THE USE AND MANAGEMENT OF PESTICIDES BY FEDERAL DEPARTMENTS AND CROWN CORPORATIONS IN MANITOBA

By

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ABSTRACT

The objective of this project was to discover and catalogue information concerning the use of pesticides by the federal government and Crown corporations in Manitoba. The information gathered from a questionnaire included the types and amounts of pesticide products used, target pests and methods of application. Also collected was information on procedures for the storage, transportation and disposal of pesticides. The project also received opinions from federal users of pesticides on the effectiveness of labelling.

Thirty-nine on-site interviews were conducted with representatives of federal departments and Crown corporations. In examining the actual use, storage and disposal of pesticides by the federal government it was discovered that there is a lack of:

1. uniform procedures in purchasing pesticides.
2. uniform policies for storage and disposal of pesticides.
3. supplemental information to educate users in pesticide handling.
4. training for employees who apply pesticides.
5. assessment in justifying pesticide use.

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CHAPTER I

INTRODUCTION

1.1 THE ROLE OF ENVIRONMENT CANADA

The duties and responsibilities of the Minister of the Environment are defined in Part III of the Government Organization Act.[1] The definition includes all matters over which the Parliament of Canada has jurisdiction, not by law assigned to any other department of the government, relating to the preservation and enhancement of the quality of the natural environment, renewable resources, water and meteorology. Also included in the Minister's responsibilities are enforcement of rules and regulations made by the International Joint Commission as far as they relate to the natural environment, and the co-ordination of the policies and programs of the Government of Canada respecting the preservation and enhancement of the natural environment.[2]

In the fulfillment of responsibilities, the Minister of the Environment may undertake programs which:

> promote and encourage the institution of practices and conduct leading to the better preservation and enhancement of environmental quality.[3]

Not the least of the Minister's responsibilities is the duty:

> to provide to Canadians enviromental information in the public interest.[4]

The Environmental Protection Service (EPS) is a division of Environment Canada responsible for environmental protection and pollution control. The Environmental Protection Service advises other departments of the federal government on questions concerning the environment and monitors federal activities to ensure compliance with pollution control legislation. The Environmental Protection Service is responsible for the enforcement of a number of statutes: the Environmental Contaminants Act; the Clean Air Act; the Ocean Dumping Control Act; and portions of both the Fisheries Act and the Canada Water Act.

Recognizing that both Canada and the provinces have jurisdictions and responsibilities in the field of environmental quality, the government of Canada and the government of the province of Manitoba have entered into an agreement for resolving environmental issues. This agreement, the Canada-Manitoba Accord for the Protection and Enhancement of Environmental Quality, was originally signed by federal and provincial Environment Ministers in 1975 and has been extended indefinitely. The Accord provides for the establishment of liaison mechanisms and for information exchange. In the Accord the federal and Manitoba governments agree to identify gaps and overlaps in enforcement areas and to establish working relationships for resolving these issues. Through these working relationships, federal and Manitoba governments have agreed that for federal facilities and activities, provincial standards will be used in the absence of specific federal codes of good practice. As a result of the Accord the federal government, through EPS, has a primary responsibility for enforcement of environmental standards at federal establishments and for federal activities.

1.2 THE REGULATION OF PESTICIDES

1.2.1 Agriculture Canada

Pesticides and their registration are the responsibility of Agriculture Canada under the Pest Control Products Act.[5] However, pesticides and their possible adverse effects on the natural environment are also the concern of EPS. This overlapping jurisdiction has given rise to a "Memorandum of Understanding between the Department of Agriculture and the Department of the Environment Concerning the Regulations of Control Products." Specifically, the memorandum applies to Agriculture Canada's administration of the Pest Control Products Act.[6] Agriculture Canada agrees to submit all pertinent data concerning pesticide products to Environment Canada. The data is used prior to the registration of a particular product to assess its potential hazard to the environment, its efficacy, and the adequacy of disposal instructions on its label. This procedure gives Environment Canada an opportunity to provide Agriculture Canada with recommendations on the acceptability of registration of a particular pest control product. Agriculture Canada agrees to give full consideration to the advice of Environment Canada.

1.2.2 Environment Canada

Environment Canada's role in the registration process is not limited to EPS; it also includes the Canadian Forestry Service. As a user, the Canadian

Forestry Service is concerned with those pesticides which are used in forestry. These chemicals are few in number and thus the Forestry Service role in pesticide registration is limited.[7]

The Contaminants Control Section in Ottawa represents EPS in evaluating the environmental impact of a pesticide being considered for registration. Although EPS has no specific criteria for assessment, it does use protocols suggested by the U.S. Environmental Protection Agency. The data, however, are developed for U.S. conditions; EPS may require more specific information for the regions of Canada in which the pesticide may be used. Research by Environment Canada includes only those pesticides under consideration for registration and does not include pesticides already registered.[8]

1.2.3 Fisheries and Oceans Canada

Fisheries and Oceans Canada has an advisory role in the registration and regulation of pesticides, as part of its mandate for protection of fish and fish habitat. The reviews of registration applications are conducted by the Chemical Hazards Division of the Fish Habitat Management Branch in Ottawa. Information on pesticides including that provided by industry is evaluated to determine the impact of pesticides on aquatic ecosystems. Particular attention is given to geographical area of use, watersheds, and methods and timing of pesticide applications. Fisheries and Oceans Canada also conducts research on pesticides at regional establishments across Canada.[9]

1.2.4 The Federal Interdepartmental Committee on Pesticides

The Federal Cabinet approved the formation of the Federal Interdepartmental Committee on Pesticides (FICP) in July 1974. The FICP is chaired by the Assistant Deputy Minister (Research) of Agriculture Canada. The members of the Committee are drawn from other departments of the federal government which have an interest in pesticides. In addition to Agriculture Canada, the FICP includes Environment Canada, Consumer and Corporate Affairs, National Defence, Fisheries and Oceans Canada, Indian Affairs and Northern Development, Health and Welfare Canada, and the National Research Council. The Committee is required to meet at least twice per year. Federal departments are invited to present planned pesticide programs at the spring meetings of the Committee. The Committee's efforts are intended to encourage development and revision of legislation affecting pesticide use; however the FICP is purely advisory and has no regulatory powers or operational role.[10]

1.3 THE PESTICIDE INVENTORY

Although registered pesticides are not subjected to scientific research by Environment Canada, their use does remain a concern to the department. This fact is especially true where the users of pesticides are other departments of the federal government. The types, amounts used, and the manner of storage and disposal are of interest to the Environmental Protection Service. The Environmental Protection Service is responsible for ensuring that use of pesticides by the federal government does not have adverse effects on the environment.

This project was sponsored by EPS and funded by the Canada Employment and Immigration Commission. The purpose of the project was to discover and catalogue information concerning the use of pesticides by the federal government and its several agencies. For the purpose of the inventory the term "pesticide" was considered to be synonymous with "control product" as defined in the Pest Control Products Act:

> "control product" means any product, device, organism, substance or thing that is manufactured, represented, sold or used as a means for directly or indirectly controlling, preventing, destroying, mitigating, attracting or repelling any pest, and includes
>
> (a) any compound or substance that enhances or modifies or is intended to enhance or modify the physical or chemical characteristics of a control product to which it is added, and
>
> (b) any active ingredient used for the manufacture of a control product.[11]

Similarily, the Pest Control Product's Act'sdefinition of "pest" was also adopted for the inventory:

> "pest" means any injurious, noxious or troublesome insect, fungus, bacterial organism, virus, weed, rodent or other animal pest, and includes any injurious, noxious or troublesome organic function of a plant or animal.[12]

Both of the above definitions made it clear that the term "pesticide" is not, as is popularly believed, synonymous with "insecticide". The term "pesticide" includes insecticides, herbicides, fungicides and similar specific terms for chemicals used against pests. These terms are defined in Appendix A.

The information gathered included the types and amounts of pesticide products being used, the target pests, the methods of application and the effectiveness of the products. Also of importance was information on the storage, transportation and disposal of pesticides. The inventory also sought the opinions of pesticide applicators within the federal government regarding the labels on product containers. These labels contain instructions regarding the application methods and rates, wind and temperature restrictions, storage restrictions, first aid and toxicity information, and rinse and disposal procedures. The Pest Control Products Act emphasizes the requirements of labelling in its regulation of pesticides.

In all, fourteen federal government departments and Crown corporations were found to be users of pesticides. The fourteen were found to be further subdivided into several specific divisions of use, each of which were canvassed for the information required by the inventory. The uses of pesticides within the federal government are as broad as the range of activities in which it is involved.

In addition to the actual inventory this report provides background information in Chapter 2 (Literature Review) on the use of pesticides. Chapter 2 begins with a discussion of the history of pest control throughout the world and pro-

gresses to the discovery and development of modern chemical pesticides. A number of the more prominent chemicals are discussed in detail with emphasis on their uses, modes of action, toxicology and potential impact on the environment. The chapter concludes with a discussion of the encouraging trend towards Integrated Pest Management, an approach which could lead to decreasing reliance on chemical pesticides in the future.

The methods used in conducting the inventory are explained in Chapter 3 (Methods). The results achieved by using these methods are discussed in Chapter 4 (Results and Discussion). The conclusions in Chapter 5 (Conclusions and Recommendations) lead to several recommendations concerning the regulation and use of pesticides by the federal government.

Integral to understanding the report is a review of federal and provincial legislative authority, which directly or indirectly control pesticides and their use in Manitoba (Appendix G). The appendix emphasizes the Canadian Pest Control Products Act and Manitoba's The Pesticides and Fertilizers Control Act.[13] Legislation specifically affecting the disposal of pesticides and used containers, and legislation influencing the application of pesticides are also discussed. This appendix also addresses constitutional issues related to environmental management and jurisdictional difficulties associated with the regulation of pesticides.

APPENDIX A

SPECIFIC TERMS FOR PESTICIDES

These are more specific terms for 'pesticide' and are found within this study (after Cornwwell 1973)[14]:

acaricide:	a substance which kills mites.
avicide:	a substance which kills birds.
bactericide:	a substance which kills bacteria.
botanical insecticides:	insecticide made from the extracts of certain parts of plants.
dessicant:	a drying substance or agent.
fungicide:	a substance which kills fungi.
growth inhibitor:	a substance which retards growth of plants.
herbicide:	a substance which kills plants.
insecticide:	a substance which kills insects.
molluscicide:	a substance which kills mollusks.
nematicide:	a substance which kills nematodes.
rodenticide:	a substance which kills rodents.
seed treatment:	addition of fungicides and insecticides to a seed prior to planting to protect the seedling against both diseases and insects.

NOTES

1. S.C. 1978-79, c.13.

2. S.C. 1978-79, c.13, s.5.

3. S.C. 1978-79, c. 13, s.6

4. S.C. 1978-79, c. 13, s.6

5. R.S.C. 1970, c. P-10

6. R.S.C. 1970, c. P-10

7. Canadian Environmental Advisory Council (1981), Report 10, at 47 (R.H.Hall)

8. Ibid.

9. Canadian Council of Resource and Environment Ministers, Pesticide Workshop Proceedings (1982), Evaluation of Pesticides in the Department of Fisheries and Oceans, 101 - 106 (N.Y. Khan).

10. Economic and Technical Review Report EPS 3-NW-78-1, Pesticide Use and Control in the Prairie Provinces, 64 - 68 (Stanley Associates Engineering (Ltd.)

    Canadian Council of Resource and Environment Ministers, meetings (1977), Pesticide Use and Control in Canada, at 16.

11. R.S.C. 1970, c. P-10, s.2.

12. R.S.C. 1970, c. P-10, s.2

13. R.S.C. 1970, c. P-10
    S.M. 1976, c.19

14. Pest Control in Buildings (P.B. Cornwell). Hutchinson of London, 1973.

CHAPTER II

LITERATURE REVIEW

2.1 INTRODUCTION

Strategies to maintain crop yields and quality and to control diseases carried by pests have been increasingly based on the use of pesticides. In 1930 there were 30 registered pesticides in Canada (McEwen and Stephenson 1979). By 1981 there were 405 registered chemicals and 3000 formulations (Hall 1981). Annual sales of pest control products increased eight times between 1947 and 1973 (Thomson 1973). These statistics do not include direct sales to government, utilities and other large users.

Historically the need for increasingly efficient food production together with improved health protection for growing populations led to the development and use of pesticides. This chapter provides background on the events leading to pesticide use. Modern fungicides, insecticides and herbicides are reviewed separately and their uses, modes of action and toxicology are discussed. The final sections of Chapter 2 review the benefits and hazards associated with pesticide use and discuss alternatives to chemical pest control.

2.2 HISTORICAL PERSPECTIVE

The deliberate cultivation of plants and animals, more familiarily known as agriculture, began about 10,000 B.C. (Ordish 1967). Primitive agricultural crops and livestock were selected based on their ability to survive under existing

environmental conditions. When pest problems arose, people moved their crops and livestock to a new location (Glass 1977).

During the middle ages, agriculture advanced slowly. The increasing population was fed from a greater acreage rather than from increasing yields on existing acreage (Ordish 1976). As towns and cities developed, their inhabitants became more dependent on local rural producers for food. It became necessary to increase productivity on the existing agricultural land rather than extend into areas remote from the cities.

Animal powered implements were introduced to break the land as early as 1000 B.C. (Alder et al. 1977), but seeding and weeding by hand continued. Until the early 18th century, seed was broadcast by hand and weeding became expensive as labour costs increased. Eventually seed was hand set in rows (Ordish 1976) and farmers used a method known as "roguing" to remove or turn under undesirable plants between seed rows. However, roguing did not control undesirable plants within the seed row itself.

Tillage practices were reasonably efficient in destroying weeds and insects which lay dormant over winter. But, depletion of soil moisture and subsequent erosion were often attributable to tillage. Since tillage only destroyed pre-planting pests, those which arose after planting were not affected (Smith et al. 1976).

Crop rotation was, and still is, an effective way to minimize weed and insect infestations. Rotation also allows the soil to replenish, in part, minerals

depleted by certain crops. Pruning, defoliation and crop isolation were also early methods of pest control (Smith et al. 1976).

A large number of charms existed in early times against various evils including pests. One general remedy for coal blight and carbuncle in vines was for the world to be on better behavior and thus placate the gods. From the middle ages into the 17th century a number of ecclesiastical courts actually indicted pests! (Ordish 1976).

Early agriculturists practiced biological control, such as the encouragement of jays as predators against locusts, the most widespread pests of the time (Ordish 1976). The selection of plants resistant to insects and diseases automatically took place and inadvertently was used as a method of pest control (Adkisson and Dyck 1980). Most folk remedies during the 1500's-1700's were ineffective but some had a measure of insecticidal qualities, for example the mixing of stored grain with gypsum and chalk to reduce insects (Ordish 1976).

By the beginning of the 18th century, agriculture was becoming more productive and science was developing along with it. Corn seeds were washed and then stored in a mixture of salt and alum to prevent fungus. The principle of insecticidal spraying arose from the idea of using a garden engine to wash insects from plants and possibly drown them (Ordish 1976).

Up to this time, however, few pesticides were available, and the agriculturist had to rely mostly on mechanical and biological methods. Two catastrophies in the mid-1800's made the world aware of the necessity for

biological information and research. These events were the potato blight in Europe, especially Ireland, and the vine powdery mildew in France (Ordish 1976). It was believed at the time that the potato blight was caused by a fungus, but no remedy was available for forty years.

2.3 FUNGICIDES

Because fungi are plants, fungicides must be very selective so as to not damage or destroy the plant being protected. Target fungus selectivity is also important, as many fungi are essential to the environment as decomposers or as food sources. Unlike insects which can travel across the plant's surface, fungi are stationary. To be effective a fungicide must cover the entire surface of a plant, sprays or spot treatments would only destroy part of the pest problem (Cremlyn 1978, McEwen and Stephenson 1979).

Copper sulfate has been used as a fungicide for over 200 years in seed treatments and wood preservation. Because it is phytotoxic, or injurious to plants, it has also been used to control weeds in cereal crops. Copper sulfate, combined with lime to reduce phytotoxicity, has been used against a large number of fungal diseases of plants (McEwen and Stephenson 1979). This combination, known as Bordeaux mixture, was first used in 1885 to control downy mildew on grapes (Ordish 1976, McEwen and Stephenson, 1979). Bordeaux mixture can also be used to combat potato blight (Worthing 1979); spraying of this mixture became common in Britain by 1890 (Ordish 1976).

Organomercurials were first used as fungicides in 1915. These chemicals are of moderate phytotoxicity and active as both fungicides and bactericides. Most organomercurials were used as seed treatments but some were used to control foliar diseases such as apple scab. The use of organomercurials as fungicides has been largely discontinued in North America (McEwen and Stephenson 1979).

Chloroneb (Tersan SP) is a systemic fungicide which was introduced in 1967. The chemical is absorbed by the roots of the plant rendering it fungistatic (i.e., the fungus is not killed but is prevented from growing). Chloroneb is applied to the soil at the time of planting to protect such crops as cotton, beans and soybeans. The chemical is of low toxicity to animals with an acute oral LD_{50} for rats (Appendix B) of greater than 11,000 mg/kg (Worthing 1979).

Benomyl (Tersan 1991) is a protective and eradicant fungicide with systemic activity. It is used on a variety of fruits, nuts, and vegetables for protection against a wide range of fungi (Worthing 1979). Benomyl is also active as an ovicide against mites. The chemical is also used for Dutch elm disease therapy and for earthworm control. Benomyl has been used at airports to control high earthworm populations which attract birds and thus pose a hazard to aircrafts (McEwen and Stephenson 1979). Benomyl is of low mammalian toxicity (Appendix B) with an acute oral LD_{50} for rats of greater than 10,000 mg/kg.

Captan was introduced in the 1950's for the control of fungal diseases in fruit, vegetable and ornamental crops (Worthing 1979). It is generally non-phytotoxic and is generally ineffective against powdery and downy mildews (McEwen

and Stephenson 1979). The acute oral LD_{50} for rats is 9,000 mg/kg (Worthing 1979). However, Agriculture Canada has recently placed restrictions on the use of captan because of its possible links with cancer.

2.4 INSECTICIDES

Table 1 is a classification of insecticides according to the type of chemical compound. It is not a complete list, but includes those chemicals whose amounts were significant in the pesticide inventory and those chemicals significant in the development of pesticide use.

Table 1: CLASSIFICATION OF INSECTICIDES BY CHEMICAL COMPOUND

Botanical Insecticides

- Nicotine
- Pyrethroids (pyrethrum, pyrethrin)
- Rotenone

Inorganic Insecticides

- Calcium arsenate
- Lead arsenate
- Paris green
- Sodium fluoride

Dinitrophenol Insecticides

- DNOC
- Dinocap
- Binapacryl

DDT and Related Compounds

- DDT
- Methoxyclor
- Dicofol (Kethane)

Cyclodiene Insecticides

- Chlordane
- Heptachlor

Organophosphorous Insecticides

- Diazinon
- Malathion
- Fenitrothion
- Crufomate (Ruelene)
- Coumaphos (Co-Ral)

Carbamate Insecticides

- Propoxur (Baygon)
- Carbaryl (Sevin)
- Carbofuran (Furadan)

Before 1800 a number of compounds were used as insecticides including lye, lime, soap, turpentine, tobacco, pyrethrum powder, oils and arsenic (Headley and Lewis 1967, O'Brien 1967, Ordish 1976).

As early as 1763, tobacco "teas" were recommended for use against insects. Around 1880 the nature of nicotine as a toxicant was discovered, and a nicotine preparation derived from the waste swept from the floors of tobacco factories was marketed (Ordish 1976, McEwen and Stephenson 1979). Nicotine kills insects rapidly, often within an hour. External applications result in tremors followed by convulsions, and then paralysis. Nicotine is popular in greenhouses for use against aphids and some mites and ticks. It is available as an ignitable fumigant. Nicotine, however, is highly toxic to mammals. The acute oral LD_{50} for rats is 50 to 60 mg/kg with similar dermal toxicity (Worthing 1979).

Pyrethrum, a mixture of pyrethroids, is perhaps the oldest of the organic insecticides (O'Brien 1967) and was first used in Persia. Pyrethrum is derived from ground up flowers of Pyrethrum cinerariaefolium and other species (Worthing 1979). Pyrethrum was introduced to the United States about 1860, and since 1950 synthetic pyrethroids have been commercially produced on a large scale. Knockdown (Appendix 1) is almost instantaneous, but pyrethrum also has the property of permitting total recovery in some circumstances. Its usefulness lies in that an insect may be knocked down by the pyrethrum, and then killed by a slower acting insecticide mixed with the pyrethrum (O'Brien 1967, Ordish 1976). The acute oral LD_{50} for rats is 584-900 mg/kg (Worthing, 1979).

Rotenone, another botanical compound was first used for insect control in 1848. It is a contact and stomach poison which is effective against some species of aphids and most species of lepidopterous larvae. Today most rotenone is used in home garden products and for cattle grub control (McEwen and Stephenson 1979). Rotenone is non-phytotoxic and the acute oral LD_{50} for white rats is 132-1500 mg/kg (Worthing, 1979).

Many inorganic compounds have been used for insect control: for example compounds of mercury, boron, thallium, arsenic, antimony, selenium and fluoride. The only ones used on a large scale were arsenates; lead arsenate is still a commonly used pesticide (O'Brien 1967).

The most widely used arsenical compounds are lead arsenate and calcium arsenate (McEwen and Stephenson 1979). Insoluble arsenical compounds were introduced for use about 1900 and used against the coddling moth, apple maggot and boll weevils (Ordish 1976). The arsenicals are stomach poisons (Appendix B) and as such are effective only against insects which bite and swallow their food (Ordish 1976, McEwen and Stephenson 1979).

Sucking insects are not affected by surface poisons; contact poisons (Appendix B) provide an alternative. It is interesting to note here that earlier than 1900 a German scientist had synthesized a contact poison, but the effectiveness of this poison, DDT, was not recognized until 1939 (O'Brien 1967, Ordish 1976).

Another important early insecticide was Paris Green. It is an arsenical

compound discovered in 1865 to be toxic to the Colorado potato beetle (McEwen and Stephenson 1979). The introduction of its use marks the beginning of commercial pesticides (Headley and Lewis 1967). Today Paris Green is used against slugs, other soil pests and mosquito larvae. It is extremely toxic to animals, as it has an acute oral LD_{50} for rats of 22 mg/kg (Worthing 1979).

In the early 1900's sodium fluoride was used in powder form against cockroaches, ants and lice (O'Brien 1967). Because it is highly phytotoxic, the use of sodium fluoride is limited to baits and timber preservatives (Worthing 1979). Other fluorides such as cryolite also have applicability as insecticides. Cryolite has the virtue of being much less toxic to animals than sodium fluoride. Acute oral LD_{50}'s for rats are 13,500 mg/kg for cryolite and 200 mg/kg for sodium fluoride. Due to their low effectiveness, the use of fluorides has declined greatly since the first half of the century (McEwen and Stephenson 1979).

The first synthetic pesticides, the dinitrophenols, include both insecticides and herbicides. They were first developed in 1892. As insecticides the most important dinitrophenols are DNOC, dinocap and binapacryl (McEwen and Stephenson 1979). DNOC is used against certain insects and spider mites. It must be applied when plants are dormant because of its phytotoxicity. Dinocap is used as an acaricide and fungicide on a variety of fruits. Binapacryl has similar applications (McEwen and Stephenson 1979). The use of dinitrophenols has decreased with the introduction of more efficient insecticides.

DDT was the most widely used and least expensive synthetic pesticide (Headley and Lewis 1967). Although first synthesized in 1874, its insecticidal

qualities were not discovered until 1939 (O'Brien 1967). DDT was patented in 1942 by J.R. Geigy (Worthing 1979). Prior to then, the use of insecticides was limited to high value crops such as fruits, vegetables, hops and cotton (Headley and Lewis 1967, Ordish 1976).

The introduction of DDT marked the beginning of a new approach to insect control. Many entomologists began to comtemplate the possibility of complete eradication of major insects pests. DDT came to be used widely in forestry, and for control of household pests, lawn pests, and livestock pests and even for control of mice and bats. In 1961 there were more than 1,200 formulations of the chemical registered for use on 334 crops in the United States (McEwen and Stephenson 1979).

Despite the initial praise accorded to DDT, it was recognized by 1950 that DDT was persistent (Appendix B) in soil and harmful to nontarget organisms. In 1952, in Italy, it was discovered that certain strains of housefly had become resistant to DDT. Resistance in fact developed in over 150 insect species. It was this resistance and fear of the environmental effects of DDT which lead to its being restricted or banned in much of North America. Nevertheless, the use of DDT continues in developing nations as a control for insect-carried diseases and in agricultural pest control (McEwen and Stephenson 1979).

DDT has had drastic effects on bird and fish populations. In one midwestern city the robin population declined after feeding on earthworms which had fed on leaves from trees treated with DDT. DDT accumulates in fat tissue; sublethal concentrations may become lethal when fat deposits are metabolized. Robins have

been poisoned when the birds utilized fat reserves in which DDT is stored. Such poisoning occurs at times of stress such as during disease, starvation or migration conditions (Headley and Lewis 1967). In predatory birds, high concentrations of DDT have affected the reproductive nesting abilities (McEwen and Stephenson 1979).

DDT is also highly toxic to fish. Used in aquatic or forested areas it has resulted in fish kills (McEwen and Stephenson 1979). A study at Cornell University showed that DDT accumulations in lake trout reduced their fecundity (Headley and Lewis 1967).

The acute oral LD_{50} for DDT in rats is 113 to 118 mg/kg. In a study conducted on humans, 17 people who ate 0.5 mg/kg daily showed no ill-effects (Worthing 1979).

A number of insecticides are closely related to DDT chemically but demonstrate very different biological effects. One example is TDE (DDD). It was much less toxic to mammals than DDT, but more effective in the control of hornworms and leafrollers. Because it shares DDT's detrimental effects on the environment, the use of TDE has been discontinued (McEwen and Stephenson 1979).

Methoxychlor, another DDT analogue, is a widely used insecticide (McEwen and Stephenson 1979). Introduced in 1945, its range of activity coincides with that of DDT (Worthing 1979); it is more effective than DDT against a few insects (O'Brien 1967). In mammals, methoxychlor is not stored in fat or excreted in milk. Thus it is useful for fly control in dairy barns (Worthing 1979). While

methoxychlor is of low toxicity to most animals (O'Brien 1967), with an acute oral LD_{50} for rats of 6,000 mg/kg, it is highly toxic to fish (McEwen and Stephenson 1979). Because it is of low persistance, repeated applications are often necessary (McEwen and Stephenson 1979).

Dicofol (Kelthane) came into use in 1955. Although closely related to DDT, it has little insecticidal activity. It is used as an acaricide, and is recommended for use against mites on a variety of crops (Worthing 1979). Environmentally dicofol is very similar to DDT. It is insoluble in water and persistent in soil for about one year. Unlike DDT, dicofol is of low toxicity to mammals (McEwen and Stephenson 1979). The oral LD_{50} for rats is 668 to 842 mg/kg (Worthing 1979).

Another group of insecticides is the cyclodienes. The first of these to be discovered was chlordane in 1945. A number of related, but purer chemicals, were developed as insecticides in the following years. The commercial product of chlordane contained a number of isomers of the chlordane molecule (McEwen and Stephenson 1979).

Chlordane is a non-systemic stomach and contact insecticide. It is used against coleopterous pests, termites, wood-boring beetles and in ant baits (Worthing 1979). Chlordane is applied to soil and has proven to be persistent. One study showed 16% of a 14 kg/ha application remained in sandy loam soil after 15 years (McEwen and Stephenson 1979). Chlordane is moderately toxic to mammals with an acute oral LD_{50} for rats of 457 to 590 mg/kg (Worthing 1979). However, some compounds of technical chlordane are much more toxic (McEwen and Stephenson 1979).

Heptachlor was isolated from technical chlordane in 1948. It is a non-systemic stomach and contact insecticide with some fumigant action (Worthing 1979). While heptachlor shares many of chlordane's properties, there are a number of differences. Heptachlor is a more active insecticide than chlordane and it is more toxic to mammals (McEwen and Stephenson 1979). The acute oral LD_{50} for heptachlor in rats is 100 to 162 mg/kg (Worthing 1979). Because of heptachlor epoxide residues in milk and ill effects on birds, heptachlor was banned in Canada in 1969.

As a group cyclodiene insecticides appear to be neurotoxicants and all act on the ganglia of the central nervous system (O'Brien 1967). However, in vertebrate systems they are metabolized at different rates and the toxicity of metabolic products are greatly different (McEwen and Stephenson 1979).

The largest group of insecticides is that known as the organophosphates. These insecticides attack the insect's nervous system by inhibiting acetylcholinesterase at the synapses. When the insecticide penetrates the synapse, it binds with the acetylcholinesterase preventing it from acting as a transmitter substance. The prevention of transmission of nervous impulses in insects results in hyperactivity, tremors, convulsions, paralysis and death. Similar poisoning in higher animals results in asphyxiation because of the muscular activity required for respiration. In contrast, respiration in insects is mostly passive through spiracles (O'Brien 1967, McEwen and Stephenson 1979).

Diazinon was introduced in 1952. It is a non-systemic insecticide used on a variety of fruits and vegetables for the control of sucking and leaf-eating

insects. It is also used against flies and ticks (Worthing 1979). In foliar applications diazinon is moderately persistent and may protect plants from insects for seven to ten days. In animals, diazinon is of low toxicity being degraded by microsomal enzymes in the presence of $NADPH_2$ and excreted (McEwen and Stephenson 1979). The acute oral LD_{50} for rats is 300 to 800 mg/kg. However, the chemical is of high toxicity to birds and fish (Worthing 1979).

Malathion is a particularly useful organophosphorous insecticide because of its high toxicity to insects but low toxicity to mammals. This low mammalian toxicity is explained by the degradation of malathion by carboxylesterases to nontoxic metabolites. Carboxylesterases are more prevalent in mammals than they are in insects. The acute oral LD_{50} for rats is 2,800 mg/kg (Worthing 1979). However, while malathion is effective against a number of agricultural pests, it must be used in higher concentrations than parathion and azinophosmethyl. Thus its use is more costly. But, because of its low mammalian toxicity, the insecticide is very useful in health, household, garden and nuisance pest control (McEwen and Stephenson 1979).

Fenitrothion, which shares many of the properties of the other organophosphorous insecticides discussed above, is not used extensively in North America. Its major application in Canada has been in the control of the spruce budworm in the forests of New Brunswick and Quebec (McEwen and Stephenson 1979). Fenitrothion is moderately toxic to animals. The acute oral LD_{50} for rats is 250 to 500 mg/kg (Worthing 1979).

The organophosphorous insecticides also contain a number of compounds for use in ectoparasite and some endoparasite control in livestock. The major

"animal systemic" is crufomate (McEwen and Stephenson 1979). Crufomate was introduced in 1959 by Dow Chemical Co. under the trade name "Ruelene" (Worthing 1979). Ruelene is applied as a spray to the back of the animal or included in its food at 20-25 mg/kg of body weight. At this rate the insecticide is toxic to the pest but is either excreted or metabolized by the animal. Coumaphos, also an animal systemic is known by its trade name Co-Ral (McEwen and Stephenson 1979).

Similar to the organophosphorous insecticides, but of more recent origin, are the carbamate insecticides. Like the organophosphates the carbamates inhibit acetylcholinesterase and prevent it from cleaving acetylcholine at the neural junction (McEwen and Stephenson 1979). Carbamates show typically erratic patterns of selective toxicity to insects and are not broad spectrum insecticides (O'Brien 1967). Carbamates are relatively non-toxic to mammals and do not accumulate in animal tissues (Headley and Lewis 1967).

Carbaryl (Sevin), introduced in 1956, was one of the first commercially successful carbamates. It is a contact insecticide used against a variety of pests of fruits, vegetables, cotton and other crops. At low rates there is no evidence of phytotoxicity. Carbaryl has been used to reduce the number of apples on heavily laden trees (Worthing 1979). It is also used for ectoparasite control on livestock and pets (McEwen and Stephenson 1979). The acute oral LD_{50} for male rats is 850 mg/kg while the acute dermal LD_{50} is greater than 4,000 mg/kg (Worthing 1979).

Carbofuran (Furadan) has a broad range of activity. It functions as an insecticide, acaricide and nematicide, being toxic to most species of insects and

some species of nematodes (McEwen and Stephenson 1979). Carbofuran is applied to both foliage and soil. It is of high mammalian toxicity (Worthing 1979).

Aldicarb (Temik), the most toxic of the commercial carbamates, is used only in soil applications (McEwen and Stephenson 1979). The acute oral LD_{50} for male rats is 0.93 mg tech./kg (Worthing 1979). Taken up by plants, aldicarb provides insect and mite control for four to 12 weeks. However, persistence in soil is much shorter; the half-life is seven to ten days. Aldicarb is mostly used to protect cotton, sugar beets, sweet potatoes, potatoes and peanuts (McEwen and Stephenson 1979).

As a result of mosquito spray programs, one commonly known carbamate in Manitoba is propoxur (Baygon). Propoxur, introduced in 1959, is a non-systemic insecticide with rapid knockdown. It is used against a variety of household pests such as flies, mosquitos, cockroaches and aphids (Worthing 1979). Propoxur is used extensively for ground fogging and for aerial application to control adult mosquitos (McEwen and Stephenson 1979). In Manitoba propoxur has been chosen over malathion for the control of mosquitos because of its activity at lower temperatures. Malathion is relatively ineffective at temperatures below 18°C.

Test results for the 1981 spray application of propoxur over the City of Winnipeg showed an average mosquito kill of 95% in open areas (City of Winnipeg, 1981a). Propoxur, however, is also highly toxic to honey bees. The bee death rate in the Winnipeg spraying of 1981 was estimated to be as high as 10% of the population. Beekeepers had been advised of the spraying and the application was

conducted at times of low bee activity (City of Winnipeg 1981b). The acute oral LD_{50} for rats is 90 to 128 mg/kg. The insecticide is very toxic to birds. The acute oral LD_{50} for red-winged blackbirds is 2 to 6 mg/kg, and for starlings 15 to 20 mg/kg (Worthing 1979). Although dead birds were collected in Winnipeg after the 1981 spraying, no correlation has been made between these deaths and propoxur (City of Winnipeg 1981b).

The bacterium Bacillus thuringiensis is formulated as the insecticides Dipel and Thuricide. It would be incorrect to refer to these as microbial insecticides, although they are of microbial origin, because they do not cause a bacterial infection in the insect. The bacterium produces a toxin which is the active agent of the insecticide (McEwen and Stephenson 1979).

Bacillus thuringiensis was first used as an insecticide in 1938 against lepidopterous larvae. It continues in use today, but it is only effective against larvae of many lepidopterous species (Worthing 1979). Experiments by Heimpel and Angus in 1959 showed that soon after ingesting the insecticide silkworm larvae suffered paralysis of the digestive tract. This paralysis is associated with the disruption of the gut lining which allows alkaline juices to leak into the blood. The alkaline juices cause a rise in blood pH which in turn causes paralysis of the digestive tract (McEwen and Stephenson 1979). Bacillus thuringiensis has the advantage that there is no evidence of either acute or chronic toxicity in mammals, man, fish or birds (Worthing 1979).

2.5 HERBICIDES

The widespread use of chemical herbicides is a recent phenomenon, but the concept of chemical weed control has its origins in the mid-19th century. The first recorded recommended use of sodium chloride as a herbicide occurred in 1854 (Alder et al. 1977). However, the nonselective nature of sodium chloride made it of doubtful utility. In 1855 sulphuric acid was recommended for use and used thereafter for several decades in the selective control of weeds in cereal and onion crops. In 1902 sodium arsenite was introduced and used in Louisiana to control water hyacinth. Also in the early part of the century petroleum oils were used for weed control in irrigation and drainage ditches and as a selective herbicide in carrot crops (Alder et al. 1977).

In 1923 sodium chlorate, combined with borates to reduce flammability, was used as a non-selective herbicide. It was applied to soil as a sterilant and was effective in the control of deep-rooted perennial weeds (McEwen and Stephenson 1979).

In the 1930's dinitrophenol compounds were introduced for use in the control of broadleaf weeds in a number of crops. These compounds were the first selective chemicals used for weed control. After 1945 dinoseb (2-sec-butyl-4,6-dinitro phenol) became the most widely used phenolic herbicide in North America. It is used to control seedling weeds and grasses in small grains, legumes, potatoes, corn, cucurbits, mint, small fruits, orchards and alfalfa. Dinoseb, however, has many undesirable properties. It is non-selective, non-residual, moderately cor-

rosive to metal and stains human skin and clothing. As well, dinoseb is highly toxic to animals with acute oral LD_{50}'s in rats ranging from 50 to 100 mg/kg (McEwen and Stephenson 1979).

The herbicide chemicals commonly used in Manitoba by the federal government are listed in Table 2. Again, some compounds are mentioned that are not widely used but are significant in the development of pesticide use.

Table 2: CLASSIFICATION OF HERBICIDES BY CHEMICAL COMPOUND

Phenoxies

- 2,4,5-T
- 2,4-D
- MCPA

Bipyridyliums

- Diquat
- Paraquat

Thiocarbamates

- Diallate (Avadex)
- Triallate (Avadex BW)

Triazines

- Atrazine

Dinitroanilines

- Trifluralin (Treflan)

Benzoic Acid

- Dicamba (Banvel)

Unclassified

- Picloram (Tordon)
- Glyphosate (Round up)

The phenoxy herbicides, which include 2,4,5-T, 2,4-D and MCPA, constitutes an essential group of chemicals for weed control. Phenoxy herbicides have a broad spectrum of uses for many of which no satisfactory alternative is available (Bovey and Young 1980). The history of 2,4,5-T closely parallels that of 2,4-D since the synthesis of both compounds in 1941. However, the early history of 2,4,5-T is obscure because of secrecy associated with military application during wartime (Bovey and Young 1980).

2,4,5-T was first marketed in 1944 by Anchem Products Inc. (Worthing 1979). Initially, 2,4,5-T was used in combatting brush and weeds in forests, along highway, utility and railway rights-of-way, in pastures and on grazing lands; and in rice, wheat and sugarcane fields (Bovey and Young 1980).

During the Vietnam War, 2,4,5-T was used as a component of "Agent Orange" in the defoliation operations by American troops. Due to the high incidence of miscarriages and birth abnormalities in Vietnam, the use of Agent Orange was discontinued. The chemical believed to be responsible for these effects is the dioxin 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) a low level contaminant of both 2,4,5-T and another herbicide known as Silvex or 2-(2,4,5-trichlorophenoxy) propionic acid (McEwen and Stephenson 1979).

In October 1969 the American Environmental Protection Agency (EPA) restricted the use of 2,4,5-T to forestry and pasture management, and to clearing of rights-of-way. The Canadian government was influenced to follow suit (Barclay-Estrup 1972). The use of 2,4,5-T was banned in residential and recreational areas in Canada.

In 1978 nine women from Alsea, Oregon wrote to the U.S. E.P.A. stating that their 13 miscarriages could be correlated with peak forestry sprayings with 2,4,5-T. Investigation of the miscarriage rate in the Alsea Basin led to the suspension of the registration of 2,4,5-T by the EPA (Ember 1979). In Canada, The Pest Control Products Act Regulations (SOR/79-180) limit the concentration of 2,3,7,8-TCDD to 100 parts per billion parts of 2,4,5-T and of Silvex. Similar

levels exist in the United States but ongoing animal studies continue to show extreme toxicity of even low levels of 2,3,7,8-TCDD (Ember 1979).

Bovey and Young (1980) describe the discovery of 2,4-D (2,4-dichlorophenoxy acetic acid) during World War II as "the greatest single advance in the science of weed control and one of the most significant in agriculture." 2,4-D was the second component of Agent Orange. It is very selective in the control of broadleaf weeds in cereal crops, pastures and rangelands (McEwen and Stephenson 1979).

The primary mode of action of 2,4-D is to disrupt normal DNA, RNA and protein metabolism. The death of plants most likely occurs when xylem and phloem tissues are plugged or crushed by stimulated growth within stems (McEwen and Stephenson 1979).

Similar to 2,4-D is MCPA, another phenoxy herbicide. It is the second most widely used phenoxy herbicide and has the virtue that some crops are more tolerant to it than they are to 2,4-D (McEwen and Stephenson 1979).

2,4-D and related herbicides demonstrate a low toxicity to animals. For rats, acute oral LD_{50}'s range from 300 to 1,000 mg/kg for most of these herbicides. Investigations have shown almost total elimination of 2,4-D in mammals in the urine within 24 to 48 hours of feeding (McEwen and Stephenson 1979).

Bipyridyliums or quarternary ammonium compounds were first discovered to be herbicides in 1958 (Brian et al. 1958). Both diquat (Reglone) and paraquat

(Gramoxone), two non-selective herbicides, belong to this group of compounds. Upon contact with soil, both herbicides are inactivated. Diquat is used as both an aquatic herbicide and a crop dessicant in seed crops. Paraquat is also used as a crop dessicant, but it is primarily used on noncropland as a non-selective herbicide. Paraquat also plays a role in weed control in orchards, nurseries and landscaping (McEwen and Stephenson 1979).

Paraquat and diquat are most effective during periods of strong light. Cations of the herbicide are reduced to free radicals by photosynthetic electrons. These free radicals then react with water and oxygen to produce hydrogen peroxide which is thought to be the toxic agent. In the dark or in nonphotosynthetic organisms, electrons from respiration will also produce free radicals, but this mode of action is considered less effective than that involving photosynthesis.

Both paraquat and diquat are toxic to animals. Paraquat has oral LD_{50}'s for rats between 100 and 150 mg/kg. Diquat is less toxic with an oral LD_{50} for rats in excess of 200 mg/kg. This lower toxicity is probably explained by the fact that diquat is more readily metabolized by mammals (McEwen and Stephenson 1979, Worthing 1979).

Another group of closely related herbicides is the thiocarbamates, sulfur derivatives of carbamic acid (McEwen and Stephenson 1979). This group includes EPTC, benthiocarb, butylate, CDEC, diallate, triallate, metham, molinate, pembulate and vernolate (Crafts 1975). EPTC was introduced in 1954 by the Stauffer Chemical Company (Worthing 1979) and was the first of the thiocarbamates to be

developed commercially. EPTC is effective on a number of annual grasses, seedlings of perennial grasses and some broadleaf weeds. It can be safely used in many vegetable crops such as corn, beans, peppers and tomatoes (Crafts 1975).

Diallate and triallate are both used to control wild oats in a variety of crops (Crafts 1975). Diallate was first introduced in 1960 by the Monsanto company under the trade name "Avadex". It is of particular value in the control of wild oats in brassicas, red beet and sugar beet (Worthing 1979). In 1961, the Monsanto Company introduced triallate or "Avadex BW" to be used for cereals and peas (Worthing 1979). The exact mode of action of the thiocarbamates has not been well established (McEwen and Stephenson 1979), however they are easily metabolized in animals to natural compounds (Fang et al. 1964). Thus all thiocarbamates are of low toxicity to animals with oral LD_{50}'s for rats ranging from 500 - 4,000 mg/kg (McEwen and Stephenson 1979).

Next to 2,4-D the most significant herbicide discovery was that of the triazines. Of this group, the most important is atrazine which was introduced in 1958 (Worthing 1979). Atrazine is suitable for preplant, preemergence or postemergence application. Preplant, it is used to control persistent weeds like quackgrass. Preemergence, it is used to control broadleaf weeds; postemergence, it is used to control some annual grasses. Because of the effectiveness on corn atrazine was the leading herbicide in volume of use during the 1970's (McEwen and Stephenson 1979). Two familiar herbicides with atrazine as a component are Aatrex and Primatol. Atrazine is slightly toxic to fish but of low toxicity to mammals. The acute oral LD_{50}'s for rats range from 1,859 to 3,080 mg/kg (Worthing 1979).

The herbicidal qualities of nitroanilines were discovered in 1960 (Crafts 1975). The first, trifluralin, was introduced by Eli Lilly & Co., under the trade name "Treflan" (Worthing 1979). It is now one of the most widely used herbicides because of its selectivity for the protection of cotton and soybeans, two important crops in North America (McEwen and Stephenson 1979). Preemergence application of trifluralin is used for the control of annual grasses and broadleaf weeds, but postemergence application is not effective (Worthing 1979).

Trifluralin is toxic to fish but of low toxicity to birds and mammals (McEwen and Stephenson 1979). The acute oral LD_{50} for rats is greater than 10,000 mg/kg. However, for mice the acute oral LD_{50} is 500 mg/kg (Worthing 1979). Despite toxicity to fish, trifluralin is not a serious threat to aquatic environments because it is very immobile and only moderately persistent in soil (McEwen and Stephenson 1979).

Dicamba (Banvel), a benzoic acid herbicide, was introduced in 1965 by the Velsical Chemical Corporation (Worthing 1979). It is effective for controlling many weeds which are resistent to 2,4-D such as conifers and other woody species. At low rates dicamba is often used with phenoxy alkanoic herbicides, such as 2,4-D, for the control of lawn weeds (McEwen and Stephenson 1979). The acute oral LD_{50} for dicamba in rats is 2900 ± 800 mg/kg (Worthing 1979).

Picloram and glyphosate fall under the heading of unclassified pesticides (Crafts 1975). The herbicidal properties of picloram were first reported in 1963. It was introduced at that time by the Dow Chemical Company under the trade name "Tordon" (Worthing 1979). Picloram has been very effective for the control

of broadleaf weeds and for the control of brush on rights-of-way and roadsides. The symptoms of destruction of the plant are similar to those of 2,4-D. The growth of stem tissues is stimulated with the result that xylem and phloem are crushed. Picloram is much more toxic to broadleaf plants than either 2,4-D or 2,4,5-T (Foy 1976). For this reason, picloram was used in Vietnam to kill plants that survived Agent Orange. Picloram is under scrutiny at the present time as it is a suspected carcinogen (Schneider 1982).

Glyphosate, better known as "Roundup", is a relatively new herbicide introduced in 1971 (Worthing 1979). It is a non-selective herbicide which is very effective against both broadleaf weeds and grasses (Crafts 1975). Glyphosate is applied to foliage when plants are actively growing or established (Government of Manitoba 1982). The mode of action is not well understood (McEwen and Stephenson 1979). It is of low toxicity to animals. The acute oral LD_{50} for rats is 4320 mg/kg; the acute dermal LD_{50} for rabbits is 7,940 mg (Worthing 1979).

2.6 BENEFITS OF CHEMICAL PESTICIDE USE

The benefits of the use of chemical pesticides have been demonstrated in agriculture, health, forest management, right-of-way maintenance and households (McEwen and Stephenson 1979). However, the major benefit in their use has been the increase in the world's food production (Smith 1978).

According to the U.S. Department of Agriculture, crop losses caused by pests from the growing stage to the storage stage can amount to 50% worldwide (Josephson 1979). Here the broad term "pest" includes all forms of life which cause damage to crops or livestock.

Herbicides for weed control have not only increased crop yields but have also lead to increased efficiency in the utilization of marginal pasture land (McEwen and Stephenson 1979). Prior to the introduction of chemical herbicides, hand tillage was practiced on all vegetation crops. In cotton, such hand tillage could require 20 hours of labour per acre or as much as 100 hours of labour in an especially weedy field (Alder et al. 1977). Weeds interfere with harvesting and harbour insect pests and plant pathogens. Weed seeds included in harvests reduce the value of the crop (McEwen and Stephenson 1979).

The use of herbicides has greatly changed the face of agriculture. Manual and animal labour were used extensively in early crop protection practices. Although tractors were introduced for agriculture in 1920, it was not until 1947 that their use became widespread. By this time machinery had replaced about 70% of manual and animal labour in agriculture. It was estimated by Alder et al. in 1977 that "human energy input for overall weed control in the U.S. today (is) no more than 5%, with only a trace of animal energy input; mechanical energy (is) 40% and declining, with herbicides responsible for the remainder."

The use of insecticides for agriculture has protected crops from insect attack and postharvest spoilage and storage losses (McEwen and Stephenson 1979). Quality is of particular importance in fruit and vegetable crops. In 1956, in California, 21% to 23% of fruit produced without insecticides was wormy compared with only 0.5% of fruit treated with the insecticide Guthion (Headley and Lewis 1967). The most dramatic benefit attributed to pesticides in the area of health is the use of DDT to control mosquitos carrying malaria. Millions of people are alive today because of the use of this insecticide (McEwen and Stephenson 1979).

Manitobans are also familiar with the benefits of insecticide use in the control of disease-carrying insects. The first major outbreak of mosquito-carried western equine encephalitis in humans in Manitoba occurred in July and August 1941. In the three to four weeks of the epidemic, 509 cases were reported with 78 deaths. There was another smaller outbreak in 1947, but subsequently there were only sporadic cases until 1975. In August 1975, 14 cases were reported (Medovy 1976).

In 1975 a health emergency was declared by the province and a plan for mosquito control was developed on August 13, 1975. This plan included aerial and ground adulticiding as well as aerial and ground larviciding. On the ground, methoxychlor was used as an adulticide in residential fogging, while breeding sites were treated with the larvicide Flit MLO. In the aerial spraying program, malathion was initially chosen, but because of its low-temperature limitations and the cool weather that prevailed it became necessary to use Baygon. Abate 2G granules were used in the aerial larviciding program. On August 29, 1975, the emergency was declared over (Ellis 1976). Spray programs were carried out with Baygon again in 1977 and 1981.

The benefits of pesticide use have also been demonstrated in the maintenance of forests. The gypsy moth and Dutch elm disease can be controlled through the use of chemical pesticides but the most significant forest pest in Canada is the spruce budworm. In the first year of its spray program (1952) New Brunswick reduced the spruce budworm population to about 20% of its normal peak. Annual spraying has continued since that time (Hall 1981).

Pesticides are also used on rights-of-way, for example, for highways and roads, electrical transmission lines, telephone and telegraph lines, railways, pipelines and at airports. The benefits of pesticides use lie in the increased visibility, the reduced maintenance costs of travel routes and the reduced fire hazard. Vegetation growth can reduce or interrupt power on electrical transmission lines (McEwen and Stephenson 1979).

Pesticides are also beneficial to the householder, however, their availability through a wide variety of markets makes it difficult to estimate the scale of domestic use (McEwen and Stephenson 1979). Herbicides may be mixed with fertilizers for lawn maintenance. Insecticides are used in the control of household pests or may be added to fabric during the manufacture of carpets and furniture (McEwen and Stephenson 1979).

2.7 ALTERNATIVES TO EXTENSIVE CHEMICAL PEST CONTROL

The use of chemical pesticides has increased steadily since World War II with a dramatic use in the last 20 years (Hall 1981). Since the publication of Rachel Carson's Silent Spring in 1962, the public's awareness and concern about the hazards of chemical use has escalated.

The first reports of ecological damage and public health problems appeared in scientific journals whose readers were largely concerned with subjects unrelated to negative chemical use (Heckman 1982). The long term effects of pesticides are not well documented (Hall 1981), and the widespread application of pesticides exposes the majority of the human population to a danger not fully understood (Heckman 1982).

Aside from the obvious environmental and health concerns arising from the use of chemical pesticides there are a number of other problems. Generally pesticides are not completely selective; damage to potentially beneficial plants and insects may result. A fungicide applied to prevent plant disease may also kill fungi which control insect pests (Blair 1977). The removal of a predator pest through the use of chemicals may allow its prey to increase to such a number that a normally insignificant species becomes a pest (Blair 1977, Heckman 1982).

More dramatically, the widespread use of chemicals often leads to resistance in the target pest. For example, organochlorine insecticides which had been effective in the control of soil insects eventually began to perform erratically or to fail completely. In 1961 Brown distinguished between "DDT resistance" and "cyclodiene resistance". In the case of "DDT resistance" resistance extends to related chemicals such as TDE, methoxychlor and perthane (Harris 1977). Several physiological and even behavioral modifications can make a normally sensitive species resistant (Corbett 1974).

Resistance to pesticides may also be responsible for a resurgence in plant and animal diseases (Josephson 1979). Another problem associated with growing numbers of resistant pests is the increasing necessity to apply greater amounts of formerly effective pesticides (Heckman 1982).

Despite the many incentives to limit the use of chemical pesticides, their extensive use remains an economic fact of life. It is suggested that pesticide

use will continue to expand for the next few decades (Glass 1977). Nevertheless, there exists a number of alternatives to chemical pesticides. Such techniques include the prevention of the introduction and spread of pests into new areas, cultural practices and sanitation, the development of pest-resistant crops, the introduction of insects which attack pests and programs for the sterilization of male insects. As well, work has been done with sex attractants and hormones which disrupt the breeding and life cycles of insects (Josephson 1979). Many scientists have suggested that these techniques will allow the production of most crops with little or no use of pesticides (Blair 1977).

Programs have been introduced which aim to prevent the introduction of new pests into certain areas. Once a new pest is introduced and established, it is necessary to take prompt action to suppress it before it spreads. This approach does involve the use of pesticides but to a much lesser extent than otherwise would be necessary. If the pest does spread, however, large amounts of pesticides would be needed to control it (Headley and Lewis 1967).

The importance of cultural practices and sanitation in the limitation of pesticide use cannot be underestimated. The destruction of crop refuse, deep plowing, mowing of weeds, crop rotation and timing planting to avoid exposure to pests, are good examples of traditional pest control (Headley and Lewis 1967). Where farmers follow traditional planting patterns, insect problems are greatly reduced (Glass 1977). Even though these techniques originate in the "trial and error" experiences of early farmers, the validity of cultural techniques is demonstrated when they are departed from (Smith 1978).

In Asia, the necessity of increased rice production required a change from the traditional one crop per year during the monsoon season, to irrigated cropping all year. This change intensified problems with stem borer, plant hopper, gall midge and other insects. Thus extensive insecticide use become necessary (Glass 1977). Cultural pest control methods are not effective against all pests, but they do reduce the extent of chemical pesticide use.

The breeding of plants resistant to disease is a well known technique. This technique may also be applied to plant's resistant to insects and nematodes. Examples of insect resistance are found in older varieties of plants which may indicate that selection of plants resistant to insects has occurred naturally over time. Wheat has been developed which is resistant to Hessian fly; alfalfa resistant to spotted alfalfa aphid has also been developed (Headley and Lewis 1967). Montana State University has taken such a genetic approach to pest control. Specific genes which enhance the plant's resistance are cultivated in conjunction with other genes having background functions which may bolster resistance (Josephson 1979).

Concern over environmental pollution caused by chemical pesticides has also prompted the use of biological methods other than the breeding of resistant plants. These methods include the introduction of natural predators, parasites and pathogens of both insects and weeds (Headley and Lewis 1967). This may be achieved by introducing a predatory agent or parasite into the area, by changing cultural practices to enhance an existing predator or parasite, or by spraying a pest with a disease organism in the same manner as a pesticide (Hall 1981).

The use of predators to control insects is not a recent phenomenon. The ancient Chinese are known to have fostered ants in citrus trees for the control of caterpillars and beetles. One technique involved placing bamboo runways among cultivated trees to assist the mobility of ants. The first recorded introduction of new predators from one country to another occurred in 1762. At that time, agriculture in Mauritius was seriously threatened by the red locust. The mynah bird was imported from India and it successfully controlled the locust by 1770.

In 1837 Vincent Kollar of Germany described the biology and habits of insect predators and parasites. He stressed that man must have knowledge of natural enemies to protect himself from injurious insects. By the late 1800's, international shipments of predators and parasites of insects had become relatively common (DeBach 1974).

Recent examples of such biological control include the importation of a variety of parasites to control the cereal leaf beetle in the United States and Canada and the importation of the parasite Microtonus aethiopoids to control the alfalfa weevil in Ontario. On both the east and west coasts of Canada the tansy ragwort weed is destructive to pasture land. The cinnabar moth, a natural predator of the weed, was introduced in Canada to control the tansy ragwort weed. This was successful on the east coast, but not on the west coast where milder winters allowed the weed to recover (Hall 1981). It should be noted that the use of predators and parasites is seldom intended to eradicate the pest, although this may occur. Generally it is only intended that the pest be reduced to a level where damage is economically acceptable. In fact total eradication

may not be desirable as there will always be a few survivors to make an explosive comeback before the predator or parasite can recover sufficient numbers to control the pest (Hall 1981).

Sexual attractants known as pheromones have been used to lure insects to traps where they may be poisoned. The Oriental fruit fly was eradicated on Rota Island with the use of an artificial pheromone which attracted the male flies to a poisoned surface. Similarily in 1956-57 the Mediterranean fruit fly was eradicated from about one million acres (400,000 hectares) in Florida. However, the cost was about $11,000,000 (DeBach 1974). It is necessary that such programs cover a large area otherwise the pest will immigrate from neighbouring areas. Although mass trapping may not always be practical, pheromones still have a role to play in pest control. They may be used to monitor insect populations and thus provide a guide for the timing and for dosage regulation of insecticide spraying (Hoyt and Gilpatrick 1976).

An alternative to the extensive use of pesticides is the use of sterile insects to prevent reproduction. This procedure has been applied to the screwworm in the southeast United States. Work has also been carried out with the fruit fly, boll weevil and codling moth (Headley and Lewis 1967). The method requires the introduction of a large number of sterile males into the area where control is desired. The result is that the majority of matings are not productive. If normal males do not migrate into the area in large numbers, the insect population will decline and eventually disappear. Success requires that the method produce sterility without decreasing the urge to mate, and that the females are satisfied by the act of mating rather than fertility (Cremlyn 1978).

The sterilization of artificially reared insects may be accomplished by exposing the insects to x-rays or to gamma rays or by treating the insects with chemicals known as chemosterilants (Cremlyn 1978). Chemosterilants have the advantage that they may be used in conjunction with attractants to sterilize insects in the field. Thus the expense of artificial breeding is eliminated (Headley and Lewis 1967). There are a large number of chemosterilants. Most of these chemicals are potentially dangerous as they are of high mammalian toxicity and easily absorbed through the skin. Because the chemicals are potentially mutagenic, there is the added risk that the target insects develop resistance (Cremlyn 1978).

None of the methods of pest control discussed above is totally effective by itself. This fact has led to the concept of integrated pest management (IPM). IPM has its origins in the overuse of and overdependence on chemical pesticides since World War II (Adkisson and Dyck 1980). More specifically, the move towards IPM has been stimulated by pressure from environmental groups, data indicating increasing target pest resistance to chemicals and the rising costs of synthetic pesticides (Smith et al. 1976, Josephson 1979). Integrated pest management is a systems approach to pest control which combines available techniques in such a manner to optimize pest control with minimal environmental impact (Josephson 1979, Adkisson and Dyck 1980).

Integrated pest management is considered a relatively recent concept, but its foundations may be traced to the late 19th Century. The boll weevil migrated from Mexico to the United States in the 1890's. Early researchers of the boll

weevil rejected eradication as unrealistic and focused on pest management systems. The systems included cultural techniques such as destruction of refuse plants, early planting and clean cultivation combined with weevil trappings (Smith 1978).

Today the concept of IPM is considerably enlarged. It requires considerable basic research, principally biological research. An illustration of IPM in Canada is the control of the codling moth in the apple-growing regions of Ontario. Populations are monitored using pheromone traps; this information is then given to growers to allow them to plan the maximum effectiveness of spraying. Through study of weather information, it is also possible to predict when the moths will appear and when the eggs will hatch. These techniques have reduced the necessity for chemical spraying. As well, specialized spray equipment has been developed to decrease wind drift. This has led to increased effectiveness and to a reduced chemical requirement.

Integrated pest management programs also utilize computer technology which will be of increasing importance in the future. It has been suggested that data banks might contain information concerning historic pest infestations, pest populations year-by-year, natural pest predators, pest resistance to chemical pesticides and a variety of other knowledge (Josephson 1979). The use of computers will permit development of pest control methods which can take into account many regional conditions such as weather conditions and the interaction of pest populations. Control strategies can be modified from region to region. Data can be collected on a continuous basis for input to the multifactor control models (Haynes and Tummala 1978). Integrated pest management will lead to economically and environmentally sound pest control practices.

APPENDIX B

DEFINITIONS

The following are some definitions as they are used the context of this report (from Cornwell 1973):

toxicity:	the capacity of a pesticide to injure or kill. Toxicity is measured by the lethal dose (LD) that kills a proportion of the test animals. Oral toxicity refers to the capacity of a pesticide to injure or kill when the pesticide is applied via the mouth. Dermal toxicity determines the toxicity of a pesticide when applied to abraded or shaved skin. A pesticide which is phytoxic is injurious to plants.
LD_{50}, LC_{50}:	the lethal dose (LD) or lethal concentration (LC) which kills 50% of the experimental population. The term "acute" or "chronic" denotes whether the treatment was given as one dose or spread over time. Acute tests give a first impression of a compound by determining at what dosage death occurs. In chronic testing the emphasis is placed on the effects of the pesticide on reproduction and the discovery of any teratogenic or carcinogenic effects. LD_{50} values are expressed as the weight of the chemical in its technical form (usually in mg) per kilogram (kg) of body weight of the test animal. To assess the toxicity to man, the experimental animal is usually the rat.
stomach poison:	a chemical which must be swallowed to cause death.
contact poison:	a chemical which kills when a pest runs over or alights on a treated surface.
knockdown:	incapacitation of an insect by quick-acting insecticides, often incorporated into insecticidal mixtures with the express purpose of producing rapid paralysis of the insect.
persistent:	pesticides which do not readily degrade but remain or accumulate in some component of the environment over a period of years are said to be persistent.

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CHAPTER III

METHODS

3.1 INTRODUCTION

Data collection for this study was conducted between May and August of 1982. This time restraint required that a decision on methodology be made early in the study. The questionnaire was designed by myself, in close consultation with members of my committee and staff of the Environmental Protection Service.

Prior to the definition of methods for this study, previous inventories were reviewed (Thomson 1973, W.L. Wardrop and Associates 1979, Siemieniuk 1980, Environmental Protection Service, Manitoba District 1981, 1982). Thomson (1973) used information obtained from Statistics Canada on manufactured pest control products. The information was broadly grouped by quantity of pesticides used per year in a particular category, for example agricultural herbicides. The quantities were not sufficiently divided by compounds for use by this study.

W.L. Wardrop and Associates (1979) and Siemieniuk (1980) conducted hazardous waste inventories by questionnaires mailed to a large number of recipients. The subject of the present study was restricted to pesticides as defined in the Pest Control Products Act and the recipients were defined as all federal departments and agencies in Manitoba.

The Environmental Protection Service (Manitoba District) conducted surveys in Manitoba on the amounts of 2,4-D and 2,4,5-T used by the federal government in

Manitoba (1981), on quantities of hazardous wastes generated by federal facilities in Manitoba (1981) and on equipment containing polychlorinated biphenyls in Manitoba (1982). The time frame for conducting these surveys was eighteen to twenty-four months.

Three basic questions regarding inventory methods were addressed.

1) Should the inventory be conducted by mail, by telephone, or in person?
2) How should the information be recorded?
3) How could all pesticide users within the federal government be reliably determined?

3.2 CONTACT ROUTE

It was decided that the inventory should be conducted by personal interview. The Environmental Protection Service had previously experienced slow response with mailed questionnaires; and it was considered that telephone interviews are too hasty and do not allow for thoroughness or for personal consideration on the part of the interviewee. In addition, it was considered that on-site inspection of storage and disposal facilities pesticides was important. It was also judged that personal interviews would reduce the variables and would allow for greater consistency in the questioning of different departments. Inventory staff were briefed on interviewing techniques by an instructor at Red River Community College. In addition, an inventory manual was compiled to standardize operational procedures (Appendix C).

3.3 RECORD OF INFORMATION

A three page interview questionnaire was developed (Appendix D). The first page identified the department, its location and the contact person for the interview. Page one focused on the trade name of the particular pesticide, the quantity purchased and stored, the target pest, the application method, and area treated. The person interviewed was also asked to comment on the perceived efficacy of the pesticide. The name of the distributor of the pesticide and the reason for choosing that distributor were also included on the first page.

The names of several of the larger distributors were printed on a card shown to the interviewee to ensure accurate identification. A similar card was prepared to determine the reason for choosing a distributor and for the accurate identification of the formulations of the various pesticides (Appendix E). Where there was difficulty in identifying the formulation, the generic names of pesticides, or the target pest, the manufacturer or distributor was contacted for clarification or confirmation. The first page of the inventory was completed for each pesticide included in the inventory.

The questions on the second and third pages were directed at storage information, transportation and disposal, and labelling information. These questions were largely factual in nature but did allow for subjective responses from the interviewee concerning personal attitudes towards the safety of pesticide use. The questions on labelling in particular were intended to elicit personal com-

ments from the interviewee. Multiple choice questions were used to ensure consistency in the interviews and easy compilation of responses. The interviewees were asked to rate various aspects of pesticide labels as excellent, good, fair, poor, or no comment. In addition, two statements concerning safety were read and the interviewees were asked if they strongly agreed, agreed, gave no comment, disagreed, or strongly disagreed. Other personal comments were also recorded. At the conclusion of the interview the interviewers recorded any deviations from standard operational procedures. Such deviations included any questions that were not part of the questionnaire, interruptions or extra comments from third persons, and changes in the location or person interviewed. Consistency between the numerous interviews that were done was a primary concern at all times.

The use of pesticides by most departments was readily fitted into the questionnaire format. However, in the case of departments conducting research on pesticides, the questions had to be adapted to the special case. Here storage and disposal were of primary concern. Use and labelling questions did not readily apply because of the small amounts handled and the types of research done.

3.4 DETERMINATION OF USERS WITHIN THE FEDERAL GOVERNMENT

Deciding which departments and agencies of the federal government to interview was a major consideration early in the project. It was impractical to contact every department and Crown corporation to ask if they used pesticides because of the large number of federal agencies in Manitoba. Also the person

contacted would not necessarily be able to comment conclusively on pesticide use. The CCH Topical Law Reports volume on Canadian Government Programs and Services (1978) was selected as a reliable source for descriptions of the responsibilities and activities of the various government departments.

These descriptions were used to eliminate departments which obviously do not use pesticides. However, where there was any doubt the department was included in the list of those to be contacted. The decision to eliminate departments was complicated by the fact that many departments have no use for pesticides in carrying out their responsibilities but may have grounds around their offices which require landscape maintenance. In the end almost every department was contacted as a potential user of pesticides.

Initially each department on the list of those likely to use pesticides was contacted by telephone. Often the appropriate contact person could be ascertained from the telephone book. Otherwise extensive inquiry at the department was necessary. The advantage of the descriptions of the responsibilities and activities of a department (Canadian Government Programs and Services, 1978) was the project staff's ability to suggest to the person contacted where the department was likely to be using pesticides. Such suggestions resulted in the discovery of the appropriate division or person to speak to in a department.

When the appropriate person was contacted he was simply asked if the department or Crown corporation used pesticides. If the answer was yes he was asked

for an estimate of types and quantities used in one year. This information was used to compile a list of pesticide users ranked according to amount used.

All departments were contacted a second time in order of their rank on the list of pesticide users. At this time a personal interview was arranged. The interviews were often with people who, although responsible for the department's pesticides, were not familiar with actual application of the chemicals. Generally it was arranged that the person who applied pesticides be available to comment on the use and labelling questions. Letters were mailed to confirm interview dates and to inform the contact person what information would be required (Appendix F).

A further complication in the initial contacting of pesticide users was the fact that many departments contract their pest control requirements with private firms. Therefore as well as the federal government several private firms were interviewed as part of the inventory. The interviews covered contract work by the firms for the government departments only. No pesticide use outside the federal government was included in the inventory.

APPENDIX C

INVENTORY MANUAL

This manual has been prepared to assist you in interviewing and to reduce the variability between interviews. Please know your questionnaire by reading the instructions and questions carefully before going into the field.

Some materials you will need for conducting the interview are questionnaire sheets; clipboard and pens; cards A, B and C (please see questionnaire); herbicide, insecticide and fungicide sheets; Manitoba guides for insect and weed control; authority letter and business cards.

Upon entering the office, indicate who you are and the purpose of the interview. If necessary, the interviewee, may be informed that EPS is part of Environment Canada, and that EPS has a mandate to provide the public with information on environmental matters. EPS also has a mandate to provide other government departments with environmental information. Presently there is no documented information on the federal use of pesticides in Manitoba. The purpose of our inventory is to provide this information. The results of the inventory will be available from EPS on request from any government agency or the public. A project information sheet which contains these points can be left with the interviewee (Attachment 1). If the interviewee asks how long the interview will take, estimate for him/her the average length of time required. The duration of the interviews will vary with the number of pesticides the agency uses.

If you are offered coffee, politely decline the offer, at least until after the interview is over. Be organized and have your papers in order. Confidence

is a virtue in interviewing. Avoid phrases like "I hope", "would you mind" and "I'm sorry". Start the interview.

Ask the questions exactly as they are worded on the questionnaire, slowly and clearly. Do not ask questions which are not in the questionnaire. If the respondent is unsure of the meaning of a question, more detailed explanations of questions in each section of the questionnaire are provided in this manual. You may prompt the respondent with other questions if the question in the questionnaire is still not understood. These clarifying questions, however, should be written down verbatim by the interviewer. BE SURE TO WRITE DOWN THE RESPONDENT'S ANSWERS VERBATIM. Do not pause unnecessarily between questions. Maintain a neutral tone of voice throughout the interview. Do not indicate in any way (facial expression or gesture) approval, disapproval, shock or surprise at any answer given by the respondent. In addition, do not indicate your own opinion about any question. If you are asked for your opinion, politely answer that your opinion is irrelevant, that the respondent's opinion or information is required.

Do not allow the respondent to see the questionnaire. If any questions are omitted in the interview, please write down why they were omitted. For example, you can write "N.A." for an irrelevant question, "no information" if the respondent does not have the information and does not know where it can be obtained, and "wrong person" if the respondent refers you to another person for the answer to that question. Be sure to write down the correct person's name for further reference. You should ask the respondent to be more specific if vague answers like "small amounts" or "not for long" are given. If you are not sure that a respondent's answer corresponds to any of the alternative answers listed

for the question, record verbatim the answer they give. For example, a formulation which "comes in a bag, is dry and looks like sugar" is probably granular, but since it is not strictly a "yes" to granules, the answer should be recorded verbatim.

THE QUESTIONNAIRE

The purpose of this section is to provide explanations of questions in the questionnaire. Page 1 is to be filled in for each pesticide the agency uses. Pages 2 and 3 can be filled in only once for each agency. More than one answer may be provided for some questions. For example, both price and availability may be the reason for the choice of the distributor.

Write down the full NAME and ADDRESS of the FEDERAL AGENCY. Write down also the NAME, ADDRESS, TITLE and PHONE NUMBER of the interviewee. Be sure you have the correct spelling of the respondent's name.

Purchase Information

Write down the full TRADE NAME of the pesticide. The TRADE NAME may contain the FORMULATION and ACTIVE INGREDIENT of the pesticide.

Ask the respondent to choose the DISTRIBUTOR of the pesticide from the alternatives on card A. If their DISTRIBUTOR is not on card A, ask for the name and address of the distributor the agency purchases from.

Do not make any suggestion which may influence the respondent for REASON FOR CHOICE OF DISTRIBUTOR. Show the respondent card B and if explanations are necessary, use the ones below. If the respondent wishes to explain the decision for distributor in greater detail, or the reason is not listed, write his/her answer in the COMMENTS section.

Price.....was the product less expensive than a similar product?

Delivery.....was the time of delivery essential for the spray program?

Availability.....did other distributors stock the pesticide or was it only available from this particular distributor?

Tradition.....have you always or do you usually conduct business with this distributor? If so, ask why.

DATE OF PURCHASE, QUANTITY PURCHASED and QUANTITY HELD is information that is probably available from the purchase orders. However, probing questions may reveal if amount used and amount stored adds up to purchased quantity, as well as useful information on the spray program. At the very least, obtain a reasonable estimate on acreage or hectares treated.

Use Information

Pesticides are prepared in different formulations to facilitate uniform dispersal over large areas. For example, by formulating a herbicide, 50 ml of the herbicide may be spread evenly over a one-hectare field. A pesticide may also be formulated to enhance the phytotoxicity of the pesticide, for easier packaging and to improve shelf life (Anderson 1977).

Solutions.....a liquid or solid pesticide dissolved in a liquid, usually water or oil.

Emulsifiable Concentrate (EC).....used in the case of an insoluble pesticide for field applications, at least one immiscible liquid is dissolved in another.

Wettable Powder (WP).....wettable powders are mixed with water and form a suspension. This type of mixture requires agitation to ensure the heavier particles do not settle out.

Flowables (Slurries).....two-phase concentrate liquid or solid in water. This concentrate, which does not pour easily and separates during transport or storage, must be mixed well and then applied to the pest with water as a carrier.

Granules.....pesticides coated to the surface of granules such as clay, sand or vermiculite. The dry granules act as the carrier.

Pellets.....same as granules, except much larger.

Glomules.....similar to granules again, except the pesticide is mixed into the carrier. This formulation allows for the slow release of the pesticide as the carrier breaks down.

Dusts.....dispersable powders used as their own carrier.

Fumigants.....pesticides that enter a pest in a gaseous state via the respiratory system.

CARRIER may be liquid (water, oil, solvent); solid (vermiculite, clay, sand) or foam.

APPLICATION METHOD examples are backpack, broadcast, aerial or foliar application.

TARGET PEST may be general (broadleaf, woody plants) or specific (mosquitos). What the pesticide was purchased for may NOT be a description of what the product controls.

EFFICACY means how effective the pesticide is. Did it give the desired results?

Storage Information

Describe the building (e.g., shed, warehouse, office or compound) and its construction (e.g., brick, metal, wood shed, open compound, etc.) for WHERE ARE THE PESTICIDES STORED.

Inhabited.....means workspace frequented by humans, for example, an office.

Living Area.....a house or station area, for example, a guard house or barracks.

Specify which term describes best the area where storage is located by circling the term. Also estimate the distance from the storage area to the inhabited or living area.

IS THE AREA VENTILATED, HEATED, and LOCKED is self-explanatory, but remember to include REASONS for not being heated. It may be that pesticides are not held after the summer months. Obtain the titles or type of work done by anyone who has access to the pesticides WHETHER THE AREA IS LOCKED OR NOT.

The answers may be both YES and NO for information on LABELLING and CONTAINERS. If the PESTICIDES ARE STORED IN THE ORIGINAL CONTAINERS, the label MUST be readable to warrant a YES for LABELS INTACT. If the PESTICIDES ARE NOT STORED IN THE ORIGINAL CONTAINERS, describe the type of container (plastic, metal drum,

bag, sealed, unsealed) they are held in. Obtain DETAILS on INFORMATION OF THE NEW LABEL; what exactly has been transferred to the new label?

Transportation and Disposal Information

In this section, describe the METHOD OF TRANSPORTATION (for example, air, rail, truck, water route or combinations of these). Obtain the NAME OF CARRIER and the address. Describe the METHOD OF DISPOSAL for RESIDUES (leftover pesticides) and CONTAINERS separately. Some possible methods are landfill (is it private, municipal or federal?), incineration, open burning, municipal sewage system, septic tank or lagoon. Determine if any pretreatment is done to the containers (e.g., rinse and puncture). DISPOSAL TRANSPORTATION and CARRIER is the same as for receipt of pesticides.

Labelling Information

This section asks the respondent to rate the labelling instructions. Write down any comments the person makes in addition to the actual rating for a general description of the classifications and more subtle details on his/her attitude.

Other Information

Remember to fill in the date and duration of the interview and sign the questionnaire. Throughout the interview and at the end, RECORD ANY DEVIATIONS FROM THE STANDARD PROCEDURES. Thank the respondent, and leave a card in case more details are remembered at a later date.

SOURCES FOR MANUAL

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Attachment 1 PESTICIDE INVENTORY Information Sheet

PESTICIDE INVENTORY

The Government Organization Act (1979) gives the federal Minister of Environment responsibility for the preservation and enhancement of environmental quality. The Environmental Protection Service (EPS) functions as a source of information for the public on environmental matters. Under the 'Federal Activities' mandate ordered by the federal cabinet on June 8, 1972, EPS is also responsible for:

- assessing the potential environmental effects of federal programs, projects and activities, including those of federal crown corporations,
- advising other federal departments and agencies on all matters pertaining to the preservation and enhancement of environmental quality,
- establishing formal guidelines related to environmental quality for use by other federal departments, boards and agencies.

In order to carry out this mandate, information about a variety of subjects is required. Conducting and updating inventories of federal programs, activities and facilities is a means of obtaining this information. In the case of pesticide use by federal agencies in Manitoba, there presently is no documented information and the purpose of the Pesticide Inventory is to provide this information.

APPENDIX D

PESTICIDE INVENTORY QUESTIONNAIRE

(Sample Only)

Federal Agency _____

Address _____

Contact Person _____

Address _____

Title _____

Phone Number _____

PURCHASE INFORMATION

Trade Name of Pesticide _____

Distributor (card A) _____

Reason for choice of distributor (card B) _____

_____

Comments _____

_____

Date of Purchase _____ Quantity Purchased _____

Quantity Stored _____ Area Treated _____

USE INFORMATION

Formulation (card C) _____

Carrier _____

Application Method _____

Target Pest _____

Efficacy _____

STORAGE INFORMATION

Do you store pesticides from year to year? _____yes _____no

Where are the pesticides stored? _____

_____

i) Is this storage area near an inhabited or living area? _____yes _____no

If yes, describe the activities in the area _____

_____

ii) Is the area ventilated? _____yes _____no _____mechanically _____naturally

iii) Is the area heated? _____yes _____no Reason:_____

iv) Is the area locked? _____yes _____no

Who has access?_____

_____

Are the pesticides stored _____alone _____with other items? What items? _____

_____

Are the pesticides stored in the original container? _____yes _____no

If yes, is the label intact? _____yes _____no Reason:_____

If no, what type of container is the pesticide stored in? _____

_____

Are the new containers labelled? _____yes _____no

Is all the information on the old label detailed on the new label?____yes____no

Details: _____

TRANSPORT AND DISPOSAL

What method of transport is used when pesticides are received? _____

Name of carrier/transporter? _____

What method of disposal is used:

i) for pesticide residues? _____

ii) for containers? _____

pretreatment? _____

What method of transport is used when pesticides are disposed of?_____

Name of carrier/transporter? _____

LABELLING INFORMATION

How would you rate the labelling instructions with reference to:

	excellent	good	fair	poor	no comment
a)use and application methods and rates	_____	____	____	____	_____
b)wind and temperature restrictions	_____	____	____	____	_____
c)storage restrictions	_____	____	____	____	_____
d)first aid and toxic information	_____	____	____	____	_____
e)rinse and disposal procedure	_____	____	____	____	_____

Comments? _____

_____

Please comment on this statement: The symbols indicating the degree of risk and hazard on the label help me to use the product safely.

strongly agree___ agree___ no comment___ disagree___ strongly disagree___

Comments: _____

_____

_____

Please comment on this statement: The pest control products I use are labelled sufficiently for safe use.

strongly agree___ agree___ no comment___ disagree___ strongly disagree___

Comments: _____

_____

_____

****

Date: _____ Duration of Interview: _____ Initials: _____

Deviations from S.O.P. _____

_____

_____

APPENDIX E

INFORMATION ON CARDS A, B AND C

This information was originally presented on three cards which were shown to the interviewee to ensure accurate identification of the distributors, reason for choice of distributor, and formulations and also to ensure consistency between questionnaires.

A DISTRIBUTORS

1) Even-Spray & Chemical Ltd.
2) Harrisons & Crosfields Canada Ltd.
3) Cargill Grain, Winnipeg
4) Cargill Grain, Brandon
5) Manitoba Pool Elevators
6) Green Cross (Ciby Geigy)
7) Pioneer Grain Co.
8) Pfizer Inc.
9) Chipman Chemical Dealers
10) Shell Canada Ltd.

B REASON FOR CHOICE OF DISTRIBUTOR

1) Price
2) Prompt Delivery
3) Availability
4) Tradition
5) Other

C FORMULATIONS

1) Emulsifiable Concentrates
2) Solutions
3) Wettable Powders
4) Slurries (Flowables)
5) Granules
6) Pellets
7) Glomules
8) Dusts
9) Fumigants

APPENDIX F

CONFIRMATION LETTER
(Sample Only)

Pesticide Inventory
800 - 275 Portage Avenue
Winnipeg, Manitoba
R3B 2B3

July _____, 1982

Dear _____:

Further to your telephone conversation on _____
with _____ of my staff, this letter confirms our
appointment to interview you on _____ at _____
at _____.

The information we require to complete our pesticide inventory questionnaire is:

-- the types and quantities of pesticides purchased, to 1980 if possible

-- spray program details including acreage/hectares treated

-- the formulation and carrier for each pesticide

-- the target pest for each pesticide

-- storage procedures including containers and labelling

-- transportation and disposal methods

Could you ensure that the information required is available at this time to expediate the interview? Thank you for your cooperation.

Sincerely,

Michele Taylor
Project Manager

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CHAPTER IV

RESULTS AND DISCUSSION

4.1 INTRODUCTION

In this section the mandates of the departments and Crown corporations are presented and the results obtained from the questionnaire are discussed. The references for the mandates are the CCH Topical Law Reports volume on Canadian Government Program and Services (1978) and Statistics Canada, Government Organizations and Related Agencies (Statistics Canada 1981).

Difficulties arose in obtaining accurate data for certain areas of the questionnaire; for example in some cases it was not possible to obtain the name of the distributor, the date of purchase and quantity purchased, because of different purchasing procedures. Some departments made their purchases through Supply and Services Canada or received their pesticides from a regional office. For smaller purchases, departments used local purchase orders or petty cash.

Pesticides were purchased for a variety of reasons: maintenance of rights-of-way, health, research and aesthetic purposes. The area treated was estimated where possible, but the information was not always relevant. The information obtained on efficacy is not presented here as it was often an opinion of the respondent rather than based on objective data.

All quantities were converted to the metric equivalents. The conversion factors were:

1 gallon = 4.55 litres (L)

1 pound = 0.4545 kilograms (kg)

1 acre = 0.4 hectares (ha)

Individual agency results are presented first, followed by a summary of the federal government's total purchases and storage. The chapter is concluded by summarizing the subjective questions on labelling and the storage and disposal practices.

4.2 AGENCY RESULTS

4.2.1 Agriculture Canada

Agriculture Canada was established in 1868 by an Act of Parliament to control livestock diseases and prevent their entry into Canada. Agriculture Canada now operates under the authority of forty-two Acts of Parliament, the most important to this report being the Pest Control Products Act. The department undertakes work on all phases of agriculture. Research and experimentation are carried out by the research branch and animal pathology division of the Food Production and Inspection Branch.

4.2.1.1 Food Production and Inspection Branch

The mandate of the Food Production and Inspection Branch includes the responsibility to ensure a dependable supply of nutritious and accurately labelled food products and to increase the efficiency of horticultural crop production. It is also their responsibility to perform research aimed at more efficient methods of storing seed and food products.

The Food Production and Inspection Branch in Winnipeg does not use or store pesticides, however they do store seeds which have been treated with pesticides. It is estimated that they store about 40 kg of treated seed amounting to approximately 0.5 kg of pesticides. These pesticides, Thiram, Carboxin, Captan, Methoxychlor, Dexon and Quintozene, are not included in the tables for Agriculture Canada.

Thiram and Carboxin used in combination appear on 18 kg of treated seed. This combination which is applied to the seeds as a solution is a fungicide.

Captan and Methoxychlor appear in combination on about 7 kg of treated seed, including a variety of garden seeds. Captan, a fungicide, is applied as a dust while Methoxychlor, an insecticide, is applied as a wettable powder.

About 15 kg of imported U.S. sugar beet seed are treated with a combination of Dexon and Quintozene. Both are fungicides and are applied as a wettable powder.

4.2.1.2 Animal Health Division

The Health of Animals Directorate under the Food Production and Inspection Branch has the responsibility for establishing animal health policy, developing programs, and for measuring the effectiveness of these policies and programs. Through its two divisions, Animal Health and Animal Pathology, the Directorate is responsible for animal diseases research and control.

The Animal Health Division operates under the authority of the Animal Disease and Protection Act. Its primary functions are to prevent the entry of livestock diseases into Canada by controlling the importation of livestock and livestock products, to control and eradicate livestock diseases that are reportable under the Act, and to negotiate the conditions for certification of livestock for export.

Animal Health Brandon was the only section in Manitoba reporting the use of pesticides. Six litres of Mange Cure were used to control mites on hogs. Warfarin was placed in the barns for rat control. A small amount of liquid Killex was used on the grounds to eradicate ragweed and chickweed (Table 3).

Pesticides are stored in a heated garage attached to the office and barn. There is natural ventilation through the cracks of a poorly fitted door. The garage is locked at all times. The pesticides are stored with lawn mowers and other tools and are stored in their original containers with the labels intact. The pesticides are delivered to the Animal Health Division in a Food Production and Inspection vehicle. The empty containers are incinerated on the Animal Health grounds after being rinsed one or two times.

4.2.1.3 Brandon Research Station

Agriculture Canada has forty-four research stations across Canada, five in Manitoba. Research stations are located in geographical areas where climate and soil conditions favor the study of particular agricultural problems.

Table 4 separates pesticides used by Brandon Research Station into two use areas, those pesticides used in the greenhouse and those pesticides used on the farm.

Greenhouse use can be broadly separated into two categories, insecticides and fungicides. Target pests for the insecticides are aphids, spider mites, white flies, ants and grubs. The fungicides are used to prevent damping off and for black spots on roses. The amount of pesticides used in the greenhouse is not large.

Farm use includes herbicides for use on test plots, around trees and buildings, and spot spraying. Three of the herbicides, Embutox E, Killex and Torch, were not used this year but were being stored, as was Co-Ral, an animal systemic insecticide. Thirty-five litres of Avadex BW was purchased for the control of wild oats on test plots but at the time of the inventory none had been used. MCPA Amine, Eradicane 8E and Stampede were purchased and used for wild oats and wild millet. Banvel or dicamba was used on leafy spurge. For more details on use see Table 4.

Pesticides are stored in a section of the barn which has concrete floors. The area is heated during the winter months, has mechanical ventilation and is locked at all times. Other items stored with the pesticides are disinfectants and cleansers. The pesticides are transported to the Brandon Research Station by Motorways Ltd. or C.P. Express.

Pesticide residues for all non-research chemicals are rinsed into a spray container located outside on a wash rack. The container is then washed with large volumes of water which drain into the sewage system.

4.2.1.4 Glenlea Research Station

At Glenlea Research Station four herbicides selective for broadleaf control were used (Table 5). These were Buctril M, Dyvel, MCPA, and Treflan. Hoe-Grass, or diclofop methyl was used to destroy barnyard grass. Four litres of Roundup were used to eradicate thistle patches. Glenlea Research Station also uses the insecticide malathion against aphids. Carbofuran (Furadan granular) bought prior to 1978 is also being stored at the station.

All pesticides are stored during the summer in an unheated equipment shed located about 9 metres from the lunchroom and offices. The shed is ventilated naturally through the main door and contains a wide variety of applicating equipment. The shed is locked at night. During the winter months the pesticides are transported to the Winnipeg Research Station and stored in a heated shed.

The Glenlea Research Station transports any pesticides with their own vehicles. The empty containers are rinsed and crushed and disposed of at the Brady Road landfill in the City of Winnipeg.

4.2.1.5 Morden Research Station

Of the five research stations in Manitoba, Morden uses the largest number of pesticide chemicals. Included in these numbers are herbicides, insecticides and fungicides (Table 6). Some pesticides were bought in preparation for pest control but were not used, for example Hoe-Grass, Kelthane EC and Kil-mor. The majority of use was aimed at test plots though some were used in the greenhouse.

There are two storage buildings on the Morden Research Station. The first is constructed of steel walls with a concrete floor. It is divided into three rooms, each with direct access outside. The rooms store herbicides, insecticides and fungicides separately. The building is heated and mechanically ventilated. It is locked at all times and several technicians have access to it.

The second storage building is a wood-framed structure with metal siding and a cement floor. This building contains old and banned pesticides which do not require heating. The building is padlocked. Small quantities of pesticides are transported using research station vehicles. Larger quantities are delivered by C.N. Rail, C.P. Express or Air Canada trucks.

Empty containers are rinsed, punctured and crushed, and the crushed containers are transported to the Stanley Landfill by research station trucks.

4.2.1.6 Portage La Prairie Research Substation

Three herbicides are used for broadleaf control at the Portage la Prairie Research Substation (Table 7). They are MCPA sodium 48, MCPA Amine mixed with Torch and Treflan. The only non-selective herbicide used is Roundup. For details on all pesticides used at the Portage la Prairie Research Substation see Table 7.

All pesticides used at the substation come from the Morden Research Station. If unused they are returned to Morden. If there is a special problem at the substation, pesticides may be purchased at the local cooperative. However, the substation prefers not to use commercially-bought pesticides because they could affect test yields. Thus most weed control is done by hand.

Pesticides are stored in the garage area at the substation on the floor against a wall and in an old refrigerator which no longer works. The area is naturally or convectionally ventilated and is heated during the winter. Other items in the storage area are general tools. The garage is locked at night. During the day all employees of the substation as well as employees of the Morden Research Station have access to the area.

All of the pesticides except the Torch are in their original containers with the label intact. The Torch is in an old Roundup container with the Roundup label removed. The container was simply marked "Torch". The interviewee said that instructions for use could be obtained from Morden.

The pesticides are delivered to the substation by car or truck. The vehicle, which comes from Morden is owned by Agriculture Canada. Empty containers are rinsed and taken to the local municipal landfill. Any empty plastic containers are burned with other garbage at the substation.

4.2.1.7 Winnipeg Research Station

The Winnipeg Research Station located on the University of Manitoba campus uses four pesticides (Table 8). Garden Fungicide (captan) is used to prevent fungi from growing on seeds. Maneb is used on a small plot to inhibit the formation of smut spores. Nicotine fumigant, an ignitable powder, was used against aphids. Temik (aldicarb) was used to control flea beetles in canola and sunflower beetles in sunflowers.

Some of the pesticides are stored in the laboratories on shelves or in fridges. The area is mechanically ventilated and heated. The area is locked at night only and anyone affiliated with the laboratories has access to the pesticides stored there. The pesticides are stored with laboratory equipment and supplies.

Another storage area for pesticides is the chemical shed. This area is mechanically ventilated and heated during the winter months. The chemicals are stored with chemical reagents and solvents. This area is locked at all times.

The pesticides are picked up and delivered by a research station truck. There is no practiced method of disposal for residual pesticides. At present

they are being stored in the chemical shed until such time that better measures can be taken.

4.2.1.8 Summary

Tables 9, 10 and 11 summarize the total pesticide storage of Agriculture Canada in Manitoba. The largest single amount of herbicides stored is 720 litres of Eradicane 8E at Brandon Research Station (Table 9). Large quantities of paraquat are being stored at Brandon Research Station (300 litres) and Morden (113.75 litres). Two hundred litres of Stampede (propanil) are being stored at Brandon.

Brandon Research Station is also storing 224 litres of coumaphos (Co-Ral) (Table 10). Co-Ral is used for warble and lice control on cattle. Small amounts of fungicides are being held by all the research stations except Glenlea (Table 11). The largest amounts of fungicides being stored are 70 litres of Difolatan 4.8 and 20 litres of Cyprex, both at Morden Research Station.

4.2.2 Atomic Energy Of Canada Limited

Atomic Energy of Canada Limited (AECL) is a Crown corporation performing a number of functions in relation to atomic energy. It operates the Chalk River Nuclear Laboratories, Whiteshell Nuclear Research Establishment and heavy water production plants at Glace Bay and Port Hawkesbury, Nova Scotia. The corporation conducts research in the field of atomic energy and its engineering group is

responsible for the design of the CANDU nuclear system in power generating stations. As well, AECL manufactures and markets radioactive isotopes such as Cobalt-60 which is used in the treatment of cancer.

Table 12 provides specific information concerning the use of pesticides at the Whiteshell Nuclear Research Establishment (WNRE) at Pinawa, Manitoba. The Whiteshell Nuclear Research establishment used 22.75 litres of 2,4-D Amine 80, 45.5 litres having been purchased in 1981. This product is sprayed by a tractor towed sprayer over about 10 acres (4 hectares) of lawn for the control of dandelions. Not included in Table 12 are weedex bars which are also used against dandelions but in hard to reach areas around buildings. In June 1982 WNRE purchased 45.45 kg of Ureabor granular. The amount stored, 181.8 kg, includes previous purchases. This product is spread by hand around the waste management area which is about one hectare in size. Ureabor granular controls all vegetation in this area where radioactive wastes are stored. Poulin's The Exterminators have been contracted by WNRE to control crawling insects. Approximately 4.55 litres of Ficam W have been used per month in the kitchens and hallways at the Pinawa site.

The Research Establishment stores three pesticides from year to year in a corrugated steel maintenance building (Table 13). The building is naturally or convectionally ventilated through doors and windows, and mechanically heated. Other maintenance equipment and supplies are also stored in this building. The building is divided into two sections. The section which houses the 2,4-D and malathion is locked at all times and has little activity. The malathion was

purchased in May 1978 for the control of forest tent caterpillars (Table 12). Some of this was sprayed on hedges but 91 litres remains in storage. The section containing the Ureabor granular is locked at night and there is greater activity of maintenance personnel. Pesticides are stored separately from fertilizers because of concern over the similarity in labels.

Pesticides are delivered to the Research Establishment by truck owned by the Naaykens Transport Co. Ltd. of Beausejour. The pesticide containers are disposed of at WNRE's own sanitary landfill. Maintenance workers are asked to rinse the containers before disposal. The containers are transported to the disposal site by an AECL truck. At the disposal site the garbage is burned and buried with gravel daily.

4.2.3 Canadian National Railways

Canadian National Railways (CNR) was incorporated to administer railway and other service facilities and activities. Canadian National Railways maintains and operates 34,000 miles (54,717 km) of track. The other service facilities and activities include operations in the fields of water transportation, hotels, real estate and telecommunications.

Three insecticides and two rodenticides are used by CNR at the Transcona shops (Table 14). Drione and General Purpose Insecticidal Spray are used against crawling insects in the shops. Record Z is an insect repellent used by the employees. Warfarin and strychnine are placed in trays for controlling rats and mice.

Canadian National Railways hires Midland Vegetation Control Limited (Saskatoon) to maintain weed free rights-of-way along the rail lines. Gramoxone E, Hyvar X, Krovar 80 and Spike 80W are non-selective herbicides. 2,4-D Amine 80 is used for thistles and pigweed (Table 14).

Canadian National Railways stores the pesticides from year to year in the Materials Distribution Centre at the Transcona Shops (Table 15). This storage area is located in an area of moderate activity. The storage area is ventilated mechanically with fans as well as naturally. The area is heated and is locked except during working hours. Employees and visitors accompanied by a supervisor have access to this area. The pesticides are stored in their original containers with the label intact. Pesticides are delivered by truck or semi-trailer from the different distributors.

4.2.4 Canadian Wheat Board

The Canadian Wheat Board is the sole marketing agency for wheat, oats and barley produced by the four western provinces and sold in export or domestic markets. The Board controls delivery of grain into elevators and railway cars in Manitoba, Saskatchewan, Alberta and British Columbia as well as the interprovincial movement for export of wheat, oats and barley generally.

The Canadian Wheat Board contracts Poulin's The Exterminators for pesticide applications (Table 16). Avitrol is used to control the pigeon population. The avicide is placed underneath the fans on the roofs. Ficam W is used on the

Canadian Wheat Board premises in the fitness area to control crawling insects. Treatment is applied mainly to the washrooms and around pipes. Prolin in pellet form is mixed with rolled oats and used as bait for mice. Because all pesticides used by the Canadian Wheat Board are applied by Poulin's The Exterminators, no information on storage, transportation or disposal was collected.

4.2.5 Canadian International Grains Institute

The Canadian International Grains Institute operates in affiliation with the Canadian Wheat Board and the Canadian Grain Commission. The Institute is designed to help develop markets both in Canada and abroad for Canada's grain and oilseed industry. Participants from countries purchasing these products are given instruction by the Institute in grain handling, transportation, marketing and technology. The Institute which is located in the Canadian Grain Commission Building in Winnipeg includes offices, a laboratory, a flour mill, and a pilot bakery.

Table 17 for the Canadian International Grains Institute shows that they use small amounts of three chemical insecticides. Malathion is sprayed around the baseboards of the milling area to kill insects. Dawson 73 was used in July 1981 to fumigate the bins in which grain is stored at the back of the building. This fumigation is done when the bins are empty to ensure that insects are not living in them. Phostoxin pellets are dropped into the grain as it is poured into the bins. Phostoxin kills stored grain insects.

The insecticides are stored in a cabinet in a meeting room at the Institute. The area is mechanically ventilated and heated. Samples of grain and laboratory sifters are stored in the same cabinet as the insecticides. All of the chemicals are in the original containers with the labels intact.

The insecticide containers are rinsed and disposed of with other garbage in the regular City of Winnipeg pick-up.

4.2.6 Department of Regional Economic Expansion

The Department of Regional Economic Expansion (DREE) was created in 1969 to reduce provincial and regional disparity of employment opportunities. DREE's present activities are divided into three major programs: general development agreements between federal and provincial governments, regional development incentives, and responsibility for the Prairie Farm Rehabilitation Administration.

DREE is involved in thirty-five cost-sharing projects throughout Manitoba. One of the projects, Value-Added Crops Investigation and Evaluation investigates the technical implications and repercussions involved with introducing and expanding value-added crops. Also investigated are the problems arising from introducing new cultural practices and from technological application to new and expanded crop production. These experiments are carried out on privately owned land and the test plots are maintained by the landowner including the use of their own pesticides. The number of test-plots for this project can range from

120-400 and as each experiment requires different amounts of land there are no standard sizes for these plots. Because of these variances it was not feasible to include the Value-Added Projects in the inventory.

4.2.6.1 Prairie Farm Rehabilitation Administration

Prairie Farm Rehabilitation Administration (PFRA) was initially established to aid in preventing drought and soil drift on the prairies in the mid-thirties. After the crisis was over, they functioned to maintain community pastures and tend to farmers' cattle grazing on these pastures during the summer months. The farmers in turn paid PFRA a set fee per head of cattle. PFRA was also involved in the production of tree nurseries which provided trees to be established as shelterbelts around farm land. They advised the farmer on how to set up and utilize efficiently a proper shelter belt.

In 1969 when the Department of Regional Economic Expansion (DREE) was organized PFRA became part of this department and attained more responsibilities. Their major function now deals with the conservation and control of water supplies. PFRA engineers design and supervise projects dealing with the preservation of water purity availability. Examples of these are stockwatering dams, irrigation projects, wells and sewage treatments.

PFRA, Brandon is the only branch in Manitoba which uses pesticides. Co-Ral and Ruelene, two insecticides that destroy warbles were purchased to treat 600

bulls. 1000 Bovaid Ear Tags were used to deter horn and face flies from aggravating the cattle. (Table 18). PFRA transports their own insecticides to the pasture sites using a PFRA vehicle.

The pesticides are stored in a wooden shed located on the pasture grounds (Table 19). The shed is not ventilated or locked. Anyone working or living in the area has access to it. The shed is not heated because the pesticides are not stored over winter. In the shed, oil, gas and spare motor parts are stored with the pesticides.

The pesticide containers are not pretreated before disposal. They are taken to the municipal dump via PFRA vehicles or dumped at the pasture dump. Plastic containers are burned in the pasture.

PFRA Regina is responsible for the maintenance of community pastures in Manitoba and Saskatchewan. To this end PFRA contracted Yorkton Flying Services to spray approximately 8,160 hectares with 14,300 litres of 2,4-D LV600 (Table 20). The objective of this operation was to discourage the growth of poplar and other trees on pasture land. The drums of 2,4-D are delivered to and removed from the individual pastures by truck.

4.2.7 Environment Canada

The Department of the Environment was formed by an Act of Parliament in 1979 and is responsible for the preservation and enhancement of the quality of the natural environment. Two programs under Environment Canada, Canadian Wildlife Service and Parks Canada, were found to be users of pesticides in Manitoba.

4.2.7.1 Canadian Wildlife Service

The Canadian Wildlife Service (CWS) now under the Environmental Conservation Service of Environment Canada was originally formed to administer the Migratory Birds Convention Act of 1917. CWS annually revises the Migratory Birds Regulations, for example hunting season dates, bag limits and hunting permits. The CWS also conducts research and management work on migratory birds.

In 1982, CWS purchased 4 litres of Roundup to be used on quackgrass (Table 21). The pesticides are not stored from year to year. If required, pesticides could be stored in a sealed area in the basement of the Freshwater Institute. The area is only accessible by the stores manager.

Because of the small quantity purchased, the Roundup was picked up by a CWS car. After use, the containers were rinsed with water and taken to the municipal landfill.

4.2.7.2 Parks Canada

The primary purpose of Parks Canada is to acquire and preserve representative areas of the country for the use of the public. Such areas include those of geographical, geological, biological or historic interest. The responsibility for administration of this general objective is divided among three branches: The National Parks Branch, the National Historic Parks and Sites Branch, and the ARC Branch.

The National Parks Branch preserves areas with particular geographical, geological or biological features for the enjoyment and education of the public. The National Historic Parks and Sites Branch preserves and restores sites of national historic importance. The ARC (Agreement for Recreation and Conservation) Branch exists to conserve areas containing important heritage resources such as canals and rivers, and to provide opportunities for outdoor recreation.

Table 22 shows the total pesticide use for Lower Fort Garry Historic Park. Lower Fort Garry uses Lignasan (carbendazim) to control Dutch elm disease. The solution is injected into elm trees which cover about 32 hectares of land. The park also stores malathion (Table 22 and 24) which in 1981 was used to control aphids on young trees.

At Lower Fort Garry Lignasan and malathion are both stored over winter. The malathion is stored in the maintenance compound which is heated and mechanically ventilated. The Lignasan is stored in an old historical building which is only slightly heated. There is no deliberate ventilation, though air does circulate through cracks in the walls. In the maintenance compound other maintenance material such as paint is stored with the malathion. The historic building also contains old furniture.

The Lignasan is received by truck owned by the supplier's transfer company. The malathion is picked up at Marshall Wells in Selkirk in a Parks Canada vehicle. Pesticide containers are disposed of with other garbage by a private collector who takes the garbage to the municipality's sanitary landfill.

It is interesting to note that Lower Fort Garry keeps two cats for the control of mice.

A number of herbicides, insecticides and fungicides are used in the operation and maintenance of Riding Mountain National Park (Table 23). The majority of use is on the golf course. The fungicides Tersan SP and Tersan 1991 are used to control mould on the greens and fairways. Weed-All Liquid (new stock) and Compitox Plus (old stock) are used to control broadleaf weeds in turf.

A larger number of pesticides are being stored this year which have been used in the past (Table 24). One thousand seventy-five (1,075) kg of copper sulphate are stored for the eventual application to 3900 m^2 of Clear Lake. Copper sulphate is used to control aquatic weeds which house flukes, the cause of swimmer's itch. Gramoxome (paraquat) has been used to reduce the labour costs of trimming weeds and grass in hard to reach areas.

Pesticides used at the golf course are stored in two wood cabin-like buildings on the golf course maintenance grounds. Neither building is heated and these pesticides are transferred to the Stores building, where the other pesticides are held, in the winter. Both of the maintenance cabins are locked at all times, but only one is ventilated, by windows. Fertilizers and grass seed are also stored in the cabins.

The Stores building is of cinderblock construction with concrete floors. It is solar heated and mechanically ventilated. Other items stored in the building

include maintenance material and equipment. All pesticides are stored in their original containers with labels intact except for one container of Later's Weed All Liquid which had lost its label.

Pesticides are delivered to Riding Mountain by Arnold Brothers Transport Limited. The empty containers are disposed of at a landfill located in the park, behind the golf course. Burning is prohibited and the garbage is buried daily because there is a problem with bears being attracted to the site. The pesticide containers are not pretreated.

4.2.8 Fisheries and Oceans Canada

The Department of Fisheries and Oceans was established as a separate entity in 1979 under the Government Organization Act. The functions of Fisheries and Oceans are grouped under three headings, fisheries management, ocean and aquatic sciences, and fisheries economic developing and marketing. As well there are research institutes and laboratories across Canada. One such institute is the Freshwater Institute located on the University of Manitoba campus in Fort Garry.

The only pesticide not used for research purposes by Institute staff was 2,4-D Amine 80 (Table 25). Five litres of the herbicide were used to destroy dandelions on the lawns at the Freshwater Institute. The 2,4-D was purchased locally and was transported to the Institute by a Fisheries and Oceans vehicle. The empty containers are not pretreated before they are disposed of. The City of Winnipeg sanitation department transports the empty pesticide containers to the municipal landfill site.

Prolin is used by Poulin's The Exterminators once a month at the Freshwater Institute. Prolin pellets are mixed with rolled oats and placed in the boiler room as bait for rats and mice (Table 25).

A number of pesticide standards are used at the Freshwater Institute for research purposes (Table 26). The quantities are small usually less than 5 mg and in total there are probably less than 5 kg of different chemicals. An inventory of the pesticides had been completed in 1980 but has not been updated. Research pesticides are held in various laboratories, on shelves and in fridges. The area is mechanically ventilated and heated. The laboratories are locked at night. The pesticide standards are usually gifts of the manufacturers and the small quantities are transported through the mail.

4.2.9 Health and Welfare Canada

Health and Welfare Canada was established in 1949 under the Department of National Health and Welfare Act. The deputy minister of Health and Welfare Canada administers eight branches. One of these branches, the Medical Services Branch, uses pesticides. The Medical Services Branch maintains health units for the care of status Indians and Inuit and all residents of the North West and Yukon Territories.

The nursing stations in Manitoba used Roundup (glyphosate) to keep the area around fuel storage berms free of all vegetation (Table 27). The pesticides are received in Winnipeg by truck and held at the McDermot Avenue warehouse, 135

McDermot Avenue. This area is ventilated through air currents and is heated. The pesticides are stored alone and the area is kept locked. From Winnipeg the pesticides are transferred to the different nursing stations by air transport.

At the nursing stations the storage areas are maintenance sheds with concrete floors. These sheds are heated and have both mechanical and natural ventilation. The pesticides are stored alone and the sheds are locked at all times. Disposal procedures at the nursing stations are to rinse the containers with water and then burn the rinsed containers in incinerators on the station grounds.

Health and Welfare Canada also contracts Poulin's The Exterminators to use Ficam W and Prolin at the Percy Moore Hospital (Table 27). Ficam W is applied to laundry areas, kitchens and sinks. Prolin is used to control rodents at the hospital.

4.1.10 National Defence

The Department of National Defence is responsible for the Canadian Armed Forces and all matters relating to national defence. The administrative structure is composed of Maritime Command, Mobile Command, Air Command, Canadian Forces Europe, and the Canadian Forces Communications Command. In Manitoba there are a number of Armed Forces bases. Telephone research revealed that bases in Portage la Prairie, Shilo, Winnipeg and Beausejour were all users of pesticides.

4.2.10.1 Canadian Forces Base Portage La Prairie

Table 28 shows the pesticides used by C.F.B. Portage la Prairie. The insecticides include Abate for mosquito larva and Baygon MOS for adult mosquitos. For the control of ants, wasps, spiders, and cockroaches the base uses Chlordane and Ficam D. Diazinon is used for leafeating insects. There is also an aerosol, Insect Spray Formula 4F, used for mosquitos and wasps. The largest amount stored at the base is Baygon with 728 litres. For general control of vegetation Portage la Prairie uses Calmix, Gramoxone, Roundup and Simmaprim 80W. Broadleaf weeds are controlled by 2,4-D Amine 500. Also included in C.F.B. Portage la Prairie's stock of pesticides are the rodent poisons Rat Bait and Strychnine.

There are six areas at the base where pesticides are stored. The first of these storage areas is a shed attached to the Roads and Grounds personnel offices. There is no ventilation and the shed relies on the offices as a source of heat. The shed has a concrete floor and is padlocked. Other items stored in this shed are such things as kerosene, oil and solvent. Within the storage shed is a metal hospital locker which also holds pesticides. Here pesticides are stored alone and the locker is padlocked.

The base stores is also used to store pesticides. The building is naturally ventilated in the summer and mechanically ventilated in the winter. It is heated in the winter. The base stores holds a variety of other items in addition to pesticides. These items include furniture, chickenwire and cement. The building is locked at night.

An old curling rink is another area used for the storage of pesticides. The building is of wood construction with a gravel floor. It is neither heated nor ventilated although air passes through cracks and spaces in the walls. Only Abate is stored in this area. Because the Abate bags were degrading the chemical is further bagged in green plastic bags. The chemical is awaiting disposal. The door to this building is padlocked.

Another storage area is located within the same building as the Roads and Grounds personnel offices. It is a wooden shed within the garage area. This area is neither ventilated nor heated although it does receive heat from the surrounding building. Other maintenance equipment is also stored with the pesticides.

A further storage site is a locker in one of the offices. It is padlocked and only the Grounds and Roads Manager has access.

Empty pesticide containers are punctured before disposal.

4.2.10.2 Canadian Forces Base Shilo

Table 29 shows the pesticides used by C.F.B. Shilo. Here again there are a variety of herbicides and insecticides. Also included is 0.85 kg of Captan 50% used against fungus in the greenhouse. Herbicides used for control of vegetation are Primatol, Roundup, Spike and Atrazine. In the greenhouse B-Nine and A-Rest are used as growth inhibitors. Around the ammunition storage site Embark is used

to suppress the growth of grass to decrease the fire hazard. Tordon 10K is used to control leafy spurge on firing ranges. Dandelions on lawns are controlled by 2,4-D Amine 80.

The largest amount of insecticide stored is 1,638 litres of Baygon MOS which is used against mosquitoes and black flies. Kelthane, Malathion and Tedion are used to control red spider mites, aphids and cankerworms. In the kitchen area of the base Ficam D and Ficam W are used to kill cockroaches and silverfish.

At C.F.B. Shilo pesticides are stored all year round in a standard sized garage. The garage is only used for the storage and mixing of pesticides. Ventilation comes from the door and one window. It is heated and locked. The only other items stored in the garage are a few tools.

All pesticides are stored in their original containers except for kelthane which is in a 500 ml brown bottle. This container is marked "Poison, kelthane". Other containers have their labels intact except for minor damage.

The pesticides are delivered to Shilo by truck owned by the supplier's transfer. Before being disposed of the containers are rinsed and then given to the Hygiene Department. The exact method of disposal was unknown to the interviewee.

4.2.10.3 Canadian Forces Base Winnipeg

Canadian Forces Base Winnipeg, has a smaller variety of pesticides than either C.F.B. Shilo or C.F.B. Portage la Prairie. The base uses 2,4-D Amine 80 to control broadleaf weeds and Simmaprim 80W to control general vegetation growth. In the greenhouse D.D.V.P. and domestic malathion are used against green flies, white flies, and red spider mites. On the grounds malathion is used to control cankerworms. For rats and mice the base uses Ratkill and Warfarin. An insecticide known as Crawl-Tox was also stored, but its purpose is unknown (Table 30). C.F.B. Winnipeg is the only base in Manitoba that contracts pesticide applications.

There are three areas at C.F.B. Winnipeg which are used for pesticide storage. Greenhouse pesticides are stored in a locker in the greenhouse. The area is heated and both naturally and mechanically ventilated. It is also locked. Other items stored with the pesticides are fertilizers and some small equipment. All of the pesticides are in their original containers with the labels intact.

Pesticides are also stored in the machine shed. This building has a concrete floor. It is heated and ventilated convectionally. Other items stored in the area include machinery and oil. All pesticides are stored in their original containers with the labels intact.

The third area is a storage building located behind the hospital. This building is of cinder block construction and is separated into two rooms, each with their own access doors. The doors are locked at all times.

Empty pesticide containers are disposed of with the regular garbage.

4.2.10.4 Canadian Forces Station Beausejour

Canadian Forces Station Beausejour uses five pesticides. The one stored in the greatest quantity is Baygon MOS with 364 litres. Baygon MOS is used here against mosquitos. All other pesticides are herbicides. Atrazine is used for total vegetation control around a septic field and other areas. 2,4-D Estemine and MCPA Amine 80 are used against dandelions and broadleaf weeds. Roundup is used along fences to control grass and weeds (Table 31).

Pesticides are stored in a garage attached to the Construction and Engineering office. The garage is heated and both naturally and mechanically ventilated. It is locked. Other items stored in the garage include maintenance equipment, cleaning substances and fertilizers.

The base supply picks up pesticides in Winnipeg. The empty containers are occasionally rinsed. They are taken to a landfill by a Canadian Forces truck. This landfill is located 3 kilometres from the station's water supply.

4.2.10.5 Summary

Tables 32-34 show the total quantities of pesticides stored by the Department of National Defence. There is a great diversity in types and amounts of pesticides. Herbicides, insecticides, fungicides and rodenticides are all pre-

sent. The majority of the pesticides are herbicides such as 2,4-D, Roundup and Spike. However, the greatest amounts of pesticides stored are the insecticides Baygon MOS and malathion. In total, the Department of National Defence stores almost 3,000 litres of Baygon and 300 litres of malathion in Manitoba. The bases use pesticides in greenhouses, for landscaping, and for the control of such nuisance pests as mosquitos.

4.2.11 Solicitor General

The Department of the Solicitor General was created in 1966 when the Solicitor General became the cabinet minister in charge of corrections and law enforcements in Canada. The Solicitor General is responsible for the Royal Canadian Mounted Police (R.C.M.P.) and the Correctional Service of Canada.

4.2.11.1 Royal Canadian Mounted Police

At the R.C.M.P. Headquarters in Winnipeg approximately 2 litres of Ficam W is sprayed per month (Table 35). Ficam W or bendiocarb, a wettable powder, is mixed with water and is used to destroy crawling insects on the premises. From January to August, 1982, 15.2 kg had been used. Act-Cure-It Pest Control Limited expected to use an additional 7.6 kg before the end of the calendar year.

4.2.11.2 Stony Mountain - Rockwood Institution

The Rockwood Institution Farm Annex uses a variety of pesticides in the operation of its farm. Table 36 contains the use data for those pesticides pur-

chased in 1982. The only contracted application was 4.9 kg of Prolin per month which is applied by Poulin's The Exterminators.

The Rockwood Institution also stores a number of pesticides (Tables 37-39). The storage area in the summer is a room within the machinery garage. The garage is not heated and in the winter the pesticides are transferred to a brick building attached to the machinery garage. This building is mechanically ventilated and is heated. The building is locked at all times. The pesticides are stored alone. Some of the containers hold pesticides which have gone out of formulation and require disposal.

Small quantities of pesticides are picked up by Stony Mountain personnel. Large quantities are delivered by the suppliers who choose the transporter.

Empty pesticide containers are rinsed and crushed and then taken to the Stonewall landfill by the Stony Mountain Sanitation Department.

4.2.12 Transport Canada

Transport Canada is responsible for the administration of transportation policies and programs in Canada. The department is divided into a number of sectors and groups. For present purposes the most important of these sectors are the Canadian Marine Transportation Administration (CMTA) and the Canadian Air Transportation (CATA).

CATA is responsible for the administration and regulation of policies and programs with respect to marine transportation and commerce in Canada. In Manitoba two divisions of CMTA are the Canadian Coast Guard and the National Harbours Board, a Crown corporation.

CATA is responsible for the administration of Part I of the Aeronautics Act and the regulation of activities in support of aeronautics. CATA operates a number of airports in Manitoba.

Telephone research revealed that neither the Canadian Coast Guard nor the National Harbours Board are users of pesticides in Manitoba. However, the Regional Supervisor of Environmental Services at CATA revealed that Winnipeg International Airport, St. Andrews Airport, Churchill Airport, the Pas Airport, and Dauphin Airport are pesticide users.

The airport at The Pas has about 4.55 kg of herbicides in storage. They have not purchased any chemicals for a few years. Dauphin Airport used 81.8 litres of weed killer last year. However, they have none in storage and have not used any this year. Neither of these airports were interviewed or included in the tables.

4.2.12.1 Churchill Airport

Churchill Airport is presently storing two herbicides (Table 40). Stanchem D & T LV Ester (2,4-D and 2,4,5-T) is to be used to control grass near the runway. Brushkiller 96 (2,4-D and 2,4,5-T) is to be used along service roads to reduce brush.

The herbicides are stored in the maintenance garage. The garage is both mechanically and naturally ventilated, heated and locked at night. Foam for the crash truck is also stored in the immediate vicinity of the herbicides. All of the herbicides are in their original containers with the labels intact.

Pesticides are transported to Churchill by C.N.R. The empty containers are disposed of at a Churchill dump for metals only. They are taken to the dump by a Transport Canada halfton truck.

4.2.12.2 St. Andrews Airport

St. Andrews Airport uses 2,4-D Amine 500 for dandelion control (Table 41). The airport used Primatol (atrazine) as a soil sterilant around runway lights. Amitrol is used in ditches to control cattails. In addition Poulin's The Exterminators Rodent Doom (chlorophacinone), in wheat, is used to kill gophers and Poulin's The Exterminators Warfarin and Sulfaquinoxiline, in oatmeal, is used to kill rats and mice.

At St. Andrews Airport the herbicides are stored in an old maintenance garage with the other maintenance equipment. It is heated, mechanically ventilated and locked at all times. The rodent poisons are stored in a room in the new maintenance garage. This building is heated, both naturally and mechanically ventilated, and locked at night. Other maintenance equipment and grass seed are stored with the rodent poisons. All herbicides were in their original containers with the labels intact. The rodenticides were in their original labelled con-

tainers except for 15 kg of "Rodent Doom" (chlorophacinone) which was in a five gallon plastic pail marked "gopher poison". The maintenance personnel were not aware that the "gopher poison" was "Rodent Doom".

The herbicides are delivered by Goodbrandson's Transfer, but the rodent poisons are picked up by Transport Canada at Poulin's The Exterminators. The herbicide containers are rinsed before disposal and then taken to the St. Andrew's landfill by a Transport Canada truck.

4.2.12.3 Winnipeg International Airport

Winnipeg International Airport purchased Aatrex (Atrazine) for use as a soil sterilant around runway lights. In the past Primatol (Atrazine) was used. The airport also uses 2,4-D Amine 500 to control dandelions on some of 182 hectares of grassland around runways and to control vegetation growth at the navigational air sites. Of the 1,137 litres purchased in June 1982 114 litres have been used (Table 42).

At Winnipeg International Airport the herbicides are stored in a hanger which is only used for storage. Other maintenance equipment is also stored in the hanger which was described as a "dead space". The hanger is heated and ventilated. All chemicals are in their original containers with labels intact. However the maintenance personnel prefer to use all of the chemicals rather than store them over winter.

When pesticides are received at Winnipeg International Airport they are delivered by the supplier's transfer truck. When the containers are disposed of they are taken by a Transport Canada truck to a pit on the airport grounds. The containers are rinsed before disposal.

4.2.12.4 Summary

Table 43 summarizes the total pesticide storage by Transport Canada airports in Manitoba. The amounts listed represent the quantities of pesticides stored. Quantities purchased were often uncertain or unobtainable. Most of the pesticides used by airports are herbicides. In total the airports had 4,438 litres of 2,4-D; some of which was in combination with 2,4,5-T. Most of the 2,4-D is used for the aesthetic purpose of weed control near runways, but that which is in combination with 2,4,5-T is used to control grass and brush. The airports also use soil sterilants. St. Andrews Airport uses two types of rodenticide to kill rats, mice, and gophers.

4.2.13 Veterans Affairs

The Department of Veterans Affairs was established in 1944 and is responsible for the well being of veterans, their dependents and some civilians. The department operates two general hospitals and two veterans homes for the treatment and care of veterans. Veterans Affairs is prepared to transfer ownership and operation of its hospitals to the province as it has recently done in the case of Deer Lodge Hospital in Winnipeg.

Deer Lodge contracts its pesticide applications to three companies (Table 44). Act-Cure-It Pest Control applies Avitrol for the control of pigeons. Avitrol, a wettable powder, is mixed with water and corn and is placed on roofs. Charles Reiss and Company Exterminators use Diazinon inside the hospital to kill crawling insects. Swat Professional Exterminators use Diazinon outside for the control of canker worms on the grounds of the Deer Lodge Hospital. Because all use of pesticides was contracted, no information on storage, transportation or disposal was collected.

4.2.14 VIA Rail

VIA Rail, a Crown corporation manages and operates all former CNR and CPR passenger rail services including marketing, reservations, stations and ticketing duties. VIA Rail reports to Parliament through the Minister of Transport.

VIA Rail regularly sprays the passenger cars with Sapho to prevent cockroaches. Poulin's The Exterminators has also been contracted to rid the Commissary of mice (Table 45).

VIA Rail stores Sapho at the CN Station, Broadway and Main, in the Commissary Stores (Table 45). This cement storeroom is mechanically ventilated and is heated year round. The storeroom is locked only at night. The pesticide is stored in the original container with the label intact. Other items such as hardware are stored with the pesticide. Sapho is delivered to the Commissary Stores by CN Express. Commissary Stores is only a distribution centre and Sapho

is also temporarily stored on the individual trains. Empty containers are disposed of in the train's garbage and dropped at stations along the route.

4.3 SUMMARY OF PESTICIDE PURCHASES AND STORAGE

Tables 46 through 49 list all the pesticides purchased or stored by the federal government, including Crown corporations and contractors, in 1982. The tables indicate the department and branch or location. The pesticides are listed alphabetically by trade name. The tables are further separated into herbicides, insecticides, fungicides and other pesticides.

Table 46 lists the herbicides purchased and stored by the federal government in 1982. The most significant purchase of a single herbicide was 14,300 litres of 2,4-D LV 600. The Department of Regional Economic Expansion, P.F.R.A. Regina contracted Yorkton Flying Services to spray 2,4-D LV 600 on community pastures in Manitoba and Saskatchewan. Agriculture Canada, Brandon Research Station purchased 810 litres of Eradicane 8E and is storing 720 litres. The largest single storage of a herbicide is 1,023 litres of 2,4-D Amine 80 stored by Transport Canada in Winnipeg.

The Department of National Defence is storing a total of 2,912 litres of Baygon MOS in Manitoba (Table 47). Co-Ral (coumaphos) was purchased by both the Agriculture Canada and P.F.R.A. in Brandon in 1982, but at the time of the inventory, all was in storage. P.F.R.A. Brandon is also storing 91 litres of crufomate (Ruelene). Large quantities of malathion were also purchased and are

being stored by various government departments in Manitoba: The most significant storage of malathion is by C.F.B. Shilo, 159.25 litres. One hundred eighty (180) litres of Riddex (piperonyl butoxide) is being stored by C.F.B. Winnipeg. It is not known how long the Riddex has been in storage.

Few fungicides were purchased by the federal government in 1982 (Table 48). Two of the larger purchases were 100 kg of manzate 8% dust by Rockwood Institution and 60 kg of Tersan 1991 by Riding Mountain National Park. Parks Canada, Riding Mountain is storing large amounts of fungicides, 1075 kg of copper sulfate, 181.8 kg of industrial borax and 81.8 kg of Tersan LSR. Rockwood Institution also stores large quantities of fungicides.

Other pesticides purchased and stored by the federal government in Manitoba largely include rodenticides and some avicides (Table 49). Many are contracted applications or purchased from contractors.

In Manitoba there are seven pesticide applications contracted by nine federal departments and Crown corporations. Up to August 30, 1982, approximately 1,325 kg and 14,675 litres of various pesticides have been used for those agencies (Table 46-49). The primary use has been for rights-of-way clearance and pasture maintenance. Health pests, which includes rodents, insects and pigeons which could possibly carry and transmit diseases, rank second. Application frequency to control weed pests is low, at one to two applications per year while the frequency to control health pests is up to once a month.

4.4 SUMMARY OF LABELLING QUESTIONS

Tables 50, 51, and 52 summarize the subjective questions from page 3 of the inventory questionnaire (Appendix C). Where possible the actual pesticide applicator for a department or Crown corporation was asked to comment on the questions. To provide consistency in percentages, those interviewers not wishing to respond to a particular aspect of a question were placed in the "no comment" category. Additional comments were sought to clarify a respondent's response.

Question 1 asked the respondent to rate different aspects of the labelling instructions (Table 50). Thirty-six percent of the respondents rated the use and application methods and rates as "good". Additional comments were that labels lacked proper instructions for aerial applications and that labels should include both metric and imperial measures. Thirty-two percent rated the instructions as fair. Two common responses with this rating were that there was a lack of information for small quantity use and that the instructions were more complicated than necessary. These responses were also stated by respondents who rated the use and application rates as poor (11%). Again it was mentioned that the more familiar imperial system was easier for the applicators to work with. The labels were not noticed by those placed in the no comment category.

Table 50, part (b) asked the interviewer to rate the wind and temperature restrictions. The largest percentage groups, 29% each, were "good" and "no comment" with no further elaboration on these points. Those that rated the wind and temperature restrictions as "fair" and "poor" complained of a lack of specific

information on restrictions. In particular, one person's response was that it was not enough to say "do not use on windy days".

We did not receive any comments from the 54% of persons rating the storage instructions as "good" (Table 50 (c)). However, of the 21% who rated the instructions as "fair" some felt the storage information was vague. Those who voted "no comment" did not remember seeing any storage instructions on the label.

Twenty-five percent labelled the first aid and toxicity information as "fair" and "poor". Generally it was felt that the information was not specific, for example, the label does not state how long to flush with water any affected area of skin or what to apply to the area. It was questionned whether the label contained sufficient details for doctors to supply an antidote in the event of a poisoning. One respondent felt that the hazards of a chemical should be more clearly stated. Forty percent rated (d) as "good" and 21% as "excellent" but no comments were offered.

Twenty-one percent of the persons interviewed rated the instructions on rinse and disposal procedures as "good". They felt that although stated on the label, few people followed the recommended procedures. Nineteen percent rated them as fair, and one person's comment was that with rising environmental concerns the instructions for rinse and disposal are improving. It was generally said by the 21% who rated the instructions as poor that instructions were confusing; sometimes the information was on the label, and sometimes it was not.

Twenty-five percent of the persons interviewed rated this section "no comment" because either they had not noticed any procedures for rinse and disposal on the label, or they had already established their own procedures.

Generally it was felt that instructions could be more effective if the instructions were simplified. Larger, bold-face print was also suggested as was clearly setting apart different aspects of pesticide use.

In question 2, the respondent was asked to comment on the symbols indicating the degree of risk and hazard (Table 51). Forty-three percent agreed with the statement, however, their comments seemed to conflict with their agreement. They felt that safety precautions stated in words would be more appropriate. This reply was echoed by those who did not wish to comment on the statement. Some respondents using pesticides did not feel they were sufficiently familiar with the significance of these symbols and household cleaners. The seriousness of pesticides is not emphasized. A statement made by one of the interviewers was "how much more emphatic can they be from the old skull and crossbones symbol?"

In question 3, the respondent was asked to comment on whether the product was labelled sufficiently for safe use (Table 52). Fifty-seven percent agreed with the statement, although their comments again contradicted their agreement. They felt that the instructions were excessive and larger print and simpler instructions were preferable. Thirty-two percent gave a no comment response. They found specific safety information lacking or difficult to locate. One person disagreed with the statement and felt that training in pesticide use should be compulsory.

4.5 SUMMARY OF STORAGE PRACTICES

Table 53 summarizes the information obtained on pesticide storage practices. Ninety-one per cent of the government departments and agencies using pesticides store pesticides from year to year. These pesticides are stored predominantly in concrete structures or maintenance garages but some are held in lockers or cabinets or in refrigerators. Seventy-seven percent of the storage areas were ventilated, twenty-seven per cent had both mechanical and natural (convectional) ventilation. For the most part, the areas where pesticides were stored were heated during the winter. Ninety per cent, or 35 of the areas were locked, 22 at all times and 13 after working hours only. Fifteen percent of the areas were accessible by one person only, while most areas were accessible by two to four people.

4.6 SUMMARY OF DISPOSAL PRACTICES

Table 54 summarizes the information obtained on disposal practices. Only twenty per cent of the pesticides used required residue disposal. These residues were either burned, rinsed into the septic system, or thrown away with the container. For the most part containers were disposed of at the local landfill, although 3% returned the containers to the manufacturers. Forty-three percent of the departments which disposed of pesticide containers rinsed them prior to disposal. Few departments crushed or punctured the containers before taking them to a disposal site.

TABLE 3: AGRICULTURE CANADA, ANIMAL HEALTH BRANDON, TOTAL PESTICIDE USE

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area to be Treated	Formulation	Carrier	Application Method	Target Pest
Mange Cure	fenthion	May/81	12.00 L	6.00 L	hogs	liquid	water	wand sprayer	mange mites
Killex	dicamba & 2,4-D & mecoprop	spring/82	0.91 L	0.56 L	557.4 m^2 (6,000 $ft.^2$)	liquid	water	wand sprayer	ragweed & chickweed
Warfarin	warfarin	May/81	0.22 kg	---	rats	pellets	none	trays in barn	rats

--- = None stored, 1982

TABLE 4: AGRICULTURE CANADA, BRANDON RESEARCH STATION, TOTAL PESTICIDE USE

Greenhouse:

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area to be Treated	Formulation	Carrier	Application Method	Target Pest
Ambush 50EC	permethrin	March/82	50.00 ml	48.00 ml	greenhouse	E.C.	water	hand sprayer	white fly
Ant & Grub Killer	chlordane	March/82	5.45 kg	4.31 kg	greenhouse	dust	none	sprinkle	ants & grubs
Lesan 35WP	fenamino-sulf	March/82	1.00 kg	0.90 kg	greenhouse	W.P.	water	drench	damping off
Orthene 75SP	acephate	March/82	0.50 kg	0.50 kg	greenhouse	S.P.	water	hand sprayer	aphids, white fly, rose midge
Piromer 50W	pirimicarb	March/82	0.75 kg	0.50 kg	greenhouse	W.P.	water	hand sprayer	aphids
Plant Fume 103	sulfatepp	March/82	3.78 kg	3.15 kg	greenhouse	ignitable powder	none	ignition	aphids, spider mites
Quintozene 75 WP	quintozene	March/82	1.36 kg	1.25 kg	greenhouse	W.P.	water	drench	damping off
Rovral 50WP	iprodione	March/82	1.00 kg	0.88 kg	greenhouse	W.P.	water	hand sprayer	black spot of roses
Safer's Insecticidal Soap	potassium salt of fatty acids	March/82	4.00 L	4.00 L	greenhouse	liquid	water	hand sprayer	white flies, spider mites, aphids

TABLE 4 (Cont'd.)

Farm Use:

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area to be Treated	Formulation	Carrier	Application Method	Target Pest
Avadex BW	triallate	April/80	35.00 L	35.00 L	test plots	E.C.	water	field or plot sprayer	wild oats
Banvel	dicamba	April/79	100.00 L	60.00 L	4-5 ha (10-12 acres)	solution	water	field sprayer	leafy spurge
Co-Ral	coumaphos	Aug/81	224.00 L	224.00 L	N/A	W.P.	water	high pressure sprayer.	warbles & lice in cattle
Embutox E	2,4-DB Iso-octyl ester	78 & 79	68.00 L	68.00 L	N/A	E.C.	water	field sprayer	mustard and stinkweed
Eradicane 8-E	EPTC & crop protectant	April/81	810.00 L	720.00 L	140 ha (350 acres)	E.C.	water	soil incorporated with a discer	millet, wild oats
Gramoxone	paraquat	April/81	80.00 L	300.00 L	around trees and buildings	solution	water	hand sprayer	all vegetation
Hoe-Grass	diclofop methyl	March/81	81.00 L	---	74 ha (185 acres)	E.C.	water	field spraye	barnyard grasses
Killex	dicamba & 2,4-D and mecoprop	March/81	9.00 L	9.00 L	N/A	solution	water	hand sprayer	dandelions
MCPA Amine	MCPA	May/82	180.00 L	80.00 L	60 ha (150 acres) of wild oats	solution	water	field sprayer	wild oats

TABLE 4 (Cont'd.)

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area to be Treated	Formulation	Carrier	Application Method	Target Pest
Roundup	glyphosate	March/81	13.65 L	6.80 L	spot spraying	solution	water	hand sprayer	all vegetation
Sanfax Liquid 580	malathion	May/81	60.00 L	50.00 L	grain mills trees	E.C.	water	fogger	rusty grain beetles, aphids
Stampede	propanil	April/81	260.00 L	200.00 L	28 ha (70 acres)	solution	water	field sprayer	wild millet
Torch	bromoxynil octanoate	March/81	20.00 L	20.00 L	N/A	E.C.	water	field sprayer	dandelions and other broad-leaves

E.C. = Emulsifiable Concentrate
W.P. = Wettable Powder
S.P. = Soluble Powder
N.A. = Not used this year
--- = None stored, 1982
ha = Hectares

TABLE 5: AGRICULTURE CANADA, GLENLEA RESEARCH STATION, TOTAL PESTICIDE USE

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area to be Treated	Formulation	Carrier	Application Method	Target Pest
Buctril M	bromoxynil octanoate MCPA ester	spring/79	20.00 L	10.00 L	1 ha (2 acres)	E.C.	water	bicycle sprayer	broadleaves
Dyvel	dicamba & MCPAK	May/80	20.00 L	15.00 L	0.5-1 ha (1-2 acres)	E.C.	water	bicycle sprayer	broadleaves
Furadan (granular)	carbofuran	pre 78	2.00 kg	2.00 kg	N/A	granular	none	mixed with seed	flea beetles
Gramoxone	paraquat	May/82	8.00 L	4.00 L	1.5-2 ha (4-5 acres)	E.C.	water	bicycle sprayer	all vegetation
Hoe-Grass	diclofop methyl	May/82	20.00 L	12.00 L	1 ha (2 acres wheat)	E.C.	water	bicycle sprayer	barnyard grass
Malathion	malathion	April/82	4.00 L	2.00 L	0.2 ha (0.5 acre) test plot	50 E.C.	water	hand and bicycle sprayer	aphids
MCPA	MCPA	April/82	80.00 L	---	16 ha (40 acres) rye, 3.2 ha (8 acres) road side	50 E.C.	water	field sprayer	dandelions & broadleaves
Roundup	glyphosate	Aug/81	4.00 L	---	spot treatment	E.C.	water	hand sprayer	thistles
Treflan (granular)	trifluralin	April/82	50.00 kg	15.00 kg	1.6 ha (4 acres)	granular	none	spreader	broadleaves

E.C. = Emulsifiable Concentrate
--- = None stored, 1982
ha = Hectares

TABLE 6: AGRICULTURE CANADA, MORDEN RESEARCH STATION, TOTAL PESTICIDE USE

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area to be Treated	Formulation	Carrier	Application Method	Target Pest
Aatrex nine-0	atrazine	March/82	31.80 kg	9.10 kg	6.4 ha (16 acres)	W.P.	water	boom sprayer	millet & broadleaves
Ambush 50EC	permethrin	March/82	0.25 L	1.00 L	8 ha (20 acres)	E.C.	water	backpack sprayer & mechanical mister	white fly, aphids, canker worms
Captan 50WP	captan	Feb/82	15.00 kg	15.90 kg	8 ha (20 acres)	W.P.	water	bessler sprayer	leaf blight fruit scab
Cygon	dimethoate	March/82	2.00 L	2.00 L	not used yet	E.C.	water	painted on or in mister	white fly, aphids
Cyprex	dodine	Feb/82	9.10 kg	20.00 kg	8 ha (20 acres)	W.P.	water	bessler sprayer	scab, blight
Difolatan 4.8	captafol	March/82	36.40 L	70.00 L	2 ha (5 acres)	E.C.	water	blast sprayer	potato blight
Eradicane 8-E	EPTC & crop protectant	March/82	68.25 L	22.75 L	6.4 ha (16 acres)	E.C.	water	boom sprayer	millet & broad-leaves
Furadan 4.8	carbofuran	July/82	12.00 L	9.10 L	6.4 ha (16 acres)	E.C.	water	aerial sprayer	corn borer
Hoe Grass	diclofop methyl	March/82	20.00 L	20.00 L	not used yet	E.C.	water	boom sprayer	barnyard grass
Kelthane EC	dicofol	March/82	8.00 L	13.65 L	not used yet	E.C. & W.P.	water	blast sprayer	two spotted spider mites

TABLE 6 (Cont'd.)

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area to be Treated	Formulation	Carrier	Application Method	Target Pest
Kil-Mor	dicamba 2,4-D mecoprop	March/82	20.00 L	20.50 L	not used yet	E.C.	water	boom sprayer	broadleaves
Lindane 25WP	lindane	March/82	2.00 kg	1.50 kg	plot work	W.P.	water	mixed with seed	flea beetles
Lorox liquid	linuron	March/82	120.00 L	80.00 L	60 ha (150 acres) of spot treatment	E.C.	water	wand or short boom sprayers	dandelions thistles, grasses
Malathion	malathion	Feb/82	2.00 L	47.50 L & 1.80 kg	over 40 ha (100 acres)	E.C. & W.P.	water	bessler & backpack sprayers	aphids, loopers flea beetles
MCPA Amine 80	MCPA	March/82	45.50 L	---	4 ha (10 acres)	E.C.	water	boom sprayer	leafy spurge milkweed
Phaltan WP	folpet	Feb/82	3.00 kg	1.80 kg	N/A	W.P.	water	bessler sprayer	apple scab
Piromer 50WP	pirimicarb	March/82	0.75 kg	---	greenhouse	W.P.	water	mechanical mister	aphids
Resmethrin	resmethrin	March/82	9.10 L	16.00 L	greenhouse	E.C.	water	mechanical mister	white flies, aphids
Roundup	glyphosate	March/82	40.00 L	---	60 ha (150 acres) of spot treatment	E.C.	water	wand & short boom sprayers	all vegetation

TABLE 6 (Cont'd.)

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area to be Treated	Formulation	Carrier	Application Method	Target Pest
Sevin 80P	carbaryl	March/82	9.10 kg	7.70 kg	10 ha (25 acres)	W.P.	water	air blast sprayer	all insects
Stampede CM	propanil	N/A	68.25 L	---	16 ha (40 acres)	E.C.	water	boom sprayer	all vegetation
Sweep Paraquat	paraquat	Mar/82	91.00 L	113.75 L	2 ha (5 acres) spot treatment	E.C.	water	hand or backpack sprayer	all vegetation
Thiodan 4E	endosulfan	Mar/82	9.10 L	45.50 L	2 ha (5 acres)	E.C.	water	blast or backpack sprayer	potato beetle
Thiram 80 WP	thiram	Feb/82	1.00 kg	---	6m x 12m (20ft x 40ft) cellar	W.P.	water	backpack sprayer	mildew
Treflan	trifluralin	Mar/82	20.00 L	51.85 L	8 ha (20 acres)	E.C.	water	boom sprayer	millet & some broadleaves
Vita-vax Captan 80W	captan	Feb/82	0.45 kg	---	all flower seeds	W.P.	none	mixed with seed	damping off, fungi

E.C. = Emulsifiable Concentrate
W.P. = Wettable Powder
--- = None stored, 1982
ha = Hectares

TABLE 7: AGRICULTURE CANADA, PORTAGE LA PRAIRIE RESEARCH SUBSTATION, TOTAL PESTICIDE USE

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area to be Treated	Formulation	Carrier	Application Method	Target Pest
Captan	captan	March/82	0.45 kg	0.15 kg	N/A	dust	none	mixed with seed	fungus
Furadan	carbofuran	May/82	2.27 L	---	0.15 ha (0.35 acres)	solution	water	low pressure hand sprayer	flea beetles
Malathion	malathion	May/82	4.55 L	1.50 L	0.4 ha (1 acre)	E.C.	water	hand or tractor sprayer	aphids
MCPA Sodium 48	MCPA and sodium salt	June/79	22.75 L	20.50 L	2-2.5 ha (5-6 acres)	solution	water	tractor sprayer	broadleaves
MCPA Amine 80 & Torch	MCPA and bromoxynl octanoate	May/82	22.75 L	9.10 L	6-8 ha (15-20 acres)	E.C.	water	tractor sprayer	broadleaves in cereals
Reglone	diquat	Aug/79	9.10 L	6.80 L	2 ha (5 acres)	solution	water	tractor sprayer	flax topgrowth
Roundup	glyphosate	June/80	4.00 L	2.00 L	around buildings	E.C.	water	hand sprayer	grass
Thiodan	endosulfan	June/82	1.13 L	0.56 L	0.4 ha (1 acre)	solution	water	tractor sprayer	potato beetle
Torch & MCPA	bromoxynil octanoate & MCPA	June/82	1.13 L	0.56 L	6-8 ha (15-20 acres)	E.C.	water	tractor sprayer	wild buckwheat
Treflan	trifluralin	Sept/81	31.50 L	21.00 L	N/A	solution	water	pre-emergence spray	broadleaves

E.C. = Emulsifiable Concentrate
--- = None stored, 1982
ha = Hectares

TABLE 8: AGRICULTURE CANADA, WINNIPEG RESEARCH STATION, TOTAL PESTICIDE USE

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area to be Treated	Formulation	Carrier	Application Method	Target Pest
Garden Fungicide	captan	April/81	0.90 kg	0.45 kg	N/A	W. P.	water	sprinkled on seed when planting	fungi
Maneb	maneb	N/A	0.25 kg	---	0.6m x 1.2m (2ft x 4ft) plot	dust	none	dust by hand	smut spores
Nicotine Fumigant	nicotine	April/81	16.38 kg	2.52 kg	N/A	powder	none	ignite	aphids
Temik	aldicarb	N/A	45.45 kg	38.60 kg	N/A	granular	none	furrow with seed	flea beetle in canola, sunflower beetle in sunflower

W.P. = Wettable Powder
--- = None stored, 1982
m = Metres
ft = Feet

TABLE 9: AGRICULTURE CANADA, TOTAL HERBICIDE STORAGE

Trade Name	Generic Name	Department Location	Quantity Stored kg	L
Aatrex nine-O	atrazine	Morden R.S.	9.10	---
Avadex BW	triallate	Brandon R.S.	---	35.00
Banvel	dicamba	Brandon R.S.	---	60.00
Basagran	bentazon	Morden R.S.	---	3.75
Buctril M	bromoxynil octanoate & MCPA ester	Glenlea R.S.	---	10.00
Dual	metolachlor	Brandon R.S.	---	60.00
Dyvel	dicamba and MCPAK	Glenlea R.S.	---	15.00
2,4-D Amine 80	2,4-D amine	Morden R.S.	---	11.38
Embutox E	2,4-DB iso-octyl-ester	Brandon R.S.	---	68.00
Eradicane 8E	EPTC & crop protectant	Brandon R.S.	---	720.00
		Morden R.S.	---	22.75
Gramoxone	paraquat	Brandon R.S.	---	300.00
		Glenlea R.S.	---	4.00
		Morden R.S.	---	8.00
Hoe Grass	diclofop methyl	Glenlea R.S.	---	12.00
		Morden R.S.	---	20.00
Killex	dicamba, 2,4-D and mecoprop	Brandon R.S.	---	9.00
		Animal Health, Brandon	---	0.56
KilMor	dicamba, 2,4-D and mecoprop	Morden R.S.	---	20.50

TABLE 9 (Cont'd.)

Trade Name	Generic Name	Department Location	Quantity Stored kg	L
Lorox liquid	linuron	Morden R.S.	---	80.00
MCPA	MCPA	Brandon R.S.	---	80.00
MCPA Sodium 48	MCPA sodium salt	Portage R.S	---	20.50
MCPA Amine 80 & Torch	MCPA and bromoxynil octanoate	Portage R.S.	---	9.10
Reglone	diquat	Portage R.S.	---	6.80
		Morden R.S.	---	76.00
Roundup	glyphosate	Brandon R.S.	---	6.80
		Portage R.S.	---	2.00
Stampede	propanil	Brandon R.S.	---	200.00
Sweep	paraquat	Morden R.S.	---	113.75
Torch	bromoxynil octanoate	Brandon R.S.	---	20.00
Torch & MCPA Amine 80	bromoxynil octanoate and MCPA	Portage R.S.	---	0.56
Treflan	trifluralin	Portage R.S.	---	21.00
		Morden R.S.	---	51.85
Treflan (granular)	trifluralin	Glenlea R.S.	15.00	---
Weedar 80	2,4-D and 2,4,5-T	Morden R.S.	---	22.75

R.S. = Research Station
--- = Not Applicable

TABLE 10: AGRICULTURE CANADA, TOTAL INSECTICIDE STORAGE

Trade Name	Generic Name	Department Location	Quantity Stored kg	L
Ambush 50EC	permethrin	Brandon R.S.	---	0.50
		Morden R.S.	---	1.00
Ant & Grub Killer	chlordane	Brandon R.S.	4.31	---
Belmark	fenvalerate	Morden R.S.	---	1.00
Chlordane	chlordane	Morden R.S.	---	4.55
Co-Ral	coumaphos	Brandon R.S.	---	224.00
Cygon	dimethoate	Morden R.S.	---	2.00
Dursban 2-E	chlorpyrifos	Morden R.S.	---	13.65
Furadon (granular)	carbofuran	Glenlea R.S.	2.00	---
Furadan 4.8 EC	carbofuran	Morden R.S.	---	9.10
Kelthane EC	dicofol	Morden R.S.	---	13.65
Kelthane WP	dicofol	Morden R.S.	3.64	---
Lindane	lindane	Morden R.S.	1.50	---
Malathion EC	malathion	Glenlea R.S.	---	2.00
		Portage R.S.	---	1.50
		Morden R.S.	---	47.50

TABLE 10 (Cont'd.)

Trade Name	Generic Name	Department Location	Quantity Stored kg	L
Malathion (granular)	malathion	Morden	1.80	---
Mange Cure	fenthion	Animal Health, Brandon	---	6.00
Nicotine Fumigant	nicotine	Winnipeg R.S.	2.52	---
Orthene 75P	acephate	Brandon R.S.	0.50	---
Phosvel	leptophos	Morden R.S.	---	31.85
Piromer 50W	pirimicarb	Brandon R.S.	0.50	---
Plant Fume 103	sulfatepp	Brandon R.S.	3.15	---
Resmethrin	resmethrin	Morden R.S.	---	16.00
Safer's Insecticidal Soap	potassium salt of fatty acids	Brandon R.S.	---	4.00
Sanfax liquid 580	malathion	Brandon R.S.	---	50.00
Sevin 80P	carbaryl	Morden R.S.	7.70	---
Temik	aldicarb	Winnipeg R.S.	38.60	---
Thiodan 4E	endosulfan	Portage R.S.	---	0.56
		Morden R.S.	---	45.50

R.S. = Research Station
--- = Not Applicable

TABLE 11: AGRICULTURE CANADA, TOTAL FUNGICIDE STORAGE

Trade Name	Generic Name	Department Location	Quantity Stored kg	L
Benlate	benomyl	Morden R.S.	2.73	---
Bravo	chlorothalonil	Morden R.S.	---	4.55
Captan 50WP	captan	Portage R.S.	0.15	---
		Morden R.S.	15.90	---
Cyprex	dodine	Morden R.S.	20.00	---
Difolatan 4.8	captafol	Morden R.S.	---	70.00
Garden Fungicide	captan	Winnipeg R.S.	0.45	---
Karathane WP	dinocap	Morden R.S.	6.82	---
Lesan 35WP	fenaminosulf	Brandon R.S.	0.90	---
Manzate	maneb	Morden R.S.	1.36	---
Mertect	thiabendazole	Morden R.S.	---	12.00
Morestan	quinomethionate	Morden R.S.	1.82	---
Phaltan WP	folpet	Morden R.S.	1.82	---
Quintozene 75 WP	quintozene	Brandon R.S.	1.25	---
Rovral 50 WP	iprodione	Brandon R.S.	0.88	---
Thiram 75P	thiram	Morden R.S.	1.82	---
Truban	etridiazole	Morden R.S.	0.91	---
Zineb	zineb	Morden R.S.	6.82	---

R.S. = Research Station
--- = None Applicable

TABLE 12: ATOMIC ENERGY OF CANADA LTD, WHITESHELL NUCLEAR RESEARCH ESTABLISHMENT, TOTAL PESTICIDE USE

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area to be Treated	Formulation	Carrier	Application Method	Target Pest
2,4-D Amine 80	2,4-D amine	June/81	45.50 L	22.75 L	4 ha	solution	water	tractor drawn sprayer	dandelions
Ficam W	bendiocarb	(C)	18.20 L (Jan.-Apr.) 4.55 L/month	(C)Poulin's	kitchens and hall-ways	W.P.	water	hand sprayer	crawling insects
Malathion	malathion	May/78	113.75 L	91.00 L	hedges	E.C.	water	hand sprayer	tent cater-pillars
Ureabor Gran (oxy)	sodium met-aborate tetrahyd-rate, sodium chlorate and bromacil	June/82	45.45 kg	181.80 kg	1 ha around waste man-agement area	pellets	none	by hand	grass

(C) = Contracted Application
W.P. = Wettable Powder
E.C. = Emulsifiable Concentrate
ha = Hectares

TABLE 13: ATOMIC ENERGY OF CANADA LTD, WHITESHELL NUCLEAR RESEARCH ESTABLISHMENT, TOTAL PESTICIDE STORAGE

Trade Name	Generic Name	Department Location	Quantity Stored kg	L
2,4-D Amine 80	2,4-D amine	Pinawa	---	22.75
Malathion	malathion	Pinawa	---	91.00
Ureabor Granular (Oxy)	66.5% sodium metaborate tetra-hydrate & 30% sodium chlorate & 1.5% bromacil	Pinawa	181.80	---

--- = Not Applicable

TABLE 14: CANADIAN NATIONAL RAILWAY, TOTAL PESTICIDE USE

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area to be Treated	Formulation	Carrier	Application Method	Target Pest
Drione	piperonyl butoxide technical, pyrethrins, amorphous silica aerogel	June/82	7.02 kg	4.20 kg	Transcona Shops	dust/powder	none	squirts from container	crawling insects
2,4-D Amine 80	2,4-D	(C)	112.00 L	(C) Midland Vegetation	rights-of-way	E.C.	water	boom sprayer behind truck	thistles, pig-weed
General purpose Insecticidal Spray	O-isopropoxyphenyl methyl carbamate, n-octyl bicycloheptane dicarboximide, piperonyl butoxide, pyrethrins	June/82	544.00 L	428.00 L	Transcona Shops	solution	15% ethylene glycol monobutylester in a petroleum based solvent	hand sprayer	crawling insects
Gramoxone E	paraquat	(C)	71.00 L	(C) Midland Vegetation	rights-of-way	E.C.	water	boom sprayer behind truck	all vegetation
Hyvar X	bromacil	(C)	528.00 kg	(C) Midland Vegetation	rights-of-way	W.P.	water	boom sprayer behind truck	all vegetation

TABLE 14 (Cont'd.)

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area to be Treated	Formulation	Carrier	Application Method	Target Pest
Krovar 80	bromacil and diuron	(C)	278.00 kg	(C) Midland Vegetation	rights-of-way	W.P.	water	boom sprayer behind truck	all vegetation
Record Z	Deet and related toluamides	June/82	450.00 L	8.10 L	skin	solution	none	skin application	insect repellent
Spike 80W	tebuthiuron	(C)	259.00 kg	(C) Midland Vegetation	rights-of-	W.P.	water	boom sprayer behind truck	all vegetation
Strychnine	strychnine	June/82	18.30 kg	9.85 kg	where mice feed	pellets	canary seed	feeder tray	mice
Warfarin	warfarin	May/82	63.00 kg	31.00 kg	N/A	glomules	none	feeder tray	rats & mice

E.C. = Emulsifiable Concentrate
W.P. = Wettable Powder
(C) = Contracted Applications

TABLE 15: CANADIAN NATIONAL RAILWAYS, TOTAL PESTICIDE STORAGE

Trade Name	Generic Name	Department Location	Quantity Stored kg	L
Drione	piperonyl butoxide technical, pyrethrins, amorphous silica aerogel	C.N.R. Winnipeg	4.20	---
General Purpose Insecticidal Spray	O-isopropoxyphenyl methyl carbamate, n-octyl bicycloheptane dicarboximide, piperonyl butoxide, pyrethrins	C.N.R. Winnipeg	---	428.00
Record Z	deet & related toluamides	C.N.R. Winnipeg	---	8.10
Strychnine	strychnine	C.N.R. Winnipeg	9.85	---
Warfarin	warfarin	C.N.R. Winnipeg	31.00	---

--- = Not Applicable

TABLE 16: CANADIAN WHEAT BOARD, WINNIPEG, TOTAL PESTICIDE USE

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area to be Treated	Formulation	Carrier	Application Method	Target Pest
Avitrol	4-amino-pyridine	(C)	7.20 kg (Jan.-Aug.) 0.90 kg/month	(C)Poulin's	roofs	WP	water and corn	bait	pigeons
Ficam W	bendiocarb	(C)	18.20 L (Jan.-Aug.) 2.28 L/month	(C)Poulin's	gym base-boards	WP	water	hand sprayer	crawling insects
Prolin	warfarin & sulfaquin-oxiline	(C)	2.72 kg (Jan.-Aug.) 0.34 kg/month	(C)Poulin's	storage	pellets	oats	bait	mice

(C)= Contracted Application
WP = Wettable Powder

TABLE 17: CANADIAN INTERNATIONAL GRAINS INSTITUTE, TOTAL PESTICIDE USE

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area to be Treated	Formulation	Carrier	Application Method	Target Pest
Dawson 73	ethylene dibromide & methyl bromide	July/81	2 U.S. gal (7.6 litres)	trace	outside grain bins	fumigant	none	sprayer	general insects
Malathion	malathion	N/A	2.27 L	1.00 L	floor corners of mill area (3 floors)	solution	water	hand sprayer	general insects
Phostoxin	aluminum phosphide	N/A	1,660 pellets	1,580 pellets	100 bushel grain bins full of grain	pellets	none	mixed with grain	general insects

TABLE 18: PRAIRIE FARM REHABILITATION ADMINISTRATION, BRANDON, TOTAL PESTICIDE USE

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area to be Treated	Formulation	Carrier	Application Method	Target Pest
Bovaid Ear Tags	fenvalerate	spring/82	1000 tags	---	cattle ears	ear tag	none	tag onto cattle ears	horn and face flies
Co-ral	coumaphos	Sept/82	91.00 L	91.00 L	300 bulls	solution	water	pour on	warbles
Ruelene	crufomate	Sept/82	91.00 L	91.00 L	300 bulls	solution	water	pour on	warbles

--- = None stored, 1982

TABLE 19: PRAIRIE FARM REHABILITATION ADMINISTRATION, TOTAL INSECTICIDE STORAGE

Trade Name	Generic Name	Department Location	Quantity Stored kg	L
Co-Ral	coumaphos	PFRA - Brandon	---	91.00
Ruelene	crufomate	PFRA - Brandon	---	91.00

--- = Not Applicable

TABLE 20: PRAIRIE FARM REHABILITATION ADMINISTRATION, REGINA, TOTAL HERBICIDE USE ON PASTURES IN MANITOBA

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area to be Treated	Formulation	Carrier	Application Method	Target Pest
2,4-D LV600	2,4-D	May 15/82	143-100 L drums (14300 L)	(C) Yorkton Flying Service	8,160 ha (20,400 acres) in Sask. and Man.	E.C.	water and fuel	aerial spraying	poplar trees

(C) = Contracted Application
E.C. = Emulsifiable Concentrate
ha = Hectares

TABLE 21: ENVIRONMENT CANADA, CANADIAN WILDLIFE SERVICE, TOTAL HERBICIDE USE

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area Treated	Formulation	Carrier	Application Method	Target Pest
Roundup	glyphosate	June/82	4.00 L	---	32 ha (80 acres)	E.C.	water	hand sprayer	quackgrass

E.C. = Emulsifiable Concentrate
ha = Hectares
--- = None stored, 1982

TABLE 22: PARKS CANADA, LOWER FORT GARRY, TOTAL PESTICIDE USE

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area to be Treated	Formulation	Carrier	Application Method	Target Pest
Lignasan	carbend-azim	Dec/81	491.40 L	36.40 L	32 ha (80 acres)	solution	water	injection	dutch elm disease
Malathion	malathion	July/81	4.55 L	1.13 L	1 ha (2 acres)	E.C.	water	backpack sprayer	aphids

E.C. = Emulsifiable Concentrate
ha = Hectares

TABLE 23: PARKS CANADA, RIDING MOUNTAIN NATIONAL PARK, TOTAL PESTICIDE USE

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area to be Treated	Formulation	Carrier	Application Method	Target Pest
Copper sulphate	copper sulphate	*	none 82	1075.00 kg	3900 m^2 Clear Lake	dust	none	broadcast by hand	swimmers itch
Gramoxone	paraquat	*	10.00 L	13.65 L	+	E.C.	water	hand sprayer	all vegetation
Industrial Borax	borax	*	none 82	181.80 kg	1.5 ha	dust	none	cyclone sprayer	snow mold on bent grass
Malathion	malathion	1978	none 82	68.25 L	+	E.C.	water	sprayer	insects
Tersan SP	chloroneb	*	5.45 kg	5.45 kg	1.5 ha	W.P.	water	power sprayer on cushman cart	snow mold
Tersan 1991	benomyl	*	60.00 kg	27.30 kg	1.5 ha	W.P.	water	power sprayer	brown patch, dollar spot
Tersan L.S.R.	maneb	*	*	81.80 kg	+	dry powder	water	power sprayer	leaf spot
Weed All liquid & Compitox Plus	mecoprop and 2,4-D	*	160.00 L	140.00 L	fairways	liquid	water	field sprayer on cushman cart	broadleaf weeds on turf

* = Records on purchasing dates and quantities not available
E.C. = Emulsifiable Concentrate
W.P. = Wettable Powder
\+ = not used in 1982
ha = Hectares

TABLE 24: PARKS CANADA, TOTAL PESTICIDE STORAGE

Trade Name	Generic Name	Type of Pesticide	Department Location	Quantity kg	Stored L
Copper Sulphate	copper sulphate	fungicide	Riding Mountain	1075.00	---
Gramoxone	paraquat	herbicide	Riding Mountain	13.65	---
Industrial Borax	borax	fungicide	Riding Mountain	181.00	---
Lignasan	carbendazim	insecticide	Lower Fort Garry	---	36.40
Malathion	malathion	insecticide	Lower Fort Garry	---	1.13
			Riding Mountain	---	68.25
Tersan S.P.	chloroneb	fungicide	Riding Mountain	5.45	---
Tersan 1991	benomyl	fungicide	Riding Mountain	27.30	---
Tersan L.S.R.	maneb	fungicide	Riding Mountain	81.80	---
Weed All Liquid and Compitox Plus	mecoprop and 2,4-D	herbicide	Riding Mountain	---	140.00

--- = Not Applicable

TABLE 25: FISHERIES AND OCEANS, TOTAL PESTICIDE USE

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area to be Treated	Formulation	Carrier	Application Method	Target Pest
2,4-D Amine 80	2,4-D Amine	April/82	6.00 L	1.00 L	12 ha (30 acres)	solution	water	hand sprayer	dandelions
Prolin	warfarin and sulfa-quinoxiline	(C)	7.20 kg (Jan.-Aug.) 0.9 kg/month	(C)Poulin's	boiler room floor	pellets	rolled oats	bait	rats and mice

(C) = Contracted Application
ha = Hectares

TABLE 36: FISHERIES AND OCEANS TOTAL PESTICIDE STORAGE

Trade Name	Generic Name	Department Location	Quantity Stored kg	L
2,4-D Amine 80	2,4-D amine	Winnipeg	---	1.00
Variety of pesticide standards, degradation products and stock solutions (research purposes)		Winnipeg	5.00	---

--- = Not Applicable

TABLE 27: HEALTH AND WELFARE CANADA, MEDICAL SERVICES BRANCH, TOTAL PESTICIDE USE

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area to be Treated	Formulation	Carrier	Application Method	Target Pest
Ficam W	bendiocarb	(C)	0.20 kg (Jan.-Aug.) 0.025 kg/month	(C)Poulin's	laundry area, kitchen sinks	W.P.	water	hand sprayer	crawling insects
Prolin	warfarin and sulpha-quinoxoline	(C)	17.60 kg (Jan.-Aug.) 2.2 kg/month	(C)Poulin's	crawl space	pellets	rolled oats	bait	rodents
Round Up	glyphosate	March/82	80.00 L	40.00 L	under 28 berms	E.C.	water	hand sprayer	all vegetation

W.P. = Wettable Powder
E.C. = Emulsifiable Concentrate
(C) = Contracted Applications

TABLE 28: DEPARTMENT OF NATIONAL DEFENCE, CFB PORTAGE LA PRAIRIE, TOTAL PESTICIDE USE

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area to be Treated	Formulation	Carrier	Application Method	Target Pest
Abate	temephos	pre-1978	*	160.00 kg	+	granular	none	aerial spreader	mosquito larva
Baygon MOS	propoxur	*	*	728.00 L	+	E.C.	water	ULV atomizing system	mosquitoes
Calmix	bromacil & 2,4-D acid	*	*	4.54 kg	+	pellets	none		all vegetation
Chlordane	chlordane	*	*	91.00 L	around buildings	solution	water	hand sprayer	wasps, ants, spiders
Dalapon 2	dalapon	*	100.00 kg	100.00 kg	around runway lights	W.P.	water	sprayer	grasses
Diazinon 50 EC	diazinon	*	9.10 L	2.27 L	+	E.C.	water	hand sprayer	leafeating insects
2,4-D Amine 500	2,4-D	*	180.00 L	225.50 L	+	E.C.	water	field sprayer	broadleaves
Ficam D	bendiocarb	*	4.00 kg	4.00 kg	around building outlets	dust	none	sprinkle by hand	cockroaches, ants, spiders
Gramoxone	paraquat	*	*	8.00 L	+	E.C.	water	hand sprayer	all vegetation
Liquid Insect spray Formula 4F	piperonyl butoxide	*	45.50 L	22.75 L	spot treatments	aerosol	none	spray	mosquitos, wasps
Malathion 50 EC	malathion	*	*	107.00 L	+	E.C.	water	hand sprayer	mosquitos

TABLE 28 (Cont'd.)

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area to be Treated	Formulation	Carrier	Application Method	Target Pest
Rat Bait	chlorpha-cinone	*	*	31.90 L 0.75 kg	buildings	treated bait	various	bait	rats
Roundup	glyphosate	*	68.00 L	16.00 L	spot treat-ments	E.C.	water	hand sprayer	all vegetation
Simmaprim 80 W	simazine	*	68.10 kg	50.00 kg	spot treat-ments	W.P.	water	hand sprayer	all vegetation
Strychnine	strychnine	*	*	2.50 L	buildings	liquid	water	bait	rodents

* = Records on purchasing dates and quantities not available
E.C. = Emulsifiable Concentrate
W.P. = Wettable Powder
\+ = Storage only at this time

TABLE 29: DEPARTMENT OF NATIONAL DEFENCE, CFB SHILO, TOTAL PESTICIDE USE

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area to be Treated	Formulation	Carrier	Application Method	Target Pest
A-Rest	ancymidol	*	*	1.13 L	greenhouse	liquid	water	atomizer	growth inhibitor
Atrazine	atrazine	*	*	36.40 L	around fences	solution	water	boom	soil sterilant
Baygon MOS	propoxur	*	*	1638.00 L	+	E.C.	water	ULV atomizing system	mosquitoes, blackflies
B-Nine	daminozide	*	*	0.56 L	greenhouse	E.C.	water	small atomizer	growth inhibitor
Captan 50%	captan	*	*	0.85 kg	greenhouse	W.P.	water	wet drench	fungus
Embark	melfluidide	*	*	27.30 L	ammo site	solution	water	wand sprayer	growth suppression of grass
Ficam D	bendiocarb	*	*	9.00 kg	outlets in kitchen	powder	none	duster	cockroaches, silverfish
Ficam W	bendiocarb	*	*	0.35 kg	kitchen baseboards	W.P.	hot water	hand sprayer with nozzle	cockroaches, silverfish
Kelthane	dicofol	*	*	18.20 L	conifers	E.C.	water	backpack or portable sprayer with wand	red spider mites
Malathion	malathion	*	*	159.25 L	spot treatments	E.C.	water	wand sprayer	aphids, canker worms, red spider mites

TABLE 29 (Cont'd.)

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area to be Treated	Formulation	Carrier	Application Method	Target Pest
Primatol	atrazine	*	*	18.20 L	fences, parking lots	E.C.	water	boom or wand sprayer	soil sterilant
Roundup	glyphosate	*	*	52.80 L	cracks in parade square	E.C.	water	backpack sprayer with portable wand	all vegetation
Spike	terbuthiuron	*	*	955.50 L	parking lots and utility sheds	W.P. and granular	water and no carrier	wand spreader	all vegetation
Tedion	tetradifon	*	*	2.27 L	conifers	E.C.	water	backpack or portable sprayer with wand	red spider mites
Tordon 10K	picloram	*	*	25.00 kg	firing range	pellets	none	portable spreader on a helicopter	leafy spurge
2,4-D Amine 80	2,4-D	*	*	159.25 L	picnic area	E.C.	water	boom sprayer	dandelions

* = Records on purchasing dates and quantities not available
E.C. = Emulsifiable Concentrate
W.P. = Wettable Powder
\+ = Storage only at this time

TABLE 30: DEPARTMENT OF NATIONAL DEFENCE, C.F.B. WINNIPEG, TOTAL PESTICIDE USE

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area to be Treated	Formulation	Carrier	Application Method	Target Pest
Avitrol	4-amino-pyridine	(C)	18.40 kg (Jan.-Aug.) 2.3 kg/month	(C)Poulin's	buildings	W.P.	water and corn	bait	pigeons
Baygon MOS	propoxur	*	*	40.00 L	storage only	N/A	N/A	N/A	N/A
Crawl-tox	unknown	*	*	0.42 L	storage only	not applic-able	not applic-able	not applic-able	not applicable
DDVP	dichlorvos	*	4.10 kg	3.10 kg	greenhouse	ignitable fumigant	none	ignition	green and white flies, red spider mites
2,4-D Amine 80	2,4-D amine	*	45.50 L	17.10 L	steam lines	E.C.	water	hand sprayer	broadleaves
2,4-D Amine and Dycleer	2,4-D and dicamba	(C)	*	(C) Supreme Spraying	620 ha	E.C.	water	hand sprayer mounted on truck	dandelions
Malathion Domestic	malathion	*	3.00 L	2.75 L	greenhouse	E.C.	water	hand sprayer	green and white flies, red spider mites
Malathion	malathion	*	113.75 L	22.22 L	spot treat-ments	E.C.	water	hand sprayer	canker worms
		(C)	95.50 L	(C) Supreme Spraying	61 ha	E.C.	water	hand sprayer mounted on truck	insects

TABLE 30 (Cont'd.)

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area to be Treated	Formulation	Carrier	Application Method	Target Pest
Rat Kill	diphacinone	*	*	45.50 L	buildings	pellets	rolled oats	bait	rats
Simmaprim	simazine	*	22.75 kg	11.40 kg	spot treat-ments	W.P.	water	hand sprayer	soil sterilant
		(C)	136.40 kg	(C) Supreme Spraying	along fences	W.P.	water	hand sprayer on truck	soil sterilant
Warfarin	warfarin	*	*	2.00 kg	buildings	pellets	none	bait	rats and mice

* = Records on purchasing dates and quantities not available
E.C. = Emulsifiable Concentrate
W.P. = Wettable Powder
(C) = Contracted Application
ha = Hectares

TABLE 31: DEPARTMENT OF NATIONAL DEFENCE, CFS BEAUSEJOUR, TOTAL PESTICIDE USE

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area to be Treated	Formulation	Carrier	Application Method	Target Pest
Atrazine	atrazine	*	40.00 L	40.00 L	1 ha	E.C.	water	hose sprayer	broadleaf & total weed control
Baygon MOS	propoxur	*	*	364.00 L	+	E.C.	water	hand sprayer	mosquitos
2,4-D Est-emine	2,4-D	*	45.50 L	13.70 L	spot treat-ment	E.C.	water	boom sprayer	dandelions
MCPA Amine 80	MCPA amine	*	20.00 L	---	8 ha	E.C.	water	boom or tractor sprayer	broadleaves
Roundup	glyphosate	*	4.55 L	2.00 L	fence post poles	E.C.	water	hand sprayer	grasses, weeds

* = Records on purchasing dates and quantities not available
E.C. = Emulsifiable Concentrate
\+ = Storage only at this time
ha = Hectares
--- = None stored, 1982

TABLE 32: DEPARTMENT OF NATIONAL DEFENCE, TOTAL HERBICIDE STORAGE

Trade Name	Generic Name	Department Location	Quantity Stored kg	L
Atrazine	atrazine	Beausejour	---	40.00
		Shilo	---	36.40
Calmix	bromacil & 2,4-D acid	Portage	4.54	---
2,4-D Estemine	2,4-D non volatile amine	Beausejour	---	13.65
2,4-D Amine 500	2,4-D amine	Portage	---	225.50
2,4-D Amine 80	2,4-D amine	Shilo	---	159.25
		Winnipeg	---	33.00
Dalapon 2	dalapon	Portage	100.00	---
Embark	melfluidide	Shilo	---	27.30
Gramoxone	paraquat	Portage	---	8.00
Primatol	atrazine	Shilo	---	18.20
Roundup	glyphosate	Shilo	---	52.80
		Beausejour	---	2.00
		Portage	---	16.00
Spike	terbuthiuron	Shilo	---	955.50
Simmaprim 80W	simazine	Portage	50.00	---
		Winnipeg	11.40	---
Tordon 10K	picloram	Shilo	25.00	---
Weed-All	mecoprop & 2,4-D	Winnipeg	0.90	---

--- = Not Applicable

TABLE 33: DEPARTMENT OF NATIONAL DEFENCE, TOTAL INSECTICIDE STORAGE

Trade Name	Generic Name	Department Location	Quantity Stored kg	L
Abate	temephos	Portage la Prairie	160.00	---
Baygon MOS	propoxur	Shilo	---	1638.00
		Beausejour	---	364.00
		Winnipeg	---	40.00
		Portage	---	728.00
Chlordane 5% Dust	chlordane	Winnipeg	10.00	---
Chlordane	chlordane	Portage	---	91.00
Crawl-Tox	propoxur	Winnipeg	0.42	---
Cygon	dimethoate	Winnipeg	0.22	---
DDT 5% Powder	DDT	Winnipeg	2.00	---
DDVP	dichlorvos	Winnipeg	3.06	---
Deritox	rotenone	Winnipeg	0.90	---
Diazinon 50% E	diazinon	Winnipeg	---	40.00
		Portage	---	2.27
Diazinon 2% Dust	diazinon	Winnipeg	3.00	---
Dicofol	dicofol	Winnipeg	0.11	---
Ficam D	bendiocarb	Shilo	9.00	---
		Winnipeg	20.00	---
		Portage	4.00	---

TABLE 33 (Cont'd.)

Trade Name	Generic Name	Department Location	Quantity Stored kg	Quantity Stored L
Ficam W	bendiocarb	Shilo	0.35	---
		Winnipeg	1.50	---
Kelthane	dicofol	Shilo	---	18.20
		Winnipeg	---	10.50
Liquid Insect Spray Formula 4F	piperonyl butoxide	Portage	---	22.75
Malathion 50EC	malathion	Shilo	---	159.25
		Winnipeg	---	22.22
		Portage	---	107.00
Malathion (Domestic)	malathion	Winnipeg	---	2.75
Methoxychlor	methoxychlor	Winnipeg	---	189.00
Potato Dust	sevin & zineb	Winnipeg	1.00	---
Pyradee Insect Powder	DDT & pyrethrins	Winnipeg	1.80	---
Pyrethrins	pyrethrins	Winnipeg	0.45	---
Riddex	piperonyl butoxide	Winnipeg	---	180.00
Roach Doom	sodium fluoride	Winnipeg	---	22.75
Sangx D-Pest	piperonyl butoxide, D-trans-allenthrins	Winnipeg	3.60	---
Tedion	tetradifon	Shilo	---	2.27

--- = Not applicable

TABLE 34: DEPARTMENT OF NATIONAL DEFENCE, TOTAL OTHER STORAGE

Trade Name	Generic Name	Type of Pesticide	Department Location	Quantity Stored kg	Quantity Stored L
A-Rest	ancymidol	growth inhibitor	Shilo	---	1.13
B-Nine	daminozide	growth inhibitor	Shilo	---	0.56
Benomyl	benomyl	fungicide	Winnipeg	0.02	---
Captan	captan	fungicide	Shilo	0.85	---
			Winnipeg	1.81	---
Metaldehyde	metaldehyde	molluscicide	Winnipeg	2.72	---
No-Damp	benzoate, oxine	fungicide	Winnipeg	---	2.50
Rat Bait	chlorphacinone	rodenticide	Portage	---	31.80
			Portage	0.75	---
Rat Kill	diphacinone	rodenticide	Winnipeg	45.50	---
Slug-Em	metaldehyde	molluscicide	Winnipeg	0.22	---
Strychnine	strychnine	rodenticide	Portage	---	2.50
Warfarin	warfarin	rodenticide	Winnipeg	2.00	---

--- = Not Applicable

TABLE 35: SOLICITOR GENERAL, R.C.M.P. WINNIPEG HEADQUARTERS, TOTAL PESTICIDE USE

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area to be Treated	Formulation	Carrier	Application Method	Target Pest
Ficam W	Bendiocarb	(C)	15.2 kg (Jan.-Aug.) 1.5-2.3 kg/month	(C) Act-Cure-It Pest Control Ltd.	buildings	W.P.	water	hand sprayer	crawling insects

(C) = Contracted Applications
W.P.= Wettable Powder

TABLE 36: SOLICITOR GENERAL, ROCKWOOD INSTITUTION, TOTAL PESTICIDE USE

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area to be Treated	Formulation	Carrier	Application Method	Target Pest
Atox Dust	rotenone	March 3/82	11.40 kg	11.40 kg	*	dust	none	portable duster	garden insects
Belmark	fenvalerate	March 3/82	1.00 L	2.00 L	*	liquid	water	field sprayer	potato & tomato insects
B-9 Growth Retardant	daminozide	April/82	4.00 L	4.00 L	*	S.P.	water	hand sprayer	geraniums growing too fast
Chloro-IPC	chlorpropham	March 3/82	22.75 L	22.75 L	*	liquid	water	field sprayer	control of weeds in onions
Dasanit 15G (15% granular)	fensulfothion	March 3/82	22.70 kg	22.70 kg	*	granular	none	soil incorporated	insects in onions and cabbage
Diazinon (2% dust)	diazinon	March 3/82	22.70 kg	22.70 kg	*	granular	none	soil incorporated	insecticide for green onions
Eptam 8-E	EPTC	March 3/82	68.00 L	68.00 L	*	liquid	water	field sprayer	herbicide for potatoes
Gopher Poison	chlorphacinone	March 3/82	6 tins	12 tins	*	liquid	wheat	fill gopher holes	gophers
Hoe-Grass	diclofop methyl	March 3/82	480.00 L	480.00 L	*	liquid	water	field sprayer	wild oats
Konk	pyrethrins	May 20/82	6 cans	6 cans	*	aerosol	none	aerosol can	flying insects in piggery

TABLE 36 (Cont'd.)

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area to be Treated	Formulation	Carrier	Application Method	Target Pest
Malathion	malathion	May/82	32.00 L	32.00 L	*	E.C.	water	field sprayer	aphids, leaf hoppers, flea beetles
Manzate Dust 8%	maneb	March 3/82	100.00 kg	100.00 kg	*	dust	water	field sprayer	fungicide for garden crops
MCPA Amine 80	MCPA	March 3/82	45.00 L	68.00 L	*	liquid	water	field sprayer	broadleaves
MH 30 Amine	maleic hydrazide	March 3/82	114.00 L	137.00 L	*	liquid	water	field sprayer	sprout inhibitor
Prolin	warfarin & sulphaquin-oxoline	(C)	39.30 kg (Jan.-Aug.) 4.9 kg/month	(C)Poulin's	buildings	pellets	rolled oats	bait	rats and mice
Roundup	glyphosate	May/82	64.00 L	64.00 L	*	E.C.	water	hand sprayer	quackgrass
TCA Solution	trichloro-acetic acid	March 3/82	40.00 L	40.00 L	*	liquid	water	field sprayer	wild oats & quackgrass
Thimet	phorate	March 3/82	9.10 kg	9.10 kg	*	powder	dust	preplant to band sprayer	flea beetles
Thiodan 4 EC	endosulfan	March 3/82	23.00 L	32.00 L	*	E.C.	water	field sprayer	mites
Torch	bromoxynil	March 3/82	120.00 L	120.00 L	*	liquid	water	field sprayer	wild millet

NOTE: The chemicals listed in this table were purchased in 1982.
Chemicals purchased prior to 1982 are listed in Table 37, 38 and 39.

* = These chemicals were used on the Rockwood Farm Annex
S.P. = Soluble Powder
E.C. = Emulsifiable Concentrate
(C) = Contracted Applications

TABLE 37: SOLICITOR GENERAL, ROCKWOOD INSTITUTION, TOTAL HERBICIDE STORAGE

Trade Name	Generic Name	Department Location	Quantity Stored kg	L
Alanap 3	naptalam	Stony Mountain	---	4.50
Atrazine 80%	atrazine	Stony Mountain	14.00	---
Atrazine 65%	atrazine	Stony Mountain	22.70	---
Avenge	difenzoquat	Stony Mountain	---	18.00
Banvel	dicamba	Stony Mountain	---	68.00
Brushkill 2,4,5-T	2,4,5-T	Stony Mountain	---	22.50
Buctril M	bromoxynil octanoate & MCPA ester	Stony Mountain	---	9.00
Chloro-IPC	chlorpropham	Stony Mountain	---	22.70
Driveway Weed Killer	sodium chlorate, sodium metaborate and boron	Stony Mountain	---	4.00
Eptam 8-E	EPTC	Stony Mountain	---	68.00
Hoe-Grass	diclofop methyl	Stony Mountain	---	480.00
Lorox (granular)	linuron	Stony Mountain	21.00	---
Lorox (liquid)	linuron	Stony Mountain	---	2.00
MCPA Amine 80	MCPA Amine	Stony Mountain	---	68.00

TABLE 37 (Cont'd.)

Trade Name	Generic Name	Department Location	Quantity Stored kg	L
MCPA Sodium Salt	MCPA & sodium chloro-acetate	Stony Mountain	---	23.00
Randox	allidochlor	Stony Mountain	---	5.00
Reglone	diquat	Stony Mountain	---	56.00
Ro-Neet	cycloate	Stony Mountain	---	23.00
Roundup	glyphosate	Stony Mountain	---	64.00
Sodium TCA	sodium trichloracetate	Stony Mountain	64.00	---
Solan	pentanochlor	Stony Mountain	---	6.00
Stampede	propanil	Stony Mountain	---	45.00
TCA solution	trichloracetic acid	Stony Mountain	---	40.00
TOK E-25	nitrofen	Stony Mountain	---	1.00
Torch	bromoxynil octanoate	Stony Mountain	---	120.00
Totril	ioxynil octanoate	Stony Mountain	---	5.00
Treflan	trifluralin	Stony Mountain	---	14.00

--- = Not Applicable

TABLE 38: SOLICITOR GENERAL, ROCKWOOD INSTITUTION, TOTAL INSECTICIDE STORAGE

Trade Name	Generic Name	Department Location	Quantity Stored kg	L
Atox Dust	rotenone	Stony Mountain	11.40	---
Belmark	fenvalerate	Stony Mountain	---	2.00
Chlordane	chlordane	Stony Mountain		23.00
Dasanit 15% gran	fensulfothion	Stony Mountain	22.70	---
Diazinon 2% dust	diazinon	Stony Mountain	22.70	---
Diazinon E	diazinon	Stony Mountain	---	5.00
Konk	pyrethrins	Stony Mountain	6 cans	
Malathion	malathion	Stony Mountain	---	32.00
Nicotine Sulphate	nicotine	Stony Mountain	0.10	---
Thimet	phorate	Stony Mountain	9.10	---
Thiodan 4EC	endosulfan	Stony Mountain	---	32.00

--- = Not Applicable

TABLE 39: SOLICITOR GENERAL, ROCKWOOD INSTITUTION, TOTAL OTHER STORAGE

Trade Name	Generic Name	Type of Pesticide	Department Location	Quantity kg	Stored L
Agrox NM	lindane and maneb	seed treatment	Stony Mountain	6.80	---
B-Nine Growth Retardant	daminozide	growth inhibitor	Stony Mountain	---	4.00
Borax	borax	fungicide	Stony Mountain	45.00	---
Captan	captan	fungicide	Stony Mountain	5.00	---
Dithane M-22	maneb	fungicide	Stony Mountain	93.00	---
Gopher Poison	chlorphacinone	rodenticide	Stony Mountain		12 tins
Manzate Dust	maneb	fungicide	Stony Mountain	100.00	---
MH 30	maleic hydrazide	growth inhibitor	Stony Mountain	---	137.00

--- = Not Applicable

TABLE 40: TRANSPORT CANADA, CHURCHILL AIRPORT, TOTAL PESTICIDE USE

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area to be Treated	Formulation	Carrier	Application Method	Target Pest
Stanchem D&T LV Ester	2,4-D & 2,4,5-T	June/82	137.00 L	137.00 L	runways	E.C.	water	sprayer pulled by truck	grass
Brush-Killer 96	2,4-D & 2,4,5-T (1:1)	June/82	137.00 L	137.00 L	service roads	E.C.	water	sprayer pulled by truck	brush

E.C. = Emulsifiable Concentrate

TABLE 41: TRANSPORT CANADA, ST. ANDREW'S AIRPORT, TOTAL PESTICIDE USE

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area to be Treated	Formulation	Carrier	Application Method	Target Pest
Amitrol	amitrol	June/82	360.00 L	360.00 L	3.2 km (2 miles) of ditches	solution	water	tractor drawn sprayer	cattails
2,4-D Amine 500	2,4-D	June/82	730.00 L	730.00 L	24 ha (60 acres)	solution	water	tractor drawn sprayer	dandelions
Primatol	atrazine	June/82	40.00 L	40.00 L	around lights	solution	water	hand sprayer	all vegetation
Prolin	chloro-phacinone	June/82	44.00 kg	39.00 kg	old buildings and 1 ha patch	treated bait	wheat	hand spread	gophers, rats and mice
Rodent Doom	warfarin and sulfa-quinoxiline	June/82	4.54 kg	2.27 kg	old building	treated bait	oatmeal	hand spread	rats and mice

ha = Hectares

TABLE 42: TRANSPORT CANADA, WINNIPEG INTERNATIONAL AIRPORT, TOTAL PESTICIDE USE

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area to be Treated	Formulation	Carrier	Application Method	Target Pest
Aatrex	atrazine	June 7/82	113.00 kg	113.00 kg	around runway lights	solution	water	sprayer from truck	all vegetation
2,4-D Amine 80	2,4-D	June 1/82	1137.00 L	1023.00 L	182 ha (450 acres) of grasslands	solution	water	sprayer from truck	dandelions

ha = Hectares

TABLE 43: TRANSPORT CANADA, TOTAL PESTICIDE STORAGE

Trade Name	Generic Name	Department Location	Quantity Stored kg	L
Amitrol	amitrole	St. Andrew's Airport	---	360.00
Aatrex	atrazine	Winnipeg International	113.00	---
Brushkiller 96	2,4-D & 2,4,5-T	Churchill Airport	136.82	---
Primatol	atrazine	St. Andrew's Airport	---	40.00
Prolin	chlorphacinone	St. Andrew's Airport	39.00	---
Rodent Doom	warfarin and sulpha-quinoxiline	St. Andrew's Airport	2.27	---
2,4-D Amine 80	2,4-D amine	Winnipeg International Airport	---	1023.00
2,4-D Amine 500	2,4-D amine	St. Andrew's Airport	---	730.00
Stanchem D & T LV Ester	2,4-D & 2,4,5-T	Churchill Airport	---	137.00

--- = Not Applicable

TABLE 44: VETERANS AFFAIRS, DEER LODGE HOSPITAL, TOTAL PESTICIDE USE

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area to be Treated	Formulation	Carrier	Application Method	Target Pest
Avitrol	4-amino pyridine	(C)	23.6 kg (Jan.-Aug.) 2.3-3.6 kg/month	(C) Act-Cure-It Pest Control Ltd.	roofs and roof ledges	W.P.	corn and water	bait	pigeons
Diazinon	diazinon	(C)	10.00 L	(C) Charles Reiss & Co. Exterminators	kitchens, baseboards, locker area, storage areas	E.C.	#9 oil in winter, water in summer	manual tank spray	crawling insects
Diazinon	diazinon	(C)	32.00 L	(C) Swat Professional Exterminators	58 trees	E.C.	water	high pressure sprayer on truck	canker worms

(C) = Contracted Applications
W.P. = Wettable Powder
E.C. = Emulsifiable Concentrate

TABLE 45: VIA RAIL, TOTAL PESTICIDE USE

Trade Name	Generic Name	Date Received	Quantity Purchased	Quantity Stored	Area to be Treated	Formulation	Carrier	Application Method	Target Pest
Prolin	warfarin and sulpha-quinoxiline	(C)	9.12 kg (Jan.-Aug.) 1.14 kg/month	(C)Poulin's	commissary	pellets	rolled oats	bait	rats and mice
Sapho	piperonyl butoxide, n-octyl bicyclo-heptane dicarbox-imide, pyrethrins	April/82	76.20 kg	61.44 kg	passenger car floors	aerosol	none	aerosol	cockroaches

(C) = Contracted Application

TABLE 46: HERBICIDES PURCHASED AND STORED BY THE FEDERAL GOVERNMENT, INCLUDING CROWN CORPORATIONS AND CONTRACTORS, 1982

Trade Name	Generic Name	Department, Location	Quantity Purchased kg	Quantity Purchased L	Quantity Stored kg	Quantity Stored L
Aatrex Nine-0	atrazine	Agriculture Canada, Morden	1.80	---	9.10	---
		Transport Canada, Winnipeg	3.00	---	113.00	---
Amitrol	amitrole	Transport Canada, St. Andrew's	---	360.00	---	360.00
Alanap 3	naptalam	Solicitor General, Rockwood	---	---	---	4.50
Atrazine	atrazine	National Defence, CFS Beausejour	---	40.00	---	40.00
		National Defence, CFB Shilo	---	---	---	36.40
Atrazine 80	atrazine	Solicitor General, Rockwood	---	---	40.00	---
Atrazine 65	atrazine	Solicitor General, Rockwood	---	---	22.70	---
Avadex BW	triallate	Agriculture Canada, Brandon	---	35.00	---	35.00
Avenge	difenzoquat	Solicitor General, Rockwood	---	---	---	15.00
Banvel	dicamba	Agriculture Canada, Brandon	---	100.00	---	60.00
		Solicitor General, Rockwood	---	---	---	68.00
Basagran	bentazon	Agriculture Canada, Morden	---	---	---	3.75
Brushkill 2,4,5-T	2,4,5-T	Solicitor General, Rockwood	---	---	---	22.50
Brushkiller 96	2,4-D & 2,4,5-T	Transport Canada, Churchill	---	137.00	---	137.00
Buctril M	bromoxynil octanoate and MCPA ester	Agriculture Canada, Glenlea	---	20.00	---	20.00
		Solicitor General, Rockwood	---	---	---	9.00

TABLE 46 (Cont'd.)

Trade Name	Generic Name	Department, Location	Quantity Purchased kg	Quantity Purchased L	Quantity Stored kg	Quantity Stored L
Calmix Pellets	bromacil & 2,4-D acid	National Defence, Portage	---	---	4.54	---
Chloro-IPC	chlorpropham	Solicitor General, Rockwood	---	22.75	---	22.75
Dalapon 2	dalapon	National Defence, Portage	100.00	---	100.00	---
Driveway Weed Killer	sodium chlorate, sodium metaborate & boron	Solicitor General, Rockwood	---	4.00	---	---
Dual	metolachlor	Agriculture Canada, Brandon	---	---	---	60.00
Dyvel	dicamba & MCPAK	Agriculture Canada, Glenlea	---	20.00	---	15.00
2,4-D Amine 80	2,4-D amine	A.E.C.L. Pinawa	---	45.50	---	22.75
		Transport Canada, Winnipeg	---	---	---	1023.00
		Fisheries & Oceans, Winnipeg	---	6.00	---	1.00
		National Defence, Winnipeg	---	45.50	---	17.10
		National Defence, Shilo	---	---	---	159.25
		Agriculture Canada, Morden	---	---	---	11.38
		C.N.R. (C)	---	112.00	---	---
2,4-D Amine 500	2,4-D amine	National Defence, Portage	---	180.00	---	225.50
		Transport Canada, St. Andrew's	---	730.00	---	730.00
2,4-D Estemine	2,4-D non volatile amine	National Defence, Beausejour	---	45.50	---	13.70
2,4-D LV 600	2,4-D low volatile ester	D.R.E.E., P.F.R.A., (C)	---	14300.00	---	---
Embark	melfluidide	National Defence, Shilo	---	---	---	27.30
Embutox E	2,4-DB iso-octyl ester	Agriculture Canada, Brandon	---	68.00	---	68.00

TABLE 46 (Cont'd.)

Trade Name	Generic Name	Department, Location	Quantity Purchased kg	Quantity Purchased L	Quantity Stored kg	Quantity Stored L
Eptam 8-E	EPTC	Solicitor General, Rockwood	---	68.00	---	68.00
Eradicane 8-E	EPTC & Crop Protectant	Agriculture Canada, Brandon	---	810.00	---	720.00
		Agriculture Canada, Morden	---	68.25	---	22.75
Gramoxone	paraquat	Agriculture Canada, Brandon	---	80.00	---	300.00
		Agriculture Canada, Glenlea	---	8.00	---	4.00
		Agriculture Canada, Morden	---	---	---	8.00
		Parks Canada, Riding Mountain	---	10.00	---	13.65
		National Defence, Portage	---	---	---	8.00
		C.N.R. (C)	---	71.00	---	---
Hoe-Grass	diclofop methyl	Agriculture Canada, Brandon	---	81.00	---	---
		Agriculture Canada, Glenlea	---	20.00	---	12.00
		Agriculture Canada, Morden	---	20.00	---	20.00
		Solicitor General, Rockwood	---	480.00	---	480.00
Hyvar X	bromacil	C.N.R. (C)	28.00	---	---	---
Killex	dicamba, 2,4-D & mecoprop	Agriculture Canada, Brandon	---	9.00	---	9.00
		Agriculture Canada, Brandon - (Animal Health)	---	0.91	---	0.56
Kil-Mor	dicamba	Agriculture Canada, Morden	---	20.00	---	20.50
Krovar I	bromacil and diruan	C.N.R. (C)	278.00	---	---	---
Lorox L (liquid)	linuron	Agriculture Canada, Morden	---	120.00	---	80.00
		Solicitor General, Rockwood	---	---	---	2.00

TABLE 46 (Cont'd.)

Trade Name	Generic Name	Department, Location	Quantity Purchased kg	Quantity Purchased L	Quantity Stored kg	Quantity Stored L
Lorox (granular)	linuron	Solicitor General, Rockwood	---	---	21.00	---
MCPA amine	MCPA amine	Agriculture Canada, Brandon	---	180.00	---	80.00
		Agriculture Canada, Glenlea	---	80.00	---	---
MCPA amine 80	MCPA amine	Agriculture Canada, Morden	---	45.50	---	---
		Solicitor General, Rockwood	---	45.00	---	68.00
		National Defence, Beausejour	---	20.00	---	---
MCPA sodium 48	MCPA sodium salt	Agriculture Canada, Portage	---	22.75	---	20.50
		Solicitor General, Rockwood	---	---	---	23.00
MCPA amine 80 & Torch	MCPA & bromoxynil octanoate	Agriculture Canada, Portage	---	22.75	---	9.10
Primatol	atrazine	National Defence, Shilo	---	---	---	18.20
		Transport Canada, St. Andrew's	---	40.00	---	40.00
Ramrod	propochlor	Agriculture Canada, Brandon	---	22.75	---	---
Randox	allidochlor	Solicitor General, Rockwood	---	---	---	5.00
Reglone	diquat	Agriculture Canada, Portage	---	9.10	---	6.80
		Agriculture Canada, Morden	---	---	---	75.00
		Solicitor General, Rockwood	---	---	---	56.00
Ro-Neet 7.2 E	cycloate	Solicitor General, Rockwood	---	---	---	23.00

TABLE 46 (Cont'd.)

Trade Name	Generic Name	Department, Location	Quantity Purchased kg	Quantity Purchased L	Quantity Stored kg	Quantity Stored L
Roundup	glyphosate	Agriculture Canada, Brandon	---	13.65	---	6.00
		Agriculture Canada, Glenlea	---	4.00	---	---
		Agriculture Canada, Morden	---	40.00	---	---
		Agriculture Canada, Portage	---	4.00	---	2.00
		Environment Canada, Winnipeg (C.W.S.)	---	4.00	---	---
		Solicitor General, Rockwood	---	64.00	---	64.00
		National Defence, Beausejour	---	4.55	---	2.00
		National Defence, Portage	---	68.00	---	16.00
		National Defence, Shilo	---	---	---	52.80
		Health & Welfare, Winnipeg	---	80.00	---	40.00
Simmaprim 80W	simazine	National Defence, Winnipeg	22.70	---	11.40	---
		National Defence, Portage	68.10	---	50.00	---
Sodium TCA	sodium trichloroacetate	Solicitor General, Rockwood	---	---	---	64.00
Solan EC	pentanochlor	Solicitor General, Rockwood	---	---	---	6.00
Spike	terbuthiuron	National Defence, Shilo	---	---	---	955.50
		C.N.R. (C)	259.00	---	---	---
Stampede	propanil	Agriculture Canada, Brandon	---	260.00	---	200.00
		Agriculture Canada, Morden	---	68.25	---	---
		Solicitor General, Rockwood	---	---	---	45.00
Stanchem D&T LV ester	2,4-D & 2,4,5-T	Transport Canada, Churchill	---	137.00	---	137.00
Sweep	paraquat	Agriculture Canada, Morden	---	91.00	---	113.75
TCA solution	trichloroacetic acid	Solicitor General, Rockwood	---	40.00	---	40.00
TOK E-25	nitrofen	Solicitor General, Rockwood	---	---	---	1.00

TABLE 46 (Cont'd.)

Trade Name	Generic Name	Department, Location	Quantity Purchased kg	Quantity Purchased L	Quantity Stored kg	Quantity Stored L
Torch	bromoxynil octanoate	Agriculture Canada, Brandon	---	20.00	---	20.00
		Solicitor General, Rockwood	---	120.00	---	120.00
Torch & MCPA amine 80	MCPA & bromoxynil octanoate	Agriculture Canada, Portage	---	1.13	---	0.56
Tordon 10K	picloram	National Defence, Shilo	---	---	25.00	---
Totril	ioxynil octanoate	Solicitor General, Rockwood	---	---	---	5.00
Treflan (liquid)	trifluralin	Agriculture Canada, Morden	---	20.00	---	51.85
		Agriculture Canada, Portage	---	31.50	---	21.00
		Solicitor General, Rockwood	---	---	---	14.00
Treflan (granular)	trifluralin	Agriculture Canada, Glenlea	50.00	---	15.00	---
Ureabor	sodium metaborate tetrahydrate, sodium chlorate & bromacil	A.E.C.L., Pinawa	45.50	---	181.80	---
Weed-All	mecoprop & 2,4-D	National Defence, Winnipeg	---	---	0.90	---
Weed All Liquid & Compitox Plus	mecoprop & 2,4-D	Parks Canada, Riding Mountain	---	160.00	---	140.00

--- = None purchased or stored in 1982, or not applicable
(C) = Contracted Applications
A.E.C.L. = Atomic Energy of Canada Limited
C.N.R. = Canadian National Railway
D.R.E.E. = Department of Regional Economic Expansion
P.F.R.A. = Prairie Farm Rehabilitation Administration
C.W.S. = Canadian Wildlife Service

TABLE 47: INSECTICIDES PURCHASED AND STORED BY THE FEDERAL GOVERNMENT, INCLUDING CROWN CORPORATIONS AND CONTRACTORS, 1982

Trade Name	Generic Name	Department, Location	Quantity Purchased kg	Quantity Purchased L	Quantity Stored kg	Quantity Stored L
Abate	temephos	National Defence, Portage	---	---	160.00	---
Ambush 50 EC	permethrin	Agriculture Canada, Morden	---	0.25	---	1.00
		Agriculture Canada, Brandon	---	0.05		0.04
Ant & Grub Killer	chlordane	Agriculture Canada, Brandon	5.45	---	4.30	---
Atox (dust)	rotenone	Solicitor General, Rockwood	11.40	---	11.40	---
Baygon	propoxur	National Defence, Beausejour	---	---	---	364.00
		National Defence, Portage	---	---	---	728.00
		National Defence, Shilo	---	---	---	1638.00
		National Defence, Winnipeg	---	---	---	40.00
Belmark	fenvalerate	Solicitor General, Rockwood	---	1.00	---	2.00
		Agriculture Canada, Morden	---	---	---	1.00
Bovaid Ear Tags	fenvalerate	D.R.E.E., P.F.R.A., Brandon	1000 tags		---	---
Chlordane	chlordane	Solicitor General, Rockwood	---	---	---	23.00
		Agriculture Canada, Morden	---	---	---	4.55
		National Defence, Winnipeg	---	---	10.00	---
		National Defence, Portage	---	---	---	91.00
Co-Ral	coumaphos	Agriculture Canada, Brandon	---	224.00	---	224.00
		D.R.E.E., P.F.R.A., Brandon	---	91.00	---	91.00
Crawl-tox	propoxur	National Defence, Winnipeg	---	---	0.42	---

TABLE 47 (Cont'd.)

Trade Name	Generic Name	Department, Location	Quantity Purchased kg	Quantity Purchased L	Quantity Stored kg	Quantity Stored L
Cygon	dimethoate	National Defence, Winnipeg	---	---	0.22	---
		Agriculture Canada, Morden	---	2.00	---	2.00
Dasanit 15G	fensulfothion	Solicitor General, Rockwood	22.70	---	22.70	---
Dawson 73	ethylene dibromide & methyl bromide	Cdn. International Grains Institute	---	7.60	---	trace
DDVP	dichlorvos	National Defence, Winnipeg	4.10	---	3.10	---
DDT 5% powder	DDT	National Defence, Winnipeg	---	---	2.00	---
Deritox	rotenone	National Defence, Winnipeg	---	---	0.90	---
Diazinon	diazinon	Veterans Affairs, Deer Lodge (C)	---	10.00	---	---
		Veterans Affairs, Deer Lodge (C)	---	32.00	---	---
Diazinon 2% dust	diazinon	National Defence, Winnipeg	---	---	3.00	---
Diazinon 2%	diazinon	Solicitor General, Rockwood	22.70	---	22.70	---
Diazinon 50E	diazinon	National Defence, Winnipeg	---	---	---	40.00
		National Defence, Portage	---	9.10	---	2.27
Dicofol	dicofol	National Defence, Winnipeg	---	---	0.11	---
Drione	piperonyl butoxide technical, pyrethrins, amorphous silica aerogel	C.N.R. Winnipeg	7.02	---	4.20	---

TABLE 47 (Cont'd.)

Trade Name	Generic Name	Department, Location	Quantity Purchased kg	Quantity Purchased L	Quantity Stored kg	Quantity Stored L
Dursban 2E	chlorpyrifos	Agriculture Canada, Morden	---	---	---	13.65
Ficam D	bendiocarb	National Defence, Portage	4.00	---	4.00	---
		National Defence, Shilo	---	---	9.00	---
		National Defence, Winnipeg	---	---	20.00	---
Ficam W	bendiocarb	National Defence, Shilo	---	---	0.35	---
		National Defence, Winnipeg	---	---	1.50	---
		Solicitor General, RCMP (C)	---	15.20	---	---
		Health & Welfare, Winnipeg (C)	0.20	---	---	---
		A.E.C.L., Pinawa (C)	---	18.20	---	---
		Canadian Wheat Board (C)	---	18.20	---	---
Furadan solution	carbofuran	Agriculture Canada, Portage	---	2.27	---	---
Furadan 4.8 EC	carbofuran	Agriculture Canada, Morden	---	---	---	9.10
Furadan (granular)	carbofuran	Agriculture Canada, Glenlea	2.00	---	2.00	---
General Purpose Insecticidal spray	O-isopropoxyphenyl methyl carbamate, n-octyl bicycloheptane dicarboximide, piperonyl butoxide, pyrethrins	C.N.R., Winnipeg	---	544.00	---	428.00
Kelthane EC	dicofol	National Defence, Shilo	---	---	---	18.20
		National Defence, Winnipeg	---	---	---	10.50
		Agriculture Canada, Morden	---	8.00	---	13.65
Kelthane WP	dicofol	Agriculture Canada, Morden	---	---	3.64	---
		National Defence, Winnipeg	---	---	0.11	---

TABLE 47 (Cont'd.)

Trade Name	Generic Name	Department, Location	Quantity Purchased kg	Quantity Purchased L	Quantity Stored kg	Quantity Stored L
Konk	pyrethrins	Solicitor General, Rockwood	12 cans		6 cans	
Lignasan	carbendazim	Parks Canada, Lower Fort Garry	---	491.40	---	36.40
Lindane	lindane	Agriculture Canada, Morden	2.00	---	1.50	---
Liquid Insect Spray/ Formula 4F	piperonyl butoxide	National Defence, Portage	---	45.50		22.75 L
Malathion 50EC	malathion	Agriculture Canada, Glenlea	---	4.00	---	2.00
		Agriculture Canada, Portage	---	4.55	---	1.50
		Agriculture Canada, Morden	---	2.00	---	47.50
		Cdn. Intenational Grains Institute	---	2.27	---	1.00
		Parks Canada, Lower Fort Garry	---	4.55	---	1.13
		Solicitor General, Rockwood	---	32.00	---	32.00
		National Defence, Portage	---	---	---	107.00
		National Defence, Shilo	---	---	---	159.25
		National Defence, Winnipeg	---	113.75	---	22.22
		A.E.C.L., Pinawa	---	113.75	---	91.00
		Parks Canada, Riding Mountain	---	---	---	68.25
Malathion (domestic)	malathion	National Defence, Winnipeg	---	3.00	---	2.75
Malathion (granular)	malathion	Agriculture Canada, Morden	---	---	1.80	---
Mange Cure	fenthion	Agriculture Canada, Brandon, Animal Health	---	12.00	---	6.00
Methoxychlor	methoxychlor	National Defence, Winnipeg	---	---	---	189.00
Nicotine Fumigant	nicotine	Agriculture Canada, Winnipeg	16.38	---	2.52	---

TABLE 47 (Cont'd.)

Trade Name	Generic Name	Department, Location	Quantity Purchased kg	Quantity Purchased L	Quantity Stored kg	Quantity Stored L
Nicotine Sulphate	nicotine & sulphate	Solicitor General, Rockwood	---	---	0.11	---
Orthene 75P	acephate	Agriculture Canada, Brandon	0.50	---	0.75	---
Phostoxin	aluminum phosphine	Cdn. International Grains Institute	1660 pellets		1580 pellets	
Phosvel	leptophos	Agriculture Canada, Morden	---	---	---	31.85
Piromer 50W	pirimicarb	Agriculture Canada, Brandon	0.75	---	0.50	---
		Agriculture Canada, Morden	0.75	---	---	---
Plant Fume 103	sulfatepp	Agriculture Canada, Brandon	3.78	---	3.15	---
Potato Dust	sevin & zineb	National Defence, Winnipeg	---	---	1.00	---
Pyradee Insect Powder	DDT & pyrethrins	National Defence, Winnipeg	---	---	1.80	---
Pyrethrins	pyrethrins	National Defence, Winnipeg	---	---	0.45	---
Record Z	deet & related toluamides	C.N.R., Winnipeg	---	480.00	---	8.10
Resmethrin	resmethrin	Agriculture Canada, Morden	---	9.10	---	60.00
Riddex	piperonyl butoxide	National Defence, Winnipeg	---	---	---	180.00
Roach Doom	sodium fluoride	National Defence, Winnipeg	---	---	---	22.75
Ruelene	crufomate	DREE, PFRA, Brandon	---	91.00	---	91.00
		Solicitor General, Rockwood	---	---	---	1.00

TABLE 47 (Cont'd.)

Trade Name	Generic Name	Department, Location	Quantity Purchased kg	Quantity Purchased L	Quantity Stored kg	Quantity Stored L
Safer's Insecticidal Soap	potassium salt of fatty acids	Agriculture Canada, Brandon	---	4.00	---	4.00
Sanfax Liquid 580	malathion	Agriculture Canada, Brandon	---	---	---	50.00
Sangx-D-Pest	piperonyl butoxide D-trans allenthrins	National Defence, Winnipeg	---	---	3.60	---
Sapho	piperonyl butoxide, n-octyl bicycloheptane dicarboximide, pyrethrins	VIA Rail	76.80	---	61.44	---
Sevin 80P	carbaryl	Agriculture Canada, Morden	9.10	---	7.70	---
Tedion	tetradifon	National Defence, Shilo	---	---	---	2.27
Temik	aldicarb	Agriculture Canada, Winnipeg	45.50	---	38.60	---
Thimet	phorate	Solicitor General, Rockwood	9.10	---	9.10	---
Thiodan 4EC	endosulfan	Solicitor General, Rockwood	---	23.00	---	32.00
		Agriculture Canada, Portage	---	1.13	---	0.56
		Agriculture Canada, Morden	---	9.10	---	45.50

--- = None purchased or stored in 1982, or not applicable
(C) = Contracted Applications
A.E.C.L. = Atomic Energy of Canada Limited
C.N.R. = Canadian National Railway
D.R.E.E. = Department of Regional Economic Expansion
P.F.R.A. = Prairie Farm Rehabilitation Administration

TABLE 48: FUNGICIDES PURCHASED AND STORED BY THE FEDERAL GOVERNMENT, INCLUDING CROWN CORPORATIONS AND CONTRACTORS, 1982

Trade Name	Generic Name	Department, Location	Quantity Purchased kg	Quantity Purchased L	Quantity Stored kg	Quantity Stored L
Benlate	benomyl	Agriculture Canada, Morden	---	---	2.73	---
Benomyl	benomyl	National Defence, Shilo	---	---	---	0.56
Bravo	chlorothalonil	Agriculture Canada, Morden	---	---	---	4.55
Captan 50WP	captan	Agriculture Canada, Morden	15.00	---	15.90	---
		Agriculture Canada, Portage	0.45	---	0.15	---
		Solicitor General, Rockwood	---	---	5.00	---
		National Defence, Shilo	---	---	0.85	---
		National Defence, Winnipeg	---	---	1.81	---
Captan (Vita-Vax)	captan	Agriculture Canada, Morden	0.45	---	---	---
Copper Sulfate	copper sulfate	Parks Canada, Riding Mountain	---	---	1075.00	---
Cyprex	dodine	Agriculture Canada, Morden	9.10	---	20.00	---
Difolatan 4.8	captafol	Agriculture Canada, Morden	---	36.40	---	70.00
Dithane M-22	maneb	Solicitor General, Rockwood	---	---	93.00	---
Garden Fungicide	captan	Agriculture Canada, Winnipeg	0.90	---	0.45	---
Industrial Borax	borax	Solicitor General, Rockwood	---	---	45.00	---
		Parks Canada, Riding Mountain	---	---	181.80	---
Karathane WP	dinocap	Agriculture Canada, Morden	---	---	6.82	---
Lesan 35 WP	fenaminosulf	Agriculture Canada, Brandon	1.00	---	0.90	---
Maneb	maneb	Agriculture Canada, Winnipeg	0.25	---	---	---

TABLE 48 (Cont'd.)

Trade Name	Generic Name	Department, Location	Quantity Purchased kg	Quantity Purchased L	Quantity Stored kg	Quantity Stored L
Manzate 8% dust	maneb	Agriculture Canada, Morden	---	---	1.36	---
		Solicitor General, Rockwood	100.00	---	100.00	---
Mertect	thiabendazole	Agriculture Canada, Morden	---	---	---	12.00
Morestan	quinomethionate	Agriculture Canada, Morden	---	---	1.82	---
No-Damp	benzoate oxine	National Defence, Winnipeg	---	---	---	2.50
Phaltan WP	folpet	Agriculture Canada, Morden	3.00	---	1.82	---
Quintozene 75 WP	quintozene	Agriculture Canada, Brandon	1.36	---	1.25	---
Rovral 50 WP	iprodione	Agriculture Canada, Brandon	---	---	0.88	---
Tersan SP	chloroneb	Parks Canada, Riding Mountain	5.54	---	5.54	---
Tersan 1991	benomyl	Parks Canada, Riding Mountain	60.00	---	27.30	---
Tersan LSR		Parks Canada, Riding Mountain	---	---	81.80	---
Thiram 75 WP	thiram	Agriculture Canada, Morden	---	---	1.82	---
Thiram 80 WP	thiram	Agriculture Canada, Morden	1.00	---	---	---
Truban	etridiazole	Agriculture Canada, Morden	---	---	0.91	---
Zineb	zineb	Agriculture Canada, Morden	---	---	6.82	---

--- = None purchased or stored in 1982, or not applicable

TABLE 49: OTHER PESTICIDES PURCHASED AND STORED BY THE FEDERAL GOVERNMENT, INCLUDING CROWN CORPORATIONS AND CONTRACTORS, 1982

Trade Name	Generic Name	Type of Pesticide	Department, Location	Quantity Purchased kg	Quantity Purchased L	Quantity Stored kg	Quantity Stored L
A-Rest	ancymidol	growth inhibitor	National Defence, Shilo	---	---	---	1.13
Agrox NM	lindane & maneb	seed treatment	Solicitor General, Rockwood	---	---	6.80	
Avitrol	4-amino pyridine	avicide	Veterans Affairs, Deer Lodge (C)	23.60	---	---	---
			National Defence, Winnipeg (C)	18.40	---	---	---
			Canadian Wheat Board (C)	7.20	---	---	---
B-nine	daminozide	growth inhibitor	National Defence, Shilo (C)	---	---	---	0.56
			Solicitor General, Rockwood	---	4.00		4.00
Gopher Poison	chlorophacinone	rodenticide	Solicitor General, Rockwood	6 tins		12 tins	
MH 30 amine	maliec hydrazide	growth inhibitor	Solicitor General, Rockwood	---	114.00	---	137.00
Metaldehyde	metaldehyde	molluscicide	National Defence, Winnipeg	---	---	2.72	---
Prolin	warfarin & sulfa-quinoxiline	rodenticide	Solicitor General, Rockwood (C)	39.30	---	---	---
			Fisheries & Oceans, Winnipeg (C)	7.20	---	---	---
			Health & Welfare, Winnipeg (C)	17.60	---	---	---
			Canadian Wheat Board (C)	2.72	---	---	---
			C.N.R., Winnipeg (C)	9.12	---	---	---
			Transport Canada, St. Andrew's	4.54	---	2.27	---
Rodent Doom	chlorophacinone	rodenticide	Transport Canada, St. Andrew's	44.00	---	39.00	---
Rat Bait	chlorophacinone	rodenticide	National Defence, Portage	---	---	31.80	---
			National Defence, Portage	---	---	0.75	---

TABLE 49 (Cont'd.)

Trade Name	Generic Name	Type of Pesticide	Department, Location	Quantity Purchased kg	Quantity Purchased L	Quantity Stored kg	Quantity Stored L
Rat Kill	diphacinone	rodenticide	National Defence, Winnipeg	---	---	45.50	---
Slug-em	metaldehyde	molluscicide	National Defence, Winnipeg	---	---	0.22	---
Strychnine	strychnine	rodenticide	C.N.R., Winnipeg	18.30	---	9.85	---
			National Defence, Portage	---	---	2.50	---
Warfarin	warfarin	rodenticide	Agriculture Canada, Brandon, Animal Health	0.22	---	---	---
			C.N.R., Winnipeg	63.00	---	31.00	---
			National Defence, Portage	---	---	2.00	---

--- = None purchased or stored in 1982, or not applicable
(C) = Contracted Application
C.N.R. = Canadian National Railway

TABLE 50: RESPONSES TO QUESTION 1 ON LABELLING: HOW WOULD YOU RATE THE LABELLING INSTRUCTIONS WITH REFERENCE TO:

	Excellent	Good	Fair	Poor	No Comment
a) Use & Application Methods & Rates?	4 (14%)	10 (36%)	9 (32%)	3 (11%)	2 (7%)
b) Wind & Temperature Restrictions?	6 (21%)	8 (29%)	2 (7%)	4 (14%)	8 (29%)
c) Storage Restrictions?	3 (11%)	15 (54%)	6 (21%)	0 (0%)	4 (14%)
d) First Aid & Toxic Information?	6 (21%)	11 (40%)	4 (14%)	3 (11%)	4 (14%)
e) Rinse & Disposal Procedures?	4 (14%)	6 (21%)	5 (19%)	6 (21%)	7 (25%)

TABLE 51: RESPONSE TO QUESTION 2 ON LABELLING: THE SYMBOLS INDICATING THE DEGREE OF RISK AND HAZARD ON THE LABEL HELP ME TO USE THE PRODUCT SAFELY.

	# of Response	%
strongly agree	2	7
agree	12	43
no comment	8	29
disagree	6	21
strongly disagree	0	0
TOTAL	28	100%

TABLE 52: RESPONSE TO QUESTION 3 ON LABELLING: THE PEST CONTROL PRODUCTS I USE ARE LABELLED SUFFICIENTLY FOR SAFE USE.

	# of Responses	%
strongly agree	2	7
agree	16	57
no comment	9	32
disagree	1	4
strongly disagree	0	0
TOTAL	28	100%

TABLE 53: STORAGE INVENTORY RESULTS

1. Year to year storage: yes 30 (91%) no 3 (9%) total 33

2. Building types:

concrete	12 *+	(31%)	total 39
garage/maintenance shed	12	(31%)	
wood siding	6	(15%)	
lockers/cabinets	5	(13%)	
labs/fridges	4	(10%)	

* one was asbestos lined
+ one had a concrete floor & walls with a wooden roof (was part of a barn)

3. Ventilation: yes 30 (77%) no 9 (23%) total 39

if yes:* mechanically 20 (67%)
convection 18 (60%)
both 8 (27%)

* eight of the areas had both mechanical & convectional ventilation

4. Heated during Winter: yes 29 (74%) no 10 (26%) total 39

if no: explain 1) for three of the areas, heating is provided by the building the pesticides are contained in
2) one area was holding a pesticide for disposal therefore heating was not necessary
3) for four of the areas, the pesticides are transferred to a winter shed for overwinter storage
4) some pesticides are kept in fridges (two areas)

5. Locked: yes 35 (90%) no 4 (10%) total 39

if yes: after working hours 13 (37%)
at all times 22 (63%)

6. Access: 1:6 (15%) 2-4:17 (44%) 5-8:9 (23%) 9 or more:7 (18%) total 39

TABLE 54: DISPOSAL INVENTORY RESULTS

A) PESTICIDE RESIDUES:

		%
Stored	8	28
Used	15	52
Incinerated	2	7
Burned in Open	1	3
Flushed into Septic System	1	3
Thrown Away with Container	2	7
TOTAL	29	100

B) CONTAINERS:

		%
Municipal Waste Disposal Ground	14	48
Local Government District Waste Disposal Ground	1	3
Landfill	6	21
Stored	3	11
Incinerated	2	7
Punctured	1	3
Given to Hygiene Department	1	3
Returned to Manufacturer	1	3
TOTAL	29	99*

*error accounted for in rounding off the percentage values

C) PRETREATMENT:

		%
Rinse Yes	13	43
No	10	33
Sometimes	2	7
Crush Cans	2	7
N/A	3	10
TOTAL	30	100

*note: one department rinsed and crushed the containers.

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CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

The primary objectives of this study were to:

a) identify the various federal departments and Crown corporations which use pesticides in Manitoba,

b) catalogue the types and amounts of pesticides which they use,

c) document use, storage and disposal practices, and

d) document other information which became available through the course of the study.

Fourteen federal departments and Crown corporations were found to be users of pesticides in Manitoba. These federal agencies did not follow a uniform procedure in purchasing pesticides. This lack of uniformity is reflected in the fact that accurate records of pesticide purchases were not readily found. Larger purchases are made through Supply and Services Canada which is an accessible source for records. However, many purchases are not made through this channel and records are difficult to find if they exist at all. The problem of access to information is compounded by the fact that a number of departments employ independent contractors to apply pesticides. The staff of this project were required to canvas a number of independent contractors to discover what quantities of what chemicals had been applied to federal land. The departments do file annual proposed use of pesticides with Environment Canada. However, there was great disparity between proposed and actual use. Therefore, I recommend that:

1) the Environmental Protection Service adopt record keeping as developed by this project to maintain continuous records on the types and quantities of pesticides actually being used by the federal government.

The intitial research has been completed; maintenance of this inventory would be neither time consuming nor costly.

The federal government uses pesticides for a number of reasons which have been indicated in this study. No ongoing assessment has been undertaken for the need or impact of that use. Some of the reasons are economic, for example the spraying of community pastures. In many instances, pesticides are used for nuisance abatement (biting flies) or for aesthetic purposes. These uses may not be justified in terms of possible effects on human health and environment. Therefore I recommend that:

2) the Environmental Protection Service develop a program to ensure that pesticide use by federal departments and agencies is adequately assessed.

Environment Canada clearly has a mandate to develop such a program under Part III of the Government Organization Act. I would suggest that EPS co-ordinate these activities associated with the use of pesticides. Where pesticide use may not be fully justified EPS should provide pertinent information to the Federal Inter-departmental Committee on Pesticides (FICP), particularly in recommending alternative methods. Therefore I recommend that:

3) the EPS actively promote Integrated Pest Management.

Integrated Pest Management, which involves the use of alternate methods of pest control in addition to pesticides, is discussed in Chapter 2.

Lack of uniform procedures in the use of pesticides by the federal government was also reflected in the way pesticides are applied and the qualifications of the individual applicators. While I found the applicators of pesticides to be generally conscientious, many were untrained in pesticide application and uninformed about the hazards associated with pesticide use. Although some departments and agencies have broad internal guidelines for the application of pesticides, there is no general instruction available for most departments and agencies. The federal government should have uniform policies and guidelines for all departments which apply pesticides. Therefore I recommend that:

> 4) the EPS co-operate with pertinent departments and agencies in the development of guidelines and training programs for federal employees and agents who apply pesticides.

The province of Manitoba's Department of Agriculture conducts a course for applicants for a commercial applicator's licence under the Pesticides and Fertilizers Control Act. Similarly, Canadian Forces Base Winnipeg has held a seminar for grounds maintenance personnel. The development of this recommendation would complement existing activities in this area.

As part of the assessment of the availability of information for applicators, interviewees were asked for their opinions on the efficiency of labelling. Thoughtful answers revealed numerous practical difficulties associated with pesticide labels and the information they contain. However, I believe that these difficulties do not exist in labelling but rather in the concept of labelling. A label fixed to a container is simply an inappropriate place to attempt to com-

municate a large and complex amount of information. The nature of a label attached to a container makes itself difficult to read, likely to be ignored and prone to damage or destruction. The amount of information required necessitates small print. Many interviewees were simply unaware of the fact that labels contain as much information as they do. Most of the concerns discussed above are subject to regulation through the requirements placed upon the labelling of pesticides by the Pest Control Products Regulations. Despite these weaknesses in labelling I do not recommend changes in the labelling regulations. However I do recommend that:

5) information which expands upon that to be found on the label be supplemented with separately available instructions. In particular this information should be developed in the areas of:

   a) toxicological and first aid information, and
   b) health and environmental hazards associated with pesticide use.

Such information could be made available through the manufacturers of pesticides or through retail outlets. At present the province of Manitoba publishes a Guide to Chemical Weed Control and a Guide to Insect Control. Access to these publications is limited as cost of publication prohibits general distribution. In the future this information could be made available through computer information retrieval systems.

Supplemental information on toxicology and first aid is imperative. This information should be directed towards physicians in particular. Agriculture Canada's Compendium of Pest Controls Products is not structured to assist physicians in the treatment of patients who have been poisoned by pesticides.

More generally supplemental information is needed on the nature of health and environmental hazards associated with pesticide use. Currently the Pest Control Products Regulations contain requirements concerning precautionary symbols and degree of hazard symbols. The symbols indicating poison, flammability, explosiveness and corrosiveness are well known to most people. However, the degree of hazard symbols, an octagon for danger, a square turned on one corner for warning, and a triangle for caution are not well understood. In fact any distinction between the terms danger, warning and caution is at best very subtle. In addition these symbols have been attached to certain properties or levels of toxicity demonstrated by pesticides. For example, an acute oral LD_{50} of less than 500 mg/kg presents a danger, while an acute oral LD_{50} of 500-1000 mg/kg deserves a warning, and an acute oral LD_{50} of 1000-2500 mg/kg deserves caution. These boundaries and the symbols associated with them may make sense to the drafters of the regulations and the manufacturers of pesticides, but I believe they are alone in this understanding. For the average pesticide user the distinction between danger, warning, and caution appears to be almost useless. Therefore, it is necessary that the significance of these distinctions and the differing degree of hazard they represent must be made clear to the applicators of pesticides.

It was discovered in the study that metric conversion has caused considerable confusion in using and applying pesticides. This arises in part from lack of familiarity with metric units and mistakes associated with actual conversion. A number of approaches could be made to this problem, including metric conversion

charts, but the most practical approach may be through recalibration of equipment. Therefore I recommend that:

6) the Environmental Protection Service encourage departments and agencies to convert applicating equipment to metric units.

The capital costs may be higher than supplying metric conversion charts, but metric conversion will be served most safely and compulsory conversion to metric would be expediated.

Storage of pesticides poses particular problems, especially where large volumes or a variety of pesticides are stored. Particular deficiencies were identified, such as lack of ventilation and temperature control and inadequate packaging of pesticides. In addition to hazards, considerable degradation takes place. I found a lack of uniformity in disposal of pesticides containers, residues and degraded chemicals. This problem is not unique to the federal government. The Environmental Protection Service does provide, in co-operation with the province, advice and co-ordination for actual disposal. Not all departments make use of or are aware of this. Therefore I recommend that:

7) the Environmental Protection Service develop guidelines for inventory control and storage of pesticides.

Particular storage problems arise in the case of pesticides which are no longer being used or have degraded to such an extent that they cannot be used. Naturally these pesticides will be disposed of but those departments which are storing them are unaware of methods of disposal.

More generally, the disposal of empty pesticide containers and pesticide residues remains a problem for all pesticide users. The government of Manitoba is currently developing a container disposal program for pesticide users throughout the province and is developing a program for hazardous and special wastes. The Environmental Protection Service has already expressed interest in these programs. When this situation is multiplied by the number of pesticide users in the private sector, disposal of pesticide containers and residues becomes an obvious concern. Therefore I recommend that:

8a) the Environmental Protection Service encourage the province to develop hazardous waste disposal facilities, and

8b) the Environmental Protection Service encourage federal departments and agencies to use existing accepted procedures and methods of disposal, and encourage co-operation with provincial counterparts as the provincial programs develop.

The principal recommendation of this study concerns the lack of instruction and guidance available to pesticide applicators. This covers not only the federal government's, but every facet of pesticide use.

APPENDIX G

LEGISLATIVE REVIEW

By Michele Taylor and Bruce Bowman

CONSTITUTIONAL JURISDICTION AND ENVIRONMENTAL MANAGEMENT

Environmental management of pesticides is a general category which includes the control by government of the manufacture or importation, the distribution, and the use of pest control products in Canada. To explain how constitutional jurisdiction relates to pesticide control, or any form of environmental management, it is necessary to treat the British North American Act in general terms rather than in specific environmental terms.[1] The discussion which follows will not deal directly with environmental matters; instead it will involve a variety of judicial decisions which have formed the history of constitutional law in Canada. Few of these cases have involved environmental matters. Nevertheless, they illustrate general principles in Canadian constitutional law which may be applied to environmental subjects.

The legislative jurisdictions of the federal and provincial governments are defined in sections 91 and 92 of the British North America Act. Many environmental subjects fall within both federal and provincial jurisdiction due to the lack of specific information concerning environmental matters. For example, forestry is subject to both federal and provincial legislation. The provinces are empowered to make laws on,

> The Management and Sale of the Public Lands belonging to the Province and of the Timber and Wood thereon.[2]

However, the federal government is able to conduct research on provincial forest resources through its responsibility for "Statistics".[3] Research on forest resources is conducted by the Canadian Forestry Service, whose function is described in the Government Organization Act.[4]

Fisheries is another environmental subject which falls under both federal and provincial control. The British North America Act grants provincial legislatures the power to make laws in relation to, "Property and Civil Rights in the Province."[5] Fisheries may therefore be considered a provincially owned natural resource. The federal government, however, is empowered to make laws respecting, "Sea Coast and Inland Fisheries."[6] As a result, the federal government controls the regulatory aspects of fishing, such as the regulation of fishing seasons and the methods of fishing.

Mining is similar to forestry in that the federal jurisdiction over "Statistics" applies to provincial land resources.[7] Thus research conducted by the federal department of Energy, Mines, and Resources affects provincial mining industries despite the provinces' proprietary rights over land.

According to Gibson in "Constitutional Jurisdiction Over Environmental Management in Canada" it is possible in some circumstances for either of the two levels of government to give to the other a responsibility that normally falls under its own jurisdiction.[8] In Prince Edward Island Potato Marketing Board v. Willis, a 1952 decision of the Supreme Court of Canada, it was held that the legislature of one government was allowed to confer authority on the administrative officers of the other government.[9] However in 1951 the Supreme Court

had ruled that the direct delegation of authority from one government to another is not possible.[10] Environmental management might make good use of flexibility of this nature in the constitutional allotment of responsibilities.

Interjurisdictional immunity exists when the laws of one level of government are not applicable to the activities of the other level of government. For example, environmental conservation laws of one level of government might not apply to the other level of government. Such immunity may also apply to non-governmental agencies or persons who operate under the legislative control of an immune level of government. Several decisions in lower courts have upheld the validity of provincial and municipal environmental legislation except when it attempts to control federal works or persons under federal control.[11] Similarly, in 1960 the Ontario High Court held in Ottawa v. Shore and Horwitz Construction Co. that a contractor building for the federal government on Crown land did not need a building permit or have to obey local building restrictions.[12] However, an 1899 decision of the Privy Council, C.P.R. v. Notre Dame de Bonsecours, said that exemptions of this kind should not be allowed as long as the provincial laws in question do not interfere substantially with federal enterprises or persons.[13] A recent decision of the Supreme Court, Cardinal v. A.-G. Alta. is one of a few later cases which have agreed with this point of view.[14]

Interjurisdictional immunity can also occur when provincial legislation on a certain subject is inconsistent with corresponding federal legislation. For example, any inconsistency between federal agricultural legislation and provincial agricultural legislation renders the provincial legislation invalid to the extent of the inconsistency.[15]

The opening words of section 91 of the British North America Act empower the Parliament of Canada to,

> ...make Laws for the Peace, Order and good Government of Canada, in relation to all Matters not coming within the Classes of Subjects, by this Act assigned exclusively to the Legislatures of the Provinces.[16]

The courts' interpretations of this clause have been sketchy and varied. In general, there have been three tests applied to legislation to determine whether it is justified by the Peace, Order and good Government clause. These three tests are the "gap" test, the national dimensions test, and the emergency test. All three tests could apply to environmental legislation.

One function of the Peace, Order and good Government clause is to fill gaps in the distribution of powers to the federal Parliament and the provincial legislatures. For example, the Official Languages Act, which guarantees the equal status of French and English in Parliament and the federal government, was held to be valid by the Supreme Court in Jones v. A - G New Brunswick.[17] Chief Justice Laskin agreed that since federal institutions and agencies are "clearly beyond provincial reach" they must come under federal jurisdiction by virtue of the Peace, Order, and good Government clause. There is, in fact, nothing in the British North America Act which gives the responsibility of regulating federal agencies to either level of government. The case was one of simply filling a gap in jurisdiction.

The second test is the national dimensions test. One might infer from the Canada Temperance and Local Prohibition cases that the importance of a subject,

such as alcohol, determines its national dimensions.[18] In both of these cases national dimension was used in the geographical sense of being of concern to all of Canada. There are matters where uniformity of law throughout Canada is necessary since the provinces alone cannot effectively deal with them.[19] For example, an epidemic could not be effectively prevented unless uniform measures were adopted in all areas of the country. There are many environmental problems which should be dealt with along similar lines.

The third test is the emergency test. A true emergency would certainly justify the federal government in exercising the Peace, Order and good Government power. In fact, the emergency test has a long history of use as a criterion for judging the use of the Peace, Order, and good Government clause. The test was invoked a few times by the Privy Council between 1911 and 1928, a period in which the national dimensions test was ignored. Using a strict interpretation of what constitutes an "emergency", these decisions had the effect of restricting federal power.[20] The national dimensions test reappeared briefly in the Aeronautics Reference in 1932.[21] However, it was the emergency test which came to be applied to the social and economic reform statutes of the 1930's.[22] The Privy Council did not address the question of whether these statutes pertained to a matter of national dimensions, namely the Depression. Most of the statutes were held to be invalid on the basis of the emergency test.

In 1951 the emergency test was applied to invalidate a federal prohibition on the manufacture and sale of margarine.[23] Conversely the War Measures Act, which was proclaimed into force for both world wars and in October 1970, satisfied the emergency test as an exercise of the Peace, Order, and good Government

clause. In addition the Supreme Court upheld the Anti-Inflation Act in 1976 as a valid emergency measure taken by the federal government.[24] However, the Act itself did not state that an emergency existed. But, Chief Justice Laskin stated that the Court,

> ...would be unjustified in concluding, on the submissions in this case and on all material put before it, that the Parliament of Canada did not have a rational basis for regarding the Anti-Inflation Act as a measure which, in its judgment, was temporarily necessary to meet a situation of economic crisis imperilling the well-being of Canada as a whole and requiring Parliament's stern intervention in the interests of the country as a whole.[25]

This statement places upon the opponents of legislation the burden of proving that Parliament did not have a "rational basis" for its belief in a state of emergency. Furthermore, the statement denies any judicial obligation to decide whether or not an emergency exists.

At the time of an environmental crisis Parliament may have a "rational basis" for regarding legislation as temporarily necessary to meet an emergency. As P.W. Hogg points out, the courts cannot definitively research the social and economic conditions of Canada in order to pass judgment on the validity of legislation.[26] In addition, due respect for the government's judgment which led to the legislation is demanded by judicial restraint. Hogg claims that the Anti-Inflation Reference entails great difficulty for anyone who wants to challenge federal legislation on the ground that an emergency does not exist.[27]

It should be noted that the emergency power of the federal government will justify only temporary measures. This fact has important consequences for

programs of prevention which would require permanent changes in the structures which created an environmental emergency or in which the emergency was possible.

Despite the fact that many difficulties have been foreseen in the preceding discussion there has never been any judicial doubt that both federal and provincial governments may validly legislate in relation to water, noise and air pollution. The only Supreme Court decision which constitutionally considers modern environment legislation is Interprovincial Co-op Ltd. v. R.[28] Here it was held that both federal and provincial legislation which is apparently similar may operate unless there is a real conflict. It is interesting to note that Gibson expects that the Peace, Order, and good Government power would be effective in pollution control under the national dimensions criterion.[29] There is no doubt that the use of chemical pesticides can pose a threat of pollution of national dimensions. Nevertheless, s.95 of the British North America Act specifically provides that both provincial legislature and the Parliament of Canada may make laws in relation to Agriculture. Thus when pesticides are used in agriculture there is dual jurisdiction. This dual jurisdiction is more clearly defined in the following discussion of legislation which controls the use of pesticides.

LEGISLATIVE CONTROL OF PESTICIDE USE

In the area of law concerning pesticides, the central federal statute is the Pest Control Products Act.[30] This Act and the regulations made under it govern the manufacture, storage, display, distribution, sale and use of pest control products in Canada. The Act is largely concerned with the process by which pest control products are registered. The administration of this process

is the responsibility of the Minister of Agriculture.

The Pest Control Products Act defines "control product" as:

> ...any product, device, organism, substance or thing that is manufactured, represented, sold or used as a means for directly or indirectly controlling, preventing, destroying, mitigating, attracting or repelling any pest, and includes (a) any compound or substance that enhances or modifies or is intended to enhance or modify the physical or chemical characteristics of a control product to which it is added, and (b) any active ingredient used for the manufacture of a control product.[31]

A "pest" is defined as:

> ...any injurious, noxious or troublesome insect, fungus, bacterial organism, virus, weed, rodent or other plant or animal pest, and includes any injurious, noxious or troublesome organic function of a plant or animal.[32]

Despite the broad definition of "control product" in the Pest Control Products Act, certain control products are exempt from registration. Section 3 of the Regulations exempts certain control products which are subject to the Food and Drugs Act and only used for:

> (i) The control of viruses, bacteria or other micro-organisms on or in humans or domestic animals,
>
> (ii) The control of arthropods on or in humans, livestock or domestic animals if the control product is to be administered directly and not by topical application,
>
> (iii) The control of micro-organisms on articles that are intended to come directly into contact with humans or animals for the purpose of preventing or treating disease when associated with medical care,
>
> (iv) The control of micro-organisms in premises in which food is manufactured, prepared or kept, or
>
> (v) The preservation of food for humans during cooling or processing.[33]

Also exempt from registration by virtue of this section are control products which are devices other than those of a type and kind listed in Schedule I of the Regulations. Schedule I includes such things as garment bags, cabinets or chests sold to protect clothing from pests, apparatuses which attract and destroy flying insects, devices which repel insects by causing physical discomfort, garden hose attachments which dispense control products, devices which automatically dispense control products, and devices which are used with cyanide to control animal pests. All of these devices must be registered.

Section 5 of the Regulations exempts from registration control products which are used for research purposes. However, a permit to do the research may be required unless:

(1) The use is confined to the premises owned or operated by a research establishment; or,

(2) All of the following conditions are met for research carried out on premises not owned or operated by the researcher.

(a) The total research commitment of the new product or use under the direction of the researcher is less than one percent of the total treated crop, commodity, or structure owned or operated by the person on whose premises the research is being carried out, and does not involve a land area in excess of one acre;

(b) The research is not associated with or adjacent to
(i) areas where feed or food is stored, manufactured, or prepared
(ii) public places such as parks, theatres, etc.
(iii) bodies of water, forest lands or other areas particularly sensitive to environmental impact;

(c) The treated material from research programs is not to be used for food without approval from the Additives and Pesticides Division, Health and Welfare Canada;

(d) The treated material from research programs is not to be used for feed without prior approval from the Pesticides Section, Agriculture Canada.[34]

The purpose of a research permit is to allow the development of data which can be used by the registrant to support registration. Research done by Agriculture Canada would satisfy the above conditions and thus a permit would not be required.

Also exempt by section 5 of the Pest Control Products Regulations are products the primary purpose of which is not controlling pests, but which are represented as having such properties. These products are listed in Schedule II and include such things as feed for animals, fertilizers and seed.

Section 7 of the Regulations prescribes the information to be contained in an application for a certificate of registration. Required information includes the name of the active ingredient, content by percentage weight and the specifications of each such ingredient. Also required is a description of the package in which the product is to be sold and the guarantee statement. Section 9(1) provides that the applicant will also provide the Minister with such further information as is necessary to "determine the safety, merit and value of the control product". The results of scientific investigations required from the applicant are itemized in s. 9(2) (Appendix H). These results are only required where the ingredient has not previously been assessed or evaluated. The scientific investigations are numerous and focus upon the effectiveness of the control product and its safety. The applicant may be required to provide a sample of the control product (s. 11). It is also necessary that the application for registration be accompanied by five copies of the proposed label for the control product (s. 10).

All of the above information having been provided, it will be recorded in the register of control products (s. 13). However, section 17 allows that the Minister may refuse to register a control product if the application does not comply with regulations, if the information is insufficient for assessment, if the applicant does not establish that the control product has merit or value, or if the control product would lead to an unacceptable risk of harm to public health, plants, animals, or the environment. Similarly, section 18 and section 19 allow for the cancellation or suspension of registration. It is this power to refuse or cancel registration that is the central strength of the Pest Control Products Act. In section 4 of the Act itself, the importation or sale of unregistered control products is prohibited.

In the event of a refusal to register by the Minster, or a cancellation or suspension of registration, the applicant may under Section 22 of the regulations apply for a hearing. The Minister will then appoint a Review Board to deal with the matter.

In section 26 to 40 of the Regulations, strict requirements with respect to the labelling of control products are set out. (Appendix I). There are two product class designations, one of which will be required to appear in capital letters on the label: "RESTRICTED" or "DOMESTIC". Other appropriate class designations may also be acceptable where the product is intended for commercial activities.

Restricted control products are those which the Minister, in his concern for the health of man or the safety of plants, animals, or the environment, has set

forth additional conditions to be shown on the label respecting the distribution and use of the product. Thus the availability of extremely hazardous products is limited to situations where they can be used safely. The hazard may be the result of the product's inherent toxicity or the result of the product's use in sensitive environmental areas. For example, control products used in aquatic and forestry situations are necessarily classified Restricted. Problems may arise where the characteristics of a product suggest a commercial classification, but the product may have some applications in a restricted use situation. Examples of such products are simazine and dalapon which have minor aquatic applications. The registrant is thus presented with the problem of an essentially commercial product being classified as restricted. This problem may be circumvented by registering the product as both a commercial product and a restricted product separately, or by simply deleting the use that is restricted from the label.

Domestic control products are those products which are intended for use in and around a dwelling. Commercial control products are those products which are intended for general use in commercial activities specified on the label.

Some chemical pest control products cannot be recognized because of their chemical properties. If such a product is likely to expose a person or domestic animal to a severe health risk, section 41 of the Regulations provides that it shall be denatured by means of colour, odour, or other means approved by the Minister to warn of its presence.

The storage of control products is regulated under section 42 of the Regulations. In particular, those control products which are marked with the poison symbol superimposed on the danger symbol are to be stored apart from food for humans or feed for animals. Other requirements for storage may be placed upon the label.

The emphasis placed upon labelling by the Regulations is concluded by the requirements in sections 43 and 44 that the distribution and use of a control product must be consistent with the conditions, directions, or limitations on the label.

General requirements concerning the design and construction of pest control product packages are set out under section 45. Standards concerning the product itself exist in sections 46 and 47:

> 46. Every control product shall conform to the specifications and bear the label contained in the register of control products.
>
> 47. Every control product shall have the chemical and physical composition and uniformity of mix necessary for it to be effective for the purposes for which it is intended.

Further general prohibitions concerning the manufacture and labelling of control products appear in sections 48 through 50. Inspectors are empowered to take samples of a control product and to seize and detain it if necessary pursuant to sections 51 through 53.

Sections 54 to 57 deal with the importation of control products into Canada. These regulations are of particular importance since most control products are

manufactured outside Canada. A collector of customs is empowered to hold the control product at the port of entry if he is not satisfied that the importer's declaration is complete and in order. The declaration must contain such information as the name and amount of the active ingredient in the control product and the purpose for which it is being imported. As previously mentioned, the Pest Control Products Act itself prohibits the importation of a control product that is not registered.

Schedule III of the Regulations prescribes the form of precautionary symbols and signal words. For the degree of hazard, symbols exist for "danger", "warning", and "caution". For the nature of hazard, symbols exist for "poison", "corrosive", "flammable" and "explosive". The appropriate nature of hazard symbol must be superimposed on the appropriate degree of hazard symbol on the label of the control product (Appendix J).

Since the publication of the consolidation of the Pest Control Products Regulations in 1978, there have been a number of amendments to the Regulations. SOR/79-180 concerns the expiration and renewal of registration. However, this amendment also adds two subsections to section 47 of the Regulations:

> (2) No control product containing 2,4,5-T (2,4,5-trichlorophenoxy acetic acid) as its active ingredient or containing an active ingredient based on or derived from 2,4,5-T shall contain 2,3,7,8-tetrachlorodibenzo-p-dioxin in excess of 100 parts per billion parts of 2,4,5-T.
>
> (3) No control product containing fenoprop (2,4,5-trichlorophenoxy propionic acid) as its active ingredient or containing an active ingredient based on or derived from fenoprop shall contain 2,3,7,8-tetrachlorodibenzo-p-dioxin in excess of 100 parts per billion parts of fenoprop.

SOR/80-628 adds to Schedule II of the Regulations certain products which are exempt from registration. Included are water conditioners containing 60% or less copper sulphate, cleansers that contain chlorinating compounds in dry formulations for household use, and bleaches that contain sodium hypochlorite for household use. These regulations also prescribe the hazard symbols to be placed on the various concentrations of these compounds.

SOR/81-187 revokes section 5(2) of the Regulations and substitutes the provision that a control product is exempt from registration if:

> (a) it is a control product, other than a live organism or other than 2-4-D, also known as 2,4-dichlorophenoxy acetic acid, that is used only in the manufacture of a registered control product and conforms to the relevant specifications of that registered control product set forth in the register of control products.

SOR/82-591 revokes subsection 47(1) of the Regulations already amended by SOR/79-180, and substitutes:

> "47(1) subject to subsections (2), (3), and (4), every control product shall conform to the specifications and bear the label contained in the register of control products."

Further section 47 is amended by adding the following subsection:

> "(4) No control product containing trifluralin (2,6-dinitro-N,N-dipropyl-4-trifluromethylaniline) as its active ingredient or containing an active ingredient based on or derived from trifluralin shall contain N-nitrosodi-n-propylamine (NDPA) in excess of 1 part per million parts of trifluralin."

The Pest Control Products Act makes a violation of the above Regulations or the Act an indictable offence punishable by imprisonment for two years or an

offence punishable on summary conviction.[35] Section 10(2) creates vicarious liability for an employer for the acts of agents or employees. This section also makes it clear that the offence is one of strict liability. The accused may only escape liability by proving "that he exercised all due diligence" to prevent the commission of the offence.[36]

The Act defines two specific offences regarding "Transactions Respecting Control Products" in sections 3 and 4. Section 3(1) states:

> 3(1) No person shall manufacture, store, display, distribute or use any control product under unsafe conditions.[37]

These "unsafe conditions" are defined in section 3(3) as conditions contrary to those prescribed by the Regulations. Dealing with the importation and sale of pest control products, section 4(1) states:

> 4(1) No person shall import into or sell in Canada any control product unless such control product,
>
> (a) has been registered as prescribed;
>
> (b) conforms to prescribed standards; and
>
> (c) is packaged and labelled as prescribed.[38]

The export of control products is dealt with similarly in section 4(2).

It is important to note that the Pest Control Products Act was not binding on the Crown until 1982. In the 1979 case of R v. Forest Protection Ltd., the New Brunswick Court of Appeal held that a servant of the Crown was immune from prosecution under the Act.[39] The accused, Forest Protection Ltd., was a

servant of the Provincial Crown spraying New Brunswick forests for spruce budworms and was charged with a number of offences. Among these offences were violations of section 3(1) of the Pest Control Products Act by spraying under "unsafe conditions", and violations of section 44(1) of the Regulations by using a control product in a manner inconsistent with the directions on the label. In allowing the appeal against conviction under these sections, Mr. Justice Hughes stated:

> The Pest Control Products Act and Regulations made thereunder are not made applicable to the Crown either in the right of Canada or of a Province. Accordingly, I am of the opinion that the Crown in the Right of the Province of New Brunswick is not bound thereby, and that F.P.L. which I found to be a servant of the Crown is also not bound by the Act when it acts in the course of its employment and within the scope of its authority as a servant of the Crown.[40]

Because federal and provincial authorities are large users of pesticides, this decision was of great importance. It significantly limited the effectiveness of the Pest Control Products Act. However, effective May 31st, 1982, Section 2 of the Pest Control Products Acts was amended to be binding on Her Majesty in Right of Canada or a province and any agent thereof.

Provincial legislation also plays a role in regulating the distribution and sale of pesticides. In Manitoba this legislation takes the form of The Pesticides and Fertilizers Control Act.[41] This Act deals with the licensing of distributors and commercial applicators of pesticides and fertilizers. For the purposes of the Act, section 1(d) defines "pesticide" as:

> ...a product or device registered under the Canada Pest Control Products Act and represented as a means for preventing, destroying, mitigating, or controlling directly or indirectly,

> and insect, fungus, bacterial organism, virus, weed, rodent or other plant or animal and is recommended for use by the Province of Manitoba.[42]

The Act prohibits the sale, distribution, or commercial application of pesticides or fertilizers without first obtaining a licence from the Minister of Agriculture for that purpose. The forms of applications for licences are prescribed by the regulations. The Act also requires that a person applying for a licence must have a "valid and subsisting liability insurance policy in an amount acceptable to the Minister".[43]

The Pesticides and Fertilizers Control Act also provides for the appointment of inspectors who among their other powers may inspect plants or plant products and livestock or livestock products for the purpose of determining whether or not they are contaminated with pesticides or fertilizers. The inspectors may cause scientific or chemical analysis to be done. If the material is found to be contaminated, section 4(2) provides that, if the contamination is to a degree that it is considered harmful to the health of people or livestock, the material may be ordered to be destroyed. If necessary, section 4(4) allows for the banning of the use of any pesticide or fertilizer in Manitoba. Thus the situation may arise where a control product is registered and approved by the federal government, but is prohibited by the provincial government.

Violation of any provision of the Act, or opposing an inspector in the enforcement of the Act or regulations, is an offence by virtue of section 7(1). The accused may be liable on summary conviction to a fine of not less than $100.00 or more than $1,000.00, or to imprisonment for a term of not less than 60 days or more than 6 months, or to both such fine and imprisonment.[44]

Regulations under The Pesticides and Fertilizers Control Act provide under section 4(1) for two classifications of licences.[45] Class I includes licences for the retail sale of pesticides classified as "commercial" or "restricted" under the Pest Control Products Act. Class II includes licences for the application of the same pesticides if designated as:

(a) agricultural pest abatement; or
(b) non-agricultural pest abatement; or
(c) structural pest abatement and product fumigation; or
(d) landscape and garden pest abatement.

It is important to note that a Class II licence is only required for a commercial application of pesticides. The Act defines "commercial applicator" in section 1(a) as:

> a person whose application equipment is used for hire or for service to others for a fee, charge or other valuable consideration to the extent of 50% or more of the annual usage of that application equipment.[46]

The Regulations also provide that a person desiring to obtain either a Class I or Class II licence may be required to attend a course respecting the use and control of pesticides or satisfy the Minister that he is a person qualified in the use and control of pesticides (s. 5). Every person holding a licence under the Act is also required to keep records of sales and applications. The information to be included in these records is outlined in section 6 of the regulations.

Certain pesticides and fertilizers are exempt from The Pesticides and Fertilizers Control Act's definition of "pesticide" in section 8 of the Regulations:

(a) All pesticide products classified as "Domestic" under the Pest Control Products Act (Canada);

(b) All fertilizers; and

(c) Any product or substance that is designed primarily as an animal repellent, anti-microbial, bactericide, fabric protectant, feed preservative, pruning paint, slime control agent or wood preservative.

Aside from Canada's Pest Control Products Act and Manitoba's The Pesticides and Fertilizers Control Act, a variety of other federal and Manitoba legislation affects the use of pesticides.

Federally, the Fertilizer Act and the Feeds Act provide that fertilizers and feeds which are registered under the respective acts and contain control products as defined in the Pest Control Products Act shall in prescribed circumstances and subject to prescribed conditions, be deemed to be registered under that Act as well.[47]

The Food and Drugs Act prohibits the sale of an article of food that "has in or upon it any poisonous or harmful substance".[48] Complementary to this provision is the Pesticide Residue Compensation Act.[49] Section 3 of that Act provides that if a food product contains a pesticide residue which would make the sale of that product contrary to the Food and Drugs Act the Minister of Agriculture may pay to the farmer compensation for any loss occasioned by reason of the residue. However, the presence of the residue must not be due to the farmer's own fault. By virtue of section 5, the farmer must mitigate the loss by taking such action as ordered by the Minister, including any possible legal action against the manufacturer.

Gas pipe-line Regulations under the National Energy Board Act prohibit the use of pesticides by federally regulated gas pipe-line companies without approval of the National Energy Board.[50]

LEGISLATION MAKING THE USE OF PESTICIDES COMPULSORY

While no legislation actually makes the use of pesticides mandatory, a number of statutes do have that effect. A variety of statutes require the eradication of certain pests and thus, as a practical matter, the use of pesticides is implied. The use of pesticides is generally the only economically feasible way to comply with such legislation.

In Manitoba The Noxious Weeds Act creates a general duty to destroy noxious weeds.[51] Noxious weeds are those plants listed in the regulations (Appendix K)[52] The purpose of the Act is to protect agriculture from the spread of weeds. Included in the Act's definition of "destroy" in section 1(c) is "kill by chemicals or toxic substances". Because of The Noxious Weeds Act, farmers have a legal motive for the control of weeds as well as their own economic motives. Legislation similar to this Manitoba statute exists in the other provinces as well.

The Railway Act makes the use of pesticides necessary as well.[53] Railway companies are required to keep rights-of-way and adjoining company lands clear of thistles and noxious weeds. If the railway fails to do so, not only may a penalty be imposed but local municipal officers may destroy the weeds at the company's expense. Again, the purpose of the section is to protect agriculture.

The Public Health Act may also be interpreted as making the use of pesticides mandatory.[54] In a Regulation Respecting Sanitation Under The Public Health Act, Division 1 (Revised Regulation P210-R3) section 2 includes in the definition of an "unsanitary condition":

> (d) The existence of bed bugs, cockroaches, or other like vermin; or
>
> (e) The existence of mice, rats, or other like rodents.[55]

The existence of such an "unsanitary condition" is prohibited by section 3 of the Regulations.

MISCELLANEOUS LEGISLATION AFFECTING THE USE AND DISPOSAL OF PESTICIDES

Apart from those statutes which directly regulate the use of pesticides, there is also a variety of federal and Manitoba legislation which can indirectly affect the use and disposal of pesticides and pesticide containers. Most of this legislation deals with the protection of the environment and the health and safety of man and animals.

For example, the Federal Transportation of Dangerous Goods Act may be relevant to the use of pesticides.[56] The definition of "dangerous goods" set out in the Schedule includes poisonous or toxic substances as well as corrosives. Thus, pesticides will fall within the Act. Section 4 of the Act provides that no person shall handle, offer for transport, or transport any dangerous goods unless all applicable safety standards and requirements are complied with. This provision, with respect to pesticides, only serves to reiterate what is required in

the Pest Control Products Act. As previously mentioned, section 3(1) of that Act requires that no person shall distribute any control product under unsafe conditions.

The Manitoba Clean Environment Act also deals with the use of pesticides.[57] Manitoba Regulation 156/74 Being a Regulation Under The Clean Environment Act Respecting Pesticides provides in section 2:

> 2. Persons intending to apply pesticides are not required to file a proposal with the Department and obtain approval as provided in section 14(1) of The Clean Environment Act provided,
>
> (1) The application of pesticides is carried out in accordance with the requirements of the Pest Control Products Act of Canada and the regulations thereunder, and
>
> (2) The application of pesticides is carried out in accordance with the requirements of the Pesticides and Fertilizers Control Act of Manitoba and the regulations thereunder, and
>
> (3) The application of pesticides is carried out in accordance with the use recommendations prepared by the Manitoba Department of Agriculture, and
>
> (4) The person is
>
> (i) an agricultural producer or a householder applying the pesticide within the confines of his own property under his control; or
>
> (ii) applying herbicides on behalf of a Government Department, Crown Corporation or Municipal Corporation to conform to the requirements of the Noxious Weeds Act; or
>
> (iii) applying insecticides on behalf of a Government Department, Crown Corporation or Municipal Corporation in an area not designated as residential or recreational.[58]

However, section 3(1) provides that prior to applying any pesticide, all Government departments, Crown Corporations, Municipal Corporations or any agent acting on their behalf shall register annually with the Department. Notwithstanding the Regulations, section 4 allows the Minister to permit the application of insecticides anywhere in the Province if it is deemed necessary to control an emergency health situation declared by the Minister of Health and Social Development. Also, section 5 of the Regulations allows the use of a number of specific control products for specific purposes at specific rates:

(a) For control of mosquito larvae and pupae

(i) Dursban 2E at a maximum rate of 3.2 fluid ounces per acre,

(ii) Abate 4E at a maximum rate of 1.5 fluid ounces per acre,

(iii) Altosid SR-10 at a maximum rate of 4.0 fluid ounces per acre,

(iv) Dimilin 16 at a maximum rate of 0.64 ounces per acre,

(v) Dimilin 25 W.P. at a maximum rate of 0.65 ounces per acre;

(b) For control of tree leaf eating insects

(i) Methoxychlor 2.4EC in a 6.0% aqueous solution at a maximum rate of 4.0 ounces of active ingredient per acre,

(ii) Dipel W.P. at a maximum rate of 0.5 pounds per acre,

(iii) Dipel 45-B at a maximum rate of 8.0 British International Units per acre.[59]

The disposal of pesticides and pesticide containers, a potentially serious threat to the environment, is governed by a broad range of legislation relevant to environmental contaminants. The Pesticides and Fertilizers Control Act Regulations state in section 7:

7. Disposal of pesticides and pesticide containers shall be carried out in compliance with The Clean Environment Act and The Public Health Act and regulations under those Acts.[60]

The Public Health Act defines "insanitary condition" in such a way that the presence of pesticides may be included:

> 2(e) "insanitary condition" means a condition or circumstance
>
> (i) that is offensive; or
>
> (ii) that is, or may be, or might become injurious to health, or
>
> (iii) that prevents or hinders the suppression of disease, or
>
> (iv) that contaminates or pollutes, or may contaminate or pollute food, air, or water; or
>
> (v) that might render food, air or water injurious to the health of any person;
>
> and includes a nuisance and any circumstance or condition declared to be an insanitary condition under the regulations.[61]

A number of regulations under the Act are designed to prevent and control such insanitary conditions.

Division VI of Regulations P210-R3, A Regulation Respecting Sanitation Under The Public Health Act deals with "Protection of Water Sources". These regulations prohibit the "deposit or discharge" of "refuse of any nature" into or on the bank of any body of water.[62] Further, there is a prohibition against any act that will contaminate any underground water supply.[63]

Division VII of the Regulation deals with "Water Supplies". Here, section 55(3) is particularly important as it states that the owner of a well which is no longer in use or abandoned must protect the water bearing formation against possible pollution.[64] The Ground Water and Water Well Act also deals with the protection of ground water from contamination.[65] Section 10(1) of the Act

requires a person who is drilling a well to take "reasonable precautions to avoid polluting, or contaminating, or diminishing the purity of ground water in the area"[66] Section 10(2) reads:

> 10(2) Subject to The Clean Environment Act, no owner shall deposit or place, or allow any other person to deposit or place in or near a well on his property, any material, substance, or thing that might pollute, or contaminate or diminish the purity of, water in the well or ground in the area of the well.[67]

The Manitoba Water Services Board Act has similar provisions for the protection of the water supplies administered by that board.[68]

Manitoba Regulation 208/76, Being a Regulation Under The Clean Environment Act Respecting Waste Disposal Grounds, specifies the manner in which waste disposal grounds are to be operated in Manitoba.[69] Waste disposal grounds are divided into three classes. A Class I waste disposal ground is one which serves a population in excess of 5,000 persons. A Class II waste disposal ground serves a population in excess of 1,000 persons, but less than or equal to 5,000 persons. And, a Class III waste disposal ground serves a population less than or equal to 1,000 persons. With respect to all three classes, section 9 provides:

> 9. A waste disposal ground shall be
>
> (i) located so that wastes or leachings therefrom are contained within the boundaries of the waste disposal ground or do not contaminate water;
>
> (ii) located where there is a separation between the base of the deepest layer of solid waste and the groundwater table of at least 1.5m (5 ft.);
>
> (iii) located at least 31m (101.7 ft.) from the nearest edge of the right of way of any public road excepting the access road of the waste disposal ground;

(iv) located at least 402m (1318.5 ft.) from any dwelling in existence at the time the waste disposal ground is established;

(v) serviced by an all weather access road.[70]

More specific regulations are provided for each class of waste disposal ground. Schedule A deals with Class I. It states that metallic waste must be deposited apart from the other solid waste.[71] This provision is relevant to the disposal of used pesticide containers, many of which are metallic. The disposal of liquid wastes is prohibited altogether in a Class I waste disposal ground unless specifically approved by the governing department.[72] This fact is of importance to the disposal of many pesticides which are liquids.

Provision for the disposal of liquid waste is made in Schedule B which concerns Class II waste disposal grounds. Section 6(2) states:

6.2 The liquid waste facility shall include

(i) an excavation to a depth not exceeding 1.5 m (5 ft.);

(ii) a dyke, constructed to a height of 0.6 m (2 ft.) around the excavation; and

(iii) an unloading facility.[73]

However, the section makes no mention of the nature of the liquid wastes to be deposited in such a facility. Again, metallic wastes must be deposited apart from the other waste.[74]

The regulations respecting the disposal of liquid and metallic wastes as

outlined in Schedule C for Class III waste disposal grounds are the same as those discussed above with respect to Class II waste disposal grounds.

Division V of The Public Health Act Regulations respecting sanitation also deals with waste disposal. [75] Section 35 states that no waste disposal ground shall be located where it may contribute to an offensive or insanitary condition. It is required by section 42 that a waste disposal ground not be located within one hundred yards of a public highway or railway or within one quarter of a mile from any dwelling, school, habitable building, or cemetery. Also, it is required by section 40 that every waste disposal ground have an adequate rodent and insect control program. Thus, these regulations are not only relevant to the disposal of pesticides, but also make their use a necessity.

With reference to the protection of water, section 43 of the regulation states:

> 43. No waste disposal ground shall be located where it may cause pollution of any surface or underground source or potable water.[76]

Federally, a variety of statutes affect the disposal of pesticides and pesticide containers. Concerning water, the major statutes are the Canada Water Act, the Fisheries Act, and the Ocean Dumping Control Act.[77] More generally, the Environmental Contaminants Act and the Migratory Birds Convention Act are relevant to the protection of the environment from pollution by pesticides.[78]

Section 2(2) combined with section 16(1) of the Canada Water Act allows the

Minister of the Environment to make regulations, with the approval of the Governor in Council, defining the term "waste". Section 8 of the Act prohibits the deposit of waste "in any waters comprising a water quality management area".[79]

The Fisheries Act has the potential to minimize water pollution because of its broad scope. Sections 33(1) and 33(2) of the Act read:

> 33(1)No one shall throw overboard ballast, coal ashes, stones, or other prejudicial or deleterious substances in any river harbour, or roadstead, or in any water where fishing is carried on or leave or deposit or cause to be thrown, left or deposited upon the shore, beach, or bank of any water or upon the beach between high and low water mark, remains or offal of fish, or of marine animals, or leave decayed or decaying fish in any net or other fishing apparatus; such remains or offal may be buried ashore, above high water mark.
>
> 33(2)Subject to subsection (4) no person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish or in any place under any conditions where such deleterious substances or any other deleterious substance that results from the deposit of such deleterious substance may enter any such water.[80]

The case of R v. Forest Protection Ltd., mentioned previously in the report, considered section 33(2) of the Fisheries Act and found it to be applicable to the accused's use of pesticides.[81] At the time of the case the Fisheries Act, unlike the Pest Control Products Act, was by virtue of section 71, binding on "Her Majesty in Right of Canada or a Province and any agent thereof".[82] However, in 1982 the Pest Control Products Act was amended to be binding on the Crown.

The Ocean Dumping Control Act may be used by the Minister of the Environment to permit or prohibit the dumping of substances dangerous to humans and marine life into the oceans. Similarly, regulations exist under the Migratory Birds Convention Act which protect water frequented by birds from pollution. Both of these statutes may be applicable to the use and disposal of pesticides.

Of more general importance to environmental protection is the Environmental Contaminants Act. The Act allows for the investigation of environmental contaminants and the implementation of any necessary regulations to control or limit possible hazards. The Act is only relevant in areas not provided for by the Pest Control Products Act. Hence, the regulations under the Environmental Contaminants Act do not as yet generally deal with pesticides. One exception to this fact is the restriction placed upon Mirex under SOR/78-891.[83]

JURISDICTIONAL CONSIDERATIONS

It is evident from the above discussion that legislative control of pesticides and their use presents numerous jurisdictional problems. These problems exist not only with respect to conflicts between federal and provincial authorities, but within the federal government itself. The environmental issues raised by the use of pesticides prompt the involvement of a number of federal government departments. Primarily pesticides are the responsibility of Agriculture Canada. However, Health and Welfare Canada, Environment Canada, and Fisheries and Oceans Canada also have a role to play in environmental management. One may envision a situation where the improper use of pesticides leads to the pollution of water

and contamination of fish which are caught for human consumption. All of the above departments would have responsibilities in such a case. In fact, environmental issues in general cut across traditional jurisdictional boundaries and defy categorization.

In an effort to resolve the jurisdictional confusion which now exists, a "Memorandum of Understanding between the Department of Agriculture and the Department of the Environment Concerning the Regulation of Control Products" has been proposed. The agreement applies to "control products" as defined by the Pest Control Products Act.

The agreement defines the administrative responsibilities of both departments. Agriculture Canada's major responsibility in the area of pesticides is the registration of control products. The agreement provides that prior to registration Environment Canada will be supplied with all pertinent data to allow,

> ...an assessment of the potential hazard of the control product to the environment, of its efficacy in the control of forest pests, and the adequacy of disposal instructions on the label.[84]

Generally, Agriculture Canada agrees to consider advice and recommendations from Environment Canada with respect to the registration of control products and the potential impact of the product on the environment.

Environment Canada agrees to evaluate all control product data relevant to

its areas of concern and to provide Agriculture Canada with recommendations on the acceptability of registration. Recommendations will be with respect to "environmental concerns, disposal instructions, efficacy in the control of forest pests, cautionary labelling statements" and any other pertinent aspects.

The purpose of the agreement is to ensure co-operation between the two departments. It is hoped that the agreement will promote efficiency in the investigation of the environmental aspects of control products.

A draft "Memorandum of Understanding between the Department of Agriculture and the Department of National Health and Welfare Concerning the Regulatory Control of Agriculture Chemicals" has also been prepared. Such a formal understanding may also be arranged between Agriculture Canada and the Department of Fisheries and Oceans. However, according to a memorandum dated April 26, 1982 from J.C. Hilborn, Pesticides Co-ordinator, Toxic Chemicals Management Centre, the Deputy Minister of Environment Canada favours a single four party agreement rather than three bilateral agreements between Agriculture Canada and each of the other departments concerned. Perhaps this would be the best way to co-ordinate the complex interdepartmental relations which may arise from the need to regulate the use and disposal of pesticides.

NOTES

1. British North America Act, 30 & 31 Victoria, c.3 (U.K.).
2. British North America Act, s.92(5).
3. British North America Act, s.91(6).
4. Government Organization Act, S.C. 1978-79 c.13, s.14.
5. British North America Act, s.92(13).
6. British North America Act, s.91(12).
7. R.D.Gibson, "Constitutional Jurisdiction Over Environmental Management in Canada", Government of Canada Constitutional Study (1970)
8. Ibid at p.58.
9. (1952) 2 S.C.R. 392.
10. A.-G. Nova Scotia v. A.-G. Canada (1951) S.C.R. 31.
11. R v. C.P.R. (1914), 23 C.C.C. 487; Fleming v. Spracklin (1921), 50 O.L.R. 289 (C.A.); R v. Can. S.S. Lines Ltd. (1960), 127 C.C.C. 205 (Ont.); R. v. Rice, (1963) 1 C.C.C. 108 (Ont.); R. v. Clark (1912), 21 C.C.C. 208 (Man.); R. v. C.N.R. (1975), 4 C.E.L.N. 78 (Ont.).
12. (1960), 22 D.L.R. (2d) 247 (Ont. H.C.).
13. (1899) A.C. 367 (P.C.).
14. Cardinal v. A.-G. Alta. (1974) S.C.R. 695.
15. British North America Act, s.95.
16. British North America Act, s.91.
17. Jones v. A.-G. New Brunswick, (1975) 2 S.C.R. 182.
18. A.-G. Ont. v. Canada Temperance Federation, (1946) A.C. 193; A.-G. Ont. v. A.-G. Canada (1896) A.C. 348.

19. Johannesson v. West St. Paul, (1952) 1 S.C.R. 292 (uniformity of inter-provincial and international air space procedures and ground facilities); Re C.F.R.B., (1973) 3 O.R. 819 (provincial adherence to national and international procedures for assigning radio frequencies); Munro v. National Capital Commission, (1966) S.C.R. 663 (development of national capital region given to federal jurisdiction, particularly since Ontario and Quebec failed to accept responsibility).

20. A.-G. Canada v. A.-G. Alta, (1916) 1 A.C. 588; Board of Commerce, (1922) 1 A.C. 191; Toronto Electric Commissioners v. Snider, (1925) A.C. 396

21. (1932) A.C. 54.

22. A.-G. Can. v. A.-G. Ont. (Labour Conventions), (1937) A.C. 326; A.-G. Can. v. A.-G. Ont. (Unemployment Insurance), (1937) A.C. 355; A.-G. B.C. v. A.-G. Can. (Price Spreads) A.C. 368; A.-G. B.C. v. A.-G. Can. (National Products Marketing), (1937) A.C. 377; A.-G. B.C. v. A.-G. Can. (Farmers' Creditors Arrangement), (1937) A.C. 391; A.-G. Ont. v. A.-G. Can. (Canada Standard Trade Mark), (1937) A.C. 405.

23. Can. Federation of Agriculture v. A.-G. Quebec, (1951) A.C. 179.

24. Anti-Inflation Reference, (1976) 2 S.C.R. 373.

25. Anti-Inflation Reference at p. 425.

26. P.W. Hogg, Constitutional Law of Canada, Carswell, Toronto, (1977) p. 256.

27. Ibid.

28. Interprov. Co-op Ltd. v. R. (1975), 53 D.L.R. (3d) 321 (S.C.C.).

29. Supra n.8, at 54.

30. R.S.C. 1970, c.P-10.

31. R.S.C. 1970, c.P-10, s.2.

32. R.S.C. 1970, c.P-10, s.2.

33. Pest Control Products Regulations, C.R.C. 1978, c. 1253, as am. by SOR/78-864, SOR/79-180, SOR/79-181, SOR/80-628, SOR/81-187 and SOR/82-591.
34. Agriculture Canada, Trade Memorandum (1980) T-1-216.
35. R.S.C. 1970, c. P-10, s.10(1).
36. R.S.C. 1970, c. P-10, s.10(2).
37. R.S.C. 1970, c. P-10, s.3(1).
38. R.S.C. 1970, c. P-10, s.4(1).
39. (1979), 25 N.B.R. (2d) 513 (N.B.C.A.).
40. Ibid at p. 530.
41. S.M. 1976, c.19.
42. S.M. 1976, c.19, s.1(d).
43. S.M. 1976, c.19, s.2(4).
44. S.M. 1976, c.19, s.7(1).
45. A Regulation Under The Pesticides and Fertilizers Control Act, Man. Reg. 105/77, as am. by Man. Reg. 1/78.
46. S.M. 1976, c.19, s.1(a).
47. Fertilizer Act, R.S.C. 1970, c. F-9, s.4; Feeds Act, R.S.C. 1970, c. F-7, s.4.
48. R.S.C. 1970, c. F-27, s.4(2).
49. R.S.C. 1970, c. P-11.
50. National Energy Board Regulations, C.R.C. 1978, c. 1052, s.29.
51. C.C.S.M., c. N110.
52. A Regulation Under The Noxious Weeds Act, Man. Rev. Reg. 1981, N110-R1.
53. R.S.C. 1970, c. R-2, s. 358.
54. C.C.S.M., c. P210.

55. A Regulation Under The Public Health Act, Man. Rev. Reg. 1973, P210-R3, s.2.

56. S.C. 1980-81-82, c.36.

57. S.M. 1972, c. 76.

58. A Regulation Under The Clean Environment Act, Man. Reg. 156/74, as am. by Man. Reg. 161/75, 26/78 and 118/79.

59. Man. Reg. 156/74, as am. by Man. Reg. 161/75, 26/78 and 118/79, s.5.

60. A Regulation Under The Pesticides and Fertilizers Control Act, Man. Reg. 105/77, as am. by Man. Reg. 1/78, s.7.

61. C.C.S.M., c. P210, s.2(e).

62. A Regulation Under The Public Health Act Man. Rev. Reg. 1973, P210-R3, s.47(1).

63. Man. Rev. Reg. 1973, P210-R3, s.47(2).

64. Man. Rev. Reg. 1973, P210-R3, s.55(3).

65. C.C.S.M., c. G110.

66. C.C.S.M., c. G110, s. 10(1).

67. C.C.S.M., c. G110, s. 10(2).

68. C.C.S.M., c. W90, s.56.

69. A Regulation Under The Clean Environment Act, Man. Reg. 208/76.

70. A Regulation Under The Clean Environment Act, Man. Reg. 208/76, s.9.

71. A Regulation Under The Clean Environment Act, Man. Reg. 208/76, Schedule A, s.6.

72. A Regulation Under The Clean Environment Act, Man. Reg. 208/76, Schedule A, s.7.

73. A Regulation Under The Clean Environment Act, Man. Reg. 208/76, Schedule B, s.6(2).

74. A Regulation Under The Clean Environment Act, Man. Reg. 208/76, Schedule B, s.5.

75. A Regulation Under The Public Health Act, Man. Rev. Reg. 1973, P210-R3.

76. A Regulation Under The Public Health Act, Man. Rev. Reg. 1973, P210-R3, s.43.

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78. Environmental Contaminants Act, S.C. 1974-75-76, c.72; Migratory Birds Convention Act, R.S.C. 1970, c.M-12.

79. Canada Water Act, R.S.C. 1970, c.5 1st Supp.

80. Fisheries Act, R.S.C. 1970, c.F-4 as am by R.S.C. 1970, c.17 1st Supp., s.33(1) and s.33(2).

81. R. v. Forest Protection Ltd. supra n.39.

82. Fisheries Act, R.S.C. 1970, c.F-4 as am. by R.S.C. 1970, c.17 1st Supp., s.71.

83. Environmental Contaminants Regulations, SOR/78-891.

84. Environment Canada (1982) Memorandum of Understanding between the Department of Agriculture and the Department of the Environment Concerning the Regulation of Control Products (J.C. Hilborn).

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APPENDIX H

INFORMATION REQUIRED FROM APPLICANT FOR REGISTRATION
(Section 9(2) of the Pest Control Products Regulation)

9(2) Without limiting the generality of subsection (1), where a control product

(a) is a device that has not been previously assessed or evaluated for the purposes of the Act and these Regulations or contains an ingredient that has not been so assessed or evaluated, the applicant shall provide the Minister with the results of scientific investigations respecting

(i) the effectiveness of the control product for its intended purposes,

(ii) the safety of the control product to persons occupationally exposed to it when it is manufactured, stored, displayed, distributed, or used,

(iii) the safety of the control product to the host plant, animal or article in relation to which it is to be used,

(iv) the effects of the control product on representative species of non-target organisms relative to the intended use of the control product,

(v) the degree of persistence, retention and movement of the control product and its residues,

(vi) suitable methods of analysis for detecting the active ingredient and measuring the specifications of the control product,

(vii) suitable methods of analysis for detecting significant amounts of the control product, including its residues in food, feed and the environment under practical conditions of use,

(viii) suitable methods for the detoxification or neutralization of the control product in soil, water, air, or on articles,

(ix) suitable methods for the disposal of the control product and its empty packages,

(x) the stability of the control product under practical conditions of storage and display, and

(xi) the compatibility of the control product with other control products with which it is recommended or likely to be mixed, or

(b) is intended for use on living plants or animals or products derived therefrom which plants, animals or products are for human consumption, the applicant shall provide the Minister with the results of scientific investigations respecting

(i) the effect of the control product or its residues when administered to test animals for the purpose of assessing any risk to humans or animals, and

(ii) the effects of storing and processing food or feed, in relation to which the control product was used, on the dissipation or degradation of the control product and any of its residues.

APPENDIX I

LABELLING REGULATIONS

The Pest Control Products Act Regulations provide in s.26 (1):

> No label shall be used on a control product unless it has been approved by the Minister and, unless the Minister otherwise directs, every label shall show the information required by sections 27 to 37.

The information required by sections 27 to 37 is outlined in sections 26(2)(a) to 26(2)(n).

Section 26(2)(a) requires that the product name of the control product shall be descriptive of the physical form and purpose of the product. The name must include the common name of the product's active ingredient. Section 26(2)(b) describes the three class designations; one of which must appear in capital letters on the products label. The first designation is "RESTRICTED" used,

> ...where the Minister, in his concern for the health of man or the safety of plants, animals, or the environment has set forth additional essential conditions to be shown on the label respecting the display, distribution, use limitations or qualifications of persons who may use the control product.

The next designation is "DOMESTIC" which applies,

> ...where the control product is to be displayed and distributed for use in and around a dwelling.

The third designation may be any word or words used to indicate that the control product is to be displayed and distributed for general use in commercial

activities specified on the label. While "COMMERCIAL" is the suggested designation here, "AGRICULTURAL", "INDUSTRIAL", "INSTITUTIONAL" or other descriptive terms may be acceptable. The "Registration Guidelines" published by the Pesticides Division of Agriculture Canada points out that the intent of this category is "to provide operators engaged in commercial activities with products that can be used safely and efficaciously in their particular business".

Section 26(2)(c) provides that information respecting the nature and degree of hazard of the control product shall be indicated by the appropriate precautionary symbols and signal words selected from Schedule III (Appendix III). The statement "READ THE LABEL BEFORE USING" in capital letters is required to appear by s.26(2)(d). Section 26(2)(e) describes the various ways in which the guarantee statement must appear on the label. The word "GUARANTEE" must appear in capital letters followed by the percentage of the active ingredient in the contents of the product. Information concerning the viscosity, specific gravity, particle size, or other property may also be required on the guarantee.

Sections 26(2)(f) to 26(2)(h) outline the presentation of the control products registration number, the net quantity of the products package, and the address of the registrant on the label. It is necessary by virtue of s.26(2)(i) that where the label is required to contain the directions for the use of the control product,

> the directions shall include dosage rates, timing of applications and use limitations.

Where the label is required to show information respecting handling,

storage, display, distribution or disposal of the control product concerning any particular hazard s.26(2)(j) requires that,

> ...the information shall include instructions respecting procedures to alleviate the hazard and, when required by the Minister, instructions respecting decontamination procedures and disposal of the control product and its empty packages.

Section 26(2)(k) makes the same provision for hazards to things in relation to which the control product is intended to be used and public health, plants, animals, and the environment.

Section 26(2)(l) requires that first aid instructions appear under the heading "FIRST AID INSTRUCTIONS" in capital letters. These instructions must describe practical measures to be taken in the event of poisoning or injury caused by the control product. Similarly toxicological information essential to the treatment of a person so injured is required by s.26(2)(m) to appear under the heading "TOXICOLOGICAL INFORMATION" in capital letters. This information must state an antidote and remedial measures to be taken, describe the symptoms of intoxication, and state any ingredients not mentioned in the guarantee statement which may affect treatment.

If the label is required to show a notice to the user s.26(2)(n) provides that it shall take the form:

> "NOTICE TO USER - This control product is to be used only in accordance with the directions on this label. It is an offence under the Pest Control Products Act to use a control product under unsafe conditions."

The devices that are listed in Schedule I of the Regulations are required by s.27 to contain the information referred to in section 26(2)(f), (h), (i), (j), and (k).

Section 28 provides that the label's display panel shall consist of one principal display panel and at least one secondary display panel. In s.29 products which do not have controlling pests as their primary purpose but are represented as having that property or contain an active ingredient possessing that property are required to have the information referred to in s.26(2)(a), (b), (c), (g), and (h), shown on the principal display panel; and the information referred to in s.26(2)(e), (f), (i), (l), and (m) must be shown on the secondary display panel.

The majority of pest control products are covered by s.30. Here, those control products which have as their primary purpose the control of pests are required to display the information referred to in s.26(2)(a), (b), (c), (d), (e), (f), (g), and (h) on the principal display panel; and the information referred to in s.26(2 (i), (j), (k), (l), (m), and (n) must be shown on the secondary display panel. Section 31 includes any compound or substance intended to enhance or modify the characteristics of a control product in the class of products covered by s.30. Section 32 allows the Minister to approve the inclusion of the information required by sections 29, 30 and 31 elsewhere than on the display panel.

Section 33(1) provides that where the principal display panel shows the designation "RESTRICTED" the notice referred to in s.26(2)(n) shall appear at the

top of the secondary display panel followed by the heading "RESTRICTED USES" in capital letters. This heading shall be followed by the directions for use, dosage rates, timing of application and use limitations to which the restriction relates. All of this information must be circumscribed by a line to set it apart from all other information on the secondary display panel. Notwithstanding s.33(1), the principal display panel shows the designation "RESTRICTED", s.33(2) allows that with the approval of the Minister, the directions for use, dosage rates, timing of application and use limitations to which the restriction relates, together with the information referred to in s.26(2)(a), (b), (c), (d), (e), (f), (g), (h), (i), and (k) may appear in a brochure or leaflet that will accompany the package for the control product. If such a brochure or leaflet is used s.34 requires that the display panel shall contain the words "READ ATTACHED BROCHURE (or LEAFLET) BEFORE USING" in capital letters displayed prominently.

The units of measurement used on labels are dealt with in s.39. Section 39(1) provides that all units of measurement be expressed only in metric units in accordance with the Weights and Measures Act. Sections 39(2), (3), and (4) deal with the actual units to be used and the number of figures in the decimal system required.

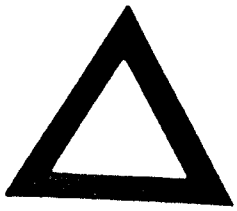
Section 40 makes the final broad requirement respecting labels:

> All information shown on a label shall be printed in a manner that is conspicuous, legible and indelible.

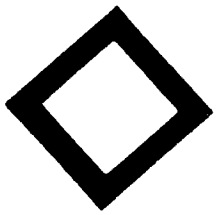
APPENDIX J

DEGREE OF RISK AND CATEGORY OF HAZARD SYMBOLS

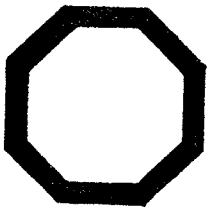
Degree of Risk Symbols



Caution



Warning



Danger

Category of Hazard Symbols

Poison

Corrosive

Flammable

Explosive

APPENDIX K

A REGULATION DECLARING CERTAIN WEEDS TO BE NOXIOUS

WEEDS UNDER THE NOXIOUS WEEDS ACT

The weeds named in Schedule A are declared to be noxious weeds in Manitoba within the meaning of The Noxious Weeds Act, Revised Regulation N110-R1.

SCHEDULE A

absinth
algae
alyssum, hoary
small
amaranth, prostrate
arrow-grass marsh
atriplex, garden
spreading
baby's-breath
barberry, all deciduous varieties
barley, foxtail
bartsia, red
bassia, five-hooked
bedstraw, northern
smooth
yellow
beggarticks
bellflower, creeping
bindweed, field
hedge
bladderwort, common
bluebur
bluebur, western
buckthorn, alder
European
common
buckwheat, Tartary
wild
bugloss, small
vipers
burdock, common
great
woolly
bur-ragweed
campion, biennial
bladder
camas, death
smooth
white
carrionflower
carrot, wild
catchfly, night-flowering
smooth
chamomile, corn
scentless
chickweed, common
field
long-stalked
mouse-eared
cleavers
cockle, cow
purple
white
cocklebur
corydalis, golden
cow-parsnip
cranesbill

cress, Austrian yellow
globe-podded hoary
heart-podded hoary
hoary
lens-podded hoary
cucumber, wild
daisy, ox-eye
dandelion
dandelion, red-seeded
darnel, Persian
dock, broad-leaved
curled
field
golden
dodder, species
dogbane, clasping-leaved
spreading
dragonhead, American
thyme-flowered
everlasting, pearly
flax, false
fleabane, Canada
Philadelphia
flixweed
foxtail, giant
green
yellow
fumitory
galinsoga, hairy
small-flowered
goat's-beard
golden-aster, hairy
goosefoot, maple-leaved
oak-leaved
spear-leaved
grass, barnyard
downy brome
large crab
prickly arnyard
quack
smooth crab
witch
gromwell, corn
field
western
ground-ivy
groundsel, common
gumweed
hawk's-beard, narrow-leaved
heliotrope, spatulate-leaved
hemlock, poison
water
hemp-nettle
henbane, black
horsetail, field
hyssop
jimsonweed
knapweed, diffuse
Russian
spotted
knotweed, erect
prostrate
kochia (summer cypress)
lady's thumb
lamb's-quarters
lamb's-quarters, net-seeded
small-seeded
larkspur, low
tall
lettuce, blue
Canada
prickly
locoweed, early yellow
late yellow
showy
woolly
loosestrife, fringed
purple
yellow
lupine, silvery
mallow, common round-leaved
mares-tail
mayweed, scentless
stinking
medic, black
milkweed, common
milkweed, showy
swamp
whorled
mullein, common
mustard, ball
dog
green tansy
gray tansy
hare's ear
Loesel's
tall wormseed
tumble

mustard, wild
wormseed
nettle, stinging
oats, wild
parsnip, water
wild
peppergrass, clasping-leaved
common
pigweed, prostrate
redroot
Russian
tumble
winged
plantain, broad-leaved
common
narrow-leaved
whorled
poison-ivy
povertyweed
purslane
pussytoes
ragweed, common
false
giant
perennial
ragwort, tansy
Russian thistle
sage, pasture
sagebrush, silver
St. John's wort
St. John's wort, spotted
shepherd's purse
skeletonweed
smartweed, green
marshpepper
mild
pale
Pennsylvania
swamp
water
sow-thistle, annual
perennial
smooth perennial
spiny annual
spurge, cypress
leafy
thyme-leaved
spurry, corn
stickseed
stinkweed
stork's-bill
sunflower, prairie
tansy
teasel
thistle, bull
Canada
Flodman's
globe
nodding
plumeless
Scotch
waxy-leaved
toadflax, Dalmation
yellow
tomato, wild
water-hemlock, bulbous
common
spotted
western
whitlow-grass, wood
wormwood, biennial
common

APPENDIX L
CONTACTS

1 USERS

Agriculture Canada:

Food Production & Inspection, Winnipeg	Mr. S.J. Kirkland Chief Agrologist 949-2378
Animal Health Brandon	Mr. Colin Campbell District Manager 725-3717
Brandon Research Station	Number for all Departments: 728-7234
	Mr. Percy Chegwyn Farm Manager
	Mr. Rod March Groundskeeper & Maintenance
	Mr. R.D. Dryden Agronomist
	Dr. P. Chow Research Scientist
	Dr. Bob Hamilton Research Scientist
Glenlea Research Station	Mr. Boris Salamon Farm Foreman 883-2169
Morden Research Station	Numbers for all Departments: 822-4471 822-4472 822-4473
	Dr. G. Frieson Head of Field Crops Inspector
	Mr. Henry Herbert Engineering Scientific Services
	Mr.John Peters Farm Foreman
Portage la Prairie Research Substation	Mr. B. Brecknall Acting Officer in Charge 857-4441
Winnipeg Research Station	Ms. Joanne Buth Technical Information Officer 269-2100

Atomic Energy of Canada Ltd.:	Number for all Departments: 753-2311
	Mr. Warner Brown Environmental Authority ext. 2861
	Mr. Henry Wojciechowski Heavy Equipment Foreman
Canadian Grain Commission:	Dr. R. Tkachuk Research Scientist 949-3325
Canadian National Railways:	Mr. Gordon Parbery Manager of Purchases 224-6338
	Mr. E. Stanik Regional Research Manager 946-2504
	Mr. W. Solomon Planning Officer 946-2286
Canadian International Grains Institute:	Mr. A. Sarkar Milling Technologist 949-5550
Department of Regional Economic Expansion:	Mr. Hank Derkson Implementation Officer 949-2938
	Mr. Alf Chorney Federal-Provincial Co-ordinator
Prairie Farm Rehabilitation Administration:	
Brandon PFRA	Mr. Jim Nugent Assistant Area Manager, Land Use Area 6 727-0601
Regina PFRA	Mr. Roger Baldwin Assistant Manager, Field Operations, Soil & Water Conservation Branch 121-5154
	944-4018

Environment Canada:

Canadian Wildlife Service	Number for all Departments: 269-7379
	Mr. Dennis Jurick Habitat Biologist
	Mr. Pat Rikowski Habitat Management Biologist
Parks Canada:	
Riding Mountain National Park	Number for all Departments: 848-2811
	Mr. Glen Brown Technical Officer
	Mr. Dave Green Grounds Maintenance Supervisor
Lower Fort Garry Historical Park	Mr. Peter Lamb Superintendant 949-3600
Fisheries & Oceans:	Number for all Departments: 269-7379
	Mr. Bill Nicholson Regional Engineer ext. 194
	Dr. Derek Muir Research Scientist
Health & Welfare Canada:	Mr. Tom Ramsey Regional Materials Manager 949-4174
National Defence:	
Canadian Forces Base Portage la Prairie	Lt. Waite BCEO 428-3363 428-3364
	Mr. Steve Waller Roads & Grounds Manager 428-3367
	Mcpl. Mercier Preventive Medical Technician 428-3364

National Defence (cont'd.)

Canadian Forces Base Shilo	Number for all Departments: 765-4821
	Major Richard Commander of the Corps of Engineers ext. 2113
	Mr. O'Halloran Grounds Specialist
	Cpl. D. Carroll Preventive Medical Technician
Canadian Forces Base Winnipeg	Number for all Departments: 832-1311 Mr. Gary Hutchison Grounds Foreman
	Mr. Fred Shalapata Greenhouse Foreman
	Lt. Goss BCEO (Base Construction Engineering Office)
	Chief Warrent Officer Meers Hospital
Canadian Forces Station Beasejour	Mr. Len Meyers Roads & Grounds Foreman 268-2611 ext. 337

To attain access to the Canadian Forces Bases in Manitoba, it is necessary to contact Mr. E.L. Dahm at CFB Winnipeg. Letters should be mailed to Mr. Dahm as:

Mr. E.L. Dahm
D.C.O.S. M.I.L.E.
Air Command Headquarters
CFB Winnipeg
Westwin, Manitoba R2R 0W0
Attn: S.O.W. 4-5

The procedure is then for Mr. Dahm to make the arrangements through the National Defence Headquarters in Ottawa.

Solicitor General:

R.C.M.P. Winnipeg Headquarters	Mr. S. Sigfusson Act-Cure-It Pest Control 247-4409

Solicitor General (cont'd.)

Rockwood Institution	Number for all Departments: 453-5541
	Mr. Bill Lewko Farm Manager ext. 223
	Mr. Virgil Smith Assistant Farm Manager

Transport Canada:

Churchill Airport	Mr. Tony Van Eindhoven Transport Canada Airport Manager 675-8868
	Mr. Doug Smith Field Maintenance Supervisor 675-2090
St. Andrew's Airport	Mr. Frank Buck Field Maintenance Supervisor 339-9559
Winnipeg International Airport	Mr. E. Thomson Field Maintenance Supervisor 786-4263
Veterans Affairs:	Mr. Doug Lang Deer Lodge Hospital Stores Manager 837-1301
VIA Rail:	Mr. Gordon Barrett 949-7458
	Mr. Trevor Williams CN-Air Canada Medical Services 946-2483

Contractors:

Act-Cure-It Pest Control Winnipeg, Manitoba	Mr. S. Sigfusson Service Technician 247-4409
Charles Reiss & Co. Winnipeg, Manitoba	Mr. Albert L. Miller Manager 783-3529
Midland Vegetation Control Ltd. Saskatoon, Saskatchewan	Mr. M.B. Rondeau General Manager (306) 352-0771

Contractors (cont'd.)

Poulin's The Exterminators Winnipeg, Manitoba	General Office 233-2580
	Ms. Rita Brakal Purchasing Agent
	Mr. Louis Forest Service Technician
	Mr. Paul Fontain Service Technician
	Mr. Tom Rivero Service Technician
	Mr. John Bernaldo Service Technician
Supreme Spraying Winnipeg, Manitoba	Mr. Don McLeod Manager 895-7941
Swat Professional Exterminators Winnipeg, Manitoba	Mr. Joel Gosselin Manager 233-3182
Yorkton Flying Service Yorkton, Saskatchewan	Mr. Leslie Ingham President (306) 783-4118

2 NON-USERS

Agriculture Canada:

Plant Quarantine, Churchill	Mr. Harry Hicks 949-3775
Interlake District Office Winnipeg	Ms. Nora Little 949-2219
Union Stockyard, Winnipeg	Ms. Etha Ryzebel 949-2218
Meat Hygiene, Winnipeg	Ms. Joanne Pratt 949-2202
Meat Hygiene, Brandon	Ms. Ella Middleton 728-4156
Animal Pathology Lab Winnipeg	Ms. Joanne Pratt 949-2205

Agriculture Canadad (cont'd.)

Animal Health, Dauphin	Mrs. Jerry Greening 638-3322
Animal Health, Emerson	Dr. Shideler 373-2346
Animal Health, Winnipeg	Ms. Nora Little 949-2203
Animal Health, Carman	Ms. Judy Dracass 745-2292
Animal Health, Portage la Prairie	Ms. Jean Grey 857-4171
Animal Health, Shoel Lake	Dr. Weetman 759-2403
Animal Health, Minnedosa	Dr. Addison 867-3241
Animal Health, Swan River	Mr. Andre Gabrielle 734-3295

Air Canada:

Winnipeg Office	Mr. Chris Marsela 775-4411

Canada Post:

Winnipeg	Mr. Gord Cross 949-2802

Canadian Broadcasting Corporation:

Winnipeg Office	Mr. Joe Marks 775-8351

Canadian Coast Guard:

Selkirk	Mr. Mitts 482-5813
Gimli	Mr. Garry Ball 642-8379

Canadian Wheat Board:	Mr. Joe Dalapenta 949-6133

Crown Assets Disposal Corporation:	
Winnipeg Office	Ms. Deb Orton 475-3843
Department of Regional Economic Expansion:	
Manitoba Department of Agriculture	Mr. A.C. Chorney 944-4018
Department of Regional Economic Expansion	Mr. S.H. Derksen 949-3901
Energy, Mines & Resources:	Mr. Wayne Bryant 942-4273
Environment Canada:	
Atmospheric Environment Service Winnipeg	Mr. M. Balshaw 949-4380
Canadian Forestry Service Winnipeg	Mr. Klem Froning 949-2961
Environmental Protection Service Winnipeg	Mrs. S. Therrien-Richards 949-2961
Parks Canada Churchill National Park	Mr. Mel Falk (Winnipeg) 949-3114
Freshwater Fish Marketing Corporation:	
The Pas District	Mr. Dave Buck 623-7468 632-7167
Winnipeg District	222-7301
National Harbour's Board:	
Churchill District	Mr. Wokes 675-8823
National Research Council:	
Winnipeg Office	Mr. Gord Saunders 255-9610
Public Works:	
Winnipeg, Lockport	Mr. Norman Lulchum 757-2241

Royal Canadian Mint:	Mr. Dave Mork 257-3350
Royal Canadian Mounted Police:	Staff Sargent McCrossin 949-5428
Transport Canada:	
The Pas Airport	Mr. Bud Codd 624-5233
Dauphin Airport	Mr. Robert Lee 638-6316