ASSESSMENT OF THE CURRENT WASTE MANAGEMENT PRACTICES ON FARM OPERATIONS IN PERTH COUNTY, ONTARIO, FINAL REPORT

Prepared for

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ABSTRACT

The management of wastes from all sources has become a major concern for governments, industry and the general public. This study examined the current waste management practices and included collecting data on; types and quantities of wastes produced by farm operations; the current waste disposal methods; possible areas of environmental concern; and opinions of farm operators regarding alternatives. The waste types examined included; pesticide related, including containers; fertilizer, including containers; machinery wastes including waste oils, oil filters and batteries; and household and yard related wastes. Data was collected through a personally administered questionnaire that was delivered to farm operators randomly throughout Perth County. The sample was stratified by farm type on the premise that different farm types could have grow different crops and thus have different wastes. Particular emphasis was given to pesticide container disposal and the potential environmental impacts resulting from current disposal practices. About 62% of farm operators reporting applying their own pesticides reported rinsing the containers 2 times or less prior to disposal. The recommended practice is to rinse the container 3 times or more, puncture and bury 50 cm below ground. The majority of those reporting applying their own pesticides reported burning the waste pesticide containers (60%). Waste fertilizer plastic bags were almost exclusively burned (98%). Machinery wastes disposal practices varied; 80% reused waste oil; 92% landfilled waste oil filters; 59% recycled waste batteries. The waste oil was used either for dust suppressant for driveways or for barn equipment lubrication. Most operators were very cooperative and concerned about the environment in general. Generally suggestions as to alternative practices for disposing of for example waste pesticide containers, had to be suggested by the interviewer. Most were willing to get involved in recycling pesticide containers but also stated that there would be some logistical problems.

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1.0 INTRODUCTION

1.1 Problem Statement

The management of wastes from various sources has been a concern of governments, industry and the public, especially in the last 15 to 20 years. The increased volumes of wastes from urban and rural areas, have put pressure on existing landfill space. Wastes from farm operations, not including animal related wastes, have not been addressed to any great extent. In 1983, the Ontario Ministry of the Environment (MOE) released a 'Blueprint for Waste Management in Ontario' which outlined some principles for waste management in Ontario; but agricultural wastes were not dealt with specifically.

The MOE amended the Environmental Protection Act (EPA) (MOE, 1982) in 1985 with the addition of Regulation 309 (MOE, 1985), to assist in the management of wastes in Ontario. Under Regulation 309, section 3, subsection 1, "Agricultural Wastes" are exempt from Part V of the EPA and Regulation 309, which both deal with waste management in the Province of Ontario. In Regulation 309 agricultural waste is defined as "...waste, other than sewage, resulting from farm operations...". This definition could include such wastes as empty pesticide containers, empty fertilizer containers, farm machinery wastes and household wastes.

MOE is currently addressing waste management from industrial and municipal sources under the Municipal / Industrial Strategy for Abatement (MISA) program (MOE, 1988). Under this program, household hazardous wastes have been identified as a potential environmental problem; however, farm hazardous wastes remain to be

addressed. The Ontario Ministry of Agriculture and Food (OMAF) have produced "factsheets" to assist farm operators in the handling and disposal of potentially hazardous wastes such as pesticides and empty pesticide containers (Frank and Ripley, 1988; Frank and Winfield, 1987c, 1986a; Frank and Chisholm, 1986b; Wolfe *et al*, 1961). These pamphlets suggest triple-rinsing "empty" containers, puncturing them to render the container useless and burying them at least 50 cm deep. A study by Miles *et al.* (1983) found that less than 0.1% of the original contents remained in either triple rinsed containers or jet rinsed containers.

The quantities of active ingredients of pesticides used in Ontario on major field crops, fruits and vegetables and roadsides increased by 32% between 1978 and 1983, with a corresponding increase in the area sprayed of only 2.6% (McGee, 1984). There were 8.8 million kilograms of active ingredients of pesticides used for the above mentioned purposes in Ontario in 1983 (McGee, 1984). Approximately 60 percent of pesticides are distributed in plastic containers (Rude, 1989). Machinery wastes from farm operations have not been addressed as being a potential pollution problem. In Ontario in 1986, census farms reported having 79,228 trucks, 187,165 tractors and a combined 85,953 grain combines, swathers, balers and harvesters (OMAF, 1987). Assuming 20 litres of waste oil could come from each of these pieces of equipment in a year, would result in about 7 million litres of waste oil from farm operations in Ontario per year.

There has been relatively very little research reported on total farm waste management which would include waste pesticide containers, waste fertilizer materials, wastes from farm machinery including used motor oil, household and yard wastes and other wastes that may be present on farm operations. A review of the literature has

not uncovered any survey reports of the overall disposal practices of farm operations. Perth County was selected due to the diversity of farm operations which is typical of Southern Ontario. Figure 1 shows the location of Perth County relative to the rest of Ontario.

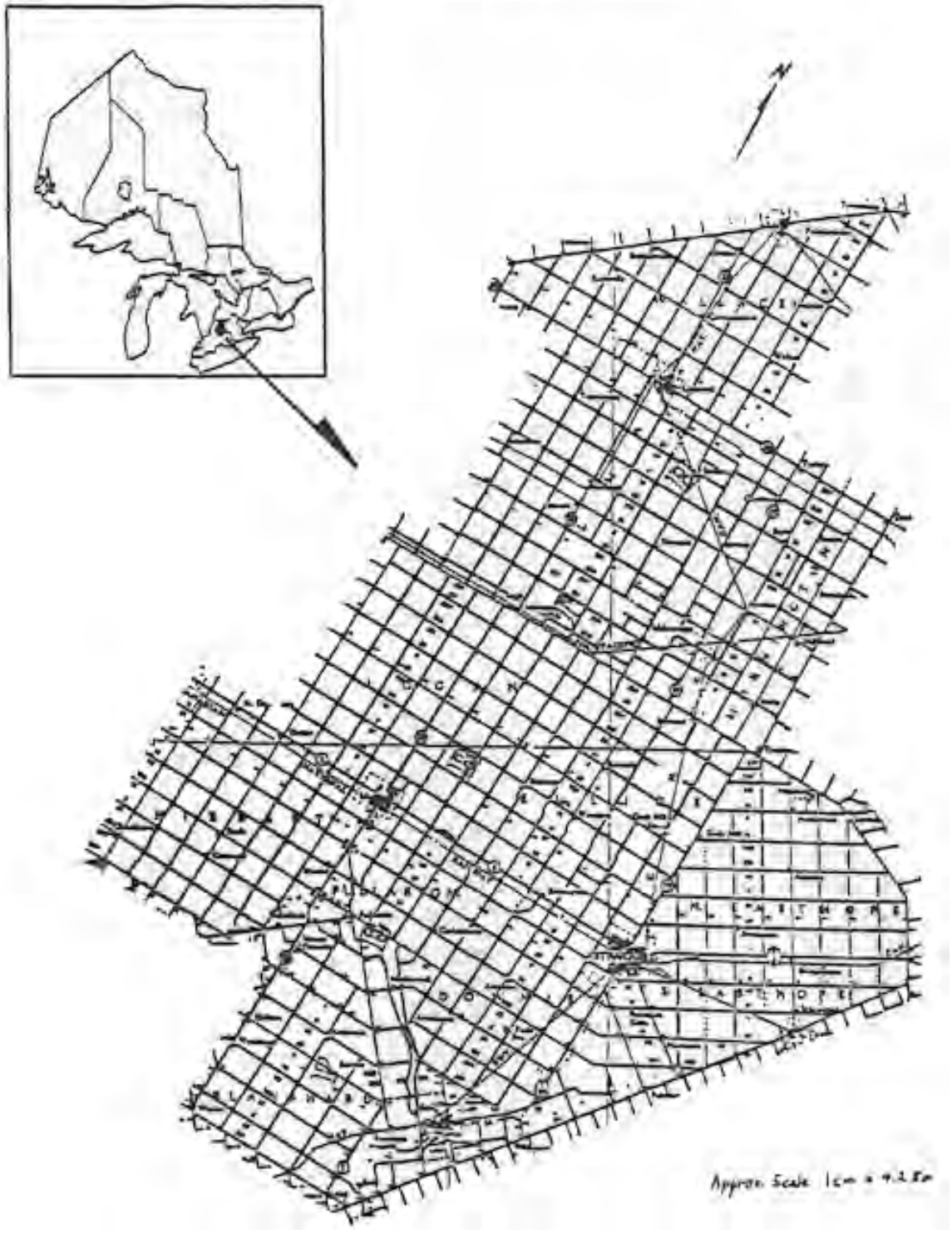
1.2 Project Objectives

The main goals of this study were to determine the types and quantities of wastes being generated by farm operations in Perth County, Ontario and to assess the general current waste management practices.

Specific objectives included:

- to identify the nature and quantity of wastes generated
- to examine the existing disposal practices
- to estimate the potential environmental impacts as a result of the current practices identified
- to survey the opinion of farm operators regarding alternatives to current waste management practices
- to provide a basis for the investigation of wastes from farms in other parts of Ontario.
- to prepare a final report of the results of the study.

FIGURE 1 Perth County, Ontario



1.3 Status of Research

Survey research involves the collection of data from people either by phone, mail, or in person using a questionnaire. Sheskin (1985) suggests that other methods of obtaining data should be pursued prior to undertaking a survey. However, she does point out that personally administered surveys tend to produce the highest response rates and the most accurate data. Personally administered surveys also tend to be the most expensive and most time consuming (Feldman, 1981; Sheskin, 1985).

There are several types of sampling strategies that can be used to collect data, such as random or systematic sampling. Random sampling has the advantage of obtaining quantities of similar data within a fixed time frame, thus making it "checkable" similar to a laboratory experiment (Feldman, 1981).

Basic survey statistics such as averaging, preparing variances and distributions can be used to analyse the data (Fruend, 1979; Gregory, 1983). As well, additional sources of survey data (Frank, 1987a; McGee, 1984; OMAF, 1987; Roller, 1975, 1979: Cahill, 1989) can be used and compared to the data collected from the farm operators. Extrapolation of survey data to estimate the waste quantities of the entire County can be performed if the survey size is large enough (Forrestal *et al.*, 1986; Fruend, 1979). There have been few studies which have examined wastes such as fertilizer, machinery, household and yard related wastes from farm operations. One of the more extensively studied areas of solid waste (excluding manure) from farm operations has been waste pesticides and empty containers (Frank *et al.* 1987a, 1987b; Miles *et al.*, 1983). One of the first studies reported on household pesticide use was conducted by Rumker *et al* (1972). Interest in varied recycling efforts is gaining popularity. For

example, introduction of source separation programs are underway in numerous communities throughout Ontario, as well recycling of used pesticide drums (Ford, 1988).

In 1988, the Crop Protection Institute of Canada formed a Task Force on Crop Protection Chemicals in Water (Sawyer, 1989). The main purpose of this task force was to help eliminate human error in handling crop protection chemicals and reduce the amount of pesticides reaching surface waters. A pamphlet was produced called "Water in Trust", which emphasized the need to protect the environment from pesticide contaminants (CPIC, Undated). Triple rinsing "empty" containers was noted as a necessary practice to minimize contamination.

Within the last couple of years, farm organizations, chemical manufacturers and governments have been attempting to address the problem of container disposal with suggested alternative packaging, deposits on containers and special dumping days for these wastes (Rude, 1989; Sawyer, 1989). A study under way at the University of Guelph is examining the potential for recycling plastic pesticide containers (Sawyer, 1989; Rude, 1989).

2.0 RESEARCH PROCEDURE

2.1 General Approach

Data collected for this study was obtained from a literature review, personal interviews of randomly selected farm operations in Perth County, Ontario and from personal communications with external agencies. The survey data was collected from a personally administered questionnaire. The questionnaire was developed to collect data on the types and quantities of wastes being generated and the current disposal methods. Farm operator opinions regarding practical alternatives were also surveyed.

2.2 Survey Procedure

2.2.1 Selection of Sample

The selection of the sample size depended largely on the amount of time and resources available to conduct the study. The availability of the participants (farm operators) also had to be considered. This depended on the length of the growing season and the schedules of the individual farmers.

A total of 2927 census farms were identified for Perth County, Ontario in 1986. Census farms were defined as farms having annual sales of $2500 or more. It was proposed to sample about 3 % of the 1986 Perth County census farms (100 farm operations). Farm operations from all townships in Perth County were selected to ensure geographic coverage and identify different waste management practices throughout the county.

2.2.2 Random Sampling

Farm operations to be surveyed were selected randomly and were slightly stratified to reflect the proportion of farm types present in the 1986 Perth County survey (OMAF 1987). During the distribution of the cover letters an attempt was made to distribute according to the 1986, Perth County census proportions. For example, one could usually identify a dairy operation by the presence of a milkhouse or dairy cows. This attempt to stratify the sample was based on the premise that certain farm types would have different crops, and thus different wastes. This type of stratification was not time consuming and proved to be relatively efficient.

2.3 Data Collection

2.3.1 Cover Letter

A cover letter was developed to be distributed for the test survey and the main survey, to outline the objectives of the research, some background on the investigator and to generally get people thinking about the topic prior to the personal survey (Appendix 1). The letter was personally delivered to the farm operators roadside mail boxes. The name and location of the farm operation was noted on a map of Perth County so the interviewer could return for the personal interview. This letter and the general scope of the study was reviewed by the University of Waterloo's Human Relations Office and any comments were incorporated into the letter. The cover letter for the main survey was printed on School of Urban and Regional Planning, University of Waterloo letterhead, to add credibility to the study and show that the researcher was affiliated with an organization.

2.3.2 Test Survey

A test survey was conducted by randomly distributing cover letters to 4 farm operations in Perth County. The intent of the survey was "...to test the sampling procedures, questionnaire design and the survey logistics." (Sheskin, 1985). The test survey cover letter was not printed on University of Waterloo letterhead.

2.3.3 Questionnaire Development

The format of the questionnaire included questions to collect data on the types and quantities of wastes generated and the current disposal methods (Appendix 2). Five general waste types were included on the questionnaire: pesticides related, fertilizers related, machinery related, house and yard related and other wastes. Pesticide and fertilizer related wastes were assessed by crop type. Much of the data sought was directed towards the areas of empty pesticide container disposal and the potential for ground water contamination.

The questionnaire also collected data that could be compared with other survey data such as the 1986 Agricultural Census (OMAF 1987) regarding farm types and sizes and the Survey of Pesticide Use in Ontario (Roller 1974, 1979, McGee 1984). Other questions related specifically to pesticide handling locations as it pertained to the drinking water well for the household (Frank and Ripley 1988). The use of the triple rinsing method of cleaning empty pesticide containers prior to disposal as recommended by government agencies was assessed (Frank and Winfield, 1987c, Health and Welfare Canada 1986, Miles *et al* 1983). Data was also collected regarding well types (drilled or dug), and fuel tank types and locations relative to wells. Finally,

farm operators were asked if they perceived any problems with their current waste management practices and if so, what they thought were practical and feasible alternatives.

2.3.4 Onsite Interviews

All 94 farm operators that were delivered cover letters were visited at least once to conduct an interview. If the questionnaire was not completed upon visitation due to ie. no one home, or the appropriate person not being home, an attempt was made to obtain a phone number or other information to expedite the interview process. Previous survey work has shown that personal surveys tend to produce the most accurate results, however, they also tend to be the most time consuming and expensive (Sheskin 1985). Upon contacting the appropriate person, the respondent was assured that all information was strictly confidential.

2.3.5 Other Data Sources

Data was collected from other government sources to complement the analysis of the survey data. Agricultural census data (OMAF 1987) was obtained to assess crop types and census farm types and to ensure the survey sample was representative.

3.1 Basic Survey Statistics

A total of 94 cover letters were distributed throughout Perth County. Of the 94 letters delivered, 27 interviews were completed. Of the 67 remaining locations where letters were distributed, 4 were not interested in participating in the study, 7 locations

were not operating as farms and the remaining 56 were not completed. The 7 locations not operating as farms rented the residences where the letters were delivered. The 56 operations where questionnaires were not completed were re-visited 2-4 times at their residences, but were not contacted.

Table 3.1 outlines the distribution of the 27 completed survey questionnaires by farm type, compared to the 1986 statistics for Perth County (OMAF, 1987). The townships were not tabled with farm types to ensure confidentiality of the relatively small sample. The largest differences between the survey data and Perth data were for dairy and cattle operations. Dairy operations accounted for about 40% of the survey population and 26% of the Perth 1986 population. Cattle operations accounted for 15% of the survey, and 18% of the Perth population. For the Perth County data, cash crop farm type included miscellaneous specialty, mixed farms and other small grain crop classes. Cash cropping farm types for the survey included cash cropping and mixed grain operations.

Table 3.2 shows the percentage of the survey reporting growing different field crops on their operations. Ninety per cent of the survey farms reported growing corn for either grain or silage compared to 86% for Perth County.

TABLE 3.1: A Comparison of the Survey Farm Types to the 1986 Perth County Census (from OMAF, 1987)

Farm Type	Survey Population	% Survey Population	Perth Co. Population	% Perth Population
Dairy	11	40	742	26
Hogs	6	22	650	23
Cash Crop	5	19	826	29
Cattle	4	15	513	18
Poultry	1	4	75	3
Other	0	0	27	1
TOTALS	**27**	**99**	**2833**	**100**

Note: Cash crop includes mixed grain operations for both survey and Perth Census populations.

TABLE 3.2: A Comparison of Percentage of Survey and Perth Co. Data as Related to Crop Type

Crop Type	% of Survey Growing Crop	% of Survey Acreage	% of Survey Pesticide Waste	% of Perth Growing Crop [1]	% of Perth Acreage [1]	1983 Ontario Pesticide Use [2]
Corn	90	38	78	86	31	43
Wheat/Grain	67	15	3	45	22	4
Soybeans	38	14	12	12	4	15
W. Beans	29	7	6	20	6	1
Barley	24	6	1	30	8	-
Hay	19	4	0	63	18	-
Alfalfa	10	6	0	-	0	-
Oats	10	1	0	5	1	-
Pasture	62	9	0	35	9	-

Note: *21 of 27 farms reporting*
Perth County: corn = silage + grain corn; wheat/ grain = mixed grains; hay = tame hay (from OMAF, 1987)

[1] *from OMAF, 1987.*
[2] *from McGee, 1984*

The next most common crop grown was mixed grain/wheat, with 67% of operations reporting these crops as compared to 45% for Perth in 1986. Soybeans and white beans had 38% and 29% of survey farm operations growing this crop respectively compared with 12% and 20% growing these crops in Perth in 1986. It was expected that the type of crop grown would effect the types and quantities of pesticide related wastes generated.

3.2 Waste Management

The waste data obtained from interviewing 27 farm operations was summarized by farm type and crop type. As well, disposal methods were assessed by farm type and waste type. Empty pesticide container disposal and general pesticide management practices were reviewed to attempt to assess potential environmental problems. The opinions of farm operators regarding practical disposal alternatives were collected.

3.2.1 Survey Waste Quantities by Farm Type

Waste quantity data was collected for pesticide, fertilizer and machinery related wastes. Specific waste type and quantity data was not collected for household/yard wastes or other wastes.

Table 3.3 summarizes the percent of operators responding to producing certain quantities of pesticide, fertilizer and machinery related wastes by farm type and the average quantity produced.

TABLE 3. 3: Percentage of Surveyed Farm Operations Reporting Wastes by Type and Average Annual Quantity.

Farm Type		Pesticide Related Wastes				Fertilizer Rel. Wastes	Machinery Rel. Wastes		
	Sizes/	Plastic Cont.		Bags		Bags	Oils	Filt.	Batt.
	Units »	5 L	10 L	<5kg	20kg	25kg	L	#	#
Dairy	% Resp.	9	64	18	27	45	100	100	91
	Av. Quant	8	8	28	21	132	165	11	2
Hogs	% Resp.	17	67	17	50	0	100	100	100
	Av. Quant	10	14	5	12	0	126	8	2
Cash Crop	% Resp.	20	100	40	0	0	80	80	80
	Av. Quant	10	7	19	0	0	127	12	3
Cattle	% Resp.	0	100	25	50	25	100	100	100
	Av. Quant	0	11	8	8	100	125	10	2
Poultry	% Resp.	0	100	100	0	100	100	100	100
	Av. Quant	0	50	20	0	15	91	10	1
Total Surveyed	% Resp.	11	78	26	30	22	96	96	93
Farm Operations	Av. Quant.	9	12	18	14	129	141	10	2

Generally, these quantities represented rough estimates from the farm operators since the operators did not refer to written records of ie. pesticide use. The Pesticide wastes were divided into two main categories; plastic liquid containers with 5 litre and 10 litre sizes; and, hag type containers for granular materials in less than 5 kilogram and 25 kilogram sizes. These sizes represent the most frequently encountered sizes. Some other sizes were extrapolated to fit into these categories. One farm operator did not estimate any quantities of pesticide related wastes. An estimate was made by the researcher based on the type of operation, crops grown and acreages.

Eighty three per cent of hog operations applied their own pesticides and 100 percent applied their own fertilizer. Cash Crop farms reported using custom application of pesticides 40% of the time while about 18% of Dairy operations used custom application. Seventy eight percent or 17 farm operations reported to apply some pesticides to their crops.

Both pesticide and fertilizer types and quantities could depend more on the types of crops grown, which often relates directly to the type of the farm operation. As well, the size of the operation, farm management practices and other socio-economic factors may also affect the wastes generated.

3.2.2 Survey Waste Quantities for Pesticides by Crop Type

Pesticide waste quantities were assessed by crop type while fertilizer wastes were found to be relatively small due mainly to bulk application. Machinery wastes were not necessarily related to the farm type or crop type, but may possibly be more related to the size of the operation and the general farm management practices used.

Looking back at Table 3.2, corn crops represented 78% of the total pesticide waste reported in the survey. From the 1983 pesticide use survey, corn crops used 49 percent of the active ingredients of pesticides used in Ontario on field crops. Between 1978 and 1983, insecticide use increased 138 % and the overall pesticide use on field crops increased 57%, for Perth County. From the survey results about 78% of pesticide related wastes produced were related to corn and 38% of the total survey acreage was dedicated to the production of corn.

3.2.3 Disposal Methods

Disposal methods of pesticide, fertilizer and machinery related wastes were assessed (Table 3.4). About 60% of pesticide wastes reported from farms were disposed by burning. Another 39% was landfilled and 1% was reported as being reused.

Ninety eight per cent of fertilizer wastes reported were burned. The fertilizer waste quantities were relatively small due to bulk application. Ninety two per cent of waste oil filters from machinery were disposed of to the landfill.

TABLE 3.4: Current Waste Disposal Methods as Reported by Farm Operators.

Waste Type	Waste Disposal Practices: Burn	Store	Landfill	Recycle	Reuse	Total
	%	%	%	%	%	
Pesticide	60	0	39	0	1	100
Fertilizer	98	0	0	0	2	100
Machinery						
1) Oils	15	5	0	0	80	100
2) Oil Filters	8	0	92	0	0	100
3) Batteries	0	37	4	59	0	100

Note: Waste quantities were not collected for house, yard and other wastes.

About 80% of waste oils were reused mainly on stable cleaner chains or to a lesser degree on driveways for dust control.

The majority of batteries were either recycled at a scrap dealer (57%) or stored for future disposal (37%).

Table 3.5 lists the distribution of survey farms reporting their pesticide container rinsing practices prior to disposal. Of the 21 operations that applied some of their own pesticides, 13 or 62% of them did not rinse the empty containers 3 or more times.

Household wastes were generally burned, disposed of at a landfill site or recycled, using a blue box program or recycling at the landfill. Quantities of household wastes were difficult to obtain; however, the reported use of recycling programs and garbage pick-up. This data was presented by farm type to obtain some kind of stratification of the sample. Recycling is probably more dependent on the availability of the service within each municipality and on the opinions of the individual farm operators towards recycling.

3.2.4 Potential for Contamination of Ground Water from Pesticide Related Wastes

The assessment of ground water contamination by pesticide residues or related wastes would involve a more detailed study beyond the scope of this report. However, data has been collected to assist in making some broad statements about the potential for contamination based on the reported practices.

Table 3.5: Pesticide Container Rinsing Practices as Reported by Those Who Apply Their Own Pesticides**.**

	No. of Rinses Prior to Disposal				
Farm Type	0	1	2	3 or >	Until Clean
Dairy	1	2	2	2	1
Hogs	0	0	4	1	0
Cash Crop	0	0	1	2	0
Cattle	1	0	1	1	1
Poultry	0	0	1	0	0
TOTALS	2	2	9	6	2
% Population	10	10	43	29	10

Note: About 78% (21 of 27) of those surveyed reported applying their own pesticides.

Some of the farm operations were asked what type of well they used for household uses, whether the well was drilled or dug, the depth of the well and the distance from the pesticide handling/mixing area(s) and fuel tank areas to their well. The distances and well depths were rough estimates, but still show the potential for ground water contamination. Other factors such as soil type, ground water levels, types and quantities of pesticides, types and quantities of fuel tanks, disposal methods and general pesticide handling practices probably have varying effects on the potential of contamination.

The data collected from farms on types of wells and distances to pesticide handling areas and fuel tank areas. Seven farms reported drilled wells 75 - 150 feet deep with 2 of these being within 150 feet of the pesticide mixing and handling area. Of the 17 operators reporting fuel tank data, 7 had drilled wells 75 - 150 feet deep, while 4 of these had fuel tanks, mostly above ground, within 150 feet of their wells. One farm reported having an underground fuel tank with a dug well 0 - 25 feet deep, greater than 200 feet from the well.

3.2.5 Farm Operator Opinions

Farm operators were asked their opinions regarding current pesticide waste management practices. Generally, farm operators had to be suggested possible alternatives prior to responding. The researcher had to suggest alternatives in most cases. Most of the operators that would get involved in recycling of pesticide containers foresaw some logistical problems such as increased handling and storage problems at the location where the containers would be returned.

In general, most operators reported being interested in some kind of pesticide container recycling effort.

3.3 Other Data Collected

Some of the other data collected in this study has already been referred to in this report. The Survey of Pesticide Use in Ontario for 1983 was used to assess the types and quantities of active ingredients of pesticides used on certain crops in Ontario. Appendix 3 outlines the percentage change in pesticide use in Ontario between 1978 and 1983 by crop type and pesticide type. There was an increase in the area sprayed for corn, soybeans and grains, 7%, 33% and 13.5% respectively. Also, the quantity of pesticides used on these crops had increased 20% for corn, 143% for soybeans and 39.5% for grains.

4.0 Discussion of Project Results

The farm operators surveyed were cooperative with this study, yet most did not keep accurate records of wastes produced on their operations. Generally, the quantities of empty pesticide containers tended to be the most accurate, probably because of the cost of these products and the increased dependence on these products.

4.1 Pesticide Related Wastes

Disposal of empty pesticide containers has recently gained momentum in becoming a waste problem for all municipalities. Disposal of these wastes has taken place for years with little or no regard for the potential contamination hazard they may pose to the environment. The magnitude of the problem is shown by the enormous amounts of pesticides used annually in North America. Most of the farm operators responding did not have exact data on the quantities of pesticides used at the time of the interviews; however, most seemed to answer with confidence to questions relating to rinsing procedures and burning practices.

Results from this research indicate that most farm operators reporting in Perth County, burn a significant amount of their pesticide container wastes without first properly rinsing the containers. It is possible and probable that this practice is common throughout the farming community (Romahn, 1988).

Much of this report has focussed on empty pesticide containers and their disposal. This was based on the authors' perception that currently these agricultural wastes had a high potential to contaminate the environment, but had few significant

research or other efforts addressing the issue. Recently governments, industry, farm organizations and farm operators are realizing that the public is increasingly concerned about the environment. More action is being taken to research recycling, collection and packaging alternatives (Burtt, 1989; Ford, 1988b; Canadian Press, 1989; Sawyer, 1989; Farm Gate, 1989). In the interim, some sort of deposit could be set on these containers with some sort of collection system for returned containers.

This research has briefly mentioned potential ground water contamination from pesticide use and container disposal. The mixing and handling of pesticides within an unconfined area relatively close to drinking water supplies poses a definite risk. The burning locations of "empty" pesticide containers, especially the containers that have not been properly rinsed, could be a major concern. It is likely that these concerns will be receiving considerably more attention from all parties involved in the near future.

4.2 Fertilizer Related Wastes

The data collected from farm operators regarding fertilizer container wastes was not very significant. This may have been to the use of bulk application of fertilizers by the majority of farms reporting. Custom application of fertilizers also accounted for the small amounts of fertilizer container wastes encountered. The containers that were reported were generally disposed of by burning. The mixing, handling and disposal of these products close to drinking water wells may pose a threat. Again, this may depend on management practices on and off the fields.

4.3 Machinery Related Wastes

Prior to this research, no research was found on machinery related wastes from farm operations. This survey collected rough estimates of quantities of waste oils, oil filters and batteries from farm operations. Little or no records were kept for these types of wastes. Waste oils were generally reused on stable cleaning chains and driveways for dust control. Waste oil filters were mostly disposed to landfill and batteries either recycled or stored for recycling.

Other wastes from the maintenance and operation of trucks, tractors and other farm equipment were not collected. Other machinery wastes such as used tires could be significant. This was because operators had difficulty in responding accurately to questions regarding waste oils, oil filters and batteries. The quantities of these wastes could be significant but were difficult to quantify during the survey.

Without more accurate data on quantities and management of these wastes it is difficult to pinpoint areas of concern; however, the storing location of these wastes and their disposal locations may present a problem, depending on the specifics of the site and the management practices.

4.4 Household, Yard and Other Wastes

Specific quantities of household and yard related wastes were not collected during this survey. Farm operators did not keep records of this data or remember quantities. This seems reasonable considering most households both urban and rural would have difficulty quantifying these wastes. Some data was collected on the use of

blue box recycling programs and bin recycling programs at landfill sites in the various municipalities. Most of the farm operators reported using some sort of recycling program for their household wastes. These wastes included newspapers, tins, glass and some fencing recycled at landfill sites. It was generally found that household and yard wastes that could be burned, were disposed by burning.

The collection of data on the use of household and yard products such as cleaners, disinfectants and household /yard pesticides could help assess the impact on the quality of the ground water considering many of these products are disposed through the septic tile beds. These tiling systems may be close to farm animal and human drinking water supplies. Possibly the burning location of household and yard wastes could also present a problem.

No other waste quantities were collected during this survey. Other wastes and wastes relating to the above mentioned wastes probably exist but this information was not offered by the respondents.

5.0 Summary of Findings

Some further considerations resulting from this study are based on the data collected during the survey and other data collected from external contacts. The major findings from this study were:

1) Empty pesticide containers are not being properly rinsed or disposed.

2) Machinery wastes were most frequently reported and most easily quantified. Waste oils were not properly disposed.

3) Household wastes were difficult to quantify, but the majority of operators reported recycling newspapers, tins and glass and burning other household burnables.

4) Most farm operators thought that empty pesticide containers should be recycled and would be willing to get involved in such a program.

5) Contacting farm operators for interviews by driving to their residences without prior warning proved to be inefficient.

Some recommendations arising from this study include:

1) Suggest implementing a pilot pesticide container deposit/return and collection system.

2) Consider developing some guidelines or objectives for farm waste management in Ontario.

3) Increase farm education programs regarding potentials for environmental

contamination as a result of waste management practices.

4) Consider an assessment of waste management practices of custom pesticide applicators and agricultural input suppliers.

5) Conduct further investigations into potential for groundwater, surface water and soil contamination from all the waste types. This could possibly be done by using watershed areas already under study in the Southwestern Region or other areas of Southern Ontario where a considerable amount of data has already been collected and farm cooperation has already been established. Monitoring for selected pesticides, nitrates, oil and grease, and PAH's could be initiated to help determine farm and waste management impacts.

6) Consider assessing the use and extent of underground and above ground fuel storage tanks by farm operations considering their potential to contaminate groundwater, surface water and soil.

7) Consider the need for implementing decontamination pads for machinery washing, pesticide mixing and fuel handling areas to decrease the potential for spills causing problems similar to manure holding systems. This could possibly be included in existing government assistance programs.

8) Consider the application of MOE's Decommissioning Guidelines to farm operations.

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APPENDIX 1

Cover Letter

University of Waterloo

Waterloo, Ontario, Canada N2L 3G1

Faculty of Environmental
Studies School of Urban & Regional Planning
(519) 885-1211

Telex Number 069-55259

June 6, 1989

Dear Sir or Madam,

This letter is to ask for your assistance on a research project I am doing with the University of Waterloo. This letter has been randomly distributed throughout Perth County. The objectives of the project are to assess the types, quantities and disposal practices of wastes such as waste pesticides and fertilizers(including empty containers), machinery wastes and household and yard wastes, from farm operations in Perth County. I chose Perth County because it has intensive farming typical of Southern Ontario and it is a convenient location.

I completed my four year Honours degree in Geography in April 1989. I have worked for the Upper Thames River Conservation Authority (Jan.1984-Jul.1985) and for Canviro Consultants (Aug.1985-Present, full-time and part-time). I plan to attend the University of Waterloo for Graduate studies in September 1989.

Over the summer months I will be dropping by to ask if you are willing to spend about one half hour discussing this project. All of the information collected will be confidential and will be coded for input into a computer for preparation of my research report. If you do not want me to drop by please call me collect at the number below. This information should help provide a basis for suggesting better ways of managing these types of wastes and decreasing the harm to the environment.

I plan to contact a variety of people including manufacturers, all levels of government, farm organizations and yourselves. I believe everybody's cooperation is essential to provide practical alternatives such as recycling, to assist in rural and urban waste management. Given the popularity and efforts many municipalities are undertaking to recycle domestic household waste, it seems timely to explore the opportunities and the difficulties of recycling the farm wastes mentioned above. Together with this letter I have included a copy of the questionnaire for you to look over.

If you have any questions please call me at 349-2816 (St. Marys) or my research advisor Murray Haight at the University of Waterloo at 885-1211 ext.3027. I hope you will be willing to spend the time and I look forward to meeting with you.

Yours Truly,

APPENDIX 2

Questionnaire

Questionnaire to Assess the Current Waste Management Practices of Farm Operators in Perth County, Ontario

1. Contact Person: _____
2. Address/ Conc. _____Lot _____ Township _____
3. Phone #: _____
4. Waste Types and Quantities

Crop Type Acres/1988					Containers t/s/q.	disp m	Contents quan.	disp m
A) Pesticides 1. Weeds 2. Insects 3. Disease								
B) Fertilizers								
C) Machinery Mach. Type	Oils quan.	disp m	Solvents quan.	disp m	Batteries quan.	disp m	Other quan.	disp m
D) House/yard wastes E) Other								

5. Type of operation (51 % or more of potential sales)
Dairy _____ Cattle _____ Hogs _____ Poultry _____ Mixed Grain _____
Wheat _____ Fruits _____ Misc. Specialty _____

6. Size of operation (include only acres actively operating) _____ acres

7.a) Usual "work" area for pesticide mixing or machinery repairs:
_____

b) Distance to well from (a) _____

c) Drainage distance to ditch or watercourse from(a) _____
or from "disposal" area _____

d) Distance from fuel tank area to well _____

e) Dominant soil type around 1)"work" area _____
and 2)"disposal" area _____

8. Do you rinse empty containers and where is the rinse water placed?
_____

9. If you bury waste, how deep do you bury it? _____

10. Do you have a specific site to store/burn/bury your wastes?
_____

11. What disposal alternatives do you think are possible?
_____
Of these, which would you participate in? _____
_____

What would it take for you to participate? _____
_____

12. General Comments:
_____
_____

APPENDIX 3

Pesticide Use Change in Ontario 1978 to 1983

Percentage Change in Pesticide Use in Ontario Between 1978 - 1983 and 1973 - 1983.

(From Roller,1979; McGee, 1984)

	1983/1978 Data - Percentage Change										
Crop	Total Area	Area Sprayed	Triazine	Phenoxy	Other	Fungicide	Nematoc.	Insect.	Gr.	Reg.	Total
Corn	3.2	7.2	12.1	121.5	25.1	-100.0		137.6			20.4
Soybeans	27.6	33.1	257.1		133.1	-100.0		-100.0			143.0
Dry Beans	-52.2	-52.4	-57.1		-64.5	22.2		-69.8			-64.1
Tobacco	-5.8	-5.8			9.2	-100.0	39.3	-53.2		46.4	35.7
Grains	4.5	13.5		28.7	300.9			-100.0			39.5
Hay/Pasture	-6.0	-29.7	-100.0	31.9	200.0			-91.7			7.8
Fruit	0.0	-100.0	11.1		205.3	118.7		-8.9			61.0
Vegetables	2.7	-100.0	-21.4	-49.6	-21.5	-16.1		-3.9			-15.6
Roadsides		-43.5	-100.0	-23.6	-85.7						-30.0
Total	0.1	2.6	17.9	25.1	43.2	48.5	39.3	2.5		46.4	31.7
% in category			-10.5	-5.1	8.7	12.7	5.7	-22.2		11.1	0.0