbell 1987. Ontario Ministry of Natural Resources. Maple, Ontario

TABLE 4.6 Use Of Protective Clothing By Mnr Employees In 1986.

District	Total # Workers	Washable Overalls	Disposable Overalls	Hat	Rubber Gloves	Neoprene Gloves	Rubber Boots	Goggles Or Face Shield	Respirator
Atikokan	3	0	3	0	0	3	3	3	0
Geraldton	14	0	0	0	0	0	0	0	0
Nipigon	3	0	3	0	0	3	0	3	0
Terrace Bay	6	0	6	0	6	0	6	6	0
Thunder Bay	2	0	2	0	2	0	2	2	2
Blind River	5	0	4	0	4	0	4	0	0
North Bay	1	0	1	1	1	0	0	0	1
Sudbury	6	0	6	0	0	6	6	6	6
Wawa	6	0	6	0	0	6	6	6	6
Chapleau	1	0	1	0	0	1	1	1	0
Algoma	11	0	9	0	0	9	9	9	9
Hearst	9	0	4	4	0	4	4	4	4
Kapuskasing	6	0	4	0	5	0	5	5	4
Kirkland Lake	13	0	13	13	13	0	13	13	0
Dryden	6	0	6	0	4	0	4	0	6
Fort Frances	3	0	2	0	3	0	3	3	3
Kenora	2	2	0	0	2	0	2	0	0
Sioux Lookout	2	0	0	0	0	0	0	0	0
Bracebridge	3	0	3	3	3	0	3	3	3
Carleton	2	1	0	1	1	0	1	1	1
Tweed	1	0	1	0	1	0	1	1	1
Napanee	4	0	4	0	4	0	4	4	4
TOTALS	99	3	78	22	49	32	77	70	50

SOURCE: Deloitte Haskins & Sells

TABLE 4.7 Use Of Protective Clothing By FMA Company Employees In 1986.

Company Involved	No.	Washable Overalls	Disposable Overalls	Hat	Rubber Gloves	Neoprene Gloves	Rubber Boots	Goggles Or Face Shield	Respirator	Other (Specify)
EB Eddy	4	4	0	0	0	0	0	0	0	--
Spruce Falls										
Power & Paper	10	0	10	10	0	10	10	10	0	--
McChesney										
Lumber	4	0	0	0	0	0	0	0	0	--
Abitibi-Price										
Iroquois Falls	5	-	5	5	-	5	5	5	-	Hearing Protect.
Thunder Bay	2	-	2	-	2	-	2	-	-	--
Ontario Paper										
Timmins	4	-	4	4	4	-	4	4	4	--
Dubreil Bros.	5	-	4	-	4	-	4		4	--
Boise Cascade	4	0	4	0	4	0	4	0	4	--
DOMTAR	2	0	2	0	2	0	2	2	0	--
Kimberly Clark	3	0	3	0	3	0	3	3	3	--
Boise Cascade	4	0	4	0	4	0	4	0	0	--
DOMTAR	2	0	2	0	2	0	2	2	0	--
Kimberly Clark	3	0	3	0	3	0	3	3	3	--
TOTAL	41	4	34	19	19	15	34	28	11	

SOURCE: Deloitte Haskins & Sells

TABLE 4.8 Use Of Protective Clothing By Custom Application Employees In 1986.

Company	No. Involved	Washable Overalls	Disposable Overalls	Hat	Rubber Gloves	Neoprene Gloves	Rubber Boots	Goggles Or Face Shield	Respirator
Canadian Ag. Air	Pilot (3)	0	0	0	0	0	0	0	0
Candu Air	Pilot (4)	0	0	0	0	0	0	0	0
	Crew (4)	0	4	4	4	0	4	4	4
Dominion Pegasus	Pilot (1)	0	0	0	0	0	0	0	0
	Crew (2)	0	2	0	2	0	2	2	2
General	Pilots (4)	0	0	0	0	0	0	0	0
	Crew (2)	0	2	0	0	2	2	2	2
Hicks & Lawrence	Pilot (7)	0	0	0	0	0	0	0	0
	Crew (2)	0	2	2	2	0	2	2	2
Oxford	Pilot (7)	0	0	0	0	0	0	0	0
	Crew (2)		2	-	2		2	2	2
Zimmer	Pilot (3)	0	0	0	0	0	0	0	0
	Crew (3)	0	3	0	3	0	3	3	3
Jim's Flying Services	Pilot (2)	0	0	0	0	0	0	0	
	Crew (2)	0	2	0	2	0	2	2	2
Agric. Air	Pilot (2)	0	0	0	0	0	0	0	
Sturgeon Falls Brushing	Crew (3)	0	3	0	3	0	3	3	3
Asplundh	6	0	6	0	6	0	6	6	6
TOTAL	59	0	26	6	24	2	26	26	28

SOURCE: Deloitte Haskins & Sells

5.0 2,4-D IN HOME AND GARDEN AND GOLF COURSE ENVIRONMENTS

This section encompasses three distinct end user groups, namely:

1. homeowners applying herbicides on residential lawns;
2. commercial lawn care companies applying herbicides on residential lawns, roadsides, parks, and schools, and;
3. golf course superintendents applying herbicides on golf course properties.

Common to all three end user groups is the application of herbicides in urban environments where potentially large numbers of people are either users or bystanders to 2,4-D application.

No survey of homeowners was conducted due to time limitations. However, information obtained from other sources was of relevance to homeowner use of 2,4-D products. In addition, twenty-one commercial lawn care companies and 12 golf courses were surveyed for the following information:

1. use of 2,4-D products in 1986;
2. number of workers involved in 2,4-D applications;
3. use of personal protective clothing and devices during mixing, loading and spraying activities, and;
4. economic impact(s) if 2,4-D is no longer available for use.

5.1 Use Of 2,4-D On Residential Lawns, Parks, Schools And Golf Courses In 1986

5.1.1 Homeowner Purchases And Use Of 2,4-D

Information presented in Section 2 indicates that just under 100,000 kilograms active ingredient of 2,4-D were sold to homeowners in Ontario for home and garden use. However, without an extensive consumer use 34 survey, it is not possible to estimate precisely how many homeowners purchased and applied 2,4-D products in Ontario in 1986.

However, information provided by manufacturers, formulators, distributors and retailers indicates how many containers/packages of herbicides and impregnated fertilizer products were sold in 1986. In particular, detailed data regarding sales of 250 ml to 2 litre herbicide containers and 2 kg to 27 kg packages of impregnated fertilizers were tabulated from all sources. It is assumed that containers and packages of these sizes were generally purchased by homeowners since they are too small for practical commercial use. Results of this tabulation are presented in Table 5.1.

Approximately 443,820 containers of domestic use herbicides, 567,853 packages of impregnated fertilizers, and 40,000 weed bars were sold to the home and garden market. In total, some 1.0 million products were sold which were potentially used by individual homeowners. Assuming some homeowners use both herbicides and impregnated fertilizer, anywhere from 600,000 to 800,000 households were treated with 2,4-D in varying degrees and amounts. This means that approximately 40 to 53% of all Ontario householders used some amount of 2,4-D products. It is important to note that these were products applied by individual homeowners only, not commercial applicators. No information is available which indicates homeowners' use of personal protective clothing or devices during pesticide handling or application activities.

5.1.2 Use Of 2,4-D By Commercial Lawn Care Companies

Information described in Section 2.0 indicates that approximately 108 thousand kilograms active ingredient of 2,4-D were sold to commercial applicators: This includes applications along rights-of-way, contracts for provincial ministries, and in home and garden (residential) environments. No estimate of the total volume of 2,4-D used by all commercial lawn care companies is available. Thus, it is not possible to determine where exactly all 2,4-D in this category was applied and for what specific uses.

TABLE 5.1. Total Number Of 2,4-D Product Containers And Packages Sold To The Home And Garden Market In Ontario, 1986.

A. HERBICIDE:	
CONTAINER SIZE	TOTAL
250 ml	40,244
500 ml	50,096
750 ml	33,540
900 ml	66,000
1litre	233,440
2 litre	<u>20,500</u>
	443,820

B. IMPREGNATED FERTILIZERS:	
PACKAGE SIZE	TOTAL
2 kg	6,000
5 kg	14,380
7 kg	11,000
8 kg	10,000
9 kg	110,816
10 kg	303,733
14 kg	17,609
15 kg	11,110
18 kg	51,123
20 kg	23,601
25 kg	3,869
16kg	1,612
27 kg	<u>3,000</u>
	567,853

C. WEED BARS:	40,000
Total Number Of All 2,4-D Products Sold To Home And Garden In Ontario	<u>1,011,673</u>

NOTE: The total volume of 2,4-D sold to homeowners in 1986 was approximately 100,000 Kg ai. The vast majority of this active ingredient would be in herbicides.

SOURCE: Deloitte Haskins & Sells

Twenty-one commercial lawn care companies were surveyed in Ontario to provide information regarding their use patterns as a proxy for the industry. These results are presented in Table 5.2. Included in this survey were 6 of the major franchised commercial lawn care companies. The surveyed companies applied approximately 23,310 Kg ai of 2,4-D in 1986. In total, 23,937 hectares were treated with 2,4-D products, where the breakdown by target use was as follows:

TARGET	HECTARES
Schools	172
Parks	188
Cemeteries	39
Roadsides	4
Lawns (Residential)	23,504
Other	37

Clearly, the vast majority of 2,4-D applied by commercial applicators was on residential lawns in 1986.

5.1.3 USE OF 2,4-D ON GOLF COURSES

Results presented in Section 2.0 indicate that companies sold approximately 4,540 Kg ai of 2,4-D to golf courses in 1986. This estimate may be low since golf course use of 2,4-D may be incorporated in other categories (see Table 2.1). Twelve golf course superintendents were surveyed for information regarding their 2,4-D use patterns as a proxy for the industry in Ontario. Results of this survey are presented in Table 5.3.

The 12 surveyed golf course superintendents applied 295.5 Kg ai of 2,4-D on approximately 272 hectares. In most cases, only limited areas of each golf course were treated with 2,4-D, namely the greens and portions of fairways.

TABLE 5.2. Use Of 2,4-D By Commercial Lawn Care Companies In 1986.

Company/ Respondent	Use 2,4-D*	Product Used	Vol. Product (L)	Vol. ai (kg)	Rate Of Application (ai L/ha)	Total HA Treated (ha)	Hectares Treated By Specific End Use					
							Schools	Parks	Cemeteries	Roadsides	Lawns	Other
1	YES	MECO-D	70,000	19,950	4.5	15,000					15,000	
2	YES	2,4-D Amine	NIL									
		MECO-D	32	6.4	D.K.	D.K.						
		Prem. Weed Killer	1060	132.5	D.K.	D.K.						
		KILLEX	260	49.4	D.K.	D.K.						
3	YES	2,4-D AMINE	12,300	6,150	2.8	3,280					3,280	
4	YES	KILLEX	1,350	256.5	5.5	600					600	
5	YES	Prem. Weed Killer	12,000	1,416	11	1,080					1,080	
6	YES	KILLEX	6,541.5	1,242.9	4.2	1,565	63.4	0	16.2	4	1,481.4	
		TRILLION	54.5	10.4	2.1	26					8	
		MECO & 2,4-D	1,809.8	170.1	2.6	684.6					684.8	
7	YES	KILLEX	22.5	4.3	1.9	12						
		WEED'N FEED	D.K.	D.K.	D.K.	D.K.					12	

D.K. - Don't Know

SOURCE: Deloitte Haskins & Sells

TABLE 5.2 (continued) Use Of 2,4-D By Commercial Lawn Care Companies In 1986.

Company/ Respondent	Use 2,4-D*	Product Used	Vol. Product (L)	Vol. ai (kg)	Rate Of Application (ai L/ha)	Total HA Treated (ha)	Hectares Treated By Specific End Use					
							Schools	Parks	Cemeteries	Roadsides	Lawns	Other
8	YES	MECO-D	175	49.9	2.51	70					70	
9	YES	MECO & 2,4-D	200	23.6	D.K.	40					40	
		MECOTURF	100	20	D.K.							
10	YES	2,4-D Amine	695	326.7	4.89	141.91					141.91	
11	YES	2,4-D Amine	22.5	10.6	4.4	D.K.			D.K.		D.K.	
12	YES	2,4-D Amine	434.4	204.1	3.5	124.1			4.1		120	
		500										
13	YES	2,4-D Amine	1,593	796.5	4.9	322.6		170	4	--	148.6	
		500										
14	YES	MECO & 2,4-D	333.8	39.4	9.5	35.1	--	--	0.4	--	34.7	
15	YES	2,4-D Amine	640	320	D.K.	D.K.	D.K.	D.K.	D.K.	D.K.	D.K.	
		500										
16	YES	KILLEX	200	38	5.5	36.4	--	--	--	--	16.2	18.2

D.K. - Don't Know

SOURCE: Deloitte Haskins & Sells

TABLE 5.2 (continued) Use Of 2,4-D By Commercial Lawn Care Companies In 1986.

Company/ Respondent	Use 2,4-D*	Product Used	Vol. Product (L)	Vol. ai (kg)	Rate Of Application (ai L/ha)	Total HA Treated (ha)	Hectares Treated By Specific End Use					
							Schools	Parks	Cemeteries	Roadsides	Lawns	Other
17	YES	Amine 500	200	38	5.5	36.4	--	--	--	-	18.2	18.2
		Diphenoprop	1518	713.5	3	506	100	6	--	--	400	--
18	YES	PROPATURF	226.0	79.1	3.5	64.0	5.0	12	6	-	41	--
		2,4-D & MCP	1145.3	50.9	5.6	152.8	3.6	--	1.6	-	147.6	--
19	YES	2,4-D Amine	211.5	99.4	1.9	110	--	--	--	--	110	--
20	YES	KILLEX	500	47.5	10	50	--	--	--	-	50	--
21	YES	AMINE 80	60	30	D.K.	D.K.	--	--	--			
TOTAL				32,310.2		23,947.1	172	188	32,3	4	23504.4	

D.K. - Don't Know

SOURCE: Deloitte Haskins & Sells

TABLE 5.3 Use Of 2,4-D by 12 Golf Courses in Ontario in 1986.

Respondents	Use 2,4-D*	Product Used	Vol. Product (L or kg)	Vol. ai (kg)	Rate Of Application (L/ha)	Hectares Treated (ha)
1	YES	Killex	120	22.8	5.5	25
2	YES	Killex	30	5.7	5.0	6
		Scotts	200 kg	1.8	--	1.6
		Estamine	10	5	2.0	5
3	NO	--	--	--	--	--
4	YES	Killex	115	21.9	5.5	20
5	YES	Killex	12.2	2.3	--	4
		2,4-D Amine	48.8	24.4	--	16
6	YES	Killex	80	15.2	5.0	36
7	YES	Killex	227	43	5.5	40
8	YES	Killex	22.75	4.3	5.5	5
		Trillion	90.0	17.1		19
		Premium				
		Lawn Weed	22.75 kg	2.7		3.3
9	YES	Killex	240	45.6	5.5	40
10	YES	Killex	100	19	5.5	16
11	YES	Green Cross				
		2,4- Amine	100	47		18
		Scotts Proturf	281 kg	2.5		2.4
12	YES	Killex	80	15.2	5.5	14.5
TOTAL				295.5		271.8

* either alone or in combination with another product.

SOURCE: Deloitte Haskins & Sells

5.2 Employee Statistics And Use Of Protective Clothing In 1986, By Commercial Applicators And Golf Course Employees

5.2.1 Commercial Applicators

Results from the survey of 21 lawn care companies indicate that 665 people were employed by all respondents in 1986 (Table 5.4). The average age was 25-27 years in companies reporting greater than 10 employees. In smaller companies, (i.e., less than 10 employees), the average age was either 25-30 years or 40 to 50 years (Table 5.4). In most cases, seasonal summer employment was used, particularly students.

The number of years experience per employee was very low for the most part, indicating a high degree of annual turnover in staff. The major exceptions to this are the small owner-operator lawn care businesses, where years of experience approach 30 (Table 5.4).

By-and-large, all commercial lawn care applicators were reported to be involved with 2,4-D spraying 75-100 days per year, with the average work day totalling 7-8 hours spraying (Table 5.4).

At least one employee in each firm had an Ontario Ministry of the Environment (OME) license. However, most applicators were provided with in-house training only, prior to the season. Generally, only franchise owners were licensed but conducted very little of the spraying, if at all.

The use of protective clothing by lawn care applicators in 1986 is reported in Table 5.5. The standard work/spray clothing included a hat, rubber boots, long pants (washable), and short sleeve shirt (washable) (Table 5.5). The use of gloves, faceshields and respirators were limited to mixing and loading activities only, which were generally conducted under supervision by licensed applicators.

Information regarding storage, handling and disposal of 2,4-D products by commercial applicators is presented in Table 5.5. Respondents 42 indicated that 2,4-D products were generally stored in separate chemical storage buildings which were locked, dry and vented.

The majority of respondents indicated that empty 2,4-D containers were triple rinsed, and either disposed in landfill sites or in Large industrial waste containers (Table 5.6).

5.2.2 Golf Course Employees

Superintendents of 12 golf courses in Ontario provided information on their employees involved in 2,4-D applications (Tables 5.7 and 5.8). Results indicate that of the 12 respondents, 19 people were involved in 2,4-D applications in 1986. The ages and experience of applicators were quite variable, ranging from age 26 to 55 with between 1 to 30 years on-the-job experience (Table 5.7). In most cases, applicators had application licenses from the Ontario Ministry of the Environment (OME).

Most employees involved in 2,4-D applications wore hats, rubber gloves, rubber boots and a respirator (primarily during mixing and loading) (Table 5.8). It is interesting to note that two people wore rainsuits during application activities in 1986, which are the only occurrences of this safety practice in the entire study.

In addition to the above, respondents indicated that no uncontrolled spills of 2,4-D occurred in 1986 (Table 5.9). The disposal practices regarding empty 2,4-D containers were similar in most cases, namely: empty containers were rinsed (usually triple), cut up or crushed, and disposed of in approved landfill sites or industrial bins.

TABLE 5.4. Commercial Lawn Care Company Employee Statistics.

Company/ Respondent	No. Workers Applying*	Avg Age	Jobs Involved	Avg Years Experience	Avg. No. Of Days Applying	Avg. # of Hours In Application Day	Training Of Personnel	Application Equipment Used
1	270	20	Loading Applying	2	90	8	In- House	Hand Sprayer
2	60	25	Loading Mixing	2.5	120	7	Some OME Licenses	Hand Sprayer; Low Volume; Low Pressure.
	123	23	Applying	3	100	8	2 Wk In- House Training	Spray Truck; Low Pressure Droplet.
4	3	26	Loading Mixing	3	100	8	In-house For 2; 1 OME License	500 Gal Truck Sprayer.
5	120	25	Applying	2	100	9	Some OME Licenses; Rest In- House Training	Use All Sorts; Hand-sprayer Boom Sprayer Truck Sprayer Spreaders
6	39	27	Applying	1	30	4	In-house Training For 6 Wks.	Hand & Spray Trucks
7	1	50	Loading Mixing Applying	30	20	4	License	Hand & Ground Sprayers & Spreader
8	4	21	Loading Mixing	1.5	20	6	OME Exter- minators License; Rest Nil	Hand & Boom Sprayer

OME - Ontario Ministry of the Environment.

SOURCE: Deloitte Haskins & Sells

* - at least one employee in each firm had MOE license

TABLE 5.4 (continued) Commercial Lawn Care Company Employee Statistics.

Company/ Respondent	No. Workers Applying*	Avg Age	Jobs Involved	Avg Years Experience	Avg. No. Of Days Applying	Avg. # of Hours In Application Day	Training Of Personnel	Application Equipment Used
9	4	25	Mixing Applying	6.75	100	2	(3) OME License (1) In-house (2) OME License	Back Pack Sprayers
10	4	28	1 Mixer 3 Applicator	2.5	50	7.5	(1) In-house (1) Hort. school	Hand Sprayers
11	3	28	Lecturer/ Training Some Appl.	9	D.K.	D.K.	OME License	Back Pack & Boom Sprayers
12	4	(1) 48 (3) 22	Mixing Loading Applying	(1) 20 1.5	33	8.5	(1) OME License	Hand Sprayers
13	4	(1) 47 (2) 25 (1) 34	Mixing Loading Applying	(1) 22 (2) 1 8	65	8.5	(2) license (2) In-house	Hand & Ground Sprayers
14	2	22	Applying	4	(1)60 (1)5	(1) 5 (1) 5	(1) OME License (1) none	Tank, hose Gun
15	4	22	Applying	6-8 (2) 2	(1)120 50 25	10	(2) license (2) none	

OME - Ontario Ministry of the Environment.

SOURCE; Deloitte Haskins & Sells

TABLE 5.4 (continued) Commercial Lawn Care Company Employee Statistics.

Company/ Respondent	No. Workers Applying*	Avg Age	Jobs Involved	Avg Years Experience	Avg. No. Of Days Applying	Avg. # of Hours In Application Day	Training Of Personnel	Application Equipment Used
16	1	25	Mixing Loading Applying	4	80	10	OME License	D.K.
17	6	(2) 37 (4) 22	(4) Applying (2) super- Vision	(1) 7 (1) 3 (4) 0	80	6	(1) License (5) in-house	Hand & Ground Sprayers
18	10	(2) 44 (1) 35 (7) 22	(2) super- vision (8) mixing Loading Applying	(1) 30 (1) 14 (1) 24 (7) 3	40	8	(4) license (6) none	Hand & Ground (Boom)
19	5	(1) 63 (1) 47 (1) 35 (2) 25	Mixing Loading Applying	(2) 15 (3) 2	120	6	(4) License (1) none	Hand a Ground Sprayers
20	2	(1) 50 (1) 28	Mixing Loading Applying	(1) 27 (1) 13	(1) 110 (1) 80	10	OME License	Hand Sprayers
21	3	(1) 42 (2) 26 (3) 33	Mixing Loading Spraying	(1) 15 (1) 5 (1) 0	18	7.5	(2) license (1) none	Hand Sprayers
TOTAL	665							

OME - Ontario Ministry of the Environment.

SOURCE: Deloitte Haskins & Sells

TABLE 5.5 Commercial Lawn Care Company Employee Use Of Protective Clothing In 1986.

Company/ Respondent	Washable Overalls	Disposable Overalls	Hat	Rubber Gloves	Neoprene Gloves	Rubber Boots	Goggles Or Face Shield	Respirator	Long Pants	Short Pants	Short Sleeves	Long Sleeves
1			270	Mixing & Loading Only		270			270		270	
2				60	60	60			60		60	
				Part- Time	Part- Time							
3	123 Mixing & Loading Only		123	123		123	123 Mixing & Loading Only	123 Mixing & Loading Only			123 Applying Only	
4	3 Mixing Only		3	3		3	3 Mixing Only	3 All Times	3			3
5	120			120		120	120 Mixing Only	120 Mixing Only	120			120
6						39			39		39	
7			1						1		1	
8					4		4 Mixing & Loading Only		4			4
9			4	4		4		4 Mixing Only	4			4

SOURCE: Deloitte Haskins & Sells

TABLE 5.5 (continued) Commercial Lawn Care Company Employee Use Of Protective Clothing In 1986.

Company/ Respondent	Washable Overalls	Disposable Overalls	Hat	Rubber Gloves	Neoprene Gloves	Rubber Boots	Goggles Or Face Shield	Respirator	Long Pants	Short Pants	Short Sleeve	Long Sleeve
10			4 Part- Time		4 Mixing Only	4			4		4 Applic. Only	4 Mixing only
11				3		3			3		3	
12	4			4		4	4 Mixing & Loading Only	4 Mixing & Loading Only	4			4
13			4		3	4			4		4	
14	1		1	2		2			2		1	1
15	4		4	4		4	4 Mixing Only	4 Mixing Only	4			4
16	D.K.	D.K.	D.K.	D.K.	D.K.	D.K.	D.K.	D.K.	D.K.	D.K.	D.K.	D.K.
17			4	6		6			6		6	
18			8	2	6	6			4	6	10	
19	4		4	1	4	5	2 Mixing Only	3 Mixing Only	5		5	
20			2	2		2	2 Mixing Only		2			2
21			3	3				3 Mixing Only	3			3
TOTAL	260	0	433	337	81	663	262	264	544	6	526	149

D.K. - Don't Know

SOURCE: Deloitte Haskins & Sells

TABLE 5.6. Commercial Lawn Care Company Storage, Handling And Disposal Of 2,4-D Storage Of 2,4-D.

Company/ Respondent	House	Garage	Shop/store	Chemical Storage Building	Storage Yard	Equipment Shed	Locked	Dry	Vented
1						YES	YES	YES	YES
2		YES		YES			YES	YES	YES
3				YES			YES	YES	YES
4				YES			YES	YES	YES
5		YES			YES	YES	YES	YES	YES
6				YES			YES	YES	YES
7	YES						YES	YES	YES
8				YES			YES	YES	YES
9				YES			YES	YES	YES
10							YES	YES	YES
11				YES			YES	YES	YES
12				YES			YES	YES	YES
13			YES				YES	YES	YES
14			YES	YES			YES	YES	YES
15				YES			YES	YES	YES
16			YES				YES	YES	YES
17			YES	YES			YES	YES	YES
18			YES				YES	YES	YES
19							YES	YES	YES
20		YES					YES	YES	YES
21				YES			YES	YES	YES

SOURCE: Deloitte Haskins & Sells

TABLE 5.6 (continued) Commercial Lawn Care Company Storage, Handling And Disposal Of 2,4-D.

Company/ Respondent	Experienced 2,4-D Spill	Procedures Followed In Spill	Disposal Of Empty 2,4-D Containers
1	NO		triple rinse; punctured; disposed of as required by OME
2	NO		triple rinse; crush and bury Or take to registered disposal site.
3	YES	Immediate cleanup & report to MOE.	returned drums; plastic containers punctured; triple rinsed and disposed of in industrial waste containers.
4	NO		returns to supplier where they are crushed and buried.
5	NO		punctured, rinsed out and buried in landfill sites.
6	YES	Contained spill; notified MOE; clean up.	triple rinse barrels, store at facility pending review of proper disposal.
7	NO		triple rinse, crush and take to disposal site.
8	NO		punctured, take to disposal site
9	NO		triple rinse, punctured; disposed of at an approved disposal site.
10	NO		triple rinse; taken to landfill site where they are punctured crushed and buried.
11	NO		rinsed, punctured and taken to disposal site.
12	NO		rinsed, punctured and disposed of at an approved site.
13	NO		small containers triple rinsed, taken to landfill site - drum triple rinsed, stored on premises.
14	NO		triple rinse and taken to landfill site.
15	NO		punctured and disposed of in bins.
16	D.K.		----
17	NO		triple rinse, punctured, disposed of at an approved site.
18	NO		triple rinse drums and store in a field
19	NO		rinsed out and disposed of in an approved waste or dump site.
20	NO		complete wash/rinse/bury
21	NO		crush and send to landfill site

D.K. - Don't Know.

OME - Ontario Ministry of the Environment

SOURCE: Deloitte Haskins & Sells

TABLE 5.7. Golf Course Employee Statistics In 1986.

	No. Workers Applying	Avg Age	Jobs Involved	Avg Years Experience	Avg. No. Of Days Applying	Avg. No. Of Hours In Application	Training Of Personnel	Application Equipment Used
1	2	26	All	6.5	14	3	1 OME License 1 not Licensed	Hand Sprayer And Ground Sprayer
2	2	28.5	Mix & Applic.	9.5	1.5	4	University Degree	Hand Sprayer Ground Sprayer Ground Spreader
3		No 2,4-D Applied In1986						
4	2	20.5	Foreman Labourer	1	7	4	1 OME License	Ground Sprayer
5	2	26.5	All	9.5	8.5	5	--	Ground Sprayer
6	1	55	Mixer Applicator	30	3	6	OME License	Ground Sprayer
7	1	26	All	6	6	4	Supervised by OME Licensee	Ground Sprayer

OME - Ontario Ministry of the Environment.

SOURCE; Deloitte Haskins & Sells

TABLE 5.7 (continued) Golf Course Employee Statistics In 1986.

	No. Workers Applying	Avg Age	Jobs Involved	Avg Years Experience	Avg. No. Of Days Applying	Avg. No. Of Hours In Application	Training Of Personnel	Application Equipment Used
8	2	34.5	Greens- Keeper Maintenance	8	3.5	2	OME License	Ground Sprayer
9	1	24	Superintendent	5	11	2	OME License	Ground Sprayer
10	1	26	All	4	4	8	OME License	Ground Sprayer
11	3	42	All	16	3.3	2.5	OME License (2) Not Licensed(1)	Ground Sprayer Ground Spreader
12	2	22	Applicator Loader	2	2	5	Licensed Supervision	Ground Sprayer
<hr/>								
TOTAL	19							

OME - Ontario Ministry of the Environment.

SOURCE: Deloitte Haskins & Sells

TABLE 5.8. Golf Course Employee Use Of Protective Clothing In 1986.

	No. Of Workers	Washable Overalls	Disposable Overalls	Hat	Rubber Gloves	Neoprene Gloves	Rubber Boots	Goggles Or Face Shield	Respirator	Other (Specify)
1	2	-	-	2	2		2	2	2	--
2	2	2	0	0	2	0	2	0	0	--
3	-	DID NOT APPLY 2,4-D IN 1986								
4	2	0	0	0	0	0	1	1	1	--
5	2	0	0	2	2	0	2	2	2	
6	1	1	0	1	1	0	0	1	1	
7	1	1	0	0	1	0	1	C	1	--
8	2	0	0	2	2	0	2	0	2	Rain Suit
9	1	0	0	1	1	0	0	1	1	--
10	1	1	0	0	1	0	0	1	1	--
11	3	0	3	3	3	0	3	3	3	--
12	2	1	0	2	2	0	1	0	2	Rain Suit
TOTAL	19	6	3	13	17	0	14	11	16	2

SOURCE: Deloitte Haskins & Sells

TABLE 5.9. Golf Course Storage, Handling And Disposal Of 2,4-D Products In 1986.

Golf Course Identification	Experienced 2,4-d Spill	Procedures Followed In Spill	Disposal Of Empty Containers
1	NO		rinsed into spray tank, cut up and put in garbage dumpster
2	NO		local municipal garbage collection
3	Does Not Use 2,4-D		
4	NO		triple rinse, punctured and place in industrial refuse bin for collection
5	NO		rinse containers and crush; disposal
6	NO		washed and punctured, crushed and put in waste disposal, buried at landfill site
7	NO		double rinse, plastic containers are punctured, place in industrial bin for disposal
8	NO		punctured, disposal at local landfill site
9	NO		rinsed out, punctured and taken to approved disposal site
10	NO		triple rinse, crush and put in disposal bin, taken to landfill site
11	NO		washed out with detergent and water, crushed and placed in garbage bin
12	NO		thoroughly rinsed and disposed of

SOURCE: Deloitte Haskins & Sells

5.3 Economic Impacts Of 2,4-D To The Home And Garden Market

Since 2,4-D products in the home and garden market represent greater than 75% of the value of all retail sales in Ontario, there are a number of possible impacts that may result should 2,4-D no longer be available. Total retail sales of products containing 2,4-D to the home and garden sector were calculated at some \$16.6 million dollars. Removal of 2,4-D from the Ontario market would eliminate a significant proportion of this value since there are only two other herbicide products registered for use in Canada that can be applied by homeowners (i.e., MCPA and mecoprop). However, they are produced in limited quantities, and with labels specific to buttercup weed control only. These products are not sold in the Ontario market. It is generally considered that MCPA and mecoprop will "control" most weeds present in residential lawns, with only minor exceptions, according to manufacturers' labels (Dr. C. Hall, University of Guelph, 1987).

There are no alternative products registered for use in impregnated fertilizer formulations, which accounts for about 50% of 2,4-D retail sales.

In contrast, the following products are available to commercial licensed applicators, if 2,4-D is removed from the market:

- ▶ dicamba (applied alone)
- ▶ mecoprop (applied alone)
- ▶ MCPA (applied alone)
- ▶ dichlorprop (not registered for use alone)

A significant feature of the home and garden herbicide and impregnated fertilizer sales volume is the relatively high margins at the wholesale/retail level for these products. Margins of up to 60% of retail value, (20-30% retail and 20-30% wholesale) are not uncommon for these products when sold to the homeowner. (That is, markups of 64 to 150 percent over manufacturer/formulator price.)

Lawn care products containing 2,4-D for use as spray treatments or impregnated fertilizer applications by the homeowner are regarded as an important source of additional customers and business by wholesalers and retailers particularly, (i.e. nurseries).

In addition, removal of 2,4-D from the Ontario market would render existing inventory, investment in seasonal promotional materials and sales training in product use and application valueless unless these materials could be used in other markets.

A restriction of home and garden use of 2,4-D, coupled with the immediate absence of the "Domestic" registered alternatives for this market leaves some homeowners with the option of employing commercial applicators to apply alternative products. This could more than triple the use of these services prior to introduction of registered alternative products for homeowner use. It is estimated that approximately \$5-10 million added revenue could potentially accrue to this group, at least in the short term depending on how many homeowners adopt their services. It is important to note however, that retail business, such as nurseries would not benefit, since sales to commercial applicators are usually conducted at the wholesale/distributor level directly.

The increased costs of commercial application of registered alternative products could be significant for the homeowner who self-applies 2,4-D products now. The difference in cost from self-applied to commercially applied could be in the order of 30 to 60 dollars per year, depending on the products used and the number of applications per year. If no 2,4-D substitutes, (chemical or manual) are applied, the appearance and quality of lawns could have an impact on the perceived and real property value of homes. However, it is likely that homeowner expenditures for other non-chemical substitutes (e.g. fertilizer, more frequent mowing and hand weed pulling aids) would increase.

5.3.1 Impact On Employment

The prospective loss in employment will largely depend on the availability and use of substitute products. Information supplied by respondents indicates that approximately 60 to 150 jobs would be lost if 2,4-D is no longer available for use in Ontario, and no substitute products are applied. Certainly, the use of substitute products in many end use markets appears probable. Consequently, the above job loss estimates must be viewed as maximum and only applicable to the very short term, until users have time to react and adjust to purchases of other herbicides to compensate for a potential 2,4-D loss.

Indeed, from a social perspective, job losses in some retail business would be compensated for, at least in a general net sense, by job gains in commercial lawn care application businesses.

TABLE 5.10 Commercial Lawn Care Companies.

What Specific Measures Would You Take As A Substitute For 2,4-D?

Company/ Respondent	Response
1	Our suppliers are presently studying substitutes, close contact with OME
2	An alternative product would have to be secured, comparable to the effectiveness of 2,4-D.
3	No 2,4-D will be used next year
4	We really don't have a lot of choice, as far as I know, the only substitute is MCPA, which I understand will not supply the same results.
5	At this time, there is no product available to effectively replace 2,4-D to my knowledge.
6	If 2,4-D is not available, there is a severe lack of suitable alternatives.
7	Try to find another combination product that does the same job.
8	None - no known substitute.
9	Check with manufacturers and Landscape Ontario to see what products could safely replace 2,4-D.
10	Products that are registered for weed control - Banvel, Dicamba, Mecoprop, MCPA, Dichlorprop.
11	Have a few areas being test treated with Methoxone Sodium 300 and with a mix of Methoxone sodium 300 and Dicamba. It would not concern us too much if 2,4-D were removed from the market.
12	Would not like to see 2,4-D removed, substitutes don't have the same performance and likely more applications would be required to get the desired control.
13	MCPA, Dicamba, Dyamine, Mecoprop, Bromoxynil, Diphenoprop, Dyvel, although some are not registered for turf and are much more toxic.
14	Check with suppliers as to the availability of a reasonable substitute.
15	Whatever they recommend to use as an alternative.
16	--
17	--
18	Use other chemicals
19	Mecoprop and/or Dicamba
20	Don't know
21	

SOURCE: Deloitte Haskins & Sells

6.0 2,4-D ALONG RIGHTS-OF-WAY

The Ministry of Transportation and Communication (MTC) and 11 utility companies known to be responsible for vegetation control along rights-of-way, were surveyed for the following information:

1. use of 2,4-D products in 1986;
2. number of workers involved in 2,4-D applications; use of personal protective clothing during mixing, loading and spraying activities; and
3. assessment of economic impact(s) if 2,4-D is withdrawn from use.

6.1 Use Of 2,4-D Along Roadsides In Ontario

2,4-D and other herbicides are routinely applied along roadsides for noxious weed control and also to control undesirable brush for the following reasons:

1. to ensure and maintain driver safety by providing adequate sight distances and an unobstructed view of signs, guideposts, animals, etc;
2. to reduce snow drifting;
3. to maintain adequate snow storage areas;
4. to reduce shading of the road surface in the winter and thereby reduce icing and a potential hazardous driving condition;
5. to protect the travelling public, highway personnel and adjacent land users from the health hazards posed by certain noxious weeds;
6. to prevent impairment of drainage ditches;
7. to protect adjacent agricultural lands and livestock from noxious weeds as required under the "Weed Control Act";
8. to aid in erosion control by improving turf cover.

The Ontario Ministry of Transportation and Communication (MTC) upon request, provides basic recommendations to counties, regions and other municipalities on how best to control weeds and brush in their respective jurisdictions along roadsides. In addition, the MTC treated approximately 20,000 hectares in 1986 itself with 33,677 Kg ai of 2,4-D along provincial highways, (Table 6.1).

Information indicating the total use of 2,4-D (KG ai) along all other roadsides in Ontario is available for 1983 only, (Table 6.2). In 1983 approximately 31,450 KG ai of 2,4-D were applied. It is assumed that volumes of 2,4-D used in 1986 were equal to 1983.

MTC estimates that the split between weed and brush control activities is 50/50. The majority of brush control occurs in Northern Ontario and weed control is largely focused in Southern Ontario.

MTC and other municipalities control vegetation through a combination of manual, mechanical and chemical methods, but rely primarily on the latter for the bulk of their operations.

To achieve optimum levels of weed and brush control, MTC and others have utilized a number of selective herbicides, all containing 2,4-D amine or 2,4-D low volatile (LV) ester as components. These include:

- 2,4-D amine
- 2,4-D/picloram
- 2,4-D/dicamba
- 2,4-D/dichlorprop

Experimentations with alternative herbicides not containing 2,4-D have been conducted, including, but not limited to:

- Chlorsulfuron
- Fosamine ammonium
- Triclopyr

TABLE 6.1. Use Of 2,4-D (Kilograms Active Ingredient) By The Ontario Ministry Of Transportation, 1986.

DISTRICT	1986		
	2,4-D AMINE	2,4-D* 2,4-DP	2,4-D & PICLORAM
Chatham		560	504
London	1200	980	201.6
Stratford	960	840	100.8
Hamilton	240	420	
Owen Sound	1080	990.5	201.6
Toronto	1680		
Port Hope		1540	151.2
Kingston	240	840	504
Ottawa		1400	504
Bancroft		3570	
Huntsville		1400	
North Bay			
N. Liskeard		70	2217.6
Cochrane			907.2
Sudbury		2310	
S.S. Marie			2923.2
Thunder Bay			1411.2
Kenora			3729.6
TOTAL	5400	14920.5	13356

SOURCE: Ralph Dell, MTC, 1986.

* indicates the volume of 2,4-D contained in each product

TABLE 6.2. Use Of 2,4-D (kg ai) By Counties/regions On Non-provincial Roadsides In 1983.

COUNTY or REGION	2,4-D AMINE	2,4-D ESTER	2,4-D	2,4-DP
Brant	728		327.5	327.5
Bruce			1344.0	1344.0
Dufferin			648.5	648.5
Dundas				
Stormont Glengarry		1248	840	840
Durham	128	969	969	
Elgin			1127	1127
Essex	510		852	852
Frontenac				
Grenville				
Grey	30		1172.5	1172.5
Haldimand- Norfolk			251.5	251.5
Halton	110	281	281	
Hamilton-Wentworth	621			
Hastings				
Huron	565.25		833	833
Kent	305		778.5	778.5
Lambton			1362.5	1362.5
Lanark			895	895
Leeds				
Lennox & Addington				
Middlesex			2106.5	2106.5
Niagara				
Northumberland			295	295
Oxford			1170	1170
Peel	230.75		525	525
Perth			1710.5	1710.5
Peterborough			350	350
Prescott			483	483
Prince Edward			560	560
Renfrew			1043	1043
Russell			880.5	880.5
Simcoe			672	672
Victoria	1986.35		141.5	1415
Waterloo			1042	1042
Wellington			1064	1064
York	375.91		287	287
TOTAL	5590.26	1248	24612	24612

SOURCE: Bill McGee, Survey of Pesticide Use in Ontario, 1983. OMAF, 1984

Current annual expenditures by MTC alone for chemical weed and brush control amount to approximately \$1.35 million in total. This includes \$1.1 M for chemicals and \$0.25 M for labour. It is assumed that approximately an equal amount is spent by other municipalities for similar roadside weed and brush control programs.

6.2 Use Of 2,4-D By Utility Companies Along Rights-of-Way

From the 11 utility companies surveyed for 2,4-D use in 1986, only 6 indicated varied degrees of use for a total of 46,951 kg ai, on approximately 21,901 hectares (Table 6.3).

Ontario Hydro was the single largest user of 2,4-D, estimated at approximately 30 thousand Kg ai on 19 thousand hectares in 1986. The second largest user was TransCanada Pipelines estimated at 5,634 kg ai of 2,4-D, applied on approximately 1,640 hectares (Table 6.3).

2,4-D and products containing 2,4-D were used in over 90% of Ontario Hydro's vegetation control programs including brush and weed control. Brush control operations generally occur in rural areas and particularly in Central and Northern Ontario. Hydro transmission corridors adjacent to and in urban environments generally require weed control only.

The total area of brush control treatments conducted by Hydro in 1986 amounted to 17,500 hectares, involving approximately 27,842 kg ai of 2,4-D. Total expenditures for brush control amounted to approximately \$6.7 million, which includes \$1.1 million for all chemicals and \$5.6 million for application costs, including labour and equipment. On the other hand, the area of weed control was 1,700 hectares involving approximately 2,052 kg ai of 2,4-D. No cost estimates for weed control were given. The costs of 2,4-D applications are significantly greater for Ontario Hydro compared to MTC for two reasons:

1. many areas requiring treatment are generally inaccessible by road, thus more expensive transportation methods are required, and
2. most applications are manually directed to undesirable brush, thus requiring more labour compared to MTC operations.

TABLE 6.3 Use Of 2,4-D (kg ai) By Utility Companies Along Rights-of-way In 1986.

Company	Use 2,4-D	Product Used	Volume Used (Litres)	2,4-D kg/ai	Hectares Treated	Location(s) of Treated Acres/ Notes
Ontario Hydro	YES	2,4-D/ Dichlorprop	70,860	23,313	17,500	Brush control is achieved in the main using 2,4-D/ dichlorprop and Tordon 101.
		2,4-D/ Picloram (Tordon101)	18,871	4,529		
		2,4-D/ Mecoprop/ Dicamba (Killex)	7,065	1,342	The use of Tordon 101 occurs, for the most part, in Northern and Central Ontario. Weed control is done around area offices, building and urban areas by Killex and 2,4-D Amine.	
		2,4-D Amine	1,420	710		
CN Rail	YES	2,4-D/ dicamba	590	221.8	56	Areas treated include Barrie/ Midland area, Bala/ Toronto and Uxbridge / Danforth
		2,4-D/ Picloram	18,859	3,806.2	759.7	Kingston/Brighton, Richmond Hill, Beaverton, Sparrow Lake / Perry Sound, Burkes Falls/ Trout Creek, Capreal/ Algoma, High River/Lorne Payne, Horne Payne/Hillsport, Nakima / Armstrong. All vegetation management is contracted out.
		2,4-D	39	11.9	34	

SOURCE: Deloitte Haskins & Sells survey.

TABLE 6.3 (continued) Use Of 2,4-D (kg ai) By Utility Companies Along Rights-of-way In 1986.

Company	Use 2,4-D	Product Used	Volume Used (L)	2,4-D kg/ai	Hectares Treated	Location(s) of Treated Acres/ Notes
CP RAIL	YES	2,4-D/ Dichlorprop	8,600.8	3,010.3	509.5	All vegetation management is contracted out.
Trans-Canada Pipelines	YES	2,4-D Dicamba	14,085	5,634	1,640	Districts of: Thunder Bay, Cochrane, Nipissing.
ICG	YES	2,4-D/ Mecoprop Dicamba (Killlex)			Limited	Use Killlex for limited lawn application around buildings.
Inter-Provincial Pipelines Inc.	YES	2,4-D/ Mecoprop Dicamba (Killlex)			Limited	Weed control only on lawns and around buildings.
Union Gas	NIL					Minor experimental use.
Great Lakes Power Ltd.	NO					No use of 2,4-D. Other herbicide used.
Trans Northern Pipelines Inc.	NO					Mechanical brush control - Ottawa-Cornwall area.
Sun Canadian	NO					

SOURCE: Deloitte Haskins & Sells survey.

The majority of vegetation management conducted by TransCanada Pipelines in 1986 involved brush control in primarily northern districts of Ontario (Table 6.3).

The only other major users of 2,4-D products in 1986 were CO and CP Rail, estimated at approximately 4,040 and 3,010 kg ai 2,4-D respectively. Details of the areas treated were provided by CN Rail and are presented in Table 6.3.

6.3 Employee Statistics And The Use Of Protective Clothing Along Roadsides And Utility Rights-of-Way

Employee statistics and use of personal protective clothing information was available for only 4 of the eleven companies and the Ontario Ministry of Transportation and Communication (MTC). (Statistics on employees working for counties/regions and other municipalities are presented in Section 7.0, since areas other than roadsides were treated with 2,4-D and further analysis involving these jurisdictions is best suited to a separate section).

Tables 6.4 and 6.5 outline the basic employee statistics and use of protective clothing for each of the five respondents. Both MTC and Ontario Hydro have the greatest number of employees involved in roadside and rights-of-way applications, estimated at approximately 46 and 500 people, respectively. However, the age structure and turnover rates between the two are unique. Specifically, MTC employees are full-time with ages ranging up to 65 years and tend not to change jobs, consequently they are potentially exposed to 2,4-D over long periods of time. However, it should be noted that MTC applies broadcast sprays from the spray vehicle only, with a 2-man crew riding the vehicle during application. They also utilize drift control materials with all spray operations to minimize operator exposure and off rights-of-way damage.

TABLE 6.4 Employee Statistics For MTC And Utility Companies Controlling Vegetation Along Rights-of-ways.

Ontario Hydro	<p>Ontario Hydro has approximately 500 people involved in vegetation management, the majority of them are working in brush control (90%). Approximately 50% of these people are temporary for 2-3 seasons, i.e. summer students, and would have 0-2 years experience. The majority of herbicides are applied by ground sprayer (90%) with some backpack application (10%) and very little aerial application (less than 1%).</p> <p>Comprehensive training is provided to all persons involved with the spraying operation in the form of complete handling, use, application and safety instructions.</p>
MTC	<p>MTC employs approximately 80-100 persons with a Class 1 land exterminators license who could be involved in 2,4-D applications. Age ranges up to 65 years. There are 19 crews of 2 each for highway work and 4 off Highway crews of 2. All persons are employed year round on highway related functions, hence a very low turnover, and about 85% of the 23 spray crews are applying 2,4-D year after year. A one week training period is provided for all new applicators.</p>
CN/CP	<p>2 persons employed by spray contractor were involved in herbicide operations. Herbicides applied using high-rail spray truck.</p>
Great Lakes Power	<p>5 persons employed in 2 week vegetation mgt. project, 1 supervisor and 4 loaders, averaging 30 years of age, and 2 years experience.</p>
Trans Canada Pipelines	<p>All herbicide applications were carried out by licensed custom applicators.</p>

SOURCE: Deloitte Haskins & Sells

TABLE 6.5 Use Of Protective Clothing By MTC And Utility Company Employees In 1986.

Ontario Hydro	Ontario Hydro publishes comprehensive guidelines and training material for its employees, as to the type of safety equipment to be used in various situations, and how to use it. Situations covered are: general precautions, container disposal, transportation of pesticides, stem foliage application and basal application techniques. Information is provided regarding use and length of time between laundering for coveralls, use of respirator cartridges and goggles, and personal hygiene when working with pesticides. All equipment is to be available at all times, as well as spare gloves, coveralls, goggles, etc.
MTC	MTC published internal guidelines regarding spraying activities, these include the requirement to wear safety helmet and disposable coveralls at all times, neoprene or rubber boots, when applying pesticides by hand, neoprene gloves when mixing or pouring chemicals, safety glasses or goggles when handling chemicals in undiluted form, and disposable dust respirators when handling powder formulations. Eye wash solutions, clean water and extra coveralls are also provided on all spray equipment. Instructions are also given for cleanup procedures, and frequency of laundering etc.
CN/CP	Application is done by one custom applicator. He indicated that each employee is issued with a change of washable coveralls, and a Cyanamid safety kit (containing goggles, neoprene gloves, 2 cartridge respirator with organic vapour filters, splash aprons and earplugs). Particular emphasis is placed on the use of gloves.
Great Lakes Power	Protective clothing for workers using herbicides is mandatory, and includes white coveralls, hard hats, leather work gloves, and fitted face mask (required only when loading). All equipment is buried at an OME-approved site at the end of the project.
Trans Canada Pipelines	Actual protective clothing was not specified, it was stated that all herbicides were applied according to health, safety and environmental requirements.

SOURCE: Deloitte Haskins & Sells

On the other hand, Ontario Hydro employees are primarily involved in brush control using ground sprayers, often in remote areas, thus they tend to be younger and many are hired only on a temporary basis. Approximately 50% of Hydro's employees are students and return for 2-3 seasons only.

Both MTC and Ontario Hydro demand very extensive safety precautions when storing, handling, mixing and spraying any pesticides, including 2,4-D products (Table 6.5). During mixing and loading activities, appropriate protective safety equipment such as goggles, gloves, boots, and coveralls are used. Both require the use of protective clothing during spray activities. Protective clothing like coveralls is changed (and laundered) on a daily basis to minimize worker exposure. The herbicides currently being used do not require a respirator during applications. It should be noted that Ontario Hydro's spray program involves selective applications to brush thereby reducing potential spray drift compared to broadcast methods of application.

Both CN and CP Rail contract out all vegetation management to one company. Information supplied by this company indicates that only 2 people are involved per season, and are supplied with washable coveralls, gloves, respirators and splash aprons for use during all activities, (Table 6.5).

TransCanada Pipelines also contracted out their vegetation management activities. The aerial applicators identified were also involved in forestry silvicultural practices (see Section 4.2).

Great Lakes Power employs 5 people for only 2 weeks per season. Although herbicides are applied by air, use of all protective clothing is required during mixing and loading activities (Table 6.5).

6.4 Economic Impacts to MTC and Ontario Hydro if 2,4-D is no Longer Available

6.4.1 MTC

As indicated earlier, MTC uses manual, mechanical, and chemical vegetation management tactics, but relies primarily on the latter due to ease and cost.

In 1980, MTC conducted a study which compared manual, mechanical and chemical vegetation control. Results of this analysis (expressed in 1980 dollars) are presented below.

WEED CONTROL			
	MECHANICAL		CHEMICAL
Effectiveness/Duration	½ year		2 years
Cost (\$/year)	\$1,510,000		\$475,000
Manhours required (manhours/year)	78,250		4,500
Fuel consumption(litres/year)	500,500		37,700

BRUSH CONTROL			
	MANUAL	MECHANICAL	CHEMICAL
Effectiveness/Duration	3 years	3 years	5 years
Cost(\$/year)	8,750,000	3,125,000	540,000
Manhours required	937,500	62,500	3,600

NOTE: Figures reflect internal MTC costs and do not cover such items as overhead costs, profits, etc. If these operations were carried out by contract, costs would be 25% to 40% higher.

SOURCE: R. Dell, 1987. MTC. Toronto, Ontario

The MTC estimates that in 1986, 20,000 hectares were treated with herbicides. The split between weed and brush control was approximately 50/50.

By extrapolation, if 2,4-D was no longer available for use in Ontario now and no substitute herbicides are used, the 1986 cost of weed control would increase from approximately \$608,000 to \$1,933,000 using mechanical methods. For bush control, the 1986 cost would increase from \$713,000 to \$4,300,000 using mechanical methods or \$12,039,000 using manual brush control.

ALTERNATIVE HERBICIDES:

WEED CONTROL: MTC has experimented with chlorsulfuron, but thus far, it has not been demonstrated it can control all noxious weeds which they are required to control by law. No other products have been fully investigated to date for efficacy and cost, including mecoprop and MCPA. Thus, in the immediate term, mechanical weed control is considered the only viable alternative to 2,4-D, until such time when alternative and new products are tested for efficacy and general public acceptance (i.e. no "brown-outs" of vegetation or discoloration of surrounding foliage).

BRUSH CONTROL: MTC has experimented with fosamine ammonium and triclopyr. Fosamine ammonium has proven unsatisfactory for a number of unstated reasons. Triclopyr, which is not registered yet shows good promise for deciduous control, but it must be added to a product which controls conifers if these are present. As with weed control, MTC would be forced to implement either mechanical or manual methods at least in the short term until all alternative and new products could be fully evaluated for efficacy and public acceptance.

In either case, one could expect new products to substitute for 2,4-D in the intermediate or long term. Thus, the mechanical and manual costs described above should be viewed as maximum cost impacts for the short term only.

All short term cost impacts described above would amount to \$13.9 million per year, assuming the same number of hectares are controlled for brush and weeds as in 1986. Alternatively, the number of treated areas could be cut back to save increased expenditures, but the incidence of road hazards could increase.

6.4.2 ONTARIO HYDRO

WEED CONTROL

Approximately 1,700 hectares were treated for weed control around and along power lines and area offices in 1986. 2,4-D applied in mixtures is currently being used because of its effective broad spectrum weed control.

Although MCPA, mecoprop and dicamba are registered for weed control separately, they are not registered as tank mixes. They therefore, would not be as effective when applied singularly as current 2,4-D mixtures for noxious weed control according to Ontario Hydro.

If 2,4-D was no longer available for weed control, Hydro would use chlorsulfuron on only a very limited basis, since it is specific for control of certain noxious weeds. The current cost per hectare for chlorsulfuron is approximately \$56 compared to \$8.50 for 2,4-D, representing a 6.6 fold cost increase. Hydro indicates that if only chlorsulfuron was available, there would be many areas where no chemicals would be applied, at least in the short term.

In many circumstances, grass is mowed along hydro corridors around built-up areas at least once per year. This practice would remain unchanged if 2,4-D was withdrawn. Thus, the impact on Hydro's weed control program would be a minor net reduction in expenditures but many noxious weeds may grow unchecked.

BRUSH CONTROL

This operation consumes the vast majority of Hydro's vegetation management resources, and, would be most severely impacted if 2,4-D was not available.

Approximately 17,500 hectares were treated for conifer and deciduous brush control in 1986. Expenditures for brush control amounted to \$6.7 million, at an average cost of approximately \$377/ha. On limited areas (i.e. 760 Ha) manual/mechanical control measures were implemented primarily due to brush being too high to spray. Expenditures in 1986 for manual/mechanical brush control amounted to approximately \$1.4 million, at an average cost of \$1,900/ha. The latter represents a 5 fold cost increase per hectare for manual / mechanical brush control over chemical vegetation control.

ALTERNATIVE BRUSH HERBICIDES

The following are some of the currently registered herbicides for brush control, however, when used singularly, they have limitations. Brush control is achieved by foliar, basal and stump application techniques. As with the alternatives registered for weed control, these materials cannot be tank mixed.

SODIUM TCA At high rates, tends to burn grass cover which is not desirable - works well on conifers, not deciduous brush - Foliar application only.

FOSAMINE AMMONIUM Does not control conifers effectively has limitations on deciduous brush - is 4 times as expensive as 2,4-D / dichlorprop - used for Foliar application only.

GLYPHOSATE Will control all vegetation, has to be applied selectively - has limited use at present - application equipment/ techniques have to be developed - registered for foliar application only.

Other materials which can be used for brush control but are either not available or not registered for this use at present:

PICLORAM registered as separate active ingredient (ai) as a pellet formulated but no longer available. Not registered as a separate active ingredient in a liquid formulation.

DICAMBA same as for Picloram

DICHLORPROP (2,4-DP) not registered as a separate active ingredient for brush control.

TRICLOPYR not registered

METSULFURON METHYL not registered

The bottom line is that there are no materials that are currently registered which will completely satisfy Ontario Hydro's vegetation management needs, should restrictions be placed on 2,4-D.

There are no products that could be used for basal or stump control of brush as alternatives to 2,4-D. The use of the available foliar applied available materials need further development work, particularly in the application (equipment) end.

Given current available registered alternatives to 2,4-D and their relative efficacy, Ontario Hydro would have to implement an extensive manual/mechanical means of brush control, until viable and acceptable alternatives become available. Consequently, if 2,4-D is no longer available for vegetation control, expenditures for 1987 could increase to \$33.5 million from \$6.7 million in 1986.

7.0 2,4-D IN COUNTIES, TOWNSHIPS, CITIES AND TOWNS

Random samples of 9 counties, 10 townships, 8 cities and 11 towns were selected to provide information on the use of 2,4-D products and statistics on employees involved with 2,4-D and their use of personal protective clothing and devices.

7.1 Use Of 2,4-D In Counties, Townships, Cities And Towns

Results indicate that 8 of 9 counties used 2,4-D products in 1986 primarily for weed and brush control along roadsides, with only minor applications in some parks and other recreational areas (Table 7.1). The total volume of 2,4-D applied in 1986 was 3,456 kg ai, of which 2,450 kg ai were used in ester formulations and 1,006 in amine formulations. Applications to roadsides here are in addition to those described in the previous section.

Only 4 of 10 townships surveyed, indicated that 2,4-D products were used primarily on roadsides with limited amounts applied on parks and recreational areas (Table 7.2). One respondent indicated that 2,4-D was used, but since all spraying was contracted out, they did not know how much was used, nor which safety precautions were followed. The remaining three townships applied approximately 924 kg ai of 2,4-D generally in the ester formulation.

Municipalities/cities control weeds and brush in parks, schoolyards, roadsides, and other minor areas such as around municipal buildings, using either manual, mechanical or chemical methods. The use of 2,4-D products by municipalities/cities was quite variable in 1986 ranging from no 2,4-D in the City of Toronto to 954 Kg ai in London (Table 7.3). The majority of 2,4-D was applied to parks either as a liquid herbicide (London, Mississauga, Scarborough, Peterborough and Sudbury) or as impregnated fertilizers (Thunder Bay). In total, greater than 2,365 Kg ai of 2,4-D was applied in the surveyed cities.

Eleven towns were contacted for use of 2,4-D products in 1986, however no 2,4-D products were applied (Table 7.4).

TABLE 7.1. Use Of 2,4-D By Selected Counties In 1986.

County	Use 2,4-D*	Product Used	Vol. Product (L)	Vol. Ai (kg)	Rate Of Application (L/ha)	Roadside Hectares Treated
Brant	YES	Diphenoprop	1025	230.6 (E)	3.6	285 ha
Kent	YES	2,4-D Amine	340	159.8 (A)	6 L/mile	56 mi
		2,4-D / Dichlorprop	1200	420.0 (E)	8.5 L/mile	141 mi
Oxford	YES	2,4-D / Dichlorprop	1480	518.(E)	4.3	343 ha
Renfrew	YES	2,4-D/ Dichlorprop	1060	371 (E)	5.0	215 ha
Huron	YES	Diphenoprop	455	102.4 (E)	3.0	155 ha
Essex	YES	Amine 500	360	180 (A)	20 L/9.5 km	--
		2,4-D / Dichlorprop	1180	413 (E)	20 L/9.5km	350 km
Muskoka	NO					
Lanark	YES	Diphenoprop 700	1200	394.8 (E)	3.4	350 ha
Grey	YES	2,4-D Amine	1418	666.5 (A)		675 ha
TOTAL				2449.8 Ester (E)		
				1006.3 Amine(A)		

SOURCE: Deloitte Haskins & Sells

TABLE 7.2 Use Of 2,4-D By Selected Townships In 1986.

Township	Use 2,4-D*	Product Used	Vol. Product (L)	Vol. ai (kg)	Rate Of Application (L/ha)	Roadside Hectares Treated (ha)
Bosanquet Twp.	None In1986					
South-Easthope Twp.	Yes	Contract To Custom Applicator England Spray Co. Ltd, - R.R.4, Stratford, Ont.				
Osgoode Twp.	No					
Alnick Twp.	None In1986					
Kincardine Twp.	Yes	Diphenoprop 700	240	84 (E)	1.33	180 ha
Roxborough Twp.	None Since 1984					
Neebing Twp.	No					
Harwick Twp.	Yes	Sylviprop LV 700	1600	560 (E)	5.88	272 ha
Chamberlain Twp.	No					
Flos Twp.	Yes	2,4-D/2,4-DP LV700	800	280 (E)		
TOTAL Kg 2,4-D ai:				924 ESTER		

D.K. = Don't Know

SOURCE: Deloitte Haskins & Sells

TABLE 7.3. Use Of 2,4-D By Selected Cities In 1986.

	Use 2,4-D*	Product Used	Vol. Product (L)	Vol. ai (kg)	Rate Of Application (ai/ha)	Hectares Treated (ha)
Sudbury:						
Parks	YES	Killex	125	11.9	Spot Spray (0.59 kg/ha)	20
Education	NO					
Roadsides	NO					
Other						
Thunder Bay:						
Parks	YES	Weed & Feed	39 tonnes	222	1.5kg/ha	150
Education	NO					
Roadsides	NO					
Other	YES	Weed & Feed	1tonne	5.7	0.19kg/ha	30
Peterborough:						
Parks	YES	Killex	300	28.5	0.52 g/ha	55
Education	YES	1. Weed & Feed	500 kg	D.K.	D.K.	3
		2. Killex	D.K.	D.K.	Spot Spray	2
Roadsides	YES (very limited)	Silviprop	2	0.06	Spot Spray 0.09 kg/ha	1-2
Scarborough:						
Parks	YES	Mecoturf	1471	294.2kg	0.9 kg/ha	313
Education	NO					
Roadsides	YES	Mecoturf	496	99.2kg	1.21/ha	85
Other (Walkways)	YES	Mecoturf	10	D.K.	D.K.	D.K.
City of Toronto:						
Parks	NO					
Education	NO					
Roadsides	NO					
Other						

D.K. = Don't Know

SOURCE: Deloitte Haskins & Sells

TABLE 7.3 (continued) Use Of 2,4-D By Selected Cities.

	Use 2,4-D*	Product Used	Vol. Product (L)	Vol. Ai (kg)	Rate Of Application (ai/ha)	Hectares Treated (ha)
Municipality Of Metro Toronto:						
Parks	YES	1. Killex	D.K.	D.K.	Spot Spray	1200 possible hectares to spot spray
		2. Compitox Plus	D.K.	D.K.	Spot Spray	
Education						
Roadsides						
Other						
Mississauga:						
Parks	YES	Killex 500	1335	514	1.2 kg/ha	446
Education	NO					
Roadsides	YES	Dycleer 24	615	235	1.6 kg/ha	144
Other						
London:						
Parks	YES	2,4-D Amine	1383	650	1.41kg/ha	461
Education	YES	Killex	965	92	0.52 kg/ha	175
Roadsides	D.K.					
Other						

D.K. = Don't Know

SOURCE: Deloitte Haskins & Sells

TABLE 7.4 Use Of 2,4-D By Selected Towns In 1986.

Wingham	- No Use Of 2,4-D On Roadsides - May Be Some Spot Spraying By Dept. Of Parks
Casselman	- No Use Of 2,4-D; Use Aatrex Nine 0 Along Sidewalks
Creemore	- No Use Of 2,4-D
Essex	- Some Possible Spot Weed Control
Alliston	- No Use Of 2,4-D By Town, Had A Custom Applicator Spray Area For Dandelions
Simcoe	- No Use Of 2,4-D Sprays Whatsoever
Athens	- No Use Of 2,4-D. Called In The County To Spray An Area At The Back Of The Ball Diamond
Parkhill	- No Use Of 2,4-D
Colborne	- No Use Of 2,4-D By Town. Uses "Weedman" From Time-to-Time to Spray Park
Napanee	- No Use Of 2,4-D In The Town. Some Use Of Killex To Control Patch Of Poison Ivy
Pelham	- No Use Of 2,4-D

SOURCE: Deloitte Haskins & Sells

7.2 Employee Statistics Regarding 2,4-D Applications

Respondents indicated that there were 28 county employees involved with 2,4-D applications, 4 in townships, and approximately 118 in municipalities/cities who could have been involved in handling or applying 2,4-D, (Tables 7.5 to 7.7). The average ages ranged from 25 to 61 years, where the majority tended to be around 40. Characteristic of the employees in these three jurisdictions is a low turnover rate, since most are full-time employees. Also, a common characteristic is that the average number of days applying 2,4-D products is less than 20, with only 2 exceptions, London and Mississauga. In addition, most applicators have OME licenses, while all others have at least some in-house training (Tables 7.5 to 7.7).

7.3 Employee Use Of Protective Clothing

Generally, the survey results indicate that the use of protective clothing by 2,4-D applicators is limited to overalls and gloves, with limited use of goggles, faceshields, and respirators during mixing and loading activities only (Tables 7.8 to 7.10). In most cases, respondents were not sure of the degree of compliance with official desires to have employees wear protective clothing. It was made clear during telephone interviews that all protective equipment was made available for each employee to utilize but compliance with safety precautions was not mandatory. Actual use was up to each individual to decide.

7.4 Economic Impacts If 2,4-D Is No Longer Available

All respondents were asked what, if any, economic impacts would arise if 2,4-D was no longer available. The common responses from counties, townships and cities were: (1) that few were aware of any alternative herbicides to 2,4-D; (2) most would await MTC's (Ontario Ministry of Transportation and Communication) response since it provides leadership and guidance for roadside applications; (3) if costs of alternate vegetation controls were to increase, fewer areas would be treated such that total annual vegetation control costs remained relatively constant in subsequent years, and; (4) if costs of vegetation control did increase, property taxes would likely increase to compensate.

TABLE 7.5. County Employee Statistics.

	No. Workers Applying	Avg Age	Jobs Involved	Avg Years Experience	Avg. No. Of Days Applying	Avg. No. Of Hours In Application	Training Of Personnel	Application Equipment Used
Brant	2	40	Spraying Inspection	30 0	3 3	10 10	CLASS 1 --	Ground Sprayer (Note: Custom Application Also Used)
Kent	8	43	Mixer/ Applicator (3) Vehicle Operator (2) Mixer Driver (1) Supervisor (2)	9 4 6 22	11	6.5	ON JOB	Ground Sprayer
Oxford	2	54	Truck Driver (2)	6	26	10.6	CLASS 1 Annual MOE Operators Course	Truck Mounted Sprayer
Renfrew	6	47	Supervisor (1) Application (5)	16 12.6	4 5.6	2 6.4	OME Pesticide License (1) In-house(4) OME Pesticide License (1)	Ground Sprayer Occasional Use Of Back Pack Sprayer
Huron	4	44	Application (4)	1 with 23 yrs 3 with 1.5yrs	7.25	7	OME Pesticide License (4)	Ground Sprayer
Essex	4	30	Truck Driver (2) Spray Application (2)	10 1	26 26	6 6	In-house (Instructions from supervisor)	Ground Sprayer
Muskoka Lanark	No Use of 2,4-D by District of Muskoka 2	35	Truck Driver (1) Applicator (1)	10	15 15	9 9	-- OME LICENSE	Truck Mounted
Grey	2	43	Truck Driver (1) Applicator (1)	6	13	7	OME LICENSE	Skid Mounted Sprayer in Back of Dump Box Of Truck.
TOTAL	28							

OME = The Ontario Ministry of the Environment

SOURCE: Deloitte Haskins & Sells

TABLE 7.6 Township Employee Statistics.

	No. Workers Applying	Avg Age	Jobs Involved	Avg Years Experience	Avg. No. Of Days Applying	Avg. No. Of Hours In Application	Training Of Personnel	Application Equipment Used
South Easthope	--	Use Custom Contractor - England Spray Company Ltd., R.R.4, Stratford. Ontario						
Kincardine Twp.	--	Use Custom Contractor - Mr. Ken Voisin, R.R.1, Formosa, Ontario						
Harwich Twp.	2	33	Applicator (1) Driver (1)	3	9	7.5	On Job	Truck Mounted Sprayer
Flos Twp.	2	~60	Applicator	10+	18	7	License	Truck Mounted Sprayer
		~27	Driver	3	18	7	N/A	
TOTAL	4							

SOURCE: Deloitte Haskins & Sells

TABLE 7.7. City Employee Statistics.

	No. Workers Applying	Avg Age	Jobs Involved	Avg Years Experience	Avg. No. Of Days Applying	Avg. No. Of Hours In Application	Training Of Personnel	Application Equipment Used
Sudbury:								
Parks	4	D.K.	Mixing Loading Spraying	D.K.	D.K.	D.K.	All Have OME License	Backpack Sprayer Ground Sprayer
Education								
Roadsides								
Other								
Thunder Bay:								
Parks	2	32	Mixing Loading Applying	5	3	4	OME License Works Under Supervision	Ground Sprayer
Education								
Roadsides								
Other								
Peterborough								
Parks	3	35	Mixing Loading Spraying	D.K.	D.K.	D.K.	All Have OME License	Ground Sprayer Backpack Sprayer
Education	4	61 ---> Supervises 35 ---> Applying		12 2	3	6	OME License Works Under Supervision	Ground Sprayer Fertilizer Spreader
Roadsides	2	D.K.	Mixing Loading Applying	D.K.	D.K.	D.K.	Both Have OME License	Backpack Sprayer
Other								

D.K. - Don't Know

OME = Ontario Ministry of the Environment

SOURCE: Deloitte Haskins & Sells

TABLE 7.7 (continued) City Employee Statistics.

	No. Workers Applying	Avg Age	Jobs Involved	Avg Years Experience	Avg. No. Of Days Applying	Avg. No. Of Hours In Application	Training Of Personnel	Application Equipment Used
Scarborough								
Parks	6 permanent 6 summer help	50	Mixing Loading Spraying Driver	10	10	8	Supervisor Has OME License Other Work Under Supervision	Ground Sprayer With Wand
Education Roadsides	3	35	Mix, Load, Apply Driver	11	35	7	Has OME License	Backpack Sprayer
Other		52		1	25	7	Trained By Licensed Sprayer	Ground Sprayer
City Of Toronto								
Parks								
Education								
Roadsides								
Other								
Municipality Of Metro Toronto:								
Parks	50	D.K.	Mix Load Spraying	D.K.	D.K.	D.K.	All Have OME License	Backpack Sprayer Ground Sprayer
Education								
Roadsides								
Other								

SOURCE: Deloitte Haskins & Sells

TABLE 7.7 (continued) City Employee Statistics.

	No. Workers Applying	Avg Age	Jobs Involved	Avg Years Experience	Avg. No. Of Days Applying	Avg. No. Of Hours In Application	Training Of Personnel	Application Equipment Used
Mississauga:								
Parks	22	35	Mixing Loading Spraying	8	195	558 (total)	2 Have OME License	Ground Sprayer Backpack Sprayer Boom Trucks
Education								
Roadsides								
Other			Spraying Is Contracted					
London:								
Parks	6	27	2 supervisors	4	2	9	Class I A III OME License	Backpack Sprayer
	4 are contract workers	25	4 applicators	1	11	9	Work Under Supervisors	Truck Mounted Sprayers
Education	1 employee	45	applicator	4	10	8	Class I & III OME License	Ground Sprayer
Roadsides								
Other	5	30	Mixing	4	90	5	Supervisor Has	D.K.
			Loading Spraying Driving		10		OME License Others Have On-job Training	
TOTAL	118							

D.K. - Don't Know

SOURCE: Deloitte Haskins & Sells

TABLE 7.8. Use Of Protective Clothing By County Employees In 1986.

	Total No. Of Workers Involved With 2,4-D	Washable Overalls	Disposable Overalls	Hat	Rubber Gloves	Neoprene Gloves	Rubber Boots	Goggles Or Face Shield	Respirator	Other (Specify)
Brant	2	--	--	--	1	--	--	--	--	--
Kent	6	6	--	6	--	4	--	--	--	Soap 6 Clean Water 6 Towels 6
NOTE: 2 supervisors over above 6 workers - these supervisors do not wear any protective clothing.										
Oxford	2	2	--	2	2	--		--	--	
Renfrew	6	5	--	--	5	--	5 (occasional use)	--	5	--
Huron	4	4	--	4	4	--	4	4	4	-
Essex	4	2	--	4	4	--	--	4	--	
Muskoka	NO USE OF 2,4-D									
Lanark	2	2	--	1	--	1	--	1	--	--
Grey	2	2	--	--	2	--	--	--	--	
TOTAL	28	23	0	17	18	5	9	9*		

*Mixing and Loading Only

SOURCE: Deloitte Haskins & Sells

TABLE 7.9. Use Of Protective Clothing By Township Employees In 1986.

	Total No. Of Workers Involved With 2,4-D	Washable Overalls	Disposable Overalls	Hat	Rubber Gloves	Neoprene Gloves	Rubber Boots	Goggles Or Face Shield	Respirator	Other (Specify)
South	- Use Custom Contractor									
Easthope										
Kincardine		1								
Harwich	2	1	--	1	1	--	--	--	1	--
Flos Twp.	2	2	--	--	1	--	--	1	--	--

SOURCE: Deloitte Haskins & Sells

TABLE 7.10 Use Of Protective Clothing By City Employees In 1986.

	Washable Overalls	Disposable Overalls	Hat	Rubber Gloves	Neoprene Gloves	Rubber Boots	Goggles Or Face Shield	Respirator	Other (Specify)
Sudbury:									
Parks		4		4			4		
Education									
Roadsides									
Other									
Thunder Bay:									
Parks	2		1	2		2	2		
Education									
Roadsides									
Other									
Peterborough:									
Parks	Eye covering Footwear and respirators made available	3							(3) disposable gloves
Education			3				3		(3) disposable filter mask (3) leather gloves
Roadsides	D.K.								
Other									
Scarborough:									
Parks		6		6		6		6	
Education									
Roadsides	3			3		3	3	3	
Other									

D.K. - Don't Know.

SOURCE: Deloitte Haskins & Sells

TABLE 7.10 (continued) Use Of Protective Clothing By City Employees In 1986.

	Washable Overalls	Disposable Overalls	Hat	Rubber Gloves	Neoprene Gloves	Rubber Boots	Goggles Or Face Shield	Respirator	Other (Specify)
City Of Toronto:									
Parks									
Education									
Roadsides									
Other									
Municipality of Toronto:									
Parks		50			50		50	50	(50) disposable gloves
Education									
Roadsides									
Other									
Mississauga:									
Parks	22			22		22	22	22	
Education									
Roadsides		Contracted							
Other									
London:									
Parks			6		6	6			(6) uniforms
Education	1		1	1			1	1	
Roadsides	4		4	4	4	4	4	4	
Other									
TOTAL	32	63	15	38	60	41	89	88	(6) uniforms (3) leather gloves (53) disposable gloves (3) disposable filter mask

D.K. - Don't Know

SOURCE: Deloitte Haskins & Sells

8.0 USE OF 2,4-D IN AQUATIC ENVIRONMENTS IN 1986

Herbicides can be applied in spring-fed ponds, dugouts, soft water lakes, hard water lakes, and wet/dry ditches to control a variety of common aquatic plants.

One of the most common aquatic plants which is controlled with 2,4-D is Eurasian water milfoil and native milfoil. Two herbicides are applied to successfully control milfoil, including:

2,4-D (granular)
diquat

Records provided by the Ontario Ministry of the Environment indicate that approximately 1,500 Kg ai of 2,4-D was applied to small freshwater lakes in Ontario. Since the 2,4-D product is pelleted, it is most commonly hand broadcast into water where needed by property owners.

If 2,4-D was no longer made available, diquat could be substituted, directly with no loss in milfoil control capability. There would be no concomitant impact on cost per treated hectare, since treatment costs are roughly equal.