

An Evaluation of Hazardous and Special
Waste Management in Alberta

by

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A Practicum Submitted
in Partial Fulfillment of the Requirement for the Degree
Master of Natural Resources Management

Natural Resources Institute
University of Manitoba
Winnipeg, Manitoba
October 1985

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ABSTRACT

The main objective of this study was to assess special waste management in Alberta. Alberta is the only province in Canada that has taken steps to establish a program and selected a site for the management of hazardous and special wastes in the province. The implementation of a special waste management plan in Alberta may be useful to other Canadian provinces in implementing hazardous and special waste management programs across Canada.

A literature review has been assembled documenting hazardous waste management in Ontario, Manitoba, the United States (federal), Minnesota, the United Kingdom, and West Germany. A set of components and characteristics including legislation, ownership of a hazardous waste facility, and public involvement was established to evaluate the approach taken by Alberta.

Legislation relating to Alberta special wastes was tailored to fit provincial government policy. A comprehensive Act does not exist, but is not considered necessary except for ease of administration. One statute governs treatment, storage, and disposal of special wastes in the province. Another regulates the transport of hazardous wastes, and a third establishes a Crown Corporation to monitor the development and operation of the facility.

Ownership is important for long term security of the facility and environmental integrity of the site. The facility is privately owned and located on a Crown land lease. Government involvement ensures continuity of ownership and that the facility will not be abandoned if it closes.

Public involvement is a necessary component of a hazardous and special waste management program. Siting a facility requires public acceptability. A public involvement program must be initiated early in a special waste management program to allow sectors of the public an opportunity to participate. After the completion of the public participation program, two sites were recommended by Alberta Environment to the Alberta Cabinet. A site near Swan Hills, Alberta was chosen as the location for a special waste management facility. The public participation program was not continued after the selection of a site. Transfer and collection stations must be selected, requiring additional public participation.

ACKNOWLEDGEMENTS

I would like to thank Mr. H.C.R. Gavin of the Environmental Protection Service for introducing me to the area of hazardous special waste management, and arranging for funding for this project. I would also like to thank the other members of my committee; Dr. G.R. Barrie Webster of the Pesticide Research Laboratory, Department of Soil Science at the University of Manitoba; and Mr. Edwin Yee, Head of Hazardous and Special Waste Management at Manitoba Environment, for their time and useful comments during the preparation of this document.

I would also like to thank the staff of the Natural Resources Institute, Dr. W. Henson, Professor T. Henley, and Professor R. Baydack for their guidance, and Mrs. E. Novotny and Ms. C. Hofer for their cooperation.

Finally, I would like to thank fellow students - too numerous to mention - who have made my time at the Natural Resources Institute more enjoyable.

Special thanks go to my fiance Mark Brownlie for his support and encouragement during the preparation of this document.

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Chapter I

INTRODUCTION

1.1 PREAMBLE

The problem of management of hazardous and special wastes¹ is common to all industrialized countries. Current waste inventories are large and growing, even though accurate figures for Alberta and Canada cannot be obtained (Environment Council of Alberta (ECA), 1980). It is difficult to estimate the quantities of special wastes generated each year. For example, W.L. Wardrop and Associates (1979) estimate 180,000 tonnes are generated annually in Alberta, whereas Reid, Crowther and Partners (1980) suggest about 90,000 tonnes. Kinetic Contaminants Canada Limited ((KCCL), 1979) estimate that wastes available to them for disposal would range from 21,000 to 100,000 tonnes per year.

¹ The terms "hazardous" and "special" are used throughout the report, but lack of uniformity of terms is evident in different jurisdictions. Although a nationally accepted definition has not yet been established in Canada, a hazardous waste, for the purposes of this study, can be defined as any material that due to its nature or quantity, poses a threat to human health or to environmental quality, and which requires special disposal techniques to eliminate the hazards. A special waste is a category of hazardous waste that requires special handling and treatment. Alberta uses the term "special" waste to refer to both categories.

Radioactive wastes are not considered in this study.

Special wastes in Alberta are largely related to the petroleum extraction and refining industries. Major wastes from these industries include acids, alkalis, waste oils and sludges. Table 1 shows major special and hazardous waste categories that are produced in Alberta.

TABLE 1
Hazardous and Special Waste Categories

PCB's PCB Fluids and Contaminated Materials OILS Oils SOLVENTS Halogenated Solvent Nonhalogenated Solvent Solvents with Heavy Metals SLUDGES General Mixed Metal Bearing Sludges Lead Chromium Copper Magnesium PESTICIDES Condemned and/or diluted Pesticides PROCESS Textile Waste Treatment Ink Dust and Scrubber Paint	AQUEOUS METAL WASTES General Mixed Aqueous Metal Wastes ACIDS Acids with heavy metals Acid Solutions ALKALIS Alkalis with Heavy Metals Alkalis CONCENTRATED ORGANICS Plastics, Resins, Latex Phenols OTHER Cyanides Explosives Contaminated Containers Contaminated Soil and Sand Asbestos Ammonia Scrap Batteries Waste Activated Carbon Infectious Waste Tank Bottoms Chemicals Sulphur Fly Ash Spent Catalyst
--	---

Source: Reid, Crowther & Partners, 1980

As early as 1972, the government of Alberta started studying the problem of disposal of special wastes. Associated Engineering Services Ltd. (1972) concluded that quantities of special wastes then being generated were sufficient to justify the establishment of centralized, systematic and effective waste treatment and disposal facilities. There was little immediate action from the provincial government, however, in response to this report.

The Canadian Council of Resource and Environmental Ministers (CCREM), consisting of provincial resource and environmental ministers and the federal Minister of Environment, affirmed in 1978 that the management of special wastes was a national problem. Together with Environment Canada, the Council initiated a cooperative national program. A Federal-Provincial-Territorial Committee on Waste Management was created by CCREM to study the issue of hazardous and special wastes, specifically relating to the Transportation of Dangerous Goods Act. One of the outcomes of its activities was a compilation of inventories of hazardous and special wastes in Alberta, Saskatchewan, Manitoba, and northwestern Ontario by W.L. Wardrop and Associates (1979). This was the first attempt to establish a comprehensive list of special wastes in western Canada. This report was useful in helping to delineate the magnitude of the problem in Alberta (ECA, 1980).

Kinetic Contaminants Canada Limited (KCCL) of Nisku, Alberta, was established in 1978 in response to the need for

safe management of hazardous and special wastes (KCCL, 1979). KCCL contracted W.L. Wardrop and Associates to carry out a feasibility study of the construction of a waste management facility in western Canada. A site near Fort Saskatchewan, Alberta was chosen as desirable for such a facility, but there was intense negative public reaction to siting a facility near the town (ECA, 1980). In response to this reaction, the Hazardous Waste Management Committee was established to examine the implications of special waste management in Alberta. Public hearings were required prior to issuance of permits for construction of a special waste facility. Public participation has now become an integral part of the management of hazardous and special wastes in Alberta.

The Canadian Chemical Producers Association (CCPA), representing the Canadian chemical industry, has expressed its commitment to ensuring that its operations and the use and ultimate disposition of its products do not present an unacceptable risk to the public or to the environment (CCPA, 1982). Control legislation, regulations and enforcement are however, the responsibility of the Alberta government.

Since the 1960's, the public has become more aware of environmental and health-related issues. A new consciousness has arisen in response to the development of our consumer and technological society (Draper, 1977). The environmental movement and consumer information programs have provided the

public with the necessary information and skills to question actions and demand accountability from those who may affect their lives. Public apprehension towards facilities has grown since hazardous and special waste management has not been entirely accountable in the past.

Public attitudes and opinions towards hazardous and special wastes are part of the problem, but are also part of the solution. The public must realize that they are demanding the products that produce hazardous wastes and thus are contributing to the problem of

waste generation and disposal. Once the public recognizes its responsibility in the generation and the efficient management of wastes, the hazardous waste problem may be partially solved. Government and industry share the responsibility for the balance of the solution.

Ideally, the public, government, and industry are looking for a 'fail-safe' system of managing and disposing of hazardous wastes. It is doubtful that such a system exists. A clear vision of what is 'ideal' needs to be explored, tempered by what is possible today and what is probable tomorrow.

Public participation is but one part of hazardous and special waste management. Public participation depends on the experience of the public in observing the presence of waste and the impact it implies. The allocation of funds

for research and for actual cleanup depends on the public perception that waste is produced and its impact can be minimized.

Just and reasonable decisions may be arrived at only through thorough examination of the various available options; generally the least harmful and the most beneficial option will be selected.

Jerrick and Tuor (1984) identify three basic principles of public participation in hazardous and special waste management:

1. The public will continue to be interested and involved in issues surrounding the siting, expansion, and cleanup of hazardous waste sites.
2. The public has the right to know and to participate in decisions that affect their health and well-being. The public recognizes this right.
3. Public involvement in the decision-making process is absolutely essential in finding and implementing hazardous waste solutions.

Public participation is part of government, industry, and public decision-making. What remains uncertain is the extent that participation should occur and the role that it should play in addressing these basic principles (Smith, 1982). The predominant concept in the literature is one of participation as a means to enhance and/or influence deci-

sion-making, where the emphasis has been on direct involvement of persons affected by proposals or actions.

The ultimate goal of public involvement is a cooperative effort among government, industry, and the public during the siting, operation, and closure and monitoring of hazardous and special waste facilities. This cooperation can lead to effective participation through an informed public. Lack of adequate information can be a barrier to a fully informed public. Ideally, all pertinent information should be made public. Unfortunately, issues in hazardous and special waste management are complex, and the information may not be adequate or in a suitable format to fully inform the public.

The information given to the public must result in two-way communication. If hazardous and special wastes are to be managed in a manner that ensures environmental quality and health, the public must be informed of the issues that relate to waste management. The knowledge gained will allow for informed actions to be taken.

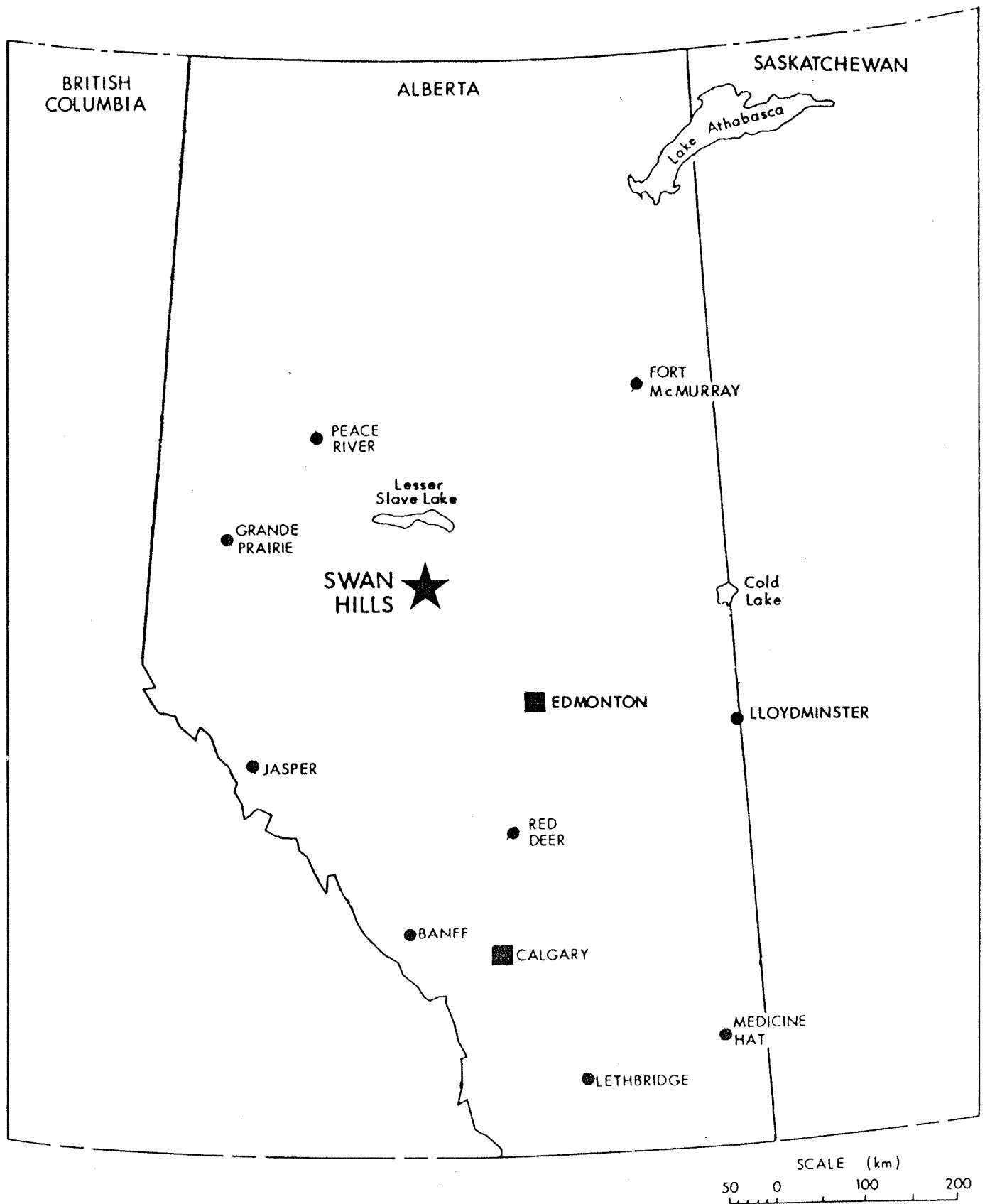
1.2 PROBLEM STATEMENT

The Environmental Protection Service (EPS), a division of Environment Canada, was formed to ensure that the responsibility of the federal government for the protection of the environment would be carried out in a manner consistent with national policy. Intrinsic to this policy is the mainte-

nance of environmental quality, human health, and economic well-being. Hazardous and special waste management is one of the areas where the federal government provides guidance to the provinces.

In 1982, an Alberta government position paper on industrial and special waste management stated that it is provincial government policy to ensure that wastes are recycled whenever possible. If recycling is not feasible, the provincial government will provide legislative, regulatory, monitoring and infrastructure requirements to ensure that treatment and disposal of special wastes are carried out in a reasonable and controlled manner. The government of Alberta has assessed site selection criteria and has chosen a site near Swan Hills, Alberta for the disposal of special wastes in Alberta (Map 1).

An evaluation of the elements of a special waste management program would be helpful in ensuring that special wastes are disposed of in such a manner that they cause no harm to the public or to the environment. A summary of special waste management in Alberta for the Environmental Protection Servicemight enable a coordinated and effective waste management plan to be implemented throughout Canada.



MAP 1 SPECIAL WASTE MANAGEMENT FACILITY LOCATION

1.3 OBJECTIVES

The primary objective of this study was to assess special waste management in Alberta and to compare it to other jurisdictions. Specific objectives were:

1. To document hazardous waste management programs in Ontario, Manitoba, Minnesota, the United Kingdom, and West Germany,
2. To establish components and characteristics for assessing the effectiveness of the Alberta special waste management program, based on the findings from the above jurisdictions,
3. To examine the present situation in Alberta in terms of the following:
 - a) waste management systems presently operating,
 - b) present and proposed legislation,
 - c) the process of public involvement, and
4. To recommend measures for improvement of hazardous waste management in the future.

1.4 METHODS

There are three key elements to any effective hazardous and special waste management program. These are a regulatory (legislative) framework, a public involvement program and an adequate waste management system. These elements do not necessarily have to be developed in the order stated.

This study involved an extensive literature review, together with meetings and conversations with individuals knowledgeable of hazardous wastes and their management. To provide an overview of hazardous waste management in Alberta, information on public involvement, hazardous waste inventories, current disposal techniques, site selection criteria and legislation was reviewed. Several studies pertaining to special waste management in Alberta were available and these provided background information.

Waste management in Canada (Ontario and Manitoba), the United States (Minnesota), the United Kingdom, and West Germany was documented through a literature review. A set of criteria was developed through an examination of the approaches taken and experiences of these several jurisdictions for the purpose of assessing the special waste management program in Alberta.

Public involvement is one of the most important elements in a successful waste management program. The public participation program in Alberta was documented from notes taken during discussions with individuals who participated in the program.

Chapter II

THE DEFINITION OF A HAZARDOUS OR SPECIAL WASTE

This chapter examines the definitions of hazardous and special wastes in a more comprehensive manner.

2.1 DEFINITION OF HAZARDOUS AND SPECIAL WASTES

In 1978, the federal Environmental Protection Service (Environment Canada) organized a Task Force on the Definition of Hazardous Wastes, with representatives from federal and provincial governments, the National Research Council, industry, and others. The following definitions have been generally accepted:

Waste: A waste is any substance for which an owner or generator has no further use.

Hazardous Waste: A hazardous waste is any material, that due to its nature or quantity, poses a threat to human health or environmental quality, and which requires special disposal techniques to eliminate the hazards.

Waste is an economic term. Waste is the non-marketable output of an industrial process. A waste can be differentiated from a product, a byproduct, or a good. A product, by-

product, or good are marketable outputs of an industrial process.

Before 1970, the terms "hazard" or "hazardous" were used primarily to describe waste pesticides or specific chemicals such as mercury and arsenic. Since then, the terms have been more closely associated with industrial and manufacturing processes. It is generally recognized that all wastes may be hazardous to some degree. Some wastes may be hazardous in extremely small quantities or in low concentrations, and others may have to be present in large quantities to pose a threat to public health or to environmental quality.

Wastes may be hazardous in a number of ways. They may be carcinogenic, chemically reactive, corrosive, of an irritant nature, flammable, genetically disruptive, infectious, toxic, or accumulative in the food chain (Lehman, 1981). Thus, a hazardous waste can be defined as any material which, due to its nature or quantity, poses a threat to human health or environmental quality, and which requires special disposal techniques to eliminate the hazards.

The term "hazardous" is used synonymously with "toxic", "poisonous", and "chemical" in statutory definitions (Lehman, 1981). Generally, an international consensus exists that specific waste materials are capable of damage to environmental quality and public health, but there is no consensus as to which term should be used. The aim is the same

for each term: to single out specific wastes for more careful management control.

A classification scheme helps identify which materials are hazardous. A sufficiently precise classification is beneficial for control purposes. It permits control measures for hazardous wastes to be strengthened and for the control to be restricted to selected wastes (Szelinski, 1981).

There is no general agreement as to the most suitable classification scheme for hazardous wastes. The United Nations has designated nine basic classes of dangerous goods (United Nations, 1984):

1. Class 1

Explosives - including explosives within the meaning of the Explosives Act (Canada).

2. Class 2

Gases - compressed, deeply refrigerated, liquefied or dissolved under pressure.

3. Class 3

Flammable and combustible liquids.

4. Class 4

Flammable solids; substances liable to spontaneous combustion; substances that on contact with water emit flammable gases.

5. Class 5

Oxidizing substances; organic peroxides.

6. Class 6

Poisonous (toxic) and infectious substances.

7. Class 7

Radioactive materials and prescribed substances within the meaning of the Atomic Energy Control Act (Canada)

8. Class 8

Corrosives

9. Class 9

Miscellaneous products; substances or organisms considered by the Governor in Council to be dangerous to life, health, property or the environment when handled, offered for transport and prescribed to be included in this class. Hazardous waste streams are also included in this class.

In Canada, Class 1 and Class 7 are regulated under federal legislation. The Canadian Classification is based on the format and criteria used by the United Nations and the Inter-Government Maritime Organization. A waste may be classified as hazardous either by designation by the UN classification criteria or by meeting criteria or characteristics of a particular waste class in the Canadian classification scheme. In 1980, a Working Group on Criteria and Manifest was created by the Federal-Provincial-Territorial Committee on Waste Management. The Working Group reports to the Toxics Committee, which consists of the deputy ministers of environment from the provinces and the federal assistant deputy minister of Environment. The Working Group generally decided on criteria by which wastes may be included in the

hazardous category in Canada. The two criteria are reactivity and toxicity. A waste is classified as reactive if it is explosive, ignitable, corrosive, or interactive. Properties of toxicity include lethality, carcinogenicity, teratogenicity, mutagenicity, and pathogenicity.

The term "dangerous good" cannot be equated with "hazardous waste" since a good is not a waste. A dangerous good refers to any product, substance or organism, that, by its nature, poses a threat to public health or environmental quality. A hazardous waste is a sub-category of a dangerous good, with the distinction that hazardous wastes do not have any economic value. Special wastes are hazardous wastes that require special handling and treatment.

2.2 STATUTORY DEFINITIONS

2.2.1 Canada

The Transportation of Dangerous Goods Act is the main federal statute regulating the transport of hazardous wastes in Canada. A dangerous good, as defined by legislation, "is any product, substance or organism included by its nature or by the regulations in any of the classes listed in the schedule."

In Alberta, a hazardous or special waste is defined in the Hazardous Chemicals Amendment Act. A hazardous chemical (waste) "is any substance, class of substance or mixture of

substances that is entering or capable of entering the environment in a quantity or concentration or under conditions that may constitute danger to the environment, plant or animal life or human health." Since 1982, the term "special waste" has been used in Alberta, to refer to hazardous wastes that require special treatment. Schedule 1 of the regulations under the Act lists 97 process waste streams and approximately 2000 commercial chemical products having the generic name listed. Each waste is assigned to a specific class based on the United Nations classification system.

The Dangerous Goods Handling and Transportation Act in Manitoba defines a hazardous waste as "any substance or group of substances so designated by the regulations or conforming to criteria set out in regulations." A dangerous good includes a hazardous waste.

In a Waste Quantities Study prepared by the Ontario Waste Management Corporation (OWMC), the definition of a hazardous waste was narrowed by starting from total waste, and excluding wastes that, for reasons, did not fit the criteria for definition. Regulation 309 is the general waste management regulation in Ontario. Hauled liquid industrial waste and hazardous waste are both defined in the Regulation. The former is "a liquid waste other than hauled sewage that results from industrial, manufacturing or commercial operations and is transported in a tank or other container for treatment or disposal." The latter is defined as "a waste

that requires special precautions in its storage, collection, transportation, treatment or disposal to prevent damage to persons, property and includes explosive, flammable, volatile, toxic and pathological waste." The OWMC has also adopted the term "special waste" because of a lack of uniformity in the province over what constitutes a liquid industrial waste and hazardous waste (Ontario Waste Management Corporation, 1982).

2.2.2 United States

In the United States, the Environmental Protection Agency (EPA) regulations state that any material cannot be classified as a hazardous waste unless it has met the tests used to classify solid wastes. The Resource Conservation and Recovery Act (RCRA) contains the definition of a hazardous waste. A solid waste is "any garbage, refuse, sludge or any other waste material that is not otherwise excluded from the regulations." This includes material that is solid, liquid, semi-solid or contained gaseous wastes, thus contradicting the natural implications of the phrase "solid waste". Wastes must result from industrial, commercial, mining or agricultural operations, or from community activities, and must meet one of several specific tests reflecting the general concept that the material is to be discarded.

A hazardous waste is one that has met the tests for classification as a solid waste, and is also listed on the EPA

list of hazardous wastes. For other unlisted wastes, EPA has prescribed tests which must be applied to representative samples to determine one of the four characteristics (ignitability, corrosivity, reactivity, toxicity) that will cause a waste to be classified as hazardous. Tests for each characteristic are prescribed by the regulations. A material first becomes a hazardous waste when it satisfies the specific requirements on which its classification as a hazardous waste depends. This is true whether the classification depends on a listing description or a characteristic. To summarize, the definition of a hazardous waste in the United States includes the following requirements:

1. that it be first a solid waste,
2. that it not be excluded from the regulations,
3. that it be one of the following:
 - a) a listed hazardous waste,
 - b) a mixture containing a listed waste, or
 - c) an unlisted waste having any one of the identified characteristics (Frick, 1981).

Minnesota defines a hazardous waste in Minnesota Statute 116.06 as: "any refuse or discarded material or combinations of refuse or discarded materials in solid, semi-solid, liquid or gaseous form which cannot be handled by routine waste management techniques because they pose a substantial present or potential hazard to human health or other living organisms because of their chemical, biological or physical

properties. Categories of hazardous waste materials include, but are not limited to the following: explosives, flammables, oxidizers, poisons, irritants, and corrosives. Hazardous waste does not include sewage sludge, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954, as amended."

2.2.3 Europe

In the relevant European statutes, the term hazardous is rarely used (NATO, 1977). Existing legislation defines the following terms: chemical waste (Netherlands, Denmark); toxic waste (Belgium); special waste (West Germany, United Kingdom, France). Each term is defined within the context of legislation and the rules that apply to that statute.

Lehman (1981) summarizes some of the statutory definitions in Europe. In the United Kingdom, a special waste is defined as a "waste of a kind which is poisonous, noxious, or polluting and whose presence on the land is liable to give rise to an environmental hazard." (Deposit of Poisonous Wastes Act). Special wastes are those which "may be dangerous or difficult to dispose of."

In West Germany, a special waste is defined as "wastes from commercial or trade companies which due to their nature, composition, or quantities are especially hazardous to human health, air, or water, or which are explosive, flamma-

ble, or may cause diseases. Their disposal may be subject to additional requirements according to the Act." (Waste Disposal Act).

2.3 ANALYSIS OF DEFINITIONS

In analysing hazardous and special waste definitions, it can be noted that there are two main levels of sophistication in identifying what is a hazardous waste. At the statutory level, phrases are chosen to broadly define hazardous wastes and their detrimental public health and environmental effects. At the regulatory level, there is further elaboration and interpretation of the definitions to produce more specific examples, criteria, categories, or listing of hazardous wastes.

The definition of a "waste" depends on the situation. For example, a material becomes a waste only when it has no market or economic value. While it is being stored, it is a good or some other term implying it has economic value.

For the purpose of this report, the definitions of a waste and hazardous waste agreed upon by the Federal-Provincial-Territorial Committee on Waste Management will be used. The definitions define the nature of a waste and the criteria used to define hazardous are based on practicality. Restated, a waste is "any substance for which an owner or generator has no further use." A hazardous waste is "any

material, that due to its nature or quantity, poses a threat to human health or environmental quality, and which requires special disposal techniques to eliminate the hazards."

Chapter III

SPECIAL WASTE MANAGEMENT IN SELECTED OTHER JURISDICTIONS

This chapter examines the Canadian federal perspective in hazardous waste management and then briefly outlines the provincial approaches taken by Ontario and Manitoba. The United States federal program is reviewed and so is that of the state of Minnesota. Two European countries, the United Kingdom and West Germany are also outlined. These jurisdictions represent an effective spectrum of current hazardous waste management practice. In each jurisdiction, four components (present facilities, legislation, ownership, and public participation) are briefly reviewed if information was available. Finally, a set of components and characteristics were identified for an evaluation of the Alberta hazardous waste management program in Chapter 4.

3.1 THE CANADIAN FEDERAL PERSPECTIVE

Many jurisdictions are involved in hazardous waste management in Canada. Waste management is constitutionally a provincial responsibility (Hay, 1984). However, because of the vastness of the country, generation of wastes in one province and disposal in another, municipal zoning and by-laws, or local public resistance to the establishment of a

waste disposal facility, the federal government has accepted responsibility for providing national direction in hazardous waste management (Hay, 1984).

The federal government has primary constitutional authority in areas such as:

1. Transboundary matters - international and interprovincial,
2. Product control - affecting that which must eventually be discarded,
3. Citizen safety - which covers health and environmental effects,
4. Activities on federal Crown Lands and federal facilities.

In practical terms, the federal government has no direct authority to conduct waste management operations, except at its own facilities. The Code of Good Practice for Management of Hazardous and Toxic Wastes at Federal Establishments (Environment Canada, 1977) provides guidelines for the handling and disposal of hazardous wastes at facilities under the jurisdiction of the federal government. Actual management and disposal of wastes is a provincial concern. Within the constitutional framework, the federal government can contribute to definition of the problem nationally, collection of information, research and development to develop necessary technology, search for solutions common to more

than one province, and monitoring and control of transboundary movement. These aspects provide a basis for division of authority between the federal and provincial governments.

The Environmental Protection Service is a component of Environment Canada. The Waste Management Branch of EPS collects and disseminates information on wastes in Canada. The Canadian hazardous waste management effort has six major components.

1. Definition of a Hazardous Waste: Through the Canadian Council of Resource and Environmental Ministers, Environment Canada coordinated a Federal-Provincial-Territorial Committee on Waste Management to define a hazardous waste. These definitions were given in Chapter 2.
2. Inventory: Once a hazardous waste has been defined, the quantities of each waste being generated can be identified. This aids in the siting of disposal facilities within a national grid.
3. Technology Development: This area is one where the federal government can make major contributions. Research and development funds are available and access to international organizations such as the Organization for Economic Cooperation and Development and the NATO Committee on the Challenges of Modern Society enable the federal government to make valuable contributions to hazardous waste management. Develop-

ment of thermal destruction technologies, reuse and recovery of wastes, and sponsoring and supporting the Canadian Waste Material Exchange are three major contributions in this area. The Development and Demonstration of Resource and Energy Conservation Technology Program pays up to 50 percent of the total estimated costs of an approved project whose primary aim is to reduce, recover, or recycle wastes, and save energy (Environment Canada, 1981a). The Canadian Waste Materials Exchange is attempts to find new uses for industrial wastes based on the concept that "one man's garbage is another man's gold" (Laughlin, 1984).

4. Siting: A modest public information program is being undertaken to disseminate basic information on waste generation and disposal so the general public can consider the tradeoffs of a waste disposal facility. Going beyond this is not directly a federal concern since the consideration of specific sites requires provincial involvement. General guidelines covering basic requirements for siting are being drafted to provide direction in hazardous waste management throughout Canada.
5. Monitoring and Control of Transboundary Waste Movement: This is an area where the federal government has clear jurisdiction. The Transportation of Dangerous Goods Act and regulations authorize a manifest

system to monitor transboundary movement of wastes if the wastes are generated in one jurisdiction and disposed of in another.

6. Legislation and Regulation: Efforts have concentrated on the control of movement of hazardous wastes. A broader spectrum, includes uniform standards that can be introduced to ensure responsible waste disposal.

Although the Canadian government does not have regulatory authority over hazardous wastes, it can provide national direction and can provide assistance where its authority permits. For example, inventory of hazardous wastes in Canada was promulgated by the federal government enabling it to analyze the problem of management of wastes, and where the problem was most acute. There is no unifying legislation of hazardous wastes; therefore each province adopts legislation tailored to its specific needs.

3.1.1 Ontario

The Ontario Ministry of Environment has two major roles in hazardous waste management in the province. The first is a regulatory role that is concerned with control and enforcement of regulations dealing with hazardous wastes. The second is a managerial role that promotes and initiates research and development, coordinates funding and long term planning, and encourages reduction, recycling, recovery, and reuse of wastes (Ontario Ministry of Environment, 1983a).

The other main coordinator of hazardous waste management in Ontario is the Ontario Waste Management Corporation (OWMC). The Crown Corporation was established by legislation to assume responsibility for establishing a waste management facility in Ontario. The OWMC has no regulatory authority; its own treatment and disposal facilities will be subject to Ministry of Environment regulations.

Ownership of the land and facility has not yet been determined. The facility will probably be financed by the Corporation and built on provincial Crown land. Long term security will be assured since the government is ultimately responsible for regulating the facility.

The policy of the Corporation is as follows (Ontario Ministry of the Environment, 1983a):

1. The Corporation is committed to finding ways to reduce and recycle wastes, and specific steps are being taken to ensure that this key corporate goal is implemented.
2. The OWMC is committed to the principle that no hazardous waste will be placed untreated in a secure landfill and will only utilize technologies that have proven successful.
3. The OWMC is committed to consulting with the public and will provide, through the hearing panel, financial assistance to eligible participants in the public hearings.

In November 1982, the Minister of the Environment set out four principles as the framework for a comprehensive review of all present waste management policies, practices and controls (Ontario Ministry of the Environment, 1983a):

1. As many recoverable and usable material and energy resources as possible must be reclaimed from the garbage we produce.
2. Those who are responsible for producing, handling and disposing of wastes must be accountable for the way they execute their responsibilities.
3. As responsible parties, we must be informed on the issues and take part in the decisions which must be made to resolve them.
4. Our disposal practices must ensure that no waste ever becomes a threat to either our environment or our well being.

The current methods of waste disposal in Ontario are waste exchange, on- or off-site recycling, recovery, and reuse, and on- or off-site treatment and disposal. Facilities which accept hazardous wastes include commercial secure landfill, liquid industrial waste incinerators, transfer stations, and on-site disposal or recovery facilities.

Regulation 309 of the Environmental Protection Act, is the primary legislative control over hazardous wastes in Ontario. Regulation 313 of the Environmental Protection Act

prescribes the waybill form. The waybill monitors activities of generators, carriers and receivers.

OWMC's public consultation program has been an important part of the Corporation's planning process. The public consultation program has evolved through three phases of the Facility Development Process from September, 1982 to March, 1984. In this period, several types of public involvement activities were developed and have contributed to each phase. These include contact with agricultural, environmental, municipal, industrial, and transportation associations; weekend seminars and regional meetings in Chatham, Sarnia, London, Hamilton, Toronto, and Oshawa; information days with displays, maps, graphics, reports, and a video program available for public review; and meetings with municipal and regional planning councils. When each major phase in the process is completed, a report was issued which summarized the issues that had been raised in the public meetings, seminars and workshops.

In Ontario, the nature of the meetings, seminars and workshops has been primarily to inform the public. Meetings were advertized through local newspapers. The OWMC hosted these meetings and invited participants from the above mentioned associations. In order to allow for feedback, timing of meetings was important. Phase 1 of the Facility Development Process did not involve any public consultations. Phase 2 involved meetings in a selected geographic area (the

'Golden Horseshoe' i.e., Oshawa to Niagara Falls). Meetings were held in this area after the search had been narrowed by the OWMC to the 'Golden Horseshoe' since approximately 70 percent of the wastes are produced in the area.

Public involvement was initiated early in the OWMC Facility Development Process. The decision had already been made that a site for the disposal of hazardous wastes was to be chosen. A province-wide public involvement program was not conducted; instead, the search for a site (and public meetings) were intensified in the Golden Horseshoe region. More detailed site selection studies are currently being conducted.

3.1.2 Manitoba

The Manitoba Department of Environment and Workplace Safety and Health is the main agency responsible for hazardous and special waste management in the province. The mandate of the department is to create a comprehensive waste management system to address hazardous and special wastes in the province. The Clean Environment Commission and the Manitoba Environmental Council are also involved in hazardous and special waste management in Manitoba.

The Clean Environment Commission is a quasi-judicial body mandated by the Clean Environment Act. The Commission reports directly to the Minister of Environment and Workplace

Safety and Health. The Minister directed the Commission to conduct public hearings on hazardous and special wastes to ascertain public attitudes and perceptions. Within the hearing process, the Commission can ask the Department of Environment and Workplace Safety and Health to assist in supplying information and to determine the scope of the hearings. The main vehicle used by the Commission in assessing public attitudes is a report to the Minister on the outcome of the hearings.

The Manitoba Environmental Council is a citizen's group which advises the Minister on major issues and problems. The Council deals directly with the public and reports to the Minister. The Council makes input to Clean Environment Commission hearings.

Present practices of waste disposal in Manitoba are inadequate. Quinn (1985) notes that approximately 50 percent of all wastes amenable to a management system are disposed of in sanitary sewer systems, and about 20 percent is disposed of in landfills. The remaining 30 percent is disposed of by several different methods, each of which account for a small percentage of the total.

The hazardous and special waste management program was initiated in November, 1982. The first phase of the program initiated a public involvement program. A non-government Steering Committee consisting of academics, the Manitoba

Naturalists Society, the Manitoba Association of Urban Municipalities, the Union of Manitoba Municipalities (rural), the Manitoba Chamber of Commerce, and the Manitoba Federation of Labour was established to organize, conduct, and report on a hazardous and special waste symposium held in Winnipeg in March, 1983.

The public was informed about the symposium through letters of invitation to organizations, including those represented on the Steering Committee. Following this, copies of the symposium calendar were printed and distributed by hand and through the mail. Newspaper advertisements were run approximately two weeks prior to the symposium in regional newspapers throughout the province. The symposium consisted of expert speakers who could play a role in public education, and panel discussions chaired by speakers knowledgeable of hazardous wastes and their management. A coordinator was assigned to hold workshops on specific waste management topics.

Workshop topics included issues of transportation, long term safety and monitoring, public participation, recycling, ownership, alternate technologies, landfill, and legislation and enforcement. Each working group nominated a spokesperson who was responsible for reporting the recommendations of the workshop to the Steering Committee. The following general recommendations were made : a waste management library should be assembled; a waste inventory in the province

should be undertaken; a common set of terms and definitions should be adopted by the province; an environmental impact study should be prepared on potential sites; public input should be included in the design and construction and long term operation and in the monitoring of a facility; legislation should include provision for a manifest system, a definition of hazardous and special wastes; and there should be "cradle to grave" control of wastes (Manitoba Environment, 1983).

The Clean Environment Commission held hearings across the province in December 1983 to February 1984. The public was informed of the hearings in much the same way as the symposium was advertized.

Hearings were held in Dauphin, Flin Flon, Winnipeg, Portage la Prairie, Brandon, Morden, and Thompson. Department of Environment staff assisted in providing information for the hearings. Topics of briefs included the need for a facility, ownership and operation, location of facilities, legislation and regulation, costs, recycling, laboratory and informational support services, transport, and public education and involvement (Manitoba Clean Environment Commission, 1984).

From the first round of hearings it was recommended that an information package be prepared and distributed prior to the next set of hearings. Letters of invitation should be

sent to organizations who might participate. Additional publicity should be utilized to promote greater participation. Hearings should be held in at least the same number of regions and communities as before.

As part of Phase 1, a Hazardous Waste Coordinator was appointed to the hazardous and special waste management program. Initial draft legislation was developed to regulate and control hazardous and special wastes. An associated public consultation program was conducted by Manitoba Environment staff. Meetings were held in major centres across Manitoba. The product of these meetings was a report outlining the proposed legislation, verbal and written comments, and probable drafting changes (Manitoba Department of Environment and Workplace Safety and Health, 1983).

An information exchange was undertaken by the Department of Environment in fall 1983. The department provided Manitoba businesses with information on the hazardous and special waste management program (specifically proposed legislation). In return, businesses gave estimates of waste quantities and types and current management practices in the province. The information has been consolidated into a report on waste management in Manitoba that was released in August 1985. In late fall 1985, this report will form the basis for a second set of Clean Environment Commission hearings to determine the need for a comprehensive hazardous and special waste management system in Manitoba.

The Dangerous Goods Handling and Transportation Act is the main statute concerned with hazardous waste management in Manitoba. It enables the government to establish standards for the generation, storage, transportation, disposal, and use of dangerous goods, including hazardous wastes. It provides for the control aspects of hazardous waste management, such as siting, monitoring, inventory, recycling, reuse, recovery, transboundary movement of waste, and perpetual care and financial responsibility. The act also outlines the role of the public.

Manitoba is the only province in Canada to amalgamate transport with other aspects of hazardous and special waste management. This 'umbrella approach' allows for greater uniformity in the establishment of regulations and controls concerning dangerous goods and hazardous and special wastes. It is also the main focal point for public participation, since most concerns are covered in one statute. One government department coordinates enforcement and coordinates activities with other departments (i.e., Highways, Agriculture).

Based on recommendations from the symposium, and through further public consultations and hearings, the Department of Environment and Workplace Safety and Health will determine the appropriate collection, treatment and disposal system for the province in Phase 2 of the program. Criteria derived from Phase 1 will help determine appropriate potential sites.

Phase 3 will address the matter of implementation of an appropriate management system. The role of the public is designed to reflect the program's policy of openness and public involvement. It is anticipated that the public involvement program in Manitoba will provide for sufficient public input since the program was initiated before the need for a waste management system was decided. The public will be involved at each phase of development. In the long run, public involvement from the beginning of the program will benefit both the decision-makers and the public. It will allow the public to make valuable and educated comments and criticisms about the process.

3.2 THE UNITED STATES FEDERAL PERSPECTIVE

In the United States in the 1970's, waste disposal practices were identified as important sources of environmental damage, especially with respect to groundwater used as drinking water. This led Congress to enact the Resource Conservation and Recovery Act (RCRA) in 1976. It took the Environmental Protection Agency (EPA) nearly six years to develop a full regulatory framework to implement the statute. Several policy considerations influenced the development of RCRA. These considerations include maximizing public participation, reducing regulatory burden to a minimum, responding to public alarm about hazardous wastes, and responding to the RCRA goal to promote resource conservation and recovery (Lehman, 1984).

The order of priority for hazardous waste management in the U.S. is the following:

1. to minimize the amounts of waste generated by changing or modifying the processes used,
2. to establish a more comprehensive waste exchange system,
3. to reprocess or recycle wastes whenever possible,
4. to separate hazardous wastes from non-hazardous wastes at the source, concentrate them, and transport them to a licenced facility,
5. to incinerate the wastes,
6. to dispose of wastes in a secure landfill (Collins and Saukin, 1981).

The underlying basic purpose of RCRA is the protection of groundwater (Quarles, 1982). The Act replaced the Solid Waste Disposal Act. RCRA addresses the handling of hazardous waste at currently operating or at future facilities. It is designed to monitor emissions not regulated in the Clean Air Act and Clean Water Act (Quarles, 1982). RCRA does not address abandoned sites or closed facilities. The Comprehensive Environmental Response, Compensation and Liability Act (Superfund) deals with abandoned sites or closed facilities.

Several major elements are detailed in the federal approach to hazardous waste management. A federal classifica-

tion of wastes characterizes wastes into two categories - hazardous wastes and other solid wastes. Definitions are given in Chapter 2. The EPA has listed a long series of industrial waste streams determined to be hazardous. It has also determined four basic criteria of ignitability, corrosivity, reactivity and toxicity. If any waste meets one of these criteria, it will be classified as hazardous and handled pursuant to the regulations.

Waste in transit classified as hazardous, and meeting the regulatory requirements, becomes subject to a manifest system where each hazardous waste can be tracked from its origin (generator) through each transporter to its ultimate disposal at a treatment, storage or disposal site. This "cradle to grave" tracking provides a mechanism for assigning accountability. A clear purpose of the statute is to place primary responsibility on waste generators. Each generator must evaluate its wastes to determine whether the wastes fall within the classification of a hazardous waste that requires compliance with federal regulations. Transporters may only deliver hazardous wastes to a designated facility subject to a RCRA permit.

The effectiveness of the federal regulatory system rests on the combination of the manifest system and the regulation of treatment, storage and disposal facilities (Quarles, 1982). The manifest system attempts to ensure that no waste can be disposed of anywhere other than an approved facility;

other regulations ensure that waste is handled in an environmentally acceptable manner once it reaches the facility. The EPA has provided regulations governing the location, design and construction of facilities. The regulations require extensive groundwater monitoring to detect and evaluate any migration of contaminants.

Administratively, the permit system is the core of RCRA. All treatment, storage and disposal facilities must obtain permits, the principal mechanism through which the federal requirements are made explicitly applicable to individual facilities. A facility cannot operate without a permit.

Less than a decade ago, there was no national program to manage hazardous wastes. Today, 60 percent of major disposal facilities still do not comply with regulatory requirements. Violators usually receive only a warning letter; illegal dumpers can often escape detection by the EPA (Boraiko, 1985). Enforcement of RCRA rules and monitoring for groundwater pollution have not been adequate at most hazardous waste disposal sites (Boraiko, 1985). In the short run, landfills are cheaper than chemical treatment or incineration. About 60 percent of all hazardous waste is disposed of in injection wells.

Any potential waste generator must hold a permit for the siting and operation of a hazardous waste management facility. The background information required in permit applica-

tions must be available for public inspection. This is the informal aspect of public participation in the U.S.

If it is decided that the site is satisfactory for disposal, a draft permit is prepared. The formal phase of public participation is initiated when the public notice of a draft permit is circulated by the EPA to federal, state, and local governments, as well as to members of the public who have expressed an interest (Forcade, 1984).

For members of the public, the comment period is the most important part of the process. All subsequent proceedings in the issuance of permits are limited to issues, arguments and facts raised during the public comment period. Public comment also allows for a formal non-adversary panel hearing. The hearing provides for verbal arguments supporting public comments.

Proceedings for issuance of permits are more complex than mentioned above. It is important to note that issuance of permits allows for an informed public to present facts for and against new facilities.

The U.S. has enacted one main statute for hazardous waste management in the country. Individual states can use RCRA as a model for their own hazardous waste management programs. This gives each state direction and a basis from which to work.

In the past, disposal facilities were generally privately owned. States are now encouraging private ownership or state ownership of facilities on public lands. The use of public lands allows for increased control by the government site operator, and greater public confidence due to increased availability of information, and continuity of ownership (during operation and after closure). There is evidence that organized crime is involved in the operation of a number of hazardous waste disposal companies. (U.S. House Committee on Energy and Commerce, 1981; Block and Scarpitti, 1985). This would tend to subvert the process of hazardous waste management in a democratic society.

During the development of RCRA, provisions were included anticipating that primary operating responsibility for issuance of permits and application of all regulatory requirements would be covered by state programs operating in compliance with federal regulations. A state program must conform with the federal program, but does not have to be identical to the EPA program. State standards must not be less stringent than federal standards. Until a state program is approved, a waste generator must comply with both state and federal requirements. Once approved, a state program has the same regulatory authority as the federal program, and effectively displaces the federal program.

3.2.1 Minnesota

The Waste Management Act of 1980 establishes procedures for managing hazardous wastes in Minnesota. The Act allowed for the creation of the Waste Management Board. The Board consists of eight part-time citizen members and a full time chairperson appointed by the Governor to four-year terms. The Board is responsible for three main activities involving hazardous wastes:

1. Development of a hazardous waste management plan,
2. Development of an inventory of preferred areas for hazardous waste processing facilities,
3. Siting of at least one hazardous waste disposal facility.

The Hazardous Waste Management Plan has specific goals. The goals or objectives are defined in the Act. These goals are:

1. A reduction in the amount of waste generated. This stands as the top priority of the Plan,
2. The separation and recovery of materials or energy from waste,
3. The orderly, deliberate development and financial security of waste facilities.

The goals reflect an "alternative" approach to policy making and decision-making. In the past, decisions on sit-

ing and on planning of state policies have been assigned to elected or appointed officials (Minnesota Waste Management Board, 1983a). The aim of the Waste Management Act is to promote and encourage citizen participation in addressing and solving the problem of hazardous wastes.

Hazardous wastes in Minnesota are also regulated by the United States EPA and the Minnesota Pollution Control Agency (PCA). The PCA conforms to federal standards and has the same regulatory authority as RCRA. The PCA is the regulatory agency while the Waste Management Board is the siting and policy making body. Final authorization of state regulations allows the PCA regulatory control over hazardous wastes in Minnesota.

Current waste management practices are regulated by the EPA and PCA. The operation of any waste treatment, storage or disposal facility is forbidden without a permit. The state regulatory program consists of two distinct reporting systems: 1) a "disclosure system" in which each generator predicts his firm's annual rate of generation and indicates the likely form of disposition of the waste, 2) a manifest system, for tracking wastes from generator to treatment or disposal facilities (Minnesota Waste Management Board, 1983a).

The manifest system accounts for only a fraction of Minnesota's total hazardous wastes. Most hazardous wastes are

not shipped for treatment or disposal. Instead, wastes are treated or disposed of by the generator. Some hazardous wastes are managed in municipal wastewater treatment systems, with or without final treatment. Hazardous waste facilities in Illinois and Wisconsin receive approximately 35 percent of the hazardous wastes produced in Minnesota.

The Waste Management Act requires that public involvement be a central element in the Hazardous Waste Management Board's siting of hazardous waste facilities (Minnesota Waste Management Board, 1981). Citizens throughout the state had the opportunity to participate and make recommendation regarding the development of siting criteria. The Board developed a sequence of four public meetings in each development region between December, 1980 and April, 1981. These meetings were designed to educate the public about Minnesota's hazardous waste problem, the functions and responsibilities of the Board, and the site selection process required by the Waste Management Act.

The first public meetings consisted of general orientation sessions in which Board members and staff presented an overview of the problem and distributed materials on hazardous waste management techniques and facility siting criteria. Each meeting stressed the opportunities for public participation. Approximately 3000 citizens attended the first round of 19 meetings.

The second round of meetings attracted 2500 participants. Meetings dealt directly with facility siting criteria, and an explanation of how each criterion might affect the selection of sites. Participants assembled into several small groups to discuss siting criteria with a Board member. Group questionnaires dealing with siting issues were completed.

Third round meetings provided an opportunity for residents to learn the results of the questionnaires and to learn how their viewpoints and recommendations affected criteria development.

The Waste Management Board believed that its extensive public involvement program has been productive in site selection decision-making. Recommendations were received not only pertaining to siting, but also pertaining to larger issues such as the reduction and processing of wastes. Through meetings and seminars, concerns that the siting had already been completed were lessened and citizens were not as negative in their reactions towards siting a facility (Minnesota Waste Management Board, 1981).

Based on the recommendations from the public, the suggestions of technical consultants, staff, and others, the Board has developed site selection criteria and identified 60 "preliminary areas" across the state for possible siting of a facility. Recognizing that some companies in the state

might already be planning to develop facilities, the Board advertized that it would consider sites volunteered by local governments or private firms (Minnesota Waste Management Board, 1983b). Formal public hearings were held on the proposed areas within the affected communities. Based on the hearings, the Board selected 10 preferred areas.

Public involvement in the Minnesota hazardous waste management program was ensured through legislation. The public involvement program was initiated before site selection, and was state-wide. The public was involved in the design of siting criteria and the site selection process. Timing of public involvement was one of the reasons for the effectiveness of the program. Public groups identified the international issue regarding drainage of rivers into adjacent states and Manitoba, and the potential for transboundary pollution. The governments of Manitoba and Minnesota are in contact with each other, informing each of the progress of the hazardous and special waste management program. Development of liaison is essential to the resolution of problems that may arise. The program is promising in that it allowed for participation from most areas of the state.

3.3 EUROPE

The United Kingdom and West Germany initiated hazardous waste management programs in the early 1970's when it was realized that many abandoned and operating disposal sites were polluting ground and surface water. The main components of the programs were legislation, policies, storage, transportation, and disposal and treatment technology.

Europe is densely populated and highly industrialized; land is not easily available for landfill sites. Hazardous wastes cross national borders continually, requiring consultation among countries. Consultation was initiated through membership in the European Common Market (Environment Canada, 1981b). The Organization of Economic Cooperation and Development (OECD) established guidelines for anticipating the effects of chemicals on man and his environment. The United Nations Commission for Europe recommended a study of industrial sectors that were generating hazardous wastes. The development of new technology, recycling and reuse of wastes, and the introduction of waste exchanges were encouraged by the Commission (Wassermann, 1982). The European Economic Council directive on "toxic and dangerous" wastes defined a hazardous waste as substances of such a nature, or in such concentrations as to constitute a risk to health or the environment, and encouraged member states to recycle and re-process wastes. Hazardous waste is to be kept separate from other waste and disposed of at licensed facilities.

Public involvement programs were virtually non-existent during the siting of European hazardous waste facilities in the mid-1970's. At that time, environmental awareness within the general population was not sufficient, and the public appeared not to be concerned about the siting of facilities. Hazardous waste facilities were sited where needs were greatest. Since the building and operation of facilities, there has been a strong public relations program, informing the public what occurs at a hazardous waste disposal facility.

3.3.1 United Kingdom

The philosophy of "attenuation and dispersion" is the policy practiced in the U.K. Waste disposal is governed by the Deposit of Poisonous Wastes Act and the Control of Pollution Act which are administered by the British Department of Environment. The Control of Pollution Act is based on the premise that all household, commercial, and industrial wastes need to be controlled in order to ensure protection of the environment (Wilson, 1982). Such wastes are defined as controlled waste. A specific fraction of industrial wastes requires more specialized control. This fraction of wastes comprises hazardous or special wastes. The Control of Pollution Act provides for a notification procedure through which generators are required to give relevant local authorities prior notice of the nature, quantities and des-

tinuation of wastes. A schedule of wastes in the regulations covers danger to human health, but ignores specific environmental problems such as water pollution and environmental impacts. Most special waste disposal is undertaken by local authorities or private companies. Approximately 5000 sites are licensed to accept controlled waste; only 500 of these can accept special wastes. About 50 percent of the special waste sites are operated by contractors; the remaining are on-site disposal facilities run by the operator and local waste disposal authorities (WDA). A nationally coordinated effort is lacking since planning is conducted at a municipal level (Anderton, 1980).

The legislation allows a local planning authority to grant permission for a disposal site. When this permission is granted, the WDA must issue a licence for a disposal site (Skitt, 1982). Public participation is very limited since planning notices are open-ended and WDA powers appear to be limited to authority to receive appeals. A public participation program is not well developed at the municipal level; therefore the public can be involved only by opposing development and there is little or no public participation in the locating of sites. In the planning phase, the public has an opportunity to appeal specific plans to the Department of Environment which can overrule local authority. The appeal process thus establishes an antagonistic relationship with respect to siting, rather than a participatory one. It

is interesting to note that for geological reasons, sites suitable for hazardous waste disposal are often found in coal field areas, which are commonly in areas of urban development. Co-disposal of industrial special wastes with municipal wastes is common because of lack of suitable sites for special waste disposal. The costs of safe disposal may be considerable, and not an option that may be considered. Incineration is less economic than landfilling (Harris, 1981). About 10 percent of all wastes in the U.K. are incinerated; the rest are landfilled.

Disposal site operators, or waste disposal authorities are faced with a dilemma. Once the WDA receives a notice from the planning authority, the WDA cannot refuse the application. Since most public involvement occurs through opposing development, public input into this process occurs late, and the public does not have a chance to participate in siting activities. Solutions amenable to all parties may not be reached since the public has not had a chance to participate in the site selection process. In general, provisions for long term security and liability of facilities are not issues with the WDA's (Environment Canada, 1981b).

3.3.2 West Germany

Special wastes in the Federal Republic of Germany are defined through statutory regulation in the Waste Disposal Act. All types of waste, not just hazardous wastes are cov-

ered in this Act. The comprehensive act gives no definition of a special waste. The act states that wastes must be disposed of in order cause the least possible harm to man or his environment. Different states have their own anti-pollution laws, but they also have to implement the federal law (Wassermann, 1982).

The Act authorizes a waybill system to track waste from its source to ultimate disposal. Waste may only be treated, stored or disposed of in facilities licenced for this purpose. A study by the United Nations Economic Commission for Europe points out some of the weaknesses of the statute. The system of routine reporting does not include reporting for accidents. The manifest system does not function when transport and final disposal of waste is handled by the producer rather than a government licensee.

Hazardous waste management facilities are non-profit facilities, owned jointly by industry and local or state governments. The largest of these, in Bavaria, Gesellschaft zur Beseitigung von Sondermüll in Bayern (GSB) is a state-wide, non-profit hazardous waste management facility owned cooperatively by the state, several municipalities, and 76 industrial firms. The state is the major partner (40 percent, the municipalities and industrial firms own 30 percent each) (Paparian, 1983). The chairman of the governing board of the facility is the Bavarian Minister of Environment; four members are from state government; three members are

from industry; and three members are from local governments (Piasecki and Davis, 1984). Since the Board members represent all partners, GSB may prove more capable of making long term investment and cost-benefit decisions than conventional corporations. The Bavarian Department of Environment oversees the entire operation, and it determines what can or cannot be disposed of in landfills.

There are three major special waste treatment facilities in West Germany. They operate a network of regional collection and pre-treatment facilities where the volume or weight of wastes is reduced to prepare for long distance transport to the central facilities. A few pretreatment facilities are publicly owned and run by cooperatives, the majority are privately owned and run.

3.4 COMPONENTS OF A HAZARDOUS AND SPECIAL WASTE MANAGEMENT PROGRAM

To assess the success or effectiveness of the Alberta special waste management program, a set of components and characteristics (Table 2) has been developed with which the Alberta program (outlined in Chapter 4) can be compared. These components and characteristics were selected from the discussion of hazardous and special waste management programs in other jurisdictions. The three main headings under which components were used to assess the Alberta program were legislation, ownership, and public involvement.

Legislation is often tailored to specific needs of a policy developed in a specific jurisdiction. Some general requirements of legislation should include:

1. A definition of what constitutes a hazardous waste,
2. A statute regulating treatment, storage, and disposal of hazardous wastes, and
3. A set of regulations under the statute identifying and listing hazardous wastes.

Specific components for assessing legislation include:

- a manifest system, with cradle to grave tracking of wastes,
- provisions for monitoring the facility and site.

Ownership of a disposal facility is particularly important for long term security of a disposal site. To ensure long term security and integrity of environmental policy, government involvement is desirable. Involvement should be effective in regulating, monitoring, and enforcing legislation. An effective means of government involvement is through ownership of the land on which the facility is built. Crown land has been indicated as the favoured type of ownership of land in Ontario.

The requirements of ownership assessment include:

- the assurance of long term security and preservation of environmental quality,
- accountability for the facility,
- bonding of a private company operating

the facility.

Public participation is an integral part of a hazardous waste management program. A public involvement program must allow for adequate input from the public into the decision-making process. This entails public involvement early in the process, with all members of the public included in the process. Public involvement must remain high through the development of siting criteria, the siting of the facility, and the operation and closure of the facility.

Effective public participation should provide for:

- allowing for significant input from
the public,
- public participation should be initiated
at a time which permits it to be
effective,
- right to participate by the public.
participate.

TABLE 2

Components of a Hazardous and Special Waste Management
Program

COMPONENTS/CHARACTERISTICS	PRESENT	ABSENT
<p>LEGISLATION</p> <ul style="list-style-type: none"> • definition of special & hazardous wastes • statute regulating transport storage, and disposal • regulations identifying hazardous & special wastes • manifest system • monitoring <p>OWNERSHIP</p> <ul style="list-style-type: none"> • long term security • accountability • bonding of a private company <p>PUBLIC PARTICIPATION</p> <ul style="list-style-type: none"> • adequate input • timing • right to participate 		

Chapter IV

SPECIAL WASTE MANAGEMENT IN ALBERTA

This chapter summarizes special waste² management in Alberta. A number of reports have been completed which provide inventories of special wastes in Alberta (Synergy West Ltd., 1975; Pritchard, 1977; Reed and Smith, 1979). A Government of Canada study conducted by W.L. Wardrop (1979) was the first to conclude that current waste disposal practices were inadequate. A program of special waste management was initiated by the Alberta government soon after these conclusions were reached. A number of studies were undertaken to assess the different components of a special waste management facility (Hu Harries and Associates Ltd., 1979; Krawetz, 1979; Cottrell, 1980; Lilley, 1980; F.G. Berch & Associates, 1980; Dalcour Group, 1980; Hazardous Waste Team, 1981). Transportation, administration and regulation, public involvement, ownership, technology and economics have been studied by the above authors. This chapter summarizes administration of special wastes in Alberta, present practices, government policy, legislation, public involvement, and site selection.

² In Alberta, the term special waste refers to hazardous and special wastes.

4.1 ALBERTA ADMINISTRATION

The Alberta Department of Environment (Alberta Environment) is the provincial department responsible for special waste management in the province. The Hazardous Chemicals Act, Clean Air Act and Clean Water Act are administered by this department.

Within the Pollution Control Division of Alberta Environment, the Waste Management Branch and Municipal Engineering Branch are involved in special waste management. The Municipal Engineering Branch monitors the operation of treatment facilities. The Waste Management Branch has been the most actively involved in special waste management. The Waste Management Branch administers the Hazardous Chemicals Act and regulations under the Act. The Waste Management Branch is responsible for the public participation program and coordinates the management system.

The Standards and Approvals Division of Alberta Environment, Air and Water Quality Branch, Industrial Waste Branch and Municipal Engineering Branch are less directly involved in the special waste management program. This division is responsible for establishing air and water quality standards.

The Soils and Groundwater Branch of the Earth Sciences Division of Alberta Environment studies soil contamination, groundwater supply, land reclamation and disposal of wastes in landfills.

4.2 PRESENT SPECIAL WASTE PRACTICES IN ALBERTA

Reid, Crowther & Partners (1980) produced a report outlining current special waste management practices in Alberta. This report appears to be the most accurate and extensive information available. This judgement of the report is confirmed by Ken Simpson of Alberta Environment. Two main components of the existing waste management system are transportation and disposal practices. Much of the following information is taken from the Reid Crowther report.

The transport of waste materials from their source to their final destination is an integral part of the overall waste management system. Details of truck fleet capacities from companies involved in the transport of special wastes were obtained. Almost complete coverage of fleets in Calgary, Edmonton and Lethbridge was received, with good representation from other areas. It was concluded that the existing truck fleet was inadequate to transport special wastes in a safe and environmentally sound manner (Reid, Crowther & Partners, 1980). Further study is required to determine the needs of a transportation system. Hazardous wastes are not transported by rail in Alberta. Rail haul is feasible and no major technological improvements would be necessary to transport wastes from storage facilities to a disposal site, other than the provision of a rail line.

Until the passage of the Transportation of Dangerous Goods Control Act and the Hazardous Chemical Amendment Act in 1982, the transport of special wastes in the province was poorly regulated and at times environmentally unsound. The list of problems includes mixing of waste types, concealment of wastes, poor equipment maintenance, lack of a tracking system from source to disposal, and disposal in unsuitable areas. These problems create difficulties in disposing of wastes since waste streams must be analyzed for suitable disposal techniques.

There are currently 5 methods of disposing of special wastes in Alberta: landfill, storage, deepwell injection, incineration, and recycling. Major landfills which accept special waste include the Clover Bar Sanitary Landfill in Edmonton and the Forest Lawn Landfill in Calgary. Other landfills are located in Calgary and Edmonton, but do not accept special wastes. Many small landfill sites in agricultural areas are known to accept special wastes. Excess or spoiled seed grain treated with pesticide, pesticide containers and their residues are commonly disposed in these landfill and open dumps.

Waste PCB's and PCB contaminated materials are landfilled. PCB's are stored at various locations around the province. Kinetic Contaminants Ltd. of Nisku, Alberta accepts wastes in sealed units for interim storage under safe and controlled conditions. Final disposal of PCB wastes will be necessary.

Deepwell injection of specific special wastes has been carried out on a small scale since 1948. The wastes injected are usually refinery process water and petrochemical process water.

The only special waste incinerator in the province is owned and operated by the University of Alberta. The incinerator was installed primarily as a result of difficulties experienced by the university with adequate disposal of wastes they produced. It processes wastes from the University of Alberta, other educational institutions and some hospitals. To increase efficiency of incineration, wastes could be accepted from other generators.

The only major recyclers of liquid wastes in Alberta are Hub Oil in Calgary and Turbo Oil in Edmonton. Waste oils from service stations and other sources are re-refined into a useable product.

4.3 ALBERTA GOVERNMENT POLICY

The special waste management system operating prior to the initiation of the special waste program lacked coordination and direction. The Government of Alberta (1982) released a policy paper in 1982 on industrial and special waste management in the province.

The basic policy objective for the development of an industrial and special waste management system in Alberta is

"to ensure continued human health and environmental quality." In order to meet this objective, the goal is "to minimize waste production and recycle wastes whenever possible." "Where these actions are not feasible courses of action, the necessary legislative, regulatory, monitoring and infrastructure requirements are being put into place to ensure all special wastes are treated and disposed in a responsible and controlled manner."

Based on the Environment Council of Alberta (1980) recommendations and the Alberta Environment (1980) report, the Alberta Cabinet agreed to three major policy decisions in January 1982:

1. that a central treatment facility would be built in Alberta on land owned by the Crown to augment existing and proposed on-site treatment facilities,
2. that the private sector would be encouraged to build and operate the central facility, and
3. that a Crown Agency would be formed to oversee the operation of the management system.

The government policy has important implications for the management of special wastes in Alberta. The facility is on land leased from the Crown, therefore, ultimate accountability rests with the government. In Alberta, the proponent is accountable to the government since the facility is on Crown land, and a Crown Corporation will be overseeing the opera-

tion of the management system. Long term security and continuity of ownership is ensured since the government of Alberta has direct involvement in special waste management.

4.4 LEGISLATION

Legislation regarding special waste management before the inception of the special waste management program in 1982 was non-existent. Most regulations dealt primarily with the disposal of municipal refuse. For example, under the Public Health Act, all landfill sites are required to obtain a permit from the Department of Public Health. One clause in the Regulations states that the disposal of any flammable liquid which creates a problem distinct from the disposal of municipal wastes is subject to approval. The Department of the Environment Act allows the Minister of Environment to take any action necessary to promote environmental quality.

Three major statutes were passed in the 1982 Spring session of the Alberta Legislature dealing specifically with special waste management. The Hazardous Chemicals Amendment Act gave legislative authority over the disposal of special wastes as well as the requirements for clean up of spills. Regulations established a schedule of hazardous chemicals, a mandatory "cradle to grave" manifest system and the standards governing storage and disposal of hazardous chemicals (Section 16).

The Alberta Transportation of Dangerous Goods Control Act provided for provincial application of the federal Transportation of Dangerous Goods Act. An administrative agreement must be signed by the governments of Alberta and Canada to address the issues of jurisdiction and uniform enforcement. The agreement will establish a highway mode of transportation stating how to apply the regulations and which regulations are a provincial or a federal concern. Regulations in the provincial Act include prescribing products as dangerous goods, safety marks, requirements and standards governing routes and times of travel and the preparation of emergency plans and programs. This Act is not dealt with in any detail since special wastes are a small sub-category of dangerous goods. The transport of special wastes falls in the larger class of the transport of dangerous goods. Dangerous goods become special wastes when they are destined for disposal at a disposal unit.

The Special Waste Management Corporation Act established the Crown agency which will oversee the central treatment facility and other elements of the management system. The Corporation was formed to ensure the establishment and operation of facilities to deal adequately with special waste.

Bill 66, the Environmental Statutes Amendment Act is ready to be proclaimed, following its passage at the 1984 fall session of the Alberta Legislature. The Bill increases the responsibilities of the Special Waste Management Corpo-

ration. The Act requires that commercial storage, transportation, treatment and disposal of special wastes be authorized by the Corporation. These activities are in addition to licences and permits required by Alberta Environment (Alberta Special Waste Management Corporation, 1984).

The Alberta Clean Air Act and the Alberta Clean Water Act provide guidelines for facility approvals. Regulations under these will establish schedules of controlled wastes and allowable disposal procedures. These Acts also regulate facilities where these wastes are generated, stored, treated and disposed of.

4.5 PUBLIC INVOLVEMENT

Since 1979, Alberta Environment has been conducting an extensive program to address the problem of how to treat and dispose of the special wastes produced in the province annually. Early in the program, it was recognized that public acceptance of a special waste treatment facility was essential. For this reason, a phased process was developed to obtain advice and public views.

A Hazardous Waste Management Committee, consisting of outside experts and Department of Environment officials was appointed in 1979 to make recommendations to the Minister of the Environment on the overall approach to special waste management. This report, Hazardous Waste Management in Al-

berta, (Alberta Environment, 1980) was released publicly, and engendered an extensive program of public hearings and meetings throughout the province by the Environment Council of Alberta (ECA). Meetings, hearings and information sessions were advertized through local newspapers. Appendix A shows locations of hearings and meetings, and lists briefs that were presented. The list of briefs indicates the wide range of people that attended the hearings. The Committee report was released in December 1980. Following this report, the Government appointed the Hazardous Waste Implementation Team in early 1981 to work with the Department of Environment to develop a process for the siting of a treatment facility. These meetings served to inform and educate the public about special waste management in the province and the future courses of action that would be taken with regards to siting a facility. Table 3 shows the chronological sequence of public participation in the site selection process.

The public participation process in Alberta was documented based on a conversation with Jim Steele of Alberta Environment. The Hazardous Waste Implementation Team was a citizen-government task force with government, industry, academic, and municipal representatives. The public participation program undertaken by the Team was primarily interested in developing siting criteria and a siting process for the province. Criteria were developed from input from the

public hearings and meetings held by the ECA. In 1981, the Team held a meeting with Directors of regional planning in the province to discuss siting of a special waste management

TABLE 3

Chronology of Public Participation in Alberta

- | | |
|------|--|
| 1981 | - Hazardous Waste Implementation Team established to develop siting criteria and siting process. |
| 1981 | - Team met with Directors of regional planning to discuss siting on a general level |
| 1981 | - Citizen Action Committees were formed to help disseminate information to the public |
| 1981 | - Municipalities in Alberta were invited by Alberta Environment to request constraint maps. Fifty-two municipalities requested maps. Meetings hosted by Alberta Environment were held in each of the 52 communities. |
| 1982 | - Five candidate areas showed an interest in hosting a facility after these meetings. |
| 1983 | - Plebiscites were organized by each community to indicate the degree of local support. |
| 1984 | - Swan Hills was chosen for a special waste treatment facility in Alberta. |

facility on a general level. Citizen Action Committees were formed in many communities during the province-wide information dissemination. These Committees helped disseminate information to the public. Citizens and County councillors were members of these Committees. Based on the information received, the Committees encouraged the government to pro-

ceed with siting criteria development. Approval was also given by the Directors of regional planning, and the Team invited counties, municipal districts, improvements and special areas of the province to request constraint maps of their areas. Appendix B shows the municipalities of Alberta, which include counties, municipal districts, and special areas. A constraint mapping technique was used to eliminate environmentally unacceptable areas from further siting consideration. An example of such a map is shown in Appendix B. Environmentally unsuitable areas are classified as constraints to development, are indicated on the map. Upon invitation, mapping was conducted and constraint maps were disseminated to the interested municipalities. Fifty-two regional municipalities received constraint maps. The Implementation Team held meetings in every municipality to present the maps to interested citizens and receive comments and criticisms on the maps. If the municipality (citizens, town and county councillors) was still interested in a special waste management facility, meetings were arranged in late 1981 to discuss and inform residents about the general nature of special waste treatment facilities, available technology and the options open in the future. Meetings were held in community halls and school gymnasiums and advertised through local newspapers and posters.

From these meetings, five candidate areas showed an interest in hosting a treatment facility. Each community or-

ganized plebiscites in late 1982 with the support of local authorities and Members of the Legislative Assembly. Two communities had positive community support. The choice of site was a Cabinet decision based on the two major criteria of environmental and public acceptability. The decision allows for political accountability for the selection of the site.

Jennifer McQuaid-Cook of the Alberta Special Waste Management Corporation noted that the public participation program in Alberta is unique because no siting was attempted before public consultation was undertaken. No decision was made on any sites before the proposal was introduced to the public.

Unlike Manitoba, the public participation program in Alberta was not initiated until it had been decided that a special waste management facility was needed. There was a danger that public acceptability of a special waste management facility would not occur since the public had not been involved in the initial decision-making process. Public involvement was initiated comparatively late. The timing of the meetings resulted in a sense of immediacy placed on the public. The fact that two communities were interested in a special waste management facility could be regarded as a success by Alberta Environment. If more public involvement had been initiated earlier in the process, more communities might have been interested in a facility.

4.6 SITE SELECTION CRITERIA

The site selection procedure in Alberta was initiated at the same time as the public involvement program. Alberta Environment officials reassessed the procedure of selecting a site first and then attempting to justify its selection to local residents. The Alberta approach was to reverse the procedure; i.e., to start with the concerns of the public (health and environmental concerns) and attempt to incorporate those concerns in the site selection process. This was achieved by a series of seminars and workshops held across the province where the fears and concerns of the public were addressed. These concerns were then consolidated into a series of criteria and constraints that could be applied to any potential site (Simpson, 1984).

Much of the siting criteria information is derived from the Constraint Map Report Series for Alberta on Site Selection for the Integrated Special Waste Management System (Alberta Environment, 1982). Most of the constraints relate closely to siting criteria in the Environment Council of Alberta Report and Recommendations of Hazardous Waste Management in Alberta (1980).

The criteria used for selecting sites are defined under four main headings: physical, biological, land use, and human criteria. The mapping of these criteria follows a logical continuum from the unchanging physical environment

through to the biological variables which result from the physical environmental conditions and human activities. The land use which is directly dependent on the landscape and biological productivity is mapped first. Man's dependence and use of the land take in all other criteria, and cultural and recreational values provide an overall impression of human activities. The experience and technical development of past siting activities is being incorporated into a manual, currently being prepared by the Environmental Protection Service. Therefore, site selection criteria are not examined in any detail.

The criteria used for constraint mapping were (Alberta Environment, 1982):

1. physical constraints
 - geology
 - hydrogeology
 - topography
 - surface water
2. biological constraints
 - forestry
 - wildlife
 - birdlife
3. land use constraints
 - agriculture
 - federal lands
 - transportation
 - resource extraction
4. human constraints
 - recreation
 - population centres

A composite constraint map is shown in Appendix C. Because of the matter of some of the constraints mapped, the Town of

Swan Hills and the two major highways leading to the town are not shown on the map and should have been included during the drafting of the maps. From the maps, part of the site appears to have moderate limitations in geology and hydrogeology. After more detailed investigation, part of the site was found suitable for a special waste management facility (C.E. Moell & Associates, 1984).

Canada Land Inventory (CLI) maps for forestry, wildlife, wetlands and waterfowl, agriculture, and recreation were used to prepare the maps.

4.7 SWAN HILLS SITE

A site near Swan Hills was announced by the Environment Minister on March 12, 1984 (Alberta Environment, 1984a; see Map 1). After the completion of the public involvement program two communities (one of them being Swan Hills) vied for the special waste management facility. The choice of Swan Hills was a Cabinet decision (Alberta Environment, 1984a). Swan Hills is located approximately 200 km northwest of Edmonton. The town is serviced by one major highway; the nearest rail line goes through Whitecourt, 70 km to the southwest. Swan Hills is primarily an oil industry town. Lynn Stocking, the municipal administrator of Swan Hills stated that the town was affected by the recession in 1982, and was very eager to see new industry located near the town. the municipal administrator of Swan Hills. Major

benefits foreseen by the community and town council include improvements to existing roads, industry diversification, increased employment opportunities, the sale of existing utilities, improved community services and facilities, and an increased tax base.

The site is located about 18 km northeast of Swan Hills on Crown land. Dominant vegetation consists of coniferous forests of lodgepole pine and black spruce. White spruce and balsam fir are found in drier areas. Geologically, the site is underlain by clay till deposits that do not allow for surface drainage to move downward to the groundwater system (C.E. Moell & Associates, 1984).

Ken Simpson of Alberta Environment noted a number of reasons why Swan Hills was chosen as the location for a special waste management facility. The main reason was public acceptance of a facility by the people of Swan Hills. Other reasons were that Crown land was available for the facility, utilities were cheaper than elsewhere, and the site is not located in or around the town.

The site did meet the current Alberta criteria for constraint mapping, including physical, biological, land use, and human constraints. Public acceptability was established by a community organized referendum. However, the site may not be appropriate for a number of reasons. The location, 200 km northwest of Edmonton, is not centrally located.

Transportation problems are increased due to distance of travel to the facility. Although problems of transportation are outside the scope of this study, they must be acknowledged. Even though a large percentage of wastes are generated near rail access, no rail service currently exists. Costs to establish such a service may be significant.

Collection and transfer systems are in the process of being developed. When a network of facilities has been designed, communities may have to be re-approached for transfer sites. Therefore, the process of public involvement may have to be repeated, including meetings and seminars.

4.8 SPECIAL WASTE MANAGEMENT CORPORATION

The Alberta Special Waste Management Corporation (ASWMC) was established in April 1984. John Elson of the Alberta Special Waste Management Corporation stated that its primary function is to provide liaison and communication between the public and the government. Activities carried out by the Corporation include monitoring the development of regulations in the Department of Environment, The Energy Resources Conservation Board, and industry and environmental groups; contracting with the private sector for the collection and transport of special wastes; and the organization of transfer and collection of wastes. If the private sector is unable to implement particular aspects of the waste management system, the Corporation may intervene to ensure a complete system is implemented.

The Swan Hills site is on leased Crown land. The Corporation is responsible for providing complete utilities to the site. The Corporation is a technical coordinator, and is not responsible for the transport and collection systems. Contracts have been awarded by the Corporation for pre-facility site development. Ecological inventories, surface and groundwater monitoring and regional geology and hydrogeology have been studied, investigating the suitability of the site (Alberta Special Waste Management Corporation, 1984). The conclusions of these studies were favourable. No serious limitations were found on the site.

The Corporation has control over the operation of the facility, yet is not involved in initial capital cost expenditures. The proponent (Chem-Security Ltd.) is providing the capital for the project. A uniform cost structure for disposal of wastes has been determined by the Corporation based on capital expenditure and operating expenses. Fees are set by the Corporation for the disposal of wastes. This allows uniform unit charges so generators in Calgary will not have to pay more than generators in Edmonton for transport of wastes to Swan Hills. Equalization of fees is necessary since the Swan Hills site is not centrally located.

There are currently 7 members on the Board representing industry, government and the academic community. They are appointed to ensure that the Corporation fulfills its mandate. The Corporation is an independent body that reports

to the Lieutenant Governor-in-Council through the Minister of Environment, not to the Waste Management Branch of Alberta Environment. The "arms length" relationship of the Corporation to both the government and disposal company increases public acceptability of the facility since information is more readily available to the public. The Corporation has set up a community office in Swan Hills so concerns of the town can be voiced directly, and public input from the community can be continued.

4.9 THE PROPONENT

Chem-Security Ltd. was awarded the contract to build the special waste treatment facility in May, 1984 (Alberta Environment, 1984b). Chem-Security is a wholly owned subsidiary of Bow Valley Resource Services of Calgary. Rod Leeland of Chem Security Ltd. stated that a defined design of the facility has not been completed due to uncertainty as to what will be regulated, and what volumes and types of wastes may be expected. The treatment facility will be located on 129 ha of Crown land. It will be a modular design, with "generic off the shelf units" of existing technology. The modular design allows for future growth of the facility if larger volumes of wastes are produced.

Chem-Security plans to treat 20,000 t per year of wastes when the facility becomes operational. Although estimates of wastes show 90,000 t per year are produced (Reid, Growth-

er & Partners, 1980), Chem-Security believe about 20,000 t/year will be available for treatment. Availability of wastes and the recent downturn in the Alberta economy are two of the main reasons for the 20,000 t per year estimate. The availability of wastes is also based on the projections for growth in the Alberta economy.

The site will include a secure landfill which will be divided into cells. Treated wastes or solids (no liquids) will be deposited into a cell to be covered. Each cell will be divided into a grid system so a record of where wastes are deposited can be kept for future purposes such as reclamation or recycling. Once a cell is full, it will be capped and the moveable cover will be placed on next cell. The cover, which will keep rain and snow out, will prevent leaching and provide a wind break.

High temperature treatment (approximately 1000°C), based on needs defined by a more detailed inventory, will be operational in late 1987. A rocking kiln, and possibly a plasma arc (a laser-like source of energy that changes the molecular structure of chemicals) may be installed. Organic liquids, sludges and vapors would be destroyed in the high temperature process. Emissions may include sulphur dioxide, hydrogen chloride, carbon monoxide, and dust. The flue gases will be scrubbed to remove sulphur dioxide and hydrogen chloride.

Chemical treatment such as neutralization, oxidation, reduction or de-emulsification for inorganics will be functioning by 1986. Facilities to enable wastes be solidified and fixed will also be constructed. These wastes, along with the chemically treated wastes, will be landfilled.

A deepwell is located on the site and will be used for treated wastewater only. A water treatment plant is to be built to treat surface runoff, truck washing water, etc. Some water may be recycled for use in high temperature treatment.

A laboratory will be located on-site to analyze in-coming wastes. Generators must send a sample of their waste so that the laboratory can analyze them and devise the best treatment option. Limited storage on-site will be available.

The landfill and deepwell are be operational by late 1985. Since this is the only facility in Alberta authorized to accept special wastes, Chem-Security must accept and treat all wastes or find alternatives. The uncertain availability of some wastes may also necessitate storage until sufficient material is available for treatment and disposal. Should Chem-Security choose to accept wastes from other provinces in order to decrease storage time, other risks involved with intra-provincial transport would need to be considered.

Chapter V

COMPARISON OF SPECIAL WASTE MANAGEMENT PROGRAMS

This chapter analyzes the Alberta special waste management program. This evaluation compares aspects of the program to the components and characteristics established in the Chapter 3 review of other jurisdictions. Legislation, ownership, and public participation are the three areas where components have been identified which enable an analysis of the Alberta program.

5.1 LEGISLATION

The following components were established for assessing legislation:

1. A definition of what constitutes a hazardous waste,
2. A statute regulating treatment, storage, and disposal of hazardous wastes, and
3. A set of regulations under the statute identifying and listing hazardous wastes.

The problems in the development of RCRA in the United States cannot be ignored in the development of a comprehensive piece of legislation. However, for administrative efficiency, a single statute does have distinct advantages.

Alberta does not have a single statute for special waste management. The definition of a special waste is given in the Hazardous Chemicals Amendment Act. Regulations under this Act established a "cradle to grave" manifest system, a schedule of hazardous wastes, and the standards for governing storage and disposal of hazardous wastes. The transport of hazardous waste in the province is governed by the Transportation of Dangerous Goods Control Act. A further statute, The Special Waste Management Corporation Act established a Crown Corporation to oversee the development and operation of the treatment facility.

Amalgamation of these acts into a single act in Alberta would be complex. Government policy explicitly states that "a Crown Agency would be formed to oversee the operation of the management system". Some aspects of the management system were not accounted for during the preparation of the Special Waste Management Corporation Act. The introduction of Bill 66, the Environmental Statutes Amendment Act, in late 1984 was evidence of this. Perhaps the government has moved too quickly in implementing the management system. The Act increased the responsibilities of the Special Waste Management Corporation, requiring commercial storage, transportation, treatment and disposal be authorized by the Corporation.

There is no federal statutory definition of a hazardous waste, therefore Alberta could not adopt such a definition.

The definition of a special waste is in the Hazardous Chemicals Amendment Act. A special waste "is any substance, class of substance or mixture of substances that is entering, or capable of entering the environment in a quantity or concentration or under conditions that may constitute danger to the environment, plant or animal life, or human health." The generally agreed upon definition suggested by the Federal-Provincial-Territorial Committee was not adopted by Alberta. Both the provincial statutory and federal definitions are similar in nature focusing on materials entering the environment that may have an effect on environmental quality and/or human health. Any particular definition only makes sense in the context of a particular piece of legislation in a particular jurisdiction. A manifest system, tracking wastes from "cradle to grave" was established in the Hazardous Chemicals Amendment Act. Provisions in the Alberta Clean Air Act and Alberta Clean Water Act provide for long term environmental quality monitoring. quality.

Based on the components in Table 4, legislation in Alberta is adequate to manage a special waste management facility in the province. The only component that is not satisfactory is that of a definition of a special waste within legislation. A simple definition at the beginning of the act stating the hazards of special wastes to human health and the environment would give the layperson an idea of what constitutes a special waste.

5.2 OWNERSHIP

The following components were discussed in Chapter 3 for assessing ownership:

1. Government involvement is desirable,
2. The involvement could be in the form of
 - a) regulating, monitoring, and enforcing legislation, and
 - b) ownership of the land that the facility is built on.

Long term security is an important issue, and one where the government can provide guidance and continuity.

The government, the Waste Management Branch of Alberta Environment, is the regulatory authority, responsible for monitoring and enforcing legislation. The facility is situated on Crown land, satisfying a requirement of government policy. The facility is privately owned by Chem-Security Ltd. The company must be bonded to ensure that the facility will not be abandoned without being accountable for the losses. It is in the best interests of Chem-Security to operate an economically viable operation for profit. This may include accepting wastes from other provinces.

Having the facility on Crown land infers that ultimate accountability rests with the government. Private ownership of the facility, with the Crown Corporation overseeing the

operation, increases public acceptability of the facility since there is a separation of enforcement and monitoring from the operation of the facility.

Ownership of the facility is satisfactory to meet the requirements of long term security, accountability for the facility, and long term environmental integrity.

5.3 PUBLIC INVOLVEMENT

The following were characteristics established in Chapter 3 for assessing public involvement:

1. Allowing for significant public involvement,
2. Public participation should be initiated at a time which permits it to be effective, and
3. The public must be given the right to participate.

The Alberta public participation process did not fully satisfy these characteristics. Public participation appeared to be in two separate segments. The first segment was initiated in 1979 when government officials were appointed to make recommendations on the overall approach to hazardous waste management in the province. Public hearings and meetings were held throughout the province to inform the public about hazardous waste management and a proposed facility, and receive comments on the proposal. Meetings were held after it had been decided that there was a need for a facility in Alberta. The public did have a chance to give com-

ments and recommendations for siting criteria. Once it had been decided there was a need for the facility, some input from the public was solicited in the site selection phase of the program.

The second segment of the public participation program was more specific in scope, focusing on areas that showed an interest in a hazardous waste management facility. Not all areas of the province were included in this segment of the program. Public acceptability of a facility was limited to five areas of the province, perhaps indicating that the public involvement program did not reach a large enough audience in its first segment. The timing of the program may have been too late, and negative attitudes towards the development of a facility may have already been created.

A collection and transfer system has not yet been developed in Alberta. The development of this system will require additional public involvement and acceptability in communities throughout the province. Some communities that have already rejected a treatment, storage, and disposal facility will not be amenable to accepting a transfer or collection station unless they are fully informed about the nature of the station.

Table 4 summarizes the assessment of the Alberta program.

The Alberta program did not fully meet the components and characteristics. Once the public participation program was

TABLE 4

An Assessment of the Alberta Special Waste Management
Program

COMPONENTS/CHARACTERISTICS	PRESENT	ABSENT
LEGISLATION		
● definition of special & hazardous wastes		X
● statute regulating transport storage, and disposal	X	
● regulations identifying hazardous & special wastes	X	
● manifest system	X	
● monitoring	X	
OWNERSHIP		
● long term security	X	
● accountability	X	
● bonding of a private company	X	
PUBLIC PARTICIPATION		
● adequate input	X	
● timing		X
● right to participate	X	

initiated, input from the public was solicited. Timing of the program was perhaps late since most communities were not interested in a special waste management facility. If involvement had begun earlier, public acceptance of a facility may have been more widespread.

The special waste management facility at Swan Hills is not yet in operation, so it is too early to determine if the program is satisfactory. Based on the above components, and the fact that Alberta has chosen a site, the program of spe-

cial waste management in the province appears promising to safely manage and dispose of the special wastes produced in the province. Over a long period of time, the program may require modifications as technological developments and other aspects of special waste management improve. Matters relating to transportation and collection still must be finalized.

Chapter VI

CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

An evaluation of the Alberta special waste management program was based on components and characteristics drawn from the experience of other jurisdictions. Hazardous waste management programs in Ontario, Manitoba, Minnesota, the United Kingdom, and West Germany are at different stages of development. Some of the aspects of each program are useful for determining the components of an effective management system.

The basis for the effectiveness or success of a waste management system is the legislative and regulatory framework established to monitor and control special wastes. Government ownership of the facility and/or the land the facility is built on indicate long term security for the site and management accountability. Accountability for the site can be accomplished through bonding of the facility, through the establishment of an industry-financed fund, or through monetary accountability by government, since it is unlikely government will go bankrupt. Public involvement allows concerns to be voiced on special waste management.

A need for a waste management facility was established in Alberta when studies by W.L. Wardrop (1979) and Reid Crowther & Partners (1980) showed that special wastes were not being disposed of in a manner that would ensure maintenance of environmental quality and health to citizens of the province.

Intrinsic to all objectives of hazardous or special waste management programs is the maintenance of environmental quality and of human health. Government policy can give direction to a program, but the legislative and regulatory framework is necessary to ensure that the facility operate in an environmentally safe manner. The requirements of legislation are fairly similar within a number of jurisdictions. Alberta does not have a single act for special waste management. A single Act, regulating transport, storage, disposal, a manifest system, and monitoring is recommended for ease of administration. The Act could be administered by one government department with assistance from other departments. The Act could provide for a single focal point for information pertaining to all aspects of dangerous goods and special wastes and allow for enforcement by departments with expertise in various areas of special wastes and dangerous goods.

Government involvement is desirable in regulating, monitoring, and enforcing legislation, and in the ownership of the land. Long term security and accountability must be en-

sured. Long term security involves monitoring what occurs during the operation and post-closure of the facility. Accountability is the capability of dealing with a problem and correcting a problem when it arises.

The success of a public involvement program is dependent on the goals and objectives of the program. The public must first recognize that they are part of the problem, and that they can voice their concerns regarding the efficient management of hazardous wastes. These concerns can be translated into mechanisms for proper treatment of hazardous wastes. Alberta allowed for input from the public, but did not continue the process through to its conclusion. Other jurisdictions should initiate public information programs early in the development of a hazardous waste management plan. These programs should continue after a site has been selected.

6.2 RECOMMENDATIONS

The following recommendations are proposed to ensure that Alberta, and other provinces in Canada, are able to successfully manage hazardous waste in the future:

1.

It is recommended that each jurisdiction develop explicit objectives for its hazardous waste management program to address potential threats to human health and to environmental quality, posed by hazardous wastes.

This will ensure that each jurisdiction works towards the goals of maintenance of human health and of environmental quality.

2.

It is recommended that Environment Canada take the lead in establishing a national definition of a hazardous waste.

There is a need for a national definition to enable a coordination or direction of hazardous waste management programs across Canada. Uniform definitions and criteria will enable uniform national transboundary shipment of wastes.

3.

It is recommended that Environment Canada promote a public involvement program on hazardous waste management.

Throughout Canada, a better understanding of public involvement is needed so there is greater understanding of hazardous wastes and hazardous waste management facilities.

4.

It is recommended that Alberta Environment undertake a long term environmental quality monitoring program at the Swan Hills site and at associated collection and transfer stations.

Long term security of a hazardous waste management facility is ensured through bonding of the facility. Long term environmental quality monitoring would en-

sure the integrity of the site and facilities. Standards already exist regarding air and water pollution in Alberta, but standards are only as strict as the enforcement.

5.

It is recommended that the Alberta government finance a study on intra- and , inter-provincial transport of special wastes in the province.

Transportation of special wastes is an important component of a special waste management program. Legislation and regulations exist for transport of dangerous goods in Alberta. A study such as this would complement the information in this report.

6.

It is recommended that Alberta Environment conduct public meetings relating to the siting of transport and collection stations in the province.

Public involvement is continuing in the community of Swan Hills, but should be continued throughout the province since a transport and collection system for special wastes has not been established. Public involvement programs will have to be repeated to see which communities are interested in a transport and collection station.

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PERSONAL COMMUNICATIONS

Elson, John. Chairman, Alberta Special Waste Management Corporation.

Leeland, Rod. Spokesperson, Chem-Security Ltd.

McQuaid Cook, Jennifer. Corporate Planner, Alberta Special Waste Management Corporation.

Simpson, Ken. Head, Waste Management Branch, Pollution Control Division. Alberta Environment.

Stocking, Lynn. Municipal Administrator, Swan Hills, Alberta.

Steele, Jim. Member, Hazardous Waste Team. Alberta Environment.

Yee, Edwin. Head, Hazardous and Special Waste Management. Manitoba Environment.

Appendix A

LOCATION OF PUBLIC HEARINGS IN ALBERTA

LOCATION AND DATE OF PUBLIC HEARINGS

Peace River	April 28, 1980
Grande Prairie	April 30, 1980
Edson	May 2, 1980
Two Hills	May 5, 6, 1980
Athabasca	May 8, 1980
Fort Saskatchewan	May 12, 13, 1980
Bonnyville	May 15, 1980
Fort McMurray	May 22, 1980
Edmonton	May 26, 27, 1980
Wainwright	May 29, 1980
Camrose	June 3, 1980
Red Deer	June 5, 1980
Lethbridge	June 10, 1980
Medicine Hat	June 12, 1980
Calgary	June 24, 25, 1980
Drumheller	June 27, 1980

LOCATION AND DATE OF INFORMATION MEETINGS

Peace River	March 3, 1980
Grande Prairie	March 4, 1980
Edson	March 6, 1980
Fort McMurray	March 10, 1980
Athabasca	March 12, 1980
Fort Saskatchewan	March 14, 1980
Two Hills	March 17, 1980
Bonnyville	March 18, 1980
Edmonton	March 19, 1980
Wainwright	March 20, 1980
Camrose	March 24, 1980
Red Deer	March 25, 1980
Drumheller	March 26, 1980
Calgary	March 27, 1980
Medicine Hat	April 1, 1980
Lethbridge	April 2, 1980

Additional Information Meetings were held in the following locations at the request of local organizations:

Elk Point	February 18, 1980
Boyle	March 12, 1980
Hardisty	March 20, 1980
Stettler	March 26, 1980
Brooks	April 1, 1980
Ponoka	April 16, 1980
Newbrook	April 22, 1980
Valleyview	May 1, 1980
Thorhild	June 16, 1980

BRIEFS PRESENTED TO THE PUBLIC HEARINGS ON HAZARDOUS WASTE MANAGEMENT

Name

Representing

Peace River - April 28, 1980

- | | | |
|-----|---------------------------------|--|
| 1. | Dupuis, Vincent | Municipal District of Smoky River
No. 130 |
| 2. | Dupuis, Vincent | Smoky River Fish & Game Association |
| 3. | Chorney, Larry | Town of Fairview |
| 4. | Padden, Bob | Ira Powell |
| 5. | Padden, Bob | Peace River Chamber of Commerce |
| 6. | Steen, Tine | Peace River Creative Playgroup |
| 7. | Koeller, Uwe
(P.H. Inspector | Peace River Health Unit |
| 8. | Papineau, Marcel | Personal |
| 9. | Rusland, Peter | Personal |
| 10. | Wallebeck, Craig | Personal |
| 11. | Allen, David | Personal |

Discussion Contributors:

John Shannon, Vincent Dupuis, Mary Ann France, Sandra Cloake, Peter Rusland, Uwe Koeller, Marcel Papineau, David Allen.

Grande Prairie - April 30, 1980

- | | | |
|-----|------------------|----------|
| 12. | Thomas, Franklin | Personal |
| 13. | Langenbach, John | Personal |
| 14. | Albright, Don | Personal |

Discussion Contributors:

Lee Morin, Bob Barker, Ted Blower, Norman Stanley, Laudy Lickacz, John Sloan, Kay Langenback, Lee McKibbin, Cal Webb, Gerald O'Connell.

Edson - May 2, 1980

- | | | |
|-----|----------------------|-----------------------------------|
| 15. | Tanghe, Robert | Alberta Fish and Game Association |
| 16. | Robb, Ed | Robb Community League |
| 17. | Semeniuk, Lawrence | Personal |
| 18. | Stitzenberger, Linda | Personal |
| 19. | Martin, Ursula | Personal |

Discussion Contributors:

Laudy Lickacz, Diane Kochanski, Robert Tanghe, Mr. Duffy, Bud Byram, Mr. Collin, Ruth Pratt, Dennis Maltais, Fred Makowecki, Laird Mitchell, Dan Peters.

Discussion Contributors:

Sylvester Lakusta, Olga Chadyk, Ron Watson, George Serna, Joe Lukasewich,
Victor Chrapko.

Athabasca - May 8, 1980

- | | | |
|-----|-------------------------|--|
| 43. | Pitman, Ted | National Farmers Union |
| 44. | Goodwin, Ralph | Newbrook Chamber of Commerce |
| 45. | Goodwin, Ralph | Personal |
| 46. | Goodwin, Ralph | Goodwin Enterprises Limited
(Newbrook) Ernest Goodwin |
| 47. | Palfenier, William | Personal |
| 48. | Harrison, Hal | Athabasca Chamber of Commerce
and Alberta Fish & Game Association |
| 49. | Leight, H.E. (Mayor) | Town of Athabasca |
| 50. | Breckenridge, (Mr.) Val | Personal |
| 51. | McLean, Della | Personal |
| 52. | Los, Cheryl | Personal |
| 53. | Bartle, Louis | Smoky Lake Fish & Game Club |
| 54. | Pitman, Janice | Personal |
| 55. | Boven, Rosalie | Personal |
| 56. | Pitman, Margaret | Personal |
| 57. | Boje, Jens | Personal |

Discussion Contributors:

Val Breckenridge, Bill Bolay.

Fort Saskatchewan - May 12, 13, 1980

- | | | |
|-----|------------------------|--------------------------------------|
| 58. | Pommen, D.W. | Town of Fort Saskatchewan |
| 59. | Greyson, S. | Unifarm |
| 60. | Abdurahman, Muriel | Personal |
| 61. | Griffiths, Graham | Clover Bar Constituency Assoc. (NDP) |
| 62. | Woolnough, Janet-Lynne | Personal |
| 63. | Marsh, Geoff | Responsible Disposal Action Comm. |
| 64. | Sherman, W.J. | Personal |
| 65. | Gawlak, M. | Personal |
| 66. | Boon, J.A. | Personal |
| 67. | Huiniga, Jan | Personal |
| 68. | Devereux, Bill | Personal |
| 69. | Lakusta, Sylvester | Personal |
| 70. | Richardson, John | Chem-Nuclear Systems |
| 71. | Richmond, Deborah | Personal |
| 72. | Lakusta, Sylvester | Personal |

Discussion Contributors:

Phil Merry, John Sheppard, Myetka Gawlak, Peter Ream, Muriel Abdurahman, Dr. G. Marsh.

Bonnyville - May 15, 1980

- | | | |
|-----|-----------------------------|----------|
| 73. | Makarewicz, Andy and Sherry | Personal |
| 74. | McKay, Jim | Personal |
| 75. | Slawuta, William (Mayor) | Personal |

- | | | |
|-----|-------------------|-------------------------------------|
| 76. | Wiebe, Kathryn K. | Personal |
| 77. | Nielsen, Peter K. | Personal |
| 78. | Ganske, Ted | Alberta Trappers Assoc. |
| 79. | Appleby, Don | Cold Lake District Fish & Game |
| 80. | Spence, Terry | Bonnyville Air Services (1980) Ltd. |

Fort McMurray - May 22, 1980

- | | | |
|-----|-------------------|-----------------------|
| 81. | Clements, John R. | Synchrude Canada Ltd. |
| 82. | Cary, William | Suncor Inc. |
| 83. | Rogers, Jim | Personal |

Discussion Contributors:

Rick Hawkins, Jim Rogers, William Cary.

Edmonton - May 26, 27, 1980

- | | | |
|-----|-----------------------------------|---|
| 84. | Weir, Gordon | University of Alberta, Dept. of Chemistry |
| 85. | Domingo, Rudy and
Neehall, Roy | City of Edmonton, Dept. Water and
Sanitation |
| 86. | Parker, D. J. | University of Alberta, Dept. of Chemistry |
| 87. | Flanagan, Dr. R. | University of Alberta, Dept. of Pharmacy |
| 88. | Grover, D. | Edmonton Fish and Game Association |
| 89. | Tywniuk, Dr. N. | Environment Canada |

- | | | |
|-----|-------------------|--|
| 90. | Smith, J.M. | Personal |
| 91. | Henning, Dr. F. | Kinetic Contaminants Canada Ltd. |
| 92. | Pattie, Dr. D. | Northern Alberta Institute of Technology |
| 93. | Blackley, Barbara | University Womens' Club Canadian
Federation of University Women |
| 94. | Rogers, Dan | University of Alberta, Student Legal
Services |
| 95. | Pritchard, R.B. | Alberta's Hazardous Chemicals Advisory
Committee |
| 96. | Gauthier, Michele | Personal |
| 97. | Mackie, Mike | Personal |
| 98. | Brown, Barry | Plant National Ltd. |

Discussion Contributors:

S. Hunt, M. Smith, D. Grover, F. Andie, Linda Duncan.

Wainwright - May 29, 1980

- | | | |
|------|-----------------------|---|
| 99. | Blatz, Alex (Reeve) | County of Flagstaff |
| 100. | Schell, Phil | Wainwright Hospital |
| 101. | Coleman, A.C. (Mayor) | Town of Wainwright |
| 102. | Ferwerda, G.J. | Dept. of National Defence Camp Wainwright |
| 103. | Dosdall, L.C. | Town of Hardisty |
| 104. | Harrison, Joyce | Town of Hardisty |

Discussion Contributors:

Orville Likness, Mr. Hutchinson, Jim Crawford, Rolf Jacobsen, Alex Blatz,
G. Goodwin.

Camrose - June 3, 1980

- | | | |
|------|------------------|---|
| 105. | Elliott, J.R. | Health Inspection Services Alberta
East Central Health Unit No. 10 |
| 106. | Elliott, J.R. | Alberta Branch - Canadian Inst. of
Public Health Inspectors |
| 107. | Matson, T.A. | County of Camrose No. 22 |
| 108. | Siebold, Emil G. | Personal |
| 109. | Lemke, Ruth E. | Camrose & County Assoc. for Children
with Learning Disabilities |
| 110. | Muc, Michael | Personal |

Discussion Contributors:

Doug Drysdale, Sergeant Lowe, Dr. McQuarrie, Doris Siebold, Mr. Francoeur,
Mr. Havlik, Mr. Baker.

Red Deer - June 5, 1980

- | | | |
|------|------------------------------------|------------------------------------|
| 111. | Lembicz, Henry | Red Deer Fish & Game Assoc. |
| 112. | Mueller, Fred | Personal |
| 113. | Kure, Elmer | Alberta Fish & Game Assoc. |
| 114. | Mills, Bob | Personal |
| 115. | Tutty, Wayne | Town Council of Blackfalds |
| 116. | Neff, W.A. | Canadian Chemical Producers Assoc. |
| 117. | Kostuch, Martha | Personal |
| 118. | Vogl, Keith | Red Deer Regional Planning Comm. |
| 119. | Weleschuk, Ivan and
White, Norm | Unifarm |

- | | | |
|------|--|---|
| 120. | Broadbent, Dorothy and
McDonald, Doreen | Red Deer River Naturalists |
| 121. | Westrop, Joanne | Personal |
| 122. | Beck, Bruce | Ponoka-Rimbey Constituency Association
(NDP) |
| 123. | Buhler, R.A. | Personal |
| 124. | Pederson, Don | Personal |

Discussion Contributors:

Lee Armstrong, Marilyn Hoar, Fred Mueller, Anita Puzey.

Lethbridge - June 10, 1980

- | | | |
|------|---------------------|--------------------------------------|
| 125. | Schurmann, Mary Lee | Oldman River Regional Planning Comm. |
| 126. | Hall, Elizabeth | City of Lethbridge |
| 127. | Hutchings, Eric | Alberta Environment |
| 128. | Carr, Roy | Canbra Foods Ltd. |
| 129. | Cooper, Mike | Foothills Protective Assoc. |
| 130. | Smith, R.J. | Del-Rio Management Ltd. |
| 131. | Marr, Janet | Personal |
| 132. | Merrick, Gordon | Lethbridge Fish & Game Assoc. |

Discussion Contributors:

Dave Graveland.

Medicine Hat - June 12, 1980

- | | | |
|------|--------------------|--------------------------|
| 133. | Thompson, Lorne R. | City of Medicine Hat |
| 134. | Richards, Bob | Anric Reclaimers Limited |
| 135. | Herrmann, Edwin | Personal |
| 136. | Schmitz, Gary | Alberta Gas Chemicals |
| 137. | Klassen, Gary | Personal |

Discussion Contributors:

Greg MacPherson.

Calgary - June 24, 25, 1980

- | | | |
|------|------------------------------|--|
| 138. | Railton, Dr. J. | Alberta Electric Utility Industry |
| 139. | Cowan, John Y. | Walker Brothers Quarries Limited
Soliroc Process |
| 140. | Shimbashi, Al | Turbo Resources Limited |
| 141. | Munzie, Jim | Canadian National Railway |
| 142. | Caldwell, E.R. | Canadian Petroleum Association |
| 143. | Posey, Mary and Harvey, Doug | Federation of Alberta Naturalists and
Sierra Club |
| 144. | Clements, Mr. J. | Syncrude |
| 145. | Dunford, Mr. C.E. | The Canadian Manufacturers' Association |
| 146. | Rattray, Mr. T.E. | Genstar Conservation Systems |
| 147. | Byran, Mr. E.J. | Pembina Oil Separators (1979) Ltd. |
| 148. | James, Mr. Lorne | Personal |
| 149. | Lee, Brian (Alderman) | The City of Calgary |

- | | | |
|------|-------------------------------|---|
| 150. | Hosking, Dr. David | The City of Calgary Health District |
| 151. | Peake, Mr. Jack | Pace-PPA-M |
| 152. | Wilk, Ken and Guilford, Nigel | Tricil Limited |
| 153. | Hicklin, Mr. L.E. | Energy Resources Conservation Board |
| 154. | Shaw, Mr. Ian | Canadian Institute of Public Health
Inspectors |
| 155. | Douglas, Mr. Glenn | Stablex (Canada) Ltd. |
| 156. | Gemmill, Mr. D. | P.A.C. - Pollution Study Group |
| 157. | Read into record | Clean Calgary Committee |
| 158. | Read into record | Nedelec, Mary Adele |

Drumheller - June 27, 1980

- | | | |
|------|--------------------|---|
| 159. | Greco, Mr. Jim | Browning-Ferris Industries |
| 160. | Wagstaff, Mr. N. | Buffalo Lake Regional Resources Project |
| 161. | Puzey, Mrs. Anita | Personal |
| 162. | Wagstaff, Mr. Neil | Personal |
| 163. | Horswill, Mr. Neil | Personal |

Supplementary Briefs -

- | | |
|------|-----------------------------------|
| 164. | County of Strathcona No. 20 |
| 165. | Trumpeter Swan Naturalist Society |
| 166. | Albright, Don |
| 167. | Lembicz, Henry |

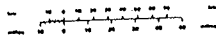
- 168. Town of St. Paul
 - 169. Baker, B.L.
 - 170. Zieffle, Gordon
 - 171. Davis, Joyce
 - 172. Bodtker, Nils
 - 173. Alberta Federation of Labour
 - 174. P.A.C. Non-Renewable Study Group
 - 175. Chem-Security Systems (Chem-Nuclear Systems)
-

Appendix B
MAP OF ALBERTA MUNICIPALITIES

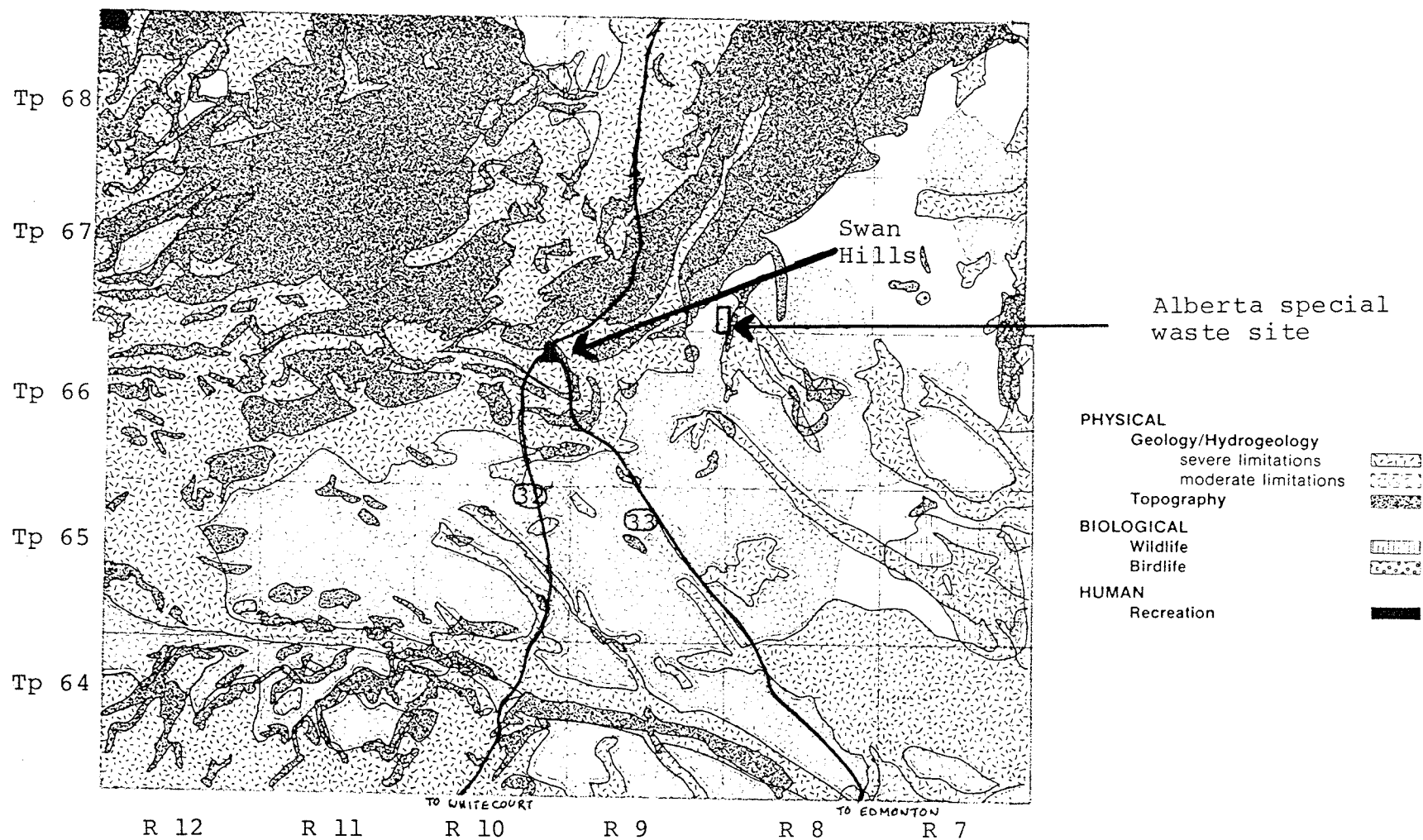


Alberta
MUNICIPAL AFFAIRS

MUNICIPALITIES
1982



Appendix C
CONSTRAINT MAP



IMPROVEMENT DISTRICT SWAN HILLS No. 17 **WASTE MANAGEMENT SITING CONSTRAINTS**

Alberta
ENVIRONMENT

