AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

ESTEY CENTRE FOR LAW AND ECONOMICS IN INTERNATIONAL TRADE

THE EVOLVING INTERNATIONAL TRADE REGIME FOR FOOD SAFETY AND ENVIRONMENTAL STANDARDS:

POTENTIAL OPPORTUNITIES AND CONSTRAINTS FOR SASKATCHEWAN'S BEEF FEEDLOT INDUSTRY

A Report prepared with the generous financial support of:

The Law Foundation of Saskatchewan

and

Saskatchewan Agriculture, Food and Rural Revitalization

January 2003

Prepared by Chad R. Wasylyniuk and Kristal M. Bessel, Research Officers,

and Dr. William A. Kerr, Senior Associate and Dr. Jill E. Hobbs, Associate

Estey Centre for Law and Economics in International Trade

EXECUTIVE SUMMARY

Both at the World Trade Organization and in Canada's new Agricultural Policy Framework (APF), systems to differentiate agricultural products on the basis of environmental friendly production are being considered. In the APF, international differentiation of Canadian food products on the basis of food safety is also being considered. "Environmental Friendliness" and the "Safety of Food" are *credence* attributes for consumers – they cannot determine whether the attribute is present either through inspecting the product when purchasing it or even after having consumed it. As a result, consumers must be informed that the product embodies the attribute. Labels or brands themselves, however, will not be sufficient to ensure consumers that the product does embody the attribute due to the possibility of negligence or fraud. Thus, there must be verification and monitoring systems in place to provide consumers with a degree of confidence in the products they are consuming. This must be done at every stage in a product's supply chain. These supply chains must be re-designed to guarantee food safety and food that is produced in an environmentally responsible manner. An ex ante monitoring system and a labeling/branding system are needed for the supply chain to achieve this goal. Incentives are needed to encourage agricultural operators to voluntarily enter into these supply chains. Part I of this report examines these possibilities for one link of Canada's beef supply chain; the feedlot sector.

Four possible international environmental standards are proposed for three different sized feedlots (10,000, 20,000, and 30,000 head) in this section of the report. All of the possible scenarios must adhere to provincial regulations and include an ex ante monitoring system in order to verify environmentally responsible production

practices to consumers. It is assumed that feedlot operators will incur the costs of labeling only once they are certain that an environmentally responsible beef premium exists in the international marketplace. The first standard (Standard #1) includes adhering to provincial regulations, environmental monitoring, and manure and effluent disposal based on crop nitrogen limits. The second standard (Standard #2) is the same but crop phosphorus limits are imposed rather than crop nitrogen limits. These two standards are considered performance standards where only the end result to the environment is considered.

The third and fourth environmental standards are considered process standards as they are based on the ISO (International Organization for Standardization) 14000 environmental management standards. The ISO 14000 series provides a basic framework to implement a tailored environmental management system for an agricultural operation such as a feedlot. In this project, environmentally responsible technologies are explored as process standards. Manure composting, wetland establishment to reduce effluent nutrient content, and manure application practices are explored as processes that could be implemented into a feedlot's operations. The third environmental standard (Standard #3) is based on crop nitrogen limits while the fourth standard (Standard #4) is based on crop phosphorus limits.

It is assumed that feedlot operators have full information regarding the detail of an international environmental standard before construction. A second assumption is that the feedlots will be built in the most environmentally responsible location in the province. The hypothetical feedlots are located very close to Lake Diefenbaker within the irrigation district that is part of rural municipality 284 around the Broderick area.

The soil in this area is a silty clay loam that contains over 13% clay composition, which is important for environmental protection. This assumption is important because based on the literature review for this project locating feedlots in sandy areas could add millions of dollars in capital costs to ensure environmental protection that is in compliance with provincial regulations.

The results indicate that the environmentally responsible beef premium is the most critical variable in the project analysis. If the premium exists at the level proposed in this project (1.6% per hundredweight) then it will more than compensate for any of the proposed international environmental standards. The gains on investment range from 1.8% to 3.6% (internal rate of return (IRR)) compared to the status quo. Even if the premium does not exist imposing Standard #3 (nitrogen limits – ISO based process standard) will result in slightly higher returns for the 20,000 and 30,000 head lots but not the 10,000 head feedlot.

This result for Standard #3 occurs because of compost revenues and technology that significantly reduces manure transportation costs and effluent disposal costs. Manure composting results in higher returns for the 20,000 and 30,000 head feedlots only if a compost market exists near their location. If feedlot operators must sell their compost for the same price as manure they should not compost due to the costs involved in composting. Imposing Standards #2 and #4 (phosphorus limits) will result in slightly lower returns for the hypothetical feedlots. Phosphorus limits will decrease returns (IRR) ranging from 0.1% to 1.3% for all of the scenarios proposed unless an environmentally responsible beef premium exists.

The results indicate that as feedlot size increases the benefits of implementing an ISO process standard based on the technologies examined in this project also increase. The costs associated with adhering to any of the proposed international environmental standards vary greatly due to feedlot location. The environment pillar of the Agricultural Policy Framework is voluntary therefore feedlots that are located where environmental protection is already sufficient due to natural surroundings would likely enter the environmentally responsible beef supply chain. The feedlots in areas with less natural environmental protection would not be likely to join the environmentally responsible beef supply chain due to the high costs involved. The areas that need more environmental protection may not receive it.

The monitoring and traceability systems that must be incorporated into international supply chains serve at least three purposes. First, they are an element in providing consumers with ex ante assurances that the food they consume was produced in an environmentally friendly manner and/or has been produced to high food safety standards. This is important for being able to secure a premium from consumers for products with these attributes. Second, traceability systems can provide considerable savings in private costs and public goods benefits from being able to pinpoint problems or systems failures. This is because problems can be more easily contained through shorter response times and targeted containment activities. Third, traceability systems can be used to better ascertain where liability lies when there is negligence or fraud. It is the latter aspect of traceability that Part II of this report attempts to address. The threat of liability is expected to provide an incentive for firms to be more diligent in their activities.

There are two major legal questions that are of interest. First, as agri-food supply chains are complex being comprised of a large number of independent entities – farmers, storage facilities, processors, distributors and retailers, etc. – that will be jointly responsible for delivering "environmentally friendly" or "super safe" food to consumers, how is liability determined in systems with interrelated responsibilities? Second, as the marketing of "environmentally friendly" or "super safe" food is targeted, to a considerable degree, at foreign consumers, the interdependent supply chains cross international boundaries raising questions regarding the assignation of liability in the context of private international law. Important questions relate to the enforcement of (large) foreign awards in Canada, which legal jurisdiction applies in cases, etc.

The analysis in Part II suggests that being able to pinpoint the origin of a systems breakdown will reduce the liability risks of firms because, in the absence of a clear culprit, a finding of joint liability may arise – meaning a firm will be required to pay a portion of the liability award even if it was diligent in its activities. As a result, firms may be deterred from joining attempts to produce and market "environmentally friendly" or "super safe" food. Further, a poor traceability system may encourage free riding because the full cost of failing to act diligently is not bourn by the individual firm.

Different legal systems determine and value liability in different ways. In some jurisdictions, particularly the US, awards tend to be significantly higher than in Canada. The conventions of private international law, however, suggest that Canadian courts are bound to enforce judgments of foreign courts. Those firms considering participating in schemes to market environmental or food safety attributes of Canadian food products should bear this in mind. A number of activities firms and or supply chains can take to

reduce these risks are outlined. These include prespecifying legal jurisdictions, contractual arrangements with supply chain partners, documenting due diligence, independent monitoring, etc. It is clear, however, that ex ante actions cannot ensure freedom from liability in complex food systems that involve a large number of firms in supply chains and when those supply chains cross international borders.

Both economic and legal factors should inform the decision to participate in the production of "environmentally friendly" or "super safe food". While the shape of the international and domestic regimes to allow product differentiation on the basis of environmental or food safety attributes is not yet clear, those considering long term investments in new facilities should do so within the broad parameters outlined in this report.

TABLE OF CONTENTS

Chapter Page

EXECUTIVE SUMMARY i

TABLE OF CONTENTS vii

PART I – ECONOMIC ANALYSIS 1

1. INTRODUCTION 2
   1.1 General Problem 2
   1.2 Specific Problem 4
   1.3 Objectives 7
   1.4 Geographical Focus of Study 7

2. A LITERATURE REVIEW – ENVIRONMENTAL REGULATIONS AND STANDARDS FOR LIVESTOCK OPERATIONS 10
   2.1 Introduction 10
   2.2 Saskatchewan's environmental regulations for ILOs 10
      2.2.1 Background 10
      2.2.2 Manure storage and manure management 12
      2.2.3 Increased regulation for large ILOs 13
   2.3 Alberta's environmental regulations for ILOs 14
   2.4 American environmental regulations for confined animal feeding operations (CAFOs or ILOs) 18
      2.4.1 Background 18
      2.4.2 USEPA animal feeding operation (AFO) definitions and rules 18
      2.4.3 Minnesota's AFO regulations 19
      2.4.4 Colorado's AFO regulations 22
   2.5 New Zealand's environmental regulations for livestock operations 24
      2.5.1 Introduction 24
      2.5.2 Environment Waikato's environmental regulations for ILOs 26
   2.6 Australia's environmental regulations for ILOs 29
      2.6.1 Background 29
      2.6.2 South Australia 29
      2.6.3 New South Wales 30
   2.7 Environmental regulations in selected European Union countries 31
      2.7.1 Background 31
      2.7.2 Britain 31
      2.7.3 Holland 34
      2.7.4 Denmark 35
   2.8 Industry driven environmental management systems (EMS) and ISO 14000 37
      2.8.1 Environmental management systems (EMS) 37
      2.8.2 ISO 14000 (International Standards Organization) 38
      2.8.3 Examples of environmental management systems 41

3. CONCEPTUAL FRAMEWORK EXAMINING MARKET FAILURE 45
3.1 Introduction 45
3.2 Information asymmetry 45

4. METHODOLOGY 48
4.1 Simulation Technique 48
4.2 Financial Analysis 48
4.3 The hypothetical feedlots 49
4.3.1 Assumptions regarding location and capacities 49
4.3.2 Adhering to provincial regulations and standards 51
4.4 Market premiums for environmentally responsible beef production 53
4.5 The proposed monitoring system for beef feedlots 56
4.5.1 Introduction 56
4.5.2 Manure management practices 56
4.6 The proposed labeling system for environmentally responsible beef feedlots .59
4.6.1 Introduction 59
4.6.2 Cattle Identification 59
4.6.3 Beef Product Identification 61
4.7 The methodology in designing the standards 61
4.8 Four proposed international environmental standards for cattle feedlots 63
4.8.1 Independent monitoring – Standard #1 63
4.8.2 Phosphorus limits as a performance standard – Standard #2 63
4.8.3 An ISO based process standard with nitrogen limits – Standard #3 64
4.8.4 An ISO based process standard with phosphorus limits – Standard #4 67

5. RESULTS AND ANALYSIS 68
5.1 The costs in complying with the four possible international environmental standards 68
5.1.1 Standard #1 - an independent monitoring standard 68
5.1.2 Standard #2 – phosphorus limits as a performance standard 69
5.1.3 Standard #3 – an ISO based process standard with nitrogen limits 70
5.1.4 Standard #4 – an ISO based process standard with phosphorus limits 74
5.2 The environmentally responsible beef premium and the associated labeling costs 76
5.2.1 The environmentally responsible beef premium 76
5.2.2 The associated labeling costs 77
5.3 Financial results 77
5.3.1 Introduction 77
5.3.2 Capital investment 77
5.3.3 Environmental investment per head 79
5.3.4 Annual operating costs per head for environmental protection 81
5.3.5 The debt to asset ratio 84
5.3.6 Investment indicators 87
5.4 Conclusion for Part I 89

PART II – Legal aspects of marketing environmentally responsible, "super-safe" food products internationally 91

6. INTRODUCTION 92

7. CANADIAN LAW 94
7.1 Traceability and Food Safety 94
7.2 Environmental Planning and Labeling 99

8. INTERNATIONAL LAW 104
8.1 Traceability and Food Safety 104
8.2 Environmental Planning and Labeling 105

9. POLICY INSTRUMENTS 107
9.1 Mandatory Guidelines (Regulation/Statute) 107
9.2 Civil Liability 111

10. CONFLICT OF LAWS 125

11. CONCLUSION TO PART II 131

12. REPORT CONCLUSION 134

LIST OF REFERENCES 136

TABLE OF STATUTORY INSTRUMENTS 145

PART I – ECONOMIC ANALYSIS

1. INTRODUCTION

1.1 General Problem

The Draft Ministerial Declaration produced from the World Trade Organization (WTO)'s Fourth Ministerial Conference (November 2001) provided some important commitments. For the first time the environment is listed on the Declaration (Bridges, 2001). Under paragraph 32 the organization has instructed the Committee on Trade and Environment (CTE) to pursue "labeling requirements for environmental purposes" (WTO, 2001). The WTO is responding to members' desires to have the environmental issue examined. The Committee is to provide recommendations regarding environmental labels at the next ministerial conference. It is unclear, as of yet, how this may involve agriculture.

In the case of agriculture, listing environmental attributes on a product's label could mean that information regarding production and processing methods (PPMs) are being conveyed to consumers. An environmentally responsible product attribute is a credence attribute where consumers cannot detect before purchase, or after consumption, if the product contained the attribute (Hobbs, 2001). The only method to convey the environmentally responsible product attribute is through the label.

The WTO is not opposed to a product's label indicating PPMs as was evidenced in the dolphin-tuna case (Golan, Kuchler, and Mitchell, 2000). However, the WTO is very unlikely to allow trade restrictions based on PPMs (Isaac, 2001). Article III of the

General Agreement on Tariffs and Trade (GATT) requires identical treatment for "like" products. A credence attribute either does not physically alter the product or, if it does, in ways that cannot be detected. The WTO has ruled that PPM labeled products and non-labeled products are "like" products (Bureau and Jones, 2000).

The Technical Barriers to Trade (TBT) agreement applies to food items that do not fall under the Sanitary and Phytosanitary (SPS) agreement. The SPS agreement is designed to protect human, plant, and animal health of the importing nation. Only the TBT agreement will apply to environmentally responsible food products because only the environment in the exporting country is affected by PPMs. According to Bureau and Jones (2000) the TBT agreement is unlikely to recognize a product's environmental PPMs to distinguish it from other products[1].

Coinciding with this debate is the Canadian government's new Agricultural Policy Framework (APF) which is to be implemented between 2003 and 2008. The new policy has five pillars; business risk management, renewal, food safety and quality, the environment, and science and innovation. It is the federal government's goal to internationally brand Canada's food products as high quality and high safety using environmentally responsible production practices. The government hopes to increase market access and create market premiums by capitalizing on the attributes of the Canadian brand. The environment pillar seems to be market driven as the APF proposals state that all environmental plans are voluntary with a goal to market

[1] "Members shall ensure that in respect of technical regulations, products imported from the territory of any Member shall be accorded treatment no less favourable than that accorded to like products of national origin and to like products originating in any other country" (Article 2.1, TBT, 1994).

environmentally responsible production practices (Agriculture and Agri-food Canada, 2002). If this is the case there are many questions to be answered in regard to branding or labeling Canadian food products as environmentally responsible.

Saskatchewan agriculture is in the midst of structural change. There is a concentrated effort to expand livestock production as an alternative to grain and oilseed production. Additionally, Canadian livestock export dependence on the United States is growing. Canadian live cattle and beef exports into the United States have tripled from 11% to 33% of Canadian cattle production from 1990 to 2001 (Statistics Canada, 2002). International trade agreements and Canadian agricultural policy will have a significant impact on the growth of Saskatchewan's livestock industry.

1.2 Specific Problem

The current international discussion surrounding environmentally responsible agricultural production has the potential to affect Saskatchewan beef market access to foreign markets. It could reduce market access if Canadian agricultural producers do not take the initiative to establish agricultural environmental management systems (EMS)[2]. In some cases, the establishment of an agricultural EMS may simply entail the ability to label and verify the production practices currently in use. Increasing global environmentally responsible agricultural production also has the potential to increase market access and provide premiums for Canadian beef. The Canadian beef industry has the ability to acquire technology to establish supply chains that provide detailed environmental information to consumers. This allows for differentiated beef markets.

[2] An EMS is a planned approach for a farm or business to manage its impacts on the environment (Castelnuovo, 1999).

The establishment of an agricultural EMS could lead to an improvement in the local environment. Foreign eco-consumers who are willing to pay for the existence value of environmentally responsible products will compensate to some degree, the costs of improving the local environment. Secondly, environmental regulations force feedlot operators to incur costs to improve the local environment. The combination of market premiums and environmental regulations should lead to a cleaner environment than one without a market mechanism and environmental regulations.

A certain threshold of eco-consumer demand will provide an incentive for livestock producers to incur costs to establish agricultural EMS. Foreign market premiums or signals may not encourage livestock producers to establish agricultural EMS that meet local citizens' expectations for their environment. A free rider problem exists. Local citizens receive the physical environmental benefits while foreign consumers' pay for those benefits. Foreign eco-consumers do receive satisfaction from purchasing the environmentally responsible beef products but they do not directly benefit. Due to these discrepancies it is necessary for a region's government to develop regulations that are a direct result of citizens' preferences for their environment.

Despite the WTO's current refusal to recognize PPMs, they maybe included in international trade and environmental agreements in the future. This is due to consumers demanding to know the PPMs for the products they consume and to discipline any PPM requirements from importing nations that are protectionist. It is important that the international community trusts Canada's environmental policy towards its agriculture. Additionally it is important for Canada to have input into any

new international environmental rules for agriculture that may be established. This will allow Canadian beef exports to increase and diversify international market access.

If a pro-active approach in developing international agri-environmental standards is not taken it could result in regulatory costs that exceed market premiums and societal environmental benefits for Saskatchewan's exportable beef production. Potential international environmental standards may not conform to consumer expectations and could potentially destroy existing export markets. For example, if the standard's term for "natural beef" does meet consumers' expectations of "natural beef" then it is conceivable that consumers will refuse to purchase "natural beef."

The focus of this project will be on Saskatchewan cattle feedlots proposed for construction. The sizes of these feedlots are in the 10,000 to 30,000 head range. Currently, intensive livestock operations (ILOs) have been the focus of much environmental regulatory debate. It is likely that cattle feedlots will be affected to a considerable degree by any international environmental standards due to their environmental impact and intensity of production. Additionally, Saskatchewan's feedlot industry is just beginning to expand so it is important that any international environmental standards are adhered to during feedlot construction.

A basic understanding of the benefits and costs of any potential international agri-environmental standards for beef production is required for this project. Four possible international environmental standards will be examined in order to compare environmental regulatory compliance costs. These environmental compliance costs will then be compared to environmentally responsible beef markets to find if it is preferable to comply with a proposed international environmental standard.

1.3 Objectives

The primary objective of this project is to compare the costs and benefits for Saskatchewan's feedlots associated with adhering to a future international environmental standard for beef production. The specific objectives are to:

1. Examine the International Organization for Standardization (ISO) 14000 certified environmental management systems and various environmental regulations with respect to beef production.
2. Calculate the change in capital, operating, and monitoring costs for proposed Saskatchewan feedlots in the 10,000 to 30,000 head range required to comply with a single international environmental standard for beef production. Four possible international environmental standards will be proposed.
3. Assess these costs against available data for environmentally responsible beef premiums.

1.4 Geographical Focus of Study

In order to decide which regions to examine to determine a single international environmental standard for beef production, two criteria are established. The region has to meet both criteria to be included in the study. The first criterion is that the region must be wealthy as wealthy regions of the world demand environmental information. Secondly, these wealthy regions must have an effect on the Saskatchewan beef industry. To have an effect on the Saskatchewan beef industry, these regions have to demand Saskatchewan beef products and/or these regions compete or complement the Saskatchewan beef industry. For example, the United States provides competition for Saskatchewan beef and its consumers purchase Saskatchewan beef.

Alberta is chosen as a region that would complement Saskatchewan's beef industry due to its' feeding capacity and packing facilities. Alberta's physical environment is very similar to Saskatchewan although its' livestock density is far greater and therefore there is a need for more rigorous environmental regulation. Alberta had 2.5 million slaughter cattle in 2000 compared to only 177,200 slaughter cattle in Saskatchewan (Alberta Agriculture, Food, and Rural Development (AAFRD), 2001).

The United States (US) is chosen as a region for Saskatchewan beef exports. The country's population consumes 25.6% of the world's beef, the highest level for an individual country in the world (AAFRD, 2001). Additionally, 80% of Canadian beef exports were to the US in 2001 (Statistics Canada, 2002). The US is a net importer of beef by volume. Minnesota and Colorado are the focus in this study. Minnesota is chosen because its climate is similar to Saskatchewan's. This state also has some of the most stringent environmental regulations in the United States. Colorado is the fourth largest beef producing state in the US and its environmental regulations are less stringent than Minnesota's regulations. This allows for a direct comparison between two regions in the US.

The European Union (EU) is also chosen as a region to examine for two reasons. Their citizens probably demand the highest level of environmental protection in the world. Secondly, the EU is a potential market for Saskatchewan beef exports. Many issues must be resolved before this becomes a reality. Animal density in the EU is much higher than Saskatchewan and the EU Nitrate Directive is placing constraints on animal production. The EU is relatively wealthy and it will expand eastward in the future

(Gaisford and Kerr, 2001). The EU is likely to pursue an international environmental standard that reflect its' domestic initiatives.

Australia and New Zealand are in competition with Saskatchewan for global beef exports. Currently, Australia is finishing only 570,000 head in intensive livestock operations but this number is rapidly growing. Despite this statistic, Australia is already the largest beef exporting country in the world by volume with 22% of all beef exports (AAFRD, 2001). The country will be an even more important exporter once its' feedlot industry has grown.

2. A LITERATURE REVIEW – ENVIRONMENTAL REGULATIONS AND STANDARDS FOR LIVESTOCK OPERATIONS

2.1 Introduction

This chapter details current intensive livestock operation (ILO) environmental regulations for the regions chosen for this study. Wealthy regions have been picked because these are regions where citizens demand environmental protection. Additionally, the wealthy regions studied provide beef marketing opportunities for Saskatchewan (European Union and the United States), beef competition (Australia and New Zealand), and regions that complement Saskatchewan's beef industry (Alberta). Industry driven environmental management systems in these regions are also explored. Environmental management systems are based on existing environmental regulations in a region so both systems must be examined. Environmental regulations become law at the state and provincial levels with the exception of the European Union, therefore specific states and provinces have been chosen. The understanding of this relationship allows accurate conclusions to be made.

2.2 Saskatchewan's environmental regulations for ILOs

2.2.1 Background

In Saskatchewan, an ILO is legally defined as when the stocking density is less than 370m^2 per animal unit (Annand, 2001). If the stocking density reaches less than

370m^2 per animal unit an ILO permit is required from Saskatchewan Agriculture, Food and Rural Revitalization (SAFRR) and possibly the rural municipality. Animal unit values vary between different species as is referenced in Table 2.1.

Table 2.1 Selected Animal Units - Saskatchewan

Type of animal	Number of head that equals one animal unit
1. Poultry	
a) Hens, cockerels, capons	100.0
b) Chicks, broiler chickens	200.0
c) Turkeys, geese, ducks	50.0
2. Hogs	
a) Boars or sows	3.0
b) Gilts	4.0
c) Feeder pigs	6.0
d) Weanling pigs	20.0
3. Cattle	
a) Cows or bulls	1.0
b) Feeder cattle	1.5
c) Replacement heifers	2.0
d) Calves	4.0

Source: Agricultural Operations A-12.1 Reg 1, 1995.

The Agricultural Operations Act governs all ILOs. The Act requires SAFRR to regulate ILOs to preserve soil, air and water quality (SAFRR, 1998). The Act maintains these quality standards by requiring management plans for two major aspects of management; manure storage and disposal. An ILO permit is required from SAFRR if the livestock operation has three hundred or more animal units. Secondly, an operation between twenty and three hundred animal units near an environmentally sensitive area will also require a SAFRR permit. Any operation with an earthen manure storage area or lagoon also requires a SAFRR permit.

ILOs are protected under "the right to farm" provisions in the Agricultural Operations Act with respect to nuisance claims such as odour and noise. The Agricultural Operations Review Board examines the complaint and if the board deems the operation to be operating under "normally accepted" agricultural practices the complaint will not be upheld in court. An ILO cannot be charged under The Clean Air Act but it is subject to private liability claims from neighbours.

The rural municipality (RM) requires a permit if the RM has land use regulations under The Planning and Development Act. The regulations detail where ILOs can be built in the RM. It allows the RM's inhabitants to raise any concerns about the ILO before it is built. SAFRR does not require a minimum distance between the general public and ILOs; this is controlled by the municipality. SAFRR only has recommended distances that it publishes.

2.2.2 Manure storage and manure management

The required manure storage plan is based on several items. The physical dimensions of the storage pond must be declared. For small operations, storage ponds may be natural ponds in low-lying areas. For larger operations, storage ponds may have to be constructed and lined with materials so as to prevent seepage. This determination is largely site specific, dependent upon geology, soil, and groundwater conditions and is determined by a professional engineer. The natural topography of the land is very important in determining storage requirements. A soil analysis must be performed and records regarding water wells, water table depth, and monitoring programs must be maintained. For operations with more than one thousand animal units, SAFRR requires

that storage facilities should be able to store up to four hundred days of manure so to encourage manure spreading once a year during the summer months.

The manure management plan regulates the spreading of manure on the land. The requirement is that the amount of manure spread is equal to crop nutrient requirements. A soil analysis is not required to meet these requirements[1]. Written agreements are required for manure spread on lands not controlled by the operator. The frequency, intensity, duration, and method of manure application must also be declared (CSALE, 1996). The management plan must also estimate the manure's degree of offensiveness to the general public in the area where the manure is to be spread. If heightened environmental concerns exist, the manure management plan may state that manure must be spread below crop nutrient requirement levels. There is no ongoing monitoring of manure - spread land by SAFRR.

2.2.3 Increased regulation for large ILOs

SAFRR will work with Saskatchewan Environment and Resource Management (SERM) to assess any application with more than one thousand animal units (SAFRR and SERM, 2001). Any livestock operation with more than one thousand animal units is considered a project proposal by SERM. SERM examines every operation of this size to see if the operation meets the definition of "development" in the Environmental Assessment Act (EAA). If the operation meets the "development" definition it will be subject to the EAA. In order to determine this SERM will evaluate the physical site design, soil conditions, effects on endangered species and manure storage design.

---

[1] Karen Bolton and Wendy Dehod, SAFRR, Personal Communication, September 3, 2002.

Saskatchewan Water Corporation (SWC) will also become involved by evaluating the proximity of water resources. Once SERM and SWC have made their recommendations SAFRR can grant a permit to the ILO subject to the conditions proposed. If the conditions are not met, the permit is not granted.

If water pollution occurs due to an approved ILO it may lose its' permit and it is subject to the Agricultural Operations Act, the Environmental Management and Protection Act and civil liability. SAFRR and SERM will jointly investigate. If the water pollution is deemed severe enough strict liability may apply.

SAFRR is concerned with air, soil, and water quality but the requirements do not constitute a full-scale environmental audit for operations with less than one thousand animal units. A full-scale environmental audit occurs between SAFRR and SERM once the one thousand animal unit threshold has been reached (SAFRR and SERM, 2001). Public consultation is not mandatory for operations with less than one thousand animal units if the RM does not have land use regulations in place. The onus is on potential operations with more than one thousand animal units to give notice to the general public that it intends to build.

2.3 Alberta's environmental regulations for ILOs

On January 1, 2002, Alberta implemented new environmental regulations for ILOs in the Agricultural Operation Practices Act (AOPA). In the past Alberta Agriculture, Food and Rural Development (AAF) and rural municipalities were partners in determining ILO regulations. A mix of provincial statutes, municipal by-laws, and voluntary codes of practice made up the regulations. The new AOPA now details how ILOs must interact with the environment. The new Act is now the only legislation ILO

operators have to refer to in order to gain regulatory approval. The objectives of the Act are to support sustainable growth of the livestock industry, protect the environment, provide consistency in ILO approvals, and to address the concerns of municipalities. A significant change is that the Natural Resources Conservation Board (NRCB) now oversees ILO environmental regulation. The NRCB reports to the Minister of Sustainable Development.

All Alberta ILOs are subject to the AOPA. The Act stipulates that any new or expanding confined feeding operations must notify the NRCB of their operations. The NRCB has created two regulatory regimes to administer ILOs. One regime is for small operations (example: 200 to 499 beef feeders and 150 to 349 beef cows) and the other is for large operations (example: 500 beef feeders and up and 350 beef cows and up) (Matters Regulation, AOPA, 2001). The ILO size groupings are defined in Schedule 2 of the appendix in the AOPA. Small operations must "register" in order to legally operate while large operations must be granted "approval" in order to legally operate. Additionally any construction of a manure storage facility with six months of storage or greater must first be authorized by the NRCB (Standards and Administration Regulation, AOPA, 2001). Any cow-calf operations with less than 150 beef cows or beef feeder operations with less than 200 feeders are exempt from the NRCB regulations. NRCB regulators use the number of head in their calculations not animal unit measurement.

The approval process for large ILOs is more stringent than the registration process for small ILOs and is outlined in Table 2.2. The most significant difference is that the NRCB requires a professional engineer to design the site for a large ILO.

Municipal by-laws are considered in the approval process but play a lesser role in the new AOPA.

Table 2.2 - Application Processes for ILOs in Alberta

Application Requirement	Approval - Large ILOs	Registration - Small ILOs
1. Listing affected persons	Yes	Yes
2. Consistent with municipal development plan	Yes	Yes
3. Engineering plans for manure storage, collection, contamination	Yes	No
4. Hydro-geological assessments	Yes	No
5. Number, species, age of livestock	Yes	Yes
6. Scaled site plan indicating water bodies, buildings, run off controls	Yes	Yes
7. Explanation of how the operation will meet the requirements of the Agricultural Operations Practices Act	Yes	Yes
8. Legal description of the land where manure is to be spread for the first three years.	Yes	Yes
9. Nutrient Management Plan	Yes	Yes
10. Documents stamped/signed by a professional engineer.	Yes	No

Source: Board Administrative Procedures Regulation, Agricultural Operation Practices Act, 2001.

The Act primarily deals with three issues: minimum distance separation, manure storage, and nutrient management. Minimum distance separation involves maintaining distances between ILOs and other operations in order to avoid nuisance claims such as odour. Schedule 1 in the appendix of the Act details the legal minimum distance requirements. The distance requirements are based on the size of the ILO and the sensitivity of neighbouring land uses. Land use categories include farming activities, acreages, towns, and cities.

Manure storage regulations address surface water control systems, natural water and wells, water table protection, erosion protection, groundwater protection, catch

basins, fly and dust control, record keeping, access, and safety (Brethour, MacGowan, Mussell, and Mayer, 2002). Schedule 2 in the appendix of the Act details how to determine the required size of the catch basin. The catch basin must have a storage capacity that can hold the maximum amount of rainfall that can fall in one day based on a thirty-year probability for the area.

The nutrient management regulations stipulate where manure can be spread, how it can be applied, soil testing procedures and requirements, and the maximum nutrient loads allowed. Schedule 3 in the appendix of the Act details the number of hectares needed to safely spread manure. The requirements are based on crop nutrient requirements and nitrate limits. The difficulty in establishing these requirements is that manure nitrogen levels vary substantially depending on the type of feed, species, and other factors. While most sections of the Act have become law, the nutrient management section will not become law until January 1, 2005.

The AOPA is the sole legislation that ILOs must follow in Alberta. If all NRCB regulations are met ILOs should encounter very little public scrutiny. The regulations are scientifically based and they take social municipal concerns into account. The Act provides fair treatment for ILOs in that it harmonizes ILO regulations across the province. The Act allows for a full environmental audit for large ILOs while still requiring heightened environmental awareness for small ILOs.

2.4 American environmental regulations for confined animal feeding operations (CAFOs or ILOs)

2.4.1 Background

In the United States, both the state and the nation have jurisdiction over the environment. In the absence of any state environmental regulations, only federal environmental regulations apply. Minnesota and Colorado are chosen as the states to examine. Minnesota is chosen because its' climate is similar to Saskatchewan and it is one of the most environmentally regulated states in the United States. Colorado is one of the seven "feedlot states" (National Agricultural Statistics Service, United States Department of Agriculture, 2002). Minnesota's environmental agency is the Minnesota Pollution Control Agency (MPCA). The Colorado Department of Public Health and Environment's Water Quality Control Commission oversees CAFOs. Nationally the United States Environmental Protection Agency (USEPA) oversees the environment. The USEPA drafted its' final text for its' new rules implemented December 15, 2002. One of the new items the USEPA imposed is a manure-spreading limit based on crop phosphorous limits rather than nitrogen in some situations.

2.4.2 USEPA animal feeding operation (AFO) definitions and rules

Animal feeding operations (AFOs) are defined by the USEPA as lots or facilities where animals are confined for a minimum of 45 days per year and there is no vegetative growth. Feed is supplied to the animals. Winter-feeding of animals on pasture is not considered an AFO. Currently, USEPA regulations use a three-tier structure to identify AFOs as CAFOs. This is based on waste discharge and

environmental harm. CAFOs must have a National Pollutant Discharge Elimination System (NPDES) permit in order to operate.

Tier 1 CAFOs include any animal feeding operations with more than 1,000 animal units. These operations cannot emit waste discharges into public lakes and rivers. The storage pond may use an earthen liner instead of a relatively expensive concrete liner but the USEPA regulations specify that clay may have to be used. It is also required that at least one additional foot of storage or freeboard is built for extraordinary circumstances. Other storage requirements include that a catch basin is built between the feedlot and the storage pond so that waste solids can separate from liquid. This allows the storage pond to exclusively hold liquid waste.

Tier 2 CAFOs include 301 to 1000 animal unit operations where public water comes into contact with the livestock operation. These operations are allowed to discharge waste directly into lakes or rivers subject to their permit. The permit is based on the total maximum daily load of a pollutant that a water body can receive and still meet water quality standards. Tier 3 CAFOs are operations with less than 300 animal units and are in a hydrologically sensitive area (USEPA, 2001e).

2.4.3 Minnesota's AFO regulations

The MPCA uses USEPA wordings to define CAFOs. The MPCA feedlot rules cover the location, construction, and operation of a CAFO along with manure storage, management, and transportation. The MPCA currently uses its' own animal unit schedule to define CAFOs which is provided in Table 2.3. Any revised EPA definitions and regulations such as a new animal unit schedule would supersede MPCA guidelines.

Table 2.3 - Selected Animal Units – Minnesota

Beef cattle	Number of head that equals one animal unit
a) Slaughter Steers	1.0*
b) Feeder cattle (backgrounding)	1.4*
c) Cow and Calf Pair	0.8*
d) Calves	5.0*

Source: Minnesota Rules chapter 7020, 2000.
*Converted to maintain consistency throughout tables in Chapter 2.

An operation is considered an AFO in Minnesota if it has 50 to 300 animal units. All AFOs must comply with MPCA regulations and register with the MPCA. The registration expires after four years at which time the AFO must re-register in order to consider any new developments.

A CAFO applicant must notify the MPCA that public notice was given about the proposed CAFO construction. The permit application must include an air emissions plan to deal with odour concerns, an emergency response plan in case of an unauthorized manure discharge, and a manure management plan. Once the MPCA receives the application it will post the application for public notice a second time. The county for the proposed CAFO is given a copy of the permit application by the MPCA for the county's administration to review. If approved the permit will be in place for five years and it is open for renewal. For a CAFO in the range of 300 to 999 animal units only a state construction short-form permit is required. This permit expires after two years and is necessary only when the CAFO intends to expand its operation.

The MPCA administers the NPDES permit program in Minnesota because the state of Minnesota has AFO regulations in place that either meet or exceed the EPA standard. With the MPCA in place in Minnesota the permit becomes a joint NPDES/SDS (State Disposal System) permit. CAFOs may only discharge pollutants in

compliance with the terms of the NPDES/SDS permit. A NPDES/SDS permit may be either an individual permit for a single facility or a general permit applicable to multiple facilities for a specific company.

Both the permit holder and other stakeholders in the supply chain are required to comply with eight areas of regulation; air quality, water quality, location, manure transportation, livestock access to waters, feedlot closure, stockpiling, and manure management plans (Minnesota Rules chapter 7020, 2000). These areas are expanded on below.

In regard to air quality, CAFOs are prohibited from emitting any odour. These operations are exempt from this regulation only when they are spreading manure and the county has been notified about it. The exemption is available for a maximum of 21 days per year. As for water quality CAFOs with more than 1000 animal units cannot discharge manure into public lakes and rivers. AFOs with less than 1000 animal units can discharge into public lakes and rivers but are subject to various restrictions. Location restrictions state that new feedlots cannot be built on shoreland or floodplains.

The regulations also state that cattle cannot enter public lakes or rivers. If CAFOs wish to use this water they must pump it into their site the entire year. A catch basin designed to capture waste runoff for a minimum of twenty-one days is required. Catch basins must be certified by a professional engineer to prove the basin is not connected to a waterway (Outlaw, Anderson, and Padberg, 1997). All water wells must be at least one hundred feet from the CAFO. If a feedlot permanently closes all manure must be removed from the site within one year. Once that is completed grass or alfalfa must be planted and grown for at least five years.

All stockpiles must be constructed so that runoff does not flow into public lakes and rivers. The stockpile size is limited to the annual agronomic needs of 320 acres of cropland. If stockpiling must occur on the same site for more than one year a storage area must be built to catch manure-contaminated runoff. Records must be maintained stating the locations of stockpiles, the date of establishment, the volume and nutrient value of the manure, and the date the manure was applied to the land. These records may be audited by the regulatory authority.

There are several conditions to be met to establish MPCA recognized manure management plans. The requirements include establishing land zones where the manure can be spread and regular testing of manure for nutrient values. Manure must be spread so to meet crop nutrient requirements, therefore soil nutrient testing is required. The regulation specifically states that all nutrient sources including inorganic fertilizer must be considered when determining the acreage needed to spread manure. All management practices must be consistent with the University of Minnesota Extension Service recommendations. All manure spreading must be recorded and may be audited by regulatory authorities. There are also regulations in regard to spreading manure in special protection areas.

2.4.4 Colorado's AFO regulations

The Colorado Department of Public Health and Environment uses EPA wordings to define CAFOs. The department's Water Quality Control Commission regulates all water concerns relating to CAFOs including manure storage, management, and transportation. The department currently uses its' own animal unit schedule to define CAFOs which is provided in Table 2.4.

Table 2.4 - Selected Animal Units – Colorado

Beef cattle	Number of head that equals one animal unit
a) Slaughter Steers	1.0
b) Feeder cattle (backgrounding)	1.0

Source: Colorado Department of Public Health and Environment, Regulation No. 81, 1999.

Colorado's CAFOs must be designed so to comply with the USEPA's terms. CAFOs may only discharge pollutants in compliance with Regulation No. 81. CAFOs are required to comply with six areas of regulation; air quality, water quality, location, manure transportation, stockpiling, and manure management (Colorado Department of Public Health and Environment, Regulation No. 81, 1999). These areas are expanded on below.

In regard to air quality, CAFOs are required to control any dust from the operation. CAFOs are protected by "right to farm" provisions in the Colorado Agricultural Protection Act (1981). The Act states that it is the government's goal to protect agricultural production from increasing urbanization. Article 3.5 of the Act protects livestock operations from nuisance claims as long as these operations are following normally accepted agricultural practices as defined in the Act. Individual counties in Colorado also have the right to pass land-zoning laws. Some counties have barred CAFOs from operating but some counties have made specific laws to protect and expand agricultural operations.

Catch basins are required by Regulation No. 81 so to catch any solids before the liquid waste moves to the storage pond. Storage ponds and catch basins must be above the one hundred year flood plain. All water wells must be at least one hundred and fifty feet from the CAFO. Manure stockpiles must be constructed so that runoff does not

flow into public lakes and rivers. Additionally these stockpiles must be located above the one hundred year flood plain.

All new or expanding CAFOs are required to prepare manure management plans and submit them to the Colorado Department of Public Health and Environment. This is also required for CAFOs deemed to be heightened environmental risks. Manure is allowed to be land spread but it is subject to two alternative conditions. Firstly, manure can be spread so to meet crop nutrient requirements, therefore soil nutrient testing is required. Secondly, manure may be spread based on the appendix in Regulation No. 81. The benefit of the second method is that soil testing is not required. The regulations state that all nutrient sources including inorganic fertilizer must be considered when determining the acreage needed to spread manure. Manure is not allowed to be spread in the winter or during rainfall.

2.5 New Zealand's environmental regulations for livestock operations

2.5.1 Introduction

The Resource Management Act (RMA) 1991 is New Zealand's legislation designed to protect and enhance the environment. The Act allows regional and district councils to administer the use of all natural resources (Ministry for the Environment, 1999). The councils administer almost all aspects of the environment such as air, water, soil, pollution, nuisance, and hazardous substances. At the RMA's inception, each council made a resource plan. The resource plan must be based on "good practice" policy attributes. The items in the plan must be necessary, effective, least cost, and cost internalized. Cost internalization is based on the "polluter pays principle." All items in the plan must be harmonized where appropriate.

In the resource plan, all permissible activities are listed. A permitted activity has no council conditions in place. If the activity is not listed as a permitted activity the individual may still be able to pursue it but he or she must obtain resource consent from the council. There are five types of resource consents; land use consents, subdivision consents, costal permits, water permits, and discharge permits. A specific activity may require multiple consents. Each of these five resource consents is subject to different levels of consent. These levels of consent are detailed in Table 2.5.

Table 2.5 - Resource Consent Categories – New Zealand

Controlled	The council must grant consent but conditions are placed on the activity based on council plans.
Limited Discretionary	The council can grant or deny consent and conditions are placed on the activity based on council plans if consent is granted.
Discretionary	The council can grant or deny consent and any conditions the council deems as necessary is placed on the activity if consent is granted.
Non-complying	The council can grant or deny consent. In this category, it is recognized that the activity is prohibited but it could be granted consent due to council consideration but subject to rigid conditions.
Prohibited	The council can only deny consent.

Source: A Guide to Preparing a Basic Assessment of Environmental Effects (AEE), Ministry for the Environment – New Zealand, 1999.

Depending on the type of activity, the council may consult the general public in order to make a decision on granting or denying the activity.

In the case of any livestock operation, resource consent is required. In addition to resource consent, an Assessment of Environmental Effects (AEE) form must also be completed in order to gain council approval. The AEE requires that the applicant complete a thorough review of all positive and negative effects to the environment and the community. These effects include site clearance, construction, and short and long-term effects of the proposed activity. The effects must be ranked in order of importance.

The AEE requires that the applicant has notified his or her potential neighbors about the planned activities. In some cases, the affected neighbor will have to sign the resource consent and the AEE. This is required for two reasons. The signature shows that the applicant has consulted the affected parties and that the neighbor knows what is being proposed and how it will affect them.

Council approval of the activity is heavily dependent upon the applicant's ability to identify all effects. The council encourages applicants to hire specialists to identify all effects. Methods to avoid, remedy, or mitigate any potential environmental hazards or nuisance claims for the proposed site must be identified. If council does not believe that all effects have been identified or that all steps have been taken to address environmental and social concerns, the council will impose its' own conditions on the activity. It is also possible that the council will deny the application. Therefore, as the size of the livestock operation increases, the complexity of the application increases.

2.5.2 Environment Waikato's environmental regulations for ILOs

New Zealand has regional councils for different areas of the country. The Environment Waikato (EW) Council is one such council with well-developed environmental regulations in place. Since the RMA became law the EW has focused on developing non-point source pollution guidelines such as manure runoff. The EW has strongly encouraged livestock producers to switch to land based manure application instead of water based manure application by making land based manure application a permitted activity while water based manure discharge is not.

Proximity regulations require that land that has had manure spread on it must be a certain distance away from water bodies, dwellings and neighboring properties so to

avoid any manure reaching surface waters. These distances vary depending on the operations involved. Maximum manure application rates have been established which are based on the soil's leaching ability and the maximum amount of nitrogen content the land can hold. In the EW, the maximum amount of effluent that may be spread is the amount that should not cause ponding[2] for more than five hours after application. As for nitrogen, the amount of manure spread should equal crop nutrient requirements. However, there is a total limit of 150 kilograms of nitrogen per hectare per year.

In New Zealand there are consent terms based on environmental risk, the farmer's compliance record and technological change. Consent terms are a length of time in which a farmer is allowed to continue with a permitted activity until the activity is subject to review. Manure application is an example. In the EW the length of the consent term for land based manure application is unlimited. For water based manure application the consent term is two to five years. Any violation of the regulations may result in the ILO being placed before the Environmental Court.

Most of the cost of complying with the EW council is borne by farmers. The EW council has taken the approach that the polluter should pay. The costs of the application process are borne 100% by producers. The cost for the EW council to process the application is $200.25 NZD (Cameron and Trenouth, 1999). Secondly, any costs to change the activity so as to be environmentally compliant are also borne 100% by producers.

The only costs producers do not fully bear are compliance monitoring once the activity is operational. The EW council pays for 80% of monitoring costs by

[2] Ponding occurs when effluent gathers on the soil surface.

independent third parties. The remaining 20% is charged back to producers. There is one exception. If producers are using land based manure application they do not have to pay any of the compliance costs. The EW council views this as an effective incentive to encourage producers to switch to land based manure application.

Generally, compliance monitoring occurs annually for each livestock operation in the EW region. The EW council contracts the audits out to AgriQuality New Zealand. Producers are usually given a few days notice that enforcement officers are coming to perform the audits as producers are required to be present. Enforcement officers look for excess manure application and ensure that the land base is large enough given the size of the livestock operation.

There are rewards for environmental stewardship. If producers are found to have an environmentally responsible operation over a period of time, the audits will occur every five years instead of annually. This results in a decrease in compliance or inspection costs that producers are obliged to pay. In the EW region, this could result in a $1000.00 NZD savings over five years (Cameron and Trenouth, 1999). At a minimum, any violation of the regulations would result in a resumption of inspections.

Penalties for violating environmental regulations vary widely. The minimum penalty for minor infractions is a mandatory education session on the environment. Persecution can occur for constant non-compliance or for a one-time environmental disaster. One farmer was convicted under these environmental regulations in 1994.

In conclusion, all livestock operations in New Zealand must apply for resource consent and complete an Assessment of Environmental Effects. The complexity of the application requirements increases with the proposed size of the operation. Once the

livestock operation is operating, it is subject to annual environmental audits. In the case of the EW region, the frequency of audits can vary depending on the producer's compliance record. Environmental regulatory costs such as application and compliance costs are borne by producers. Producers usually only incur a small part of the annual monitoring costs. The EW council covers these monitoring costs if the producer's compliance record is good.

2.6 Australia's environmental regulations for ILOs

2.6.1 Background

In Australia, each state governs ILOs therefore environmental regulations vary across the country. The regulations attempt to achieve the effective utilization of manure and the protection of land, groundwater, surface water, and community amenity. The following subsections detail the environmental regulations for ILOs in two Australian states, South Australia and New South Wales.

2.6.2 South Australia

In South Australia, a cattle feedlot is defined as a livestock operation that has an average of 500 head of cattle per day over a twelve-month period (Environment Protection Act – Schedule 1, 1993). The "animal unit" measurement is not used. If the livestock operation is in a designated water protection area, the definition of a cattle feedlot drops to an average of 200 head per day over a twelve-month period.

Cattle feedlots also fall under the Development Act 1993 (Phillipson and Bowden, 1999) in South Australia. ILOs are viewed as commercial operations. Thus, ILOs must provide information to the public about their operations. The Development

Regulations state that cattle feedlots must undergo a full environmental assessment. All applications go to the Environment Protection Authority (EPA) for processing. Items considered include air, soil, and water quality and any nuisance concerns. The EPA has authority over all local planning authorities. Once the EPA has made its decision it will notify the relevant local planning authority on how to proceed with the application.

The EPA is responsible for assessing any impacts the livestock operation will have on the eco-system and considers any public concerns the agency has been notified about. Just one of these two criteria could cause the EPA to deny the application.

2.6.3 New South Wales

ILOs are regulated in State Environmental Planning Policy No.30 – Intensive Agriculture (2000) (Environmental Planning and Assessment Act, 1979). Cattle feedlots are defined as any structure that can house 50 head of cattle. The legislation calls for full public participation in the feedlot application process. The consenting authority (the local government) for the livestock operation is to consider five main points; the application information, the potential for odour, water pollution, and soil degradation, the applicant's measures to minimize any potential environmental problems, site suitability and industry codes of practice for the health and welfare of the animals, and any guidelines already in force (Environmental Planning and Assessment Act, 1979).

Any cattle feedlots that were in operation before 2000 have been "grand fathered" and are subject to the regulations that were in place when these feedlots came into existence. ILOs are a designated development under the Environmental Planning and Assessment Act and are therefore subject to an environmental audit.

ILOs are also subject to the Protection of the Environment Operations Act 1997. This Act requires that ILOs obtain an environment protection license from the appropriate regulatory authority. Detailed environmental plans must be provided to obtain the license. Public participation during the application process is required.

2.7 Environmental regulations in selected European Union countries

2.7.1 Background

In 1991, the European Community (EC) Nitrate Directive (91/676/EEC) was passed. It is the primary legislation to regulate water quality in the European Union (EU) (Beghin and Metcalfe, 2000). The directive states that nitrogen concentration in water should not exceed 50 parts per million. Secondly, residual nitrogen in the land should not exceed 170 kilograms per hectare by 2003. If the limit is exceeded, manure must be transported to a nutrient deficient area. The legislation is a directive so each member country must pass its' own laws regarding nitrates to conform with the directive. Legislation in various EU countries has attempted to gradually phase in lower limits for the livestock industry in order to comply with the Nitrate Directive. As of 2000, most EU countries have not met the Directive's nitrate limits (Metcalfe, 2002). The following material examines legislated environmental regulations in the EU.

2.7.2 Britain

In Britain, the Water Resources Act 1991 governs potential pollutants such as livestock manure. The Act stipulates how pollutants must be stored. It also states that the Environmental Agency can clean a contaminated site and then recover costs from the polluting farmer. British courts allow for unlimited fines should the agency need to

legally challenge a farmer. The Environmental Protection Act 1990 allows local government to investigate nuisance claims such as livestock manure odour. If the nuisance claim is valid a farmer could be heavily fined.

The Town and Country Planning Order 1995 stipulates that agricultural operations within four hundred metres of any protected building such as a house or a school require a planning permit (Ministry of Agriculture, Fisheries & Food, 2001). Secondly, all livestock operators must notify the local planning authority of their operations. The 1999 regulations require that certain livestock developments undergo an environmental assessment. Large hog and poultry operations may have to undergo an assessment, while cattle operations do not. The local planning authority performs the environmental assessment.

ILOs are subject to different environmental regulatory requirements depending on whether the ILOs are in Nitrate Vulnerable Zones (NVZ) or not. NVZs were created in order to comply with the EC Nitrate Directive. If an ILO is in a NVZ, the ILO must comply by law with the Action Programme. The Action Programme's main directive is to place limits on the amount of nitrogen that can be spread per hectare. It requires that the occupier, not necessarily the landowner, of the farm must comply with the regulations. The Department for Environment, Food, and Rural Affairs (DEFRA) will cover the costs of analyzing a farm for environmental risks. The agency will also provide funding to farmers to invest in technology that will improve the environment.

The Action Programme states that no more than 250kg/ha of nitrogen from manure can be spread on grass per year. Secondly, for land that is not in grass, no more than 210kg/ha of nitrogen from manure can be spread per year. As of December 19,

2002 these amounts will be reduced to 210kg/ha and 170kg/ha respectively. Record keeping is required. The farm producing the manure must record the farm receiving the manure, the type and quantity of the manure and the date on which it left the producing farm. Records must be kept for five years. Manure spreading is banned during the autumn months (August 1 to November 1) and for a short time period after a significant amount of rain. At least three months of manure storage is required in order to comply with the autumn manure-spreading ban. It is also required that spreading equipment should be able to spread manure uniformly.

If the ILO is not in a NVZ, the operation is encouraged to follow the Codes of Good Agricultural Practice for the Protection of Water, Air and Soil now regulated by the DEFRA. While compliance is voluntary, if a legal action was filed against an ILO it has a better chance to defend itself if it is following the code.

The Code of Good Agricultural Practice for the Protection of Soil recommends that the amount of nitrogen applied does not exceed 250 kilograms per hectare per year and that phosphorus levels should be monitored. Both the Action Programme and the Code of Good Agricultural Practice state that a ten metre buffer zone is required between surface water and manure spread or piled and fifty metres is required between manure spread or piled and a well used for human consumption. Secondly, if crop nutrient requirements are less than the total nitrogen limit allowed, then the limit becomes the crop nutrient requirement. One of the main differences between the Code and the Programme is that the Programme considers the amount of manure from grazing cattle in the nitrogen limit while the Code excludes manure from grazing cattle in its'

nitrogen limit. Both the Code and the Action Programme encourage the use of manure management plans however in both cases these plans are not mandatory.

2.7.3 Holland

Dutch agriculture has an excess of nutrients in its' ecosystem (Mureau, 2000). The amount of manure produced in Holland in excess of crop requirements each year is equal to the total amount of manure produced annually by livestock in Manitoba (Manitoba Agriculture & Food, 2000). The entire country of Holland is considered a nitrate vulnerable zone in the EC Nitrate Directive.

The Minerals Reporting System (MINAS) was established on January 1, 1998 to comply with the EC Nitrate Directive. The farmer must record all feed, animal, and manure production in order to achieve a nutrient balance on their operation. If a farmer produces an excess of nutrients above the limits they are fined and may have to sell livestock to achieve the nutrient reduction (Lammers-Help, 2001). In order to comply with the EC Nitrate Directive in 2003, farmers must reduce their nutrient limit to 20 kilograms of phosphate and 170 kilograms of nitrogen per hectare of grassland.

A manure market has been created to reduce manure production. Geographical regions have been established which are designated as either manure surplus or manure deficit. Manure surplus regions can sell their manure production rights to manure deficit regions but the reverse is not allowed. Contracts between farmers in manure surplus regions and manure deficit regions are mandatory. As for air quality concerns, fall and winter manure application is prohibited and all manure application must be directly injected into the soil (Hacker and Du, 1993). Six months of manure storage is required to comply with the ban.

2.7.4 Denmark

The Ministry of Environment and Energy in Denmark uses the animal unit system to regulate ILOs. One animal unit is equal to one cow, two horses, three sows, or 2500 broilers. Permits are required to operate all livestock operations in order to consider the general public's concerns. Cattle operations must store their manure heaps on a concrete base so to stop any nitrogen leaching and have the capacity to store one year of manure. It is also required that there is no more than 2.3 animal units per hectare. If an operation cannot meet this requirement then it must enter into a written contract with another producer to spread manure on his or her land.

Manure spreading cannot occur between post-harvest and February 1. It is also required that 65% of a farmer's land is planted to cover crops over the winter for nutrient uptake. Farmers must prepare fertilization budgets twice a year. In order to ensure compliance, the government may audit these budgets. Farms with less than 120 animal units must be at least fifty metres from any development and farms with more than 120 animal units must be three hundred metres from any development (Moe, 1995).

The Danish Agricultural Properties Act further regulates farms. A farmer with 251 to 500 animal units must own 75% of the land to comply with the 2.3 animal unit per hectare regulation. Secondly, a farmer with more than 500 animal units must own 100% of the land. This law helps to limit farm size. The entire country of Denmark is considered a nitrate vulnerable zone in the EC nitrate directive so Danish livestock operations may have to contract their manure disposal with operations in other countries. Table 2.6 is a summary table for the environmental regulations covered in this chapter.

Table 2.6 - Environmental regulations for cattle feedlots in various regions.

	Threshold for regulating cattle feedlots	Environmental assessment required	Nutrient limits for manure management	Nuisance concerns	Manure storage regulations
Saskatchewan	More than 300 animal units and less than 370m^2 per animal unit.	More than 1000 animal units	Crop nutrient requirements where manure is to be spread.	Determined by the rural municipality.	One year storage if more than 1000 animal units.
Alberta	An area where feed must be brought to at least 200 feeders or 150 cows.	Partial assessment for 150 – 349 cows, full assessment if 350 cows or greater	Schedule 3 of AOPA. Depends on soil type & animal species.	Schedule 1 of AOPA. Depends on operation size.	Schedule 2 of AOPA. Size of catch basin dependent on average annual rainfall in the area.
United States	3 - tier structure depending on operation size and environmental risk.	3 -tier structure depending on operation size and environmental risk.	Crop nutrient requirements or NPDES permit limit.	Varies – state specific.	NPDES permits limit waste discharges into public water bodies.
New Zealand (Environment Waikato)	All operations are regulated.	All operations.	Crop nutrient requirements to a maximum of 150 kg/hectare of nitrogen.	Must obtain neighbour's signature during application process.	Determined by operation size.
Australia (South Australia and New South Wales)	50 head - NSW 500 head – South Australia.	50 head – NSW 500 head – South Australia.	Nitrogen & salt holding capacity of the soil type.	Public consultation during approval process.	Determined by operation size.
Britain	All operations are regulated. Varies if operation is in NVZ or not.	Cattle operations are not subject to assessment.	Crop nutrient requirements to a max. of 170kg/hectare of nitrogen.	Permit required if within 400 metres of public.	3 months storage.
Holland	All operations are regulated.	All operations.	170kg/hectare of nitrogen.	Manure must be injected into the soil.	6 months of storage.
Denmark	All operations are regulated.	All operations.	170kg/hectare of nitrogen.	Distance varies depending on operation size.	1 year of storage, concrete base for stockpile.

Sources: Agricultural Operations A-12.1 Reg 1, 1995 (Saskatchewan), Agricultural Operation Practices Act, 2001 (Alberta), Minnesota Rules chapter 7020, 2000, A Guide to Preparing a Basic Assessment of Environmental Effects, 1999 (New Zealand), Environment Protection Act, 1993 (South Australia), Environmental Planning and Assessment Act, 1979 (New South Wales), Code of Good Agricultural Practice, 1998 (Britain), Lammers-Help, 2001 (Holland), Moe (Denmark), 1995.

2.8 Industry driven environmental management systems (EMS) and ISO 14000

2.8.1 Environmental management systems (EMS)

In addition to governments' environmental regulations there are also voluntary industry driven environmental management systems (EMS). These systems have been initiated for various reasons such as increasing market access and to establish stronger links in the supply chain (Carruthers, 1999). Another reason is to allow industry to have more input into environmental regulations. When the government decides to implement environmental regulations, the industry will already have a set of standards available which can be used in dialogue with the government. The literature is inconclusive if a market premium exists for EMS products however EMS allows industry to be pro-active with environmental decisions and legislation.

An EMS is a planned approach for a farm or a business to manage its impacts on the environment (Castelnuovo, 1999). It is a process standard, not a performance standard. An EMS usually has four steps. The first step is environmental goals are established. Secondly, plans are implemented to achieve the goals. Next, an independent third party monitors implementation. Finally, results are reviewed through third party monitoring and record keeping.

Some industry groups have chose to ignore independent third party monitoring in their EMS as there is no legislation in what an EMS must encompass. These groups believe that a third party may interfere with the environmental image they are trying to project. For example if a company wishes to market environmentally responsible detergent in three months, the third party may find that the detergent is not environmentally responsible or the third party may slow the company's marketing

efforts. This is a widely held belief in North American business (Isaac and Woolcock, 1999). North American consumers do not widely look for environmental labels. More so, if they do see them they are not concerned if an independent third party has guaranteed the label or not. In contrast European consumers are very aware of the different types of environmental labels and they trust labels that have been third party verified, especially when verified by government agencies (Isaac and Woolcock, 1999). This is a fundamental difference between North America and Europe.

At a minimum the EMS must comply with local and national environmental regulations. In some cases environmental standards are established by the industry group which are more rigorous than environmental regulations in order to appeal to a niche market. An environmental label may be applied to a product without independent certification and where the product is only complying with local environmental regulations.

2.8.2 ISO 14000 (International Standards Organization)

In order to market environmentally responsible products internationally it is preferable to seek ISO 14000 certification as it is a recognized environmental standard globally. The ISO 14000 series is designed to implement best environmental management practices for individual firms and to market these practices globally, therefore it is industry driven. Like the EMS, the ISO series is designed to allow firms to identify their own areas of environmental importance and to schedule to improve their environmental performance. Not all EMS have been ISO certified and the EMS that are ISO 14000 certified could be quite different between geographical regions.

The ISO itself does not accredit an EMS, this power is granted to numerous ISO-65 accredited third party auditors around the world. An ISO-65 accredited third party auditor is required when the EMS wishes to use a Type I environmental label which falls under the ISO 14001 category (ISO, 1998). The regulator's seal must be on the product. A Type I environmental label is the only label to use an ex ante verification system. One example of an ISO certified third party auditor for Canadian agriculture is SGS Canada Inc. (Société Générale de Surveillance). This group is involved with exporting grain. Significant costs are involved due to the audit process but the audits provide consumer confidence.

The ISO 14000 series also allows an EMS to use a Type II environment label which falls under the ISO 14021 category (ISO, 1998). A Type II environmental label requires scientific proof but is not subject to independent third party verification. If a Type II environmental label is found to be false at some point the firm is subject to legal action. Therefore, if a product is ISO 14000 certified it does not necessarily mean that an independent third party has environmentally tested the product's production and processing methods. All that can be assumed is that the organization had initially establish an ISO 14000 certified environmental plan subject to certain criteria.

Yiridoe, Clark, Marett, Gordon, and Duinker (2002) found that the primary reason Canadian companies implemented ISO 14001 was to establish goodwill with customers. These companies' employees stated however that the certification was a proactive approach. They stated that consumers were not demanding ISO 14001 certification. The second reason these companies implemented ISO 14001 was to better comply with existing environmental regulations in their regions.

There are many reasons for farm operators to seek ISO 14000 certification. According to Bergström, Hellqvist, and Ljung (1999) these include:

- To provide market signals through environmental labeling.
- To project a better image of the industry to the general public.
- To demand good environmental practices within the supply chain.
- To implement an approach that deals with local environmental problems.
- To lower total farm costs due to better record keeping, necessitated by the ISO plan.
- To deliver high quality, environmentally responsible products.

The ISO 14000 series also provides general guidelines for environmental auditing and life cycle assessment. Life-cycle assessment consists of analyzing a product's environmental impacts from its' production to its' disposal.

An ISO 14000 certified EMS must contain four key components; clearly stated policy, planning, implementation, and evaluation. The policy statement must commit to continuous environmental improvement and adherence to environmental regulations. The planning statement details environmental goals and a management system must be in place to achieve those goals. An internal mechanism must also be in place for the organization to measure its' environmental success.

While ISO 14000 certification does not necessarily create market premiums, it can lower farm insurance premiums due to the plan design (Iowa State University Extension, 1999). Certification may decrease the frequency of third party verification and auditing. The auditing would still occur but farms with ISO systems in place are deemed by auditors to be of less risk in violating the quality assurance system.

2.8.3 Examples of environmental management systems

Various organizations and producer groups in the United Kingdom, Australia, Holland, and Denmark have attempted to establish voluntary, third party accredited quality assurance schemes for different sectors of the agricultural industry. In Canada, Ontario has developed the Ontario Environmental Farm Plan which is a voluntary environmental management system. The Ontario plan initializes the process by identifying farming practices that are environmentally sustainable. The farmer is given the flexibility to adapt the recommendations to his or her own farming situation. Once a farmer has finalized his or her environmental plan it is submitted for peer review. The reviewers may approve the plan but once that is completed there is no further auditing. The Ontario plan is not ISO 14000 certified because it does not have a commitment to continual environmental improvement (Carruthers, 1999). An approved plan garners a $1500.00 CDN subsidy from the Ontario government.

In Australia, each state governs ILOs therefore environmental regulations vary across the country. However, industry groups such as Meat and Livestock Australia saw a need to publish general standards that would apply to all feedlots in Australia. The National Guidelines for Beef Cattle Feedlots was published in 1992. The intent of these Guidelines is to provide a framework of acceptable principles for the establishment and operation of feedlots in Australia. The requirements in the Guidelines are acceptable standards for good management practice across Australia although individual states may have more stringent regulations.

A separate guide called the "National Beef Cattle Feedlot Environmental Code of Practice" was published in 2000. This guide recommends environmental standards for

feedlots across the country, however individual states may have more stringent regulations. If the standard is more stringent than the regulation, the standard becomes voluntary. The guide provides recommendations on site design, nuisance reduction, manure storage and manure management practices.

It appears that these Codes have been established in order to market the production methods certified feedlots use to finish cattle. The National Feedlot Accreditation Scheme (NFAS) uses these Codes in order to accredit participating feedlots in their program. The NFAS was established by the Australian Lotfeeders Industry. Under the scheme, the environmental code is accompanied by an animal welfare code and a veterinary chemical code. The environmental code identifies environmental objectives, establishes plans to achieve those objectives, and then the results are monitored by both the feedlot and independent third party auditors. The objectives to be achieved are the effective utilization of manure and the protection of land, groundwater, surface water, and community amenity (Meat and Livestock Australia, 2000).

There is also increasing public concern over the environment, animal welfare, and food quality and safety in the EU (Iowa State University Extension, 1999). According to Assured British Meat (ABM), a voluntary beef quality program, food safety and animal welfare concerns take precedent over the environment. In response to these concerns, various EU countries have established voluntary labeling programs to brand their product. Often, the government is involved in these programs in order to build consumer confidence (Iowa State University Extension, 1999). EU consumers trust public labels more than private labels (Isaac and Woolcock, 1999). These

programs are subject to third party verification. In several EU countries, environmental standards and regulations complement one another in order to achieve sound environmental policy and a program to market environmental standards above regulatory requirements.

Assured British Meat (ABM) covers the entire red meat supply chain for food safety, animal welfare, and environmental stewardship. Various certification bodies employ veterinarians to do the farm inspection process. Farming and feedlot operations can comply with the environmental component of the ABM by complying with the ILO environmental standards in the Code of Good Agricultural Practice. This includes proper animal waste disposal to minimize disease exposure to humans and to protect the environment. As of April 1, 2002 ABM also required approved waste management plans, which is higher than the Code's standard.

The Dutch have twelve beef quality labels that promote either organic production or sustainable production. The criteria for organic production include chemical free, animal welfare, and environmental stewardship. The criteria for sustainable production excludes chemical free. The labels set a higher standard than the government's regulations. Third party monitoring is a requirement. The largest cost in complying with these labels is the additional space required to house the animals. Dutch supermarkets expect that organic and sustainable beef demand will be 5% of Dutch beef demand between 2005 and 2010 (van Os, 1999).

The Dutch Product Board has established the most well-known quality assurance system in Holland. The Dutch Chain Quality Assurance program (IKB) uses third party auditing and places higher standards on farmers than government regulations. The

program is export focused. In 1999, 15% of Dutch cattle were in this system. Segregation of certified and non-certified beef in the supply chain has been relatively easy (Iowa State University Extension, 1999).

Denmark also has quality assurance programs in order to brand their beef. The Danish government has encouraged organic beef production. In order to assist in its' development, the government operates the inspection system for the program. Additionally, the Danish government has financially encouraged ISO production systems.

3. CONCEPTUAL FRAMEWORK EXAMINING MARKET FAILURE

3.1 Introduction

When a market failure occurs, individuals are unable to respond to market forces in a way that will lead to an efficient allocation of resources (Boardman et al, 1996). If markets fail there is justification for government intervention if the benefits of that intervention outweigh the costs. Ideally a number of cost-benefit analyses should be undertaken to determine whether any intervention is justified and if so, the most cost effective form of government intervention to correct the market failure. There are four commonly identified types of market failures: natural monopoly, information asymmetry, externalities, and public goods. This project examines all of these except monopoly.

3.2 Information asymmetry

Information asymmetry leads to market failure. This is a frequent problem with environmentally responsible goods (ERG), as they possess credence attributes where consumers cannot tell if the label information provided to them is truthful. In new institutional economics, consumers are portrayed as having bounded rationality; they do not have perfect information as is assumed in the standard neo-classical model of consumer behaviour. Their search costs are high if they wish individually to acquire information regarding process attributes of the beef they consume. Labeling improves

information to consumers who are able to express their preferences for environmental attributes by paying a premium which entices firms to invest in ERGs (Golan, Kuchler, and Mitchell, 2000). There is information asymmetry in that consumers cannot distinguish between truthfully labeled ERGs and false ERGs (Akerlof, 1970; Hobbs, 2001).

A "lemons" problem exists with respect to false ERGs and the adverse selection by consumers causes a market failure. Firms have an incentive to cheat without third party monitoring. Firms have this incentive because it results in higher profits (Golan, Kuchler, and Mitchell, 2000). Without third party monitoring, firms can price at the ERG output price but they only have to incur costs to produce non-ERGs. These firms have the most to gain from labeling but they are committing fraud. A free rider problem exists (Raynaud and Sauvee, 1999). This can be shown by the following three equations (Hobbs, 2001)[1]:

$$\pi_H = R_H - C_H - V \qquad [3.1]$$

$$\pi_L = R_L - C_L \qquad [3.2]$$

$$\pi_{HC} = R_H - C_L - V \qquad [3.3]$$

where:

- π_H are the profits from ERGs for firms that do not cheat.
- π_L are the profits from non-ERGs.
- π_{HC} are the profits from ERGs for firms that cheat.

[1] Hobbs (2001) includes a goodwill premium for firms that voluntarily adopt environmentally responsible production practices for their goods. This premium is in addition to the premium eco-consumers are willing to pay for environmentally responsible goods. The author has chosen not to include the goodwill premium, as it would further complicate this analysis.

- R_H is the revenue from goods labeled as ERGs, R_L is the revenue from non-ERGs.
- C_H is the production costs of ERGs, C_L is the production costs of non-ERGs.
- V is the cost of the labeling system.

It is assumed that R_H is greater than R_L and C_H is greater than C_L, therefore $\pi_H > \pi_L$, $\pi_{HC} > \pi_L$, and $\pi_{HC} > \pi_H$. The fraudulent firm has the most to gain in an environmental labeling process assuming there is no chance of being caught by an auditor. It is essential that a mandatory ex ante verification system exists for ERGs if eco-consumers want assurances that every ERG they consume is produced in an environmentally responsible manner.

Cason and Gangadharan (2002) hypothesized that consumers would not pay higher prices for environmental labeled goods unless third party verification existed and consumers deemed the third party credible. They performed two experimental auctions, one at Purdue University, the other at the University of Melbourne to test their hypothesis. They found that unverified ERG labels are not sufficient to improve market outcomes above normal good prices. Verification of the product claim corrected the market failure. They did not reject their hypothesis.

4. METHODOLOGY

4.1 Simulation Technique

The empirical work for this project consists of an environmental cost/benefit analysis for various sizes of Saskatchewan feedlots. The costs for four proposed international environmental standards are calculated using a ten-year financial model for feedlots with a one-time capacity of 10,000, 20,000, and 30,000 head. Cattle labeling costs for an ex ante verification system are examined. If beef product labeling is allowed by the federal government, market premiums may exist for environmentally responsible beef. Environmental compliance and labeling costs will be compared to possible market premiums for environmentally responsible beef in order to determine the merits of imposing these costs.

4.2 Financial Analysis

A ten-year (2003 – 2012) financial model is established for each feedlot size. The model includes a statement of income, a balance sheet, a cash flow schedule, revenue projections, a cost of good sold schedule, a capital budget, a capital cost allowance schedule, a debt repayment schedule, ratio analysis, and investment analysis. The model is based on a project by Basset et al (2002) entitled, "Northwest Feeders Ltd." The "base case" model is designed to reflect the environmental protection costs associated with adhering to SAFRR requirements and provincial environmental

regulations. The "base case" model is then adjusted to reflect each of the four proposed international environmental standards in section 4.8, an environmentally responsible beef premium detailed in section 4.4, and a labeling system described in section 4.6.

There are various financial indicators used to evaluate a feedlot's financial performance. These indicators are used to compare the financial performance of the "base case" to the financial performance of feedlot models adjusted for each international environmental standard. The investment analysis consists of comparing the net present value and the internal rate of return from one feedlot model to another. Additionally, the increased capital investment required due to each international environmental standard is examined.

The leverage analysis consists of examining the debt to asset ratio of each feedlot model as suggested by the USEPA (2001c). These feedlot models are highly leveraged so the debt to asset ratio is an important ratio to examine. The majority of the asset value is the cattle (Iowa State University Extension, 2001). From a revenue perspective it is important to examine what consumers are willing to pay for the protection of natural resources through product prices (Boardman et al, 1996). The cost to comply with each international environmental standard is analyzed on a per head basis so as to allow comparison between the three feedlot capacities.

4.3 The hypothetical feedlots

4.3.1 Assumptions regarding location and capacities

As mentioned earlier, for the purposes of this project, three hypothetical feedlots models are evaluated. The first feedlot will have a one-time capacity of 10,000 head, the second a capacity of 20,000 head and the third a capacity of 30,000 head. The cattle

turnover ratio is assumed to be 1.7 times per year (Basset et al, 2002). It is assumed that the feedlot is usually at 85% capacity. Therefore these feedlots with a capacity of 10,000, 20,000, and 30,000 head feed 14,450, 28,900, and 43,350 head respectively per year. The weights of the animals range from four hundred pounds to twelve hundred pounds but on average, these animals produce thirteen pounds of dry manure[1] per day (AAFRD, 1996 as cited in Unterschultz and Jeffrey, 2001).

It is assumed that feedlot operators will have full information regarding the detail of an international environmental standard before construction. Therefore, the costs of retrofitting feedlots to comply with environmental standards will not be examined in this project. A second assumption is that the feedlots will be built in the most environmentally responsible location in the province. This is assumed to simplify the analysis because soil type varies greatly across the province and therefore the potential for surface and groundwater contamination also varies greatly.

Another important factor in citing feedlots this size is the availability of water. Therefore the hypothetical feedlots will be located very close to Lake Diefenbaker[2] within the irrigation district that is part of rural municipality 284 around the Broderick area. The soil in this area is a silty clay loam which contains over 13% clay composition which is an important environmental consideration in determining feedlot location (SAFRR, 1999). Clay substantially slows nutrient leaching into groundwater (USEPA,

---

[1] For the purposes of this project, dry manure refers to six month old manure after the moisture content has been significantly reduced. This is the amount of manure per animal that would have to be removed from the feedlot site.

[2] Feedlot location was determined in consultation with Russell Johnson, environmental engineer with SAFRR on September 19, 2002. Any errors are the responsibility of the author.

2001a). The clay component of the soil prevents some additional initial capital costs such as installing a synthetic liner for the storage pond and constructing concrete pads for manure stockpiles. These two additional components can add three million dollars (CDN) in initial capital investment for a feedlot in the 10,000 to 30,000 head range (USEPA, 2001a).

It is also assumed that all three sizes of feedlots will be identical from an operations perspective. For example, each feedlot will buy 40% of its' calves in the 400-500 pound volume range. A substitution of capital for labour was not assumed in this project as feedlot size increases. Realistically, as feedlot size increases capital will substitute for labour because larger feedlots are more automated. However, this is not the focus of this project and the author believes the models will give accurate results for the objectives of this project.

4.3.2 Adhering to provincial regulations and standards

It is assumed in this project that at a minimum, the hypothetical feedlots are adhering to provincial standards and regulations. SAFRR's site-specific requirements include grading slopes for adequate drainage, storage ponds for liquid waste, and proper stockpiling of solid waste (SAFRR and SERM, 2001). SAFRR also requires the feedlot operator to develop a manure management plan where the manure-spread land area is equal to crop nutrient requirements. It is assumed in Saskatchewan that nitrogen is the limiting nutrient. It is also assumed in this project that feedlot operators will not transport manure until it has been stockpiled for six months. This is important because the volume of manure is reduced by 76% when comparing fresh manure volume to a six month, dried manure volume (AAFRD and Alberta Cattle Feeders' Association

(ACFA), 2002). The hypothetical feedlots already incur environmental protection costs under provincial standards and regulations. These items include:

- Geo-technical fees[3] for feedlot landscaping design and storage pond design to eliminate water contamination.
- Landscaping costs.
- Runoff storage pond construction. Factors involved in designing earthen storage ponds for runoff include the size and slope of the feedlot, the amount of annual precipitation, soil characteristics, and the amount of freeboard required (additional storage capacity designed to deal with catastrophic events).
- A perimeter ditch to prevent runoff from exiting the feedlot site during rainstorms.
- Effluent disposal once significant effluent accumulation occurs in the storage pond.
- Manure stockpiling and removal. It is important that solid manure stockpiles are stored so to prevent contamination of surface water and to avoid any nuisance concerns. The land area the manure is spread on is equal to crop nutrient requirements.
- Establishing manure-spreading practices to avoid nuisance complaints from rural and urban communities. This requirement may increase manure transportation costs.

[3] Geotechnical fees are engineering costs incurred to protect the local environment around the feedlot. These fees do not include locating and developing a water supply.

- Establishing manure-spreading practices to avoid water contamination. For example, this includes minimum separation distances between manure-spread land and water wells.

In the base case scenario two assumptions must be made as to these feedlots' environmental protection practices. The first assumption is that feedlot operators will try to minimize their manure transportation costs while still complying with provincial standards. The most common practice is to spread 200% of crop nutrient requirements on the land (SAFRR, 2000). However in order to meet the standard, manure is applied to the land only once every two or three years. This practice results in meeting but not exceeding crop nutrient requirements over a two-year period. While this practice is acceptable, it also creates an opportunity for excess nutrients to contaminate water. However according to Waskom (1994) and Howard (2001) phosphorus is highly immobile in the soil and is not likely to leach into groundwater but excess phosphorus could be carried by runoff into water bodies.

The second assumption is that feedlot operators will use centre pivot irrigation to obtain a high level of control when applying effluent from runoff storage ponds to land (USEPA, 2001a). Centre pivot irrigation technology allows the operator to be very precise in the amount of water or effluent that is released onto the land. This will result in nutrient levels equaling crop nutrient requirements.

4.4 Market premiums for environmentally responsible beef production

As mentioned earlier, the environment pillar of the new Canadian Agricultural Policy Framework is based on the idea that market premiums are available for food verified to be produced in an environmentally responsible manner. Of the $589.5

million federal transition fund to implement the Agricultural Policy Framework (APF), $264.5 million has been reserved for environmental farm plans (Ontario Ministry of Agriculture and Food, 2002). An agricultural operator has the option to develop an approved environmental farm plan in the APF as the environment pillar is voluntary (Agriculture and Agri-food Canada, 2002). The APF transition funds are needed in order to attract agricultural operators to develop environmental farm plans. It is possible that once the environmental farm plans are established, agricultural operators could market their production as being environmentally responsible.

Clarke et al (1999) found that 62% of consumers who agreed to participate in their interview process were inclined to pay a premium for environmentally responsible food products. Volpi (2002) compared the economics of natural beef[4] to conventional beef production. Volpi found that a finished natural beef animal sold for $115.87 CDN per hundredweight and a conventionally produced beef animal sold for $103.17 CDN per hundredweight. This is somewhat in line with the Montana Range Meat Company which has paid a thirteen-cent ($ US) premium per pound to its' natural beef producers (Hodgins and Company, 2002). Grannis and Thilmany (2000) found through a survey in Colorado, New Mexico, and Utah that consumers were willing to pay a 12% premium for organic beef[5] over conventional beef. They found that the majority of the organic

[4] Natural beef is hormone free, antibiotic free and is produced in an environmentally responsible and animal welfare friendly manner. The cattle feed may not be organic or natural however animal by-products are not allowed in the feed (Coleman Natural Beef, 2002). Coleman Natural Beef is certified by the United States Department of Agriculture.

[5] Organic beef is almost identical to the footnote above with two exceptions. Firstly, the cattle feed must also be organic (Maverick Ranch Beef, 2002). Secondly, various independent organic agencies may certify a beef product to be organic.

beef premium was related to hormone free and antibiotic free product attributes. They did find however some consumer willingness to pay through beef market prices for improved water quality in streams around beef production locations and to maintain biodiversity around these locations. By examining Grannis and Thilmany's survey results it could be deduced that between 14% and 26% of the total organic beef premium of 12% is due to the idea that organic beef and natural beef are produced in an environmentally responsible manner.

Questions exist with respect to an environmentally responsible beef premium. If a premium exists, how large is the market? Smith (2000) suggests that only consumers from the European Union would be interested in beef with the single trait of being environmentally responsible. Additionally, consumers may only want to purchase beef that is "bundled," namely hormone and antibiotic free with humane animal treatment and produced in an environmentally responsible manner. There are also questions regarding product certification. For example, if Canadian beef is marketed as safe and environmentally responsible under the Agricultural Policy Framework, it is possible that feedlots may need ISO 9000 (quality) and 14000 (environmental management) certification to market abroad. This could prove to be costly.

If an environmentally responsible beef premium exists, it is essential, based on Hobbs (2001); that an environmental monitoring system exists to verify the environmental label to beef eating eco-consumers. A feedlot will adhere to a recognized cattle-labeling system for environmental branding if an environmentally responsible beef premium exists. However a monitoring system must be in place to verify that a feedlot is truly adhering to the labeling requirements. If the premium does not exist, feedlots

will not label their cattle. The environmental monitoring system and the cattle-labeling system for environmental branding evaluated in this project are described in the next two sections.

4.5 The proposed monitoring system for beef feedlots

4.5.1 Introduction

Site-specific monitoring is a basis on which to begin a verification system for a feedlot in a dedicated environmentally responsible beef supply chain. This is necessary because there are economic incentives available to encourage feedlot operators to cheat because they could label their product as environmentally responsible, they would collect the premium, but they would not incur any of the additional environmental protection costs. Environmental monitoring by an independent third party (private or public sector) is essential to verify a credence attribute such as environmentally responsible beef production to eco-consumers. Monitoring may allow a feedlot to implement an ISO 14000 compliant environmental management system.

The primary environmental concerns surrounding feedlots is the protection of soil and water. SAFRR requires the development of environmental plans when establishing Saskatchewan feedlots of this size. These plans are designed to control runoff and manage manure. However, there is no continuous monitoring of groundwater or manure management practices by an independent party.

4.5.2 Manure management practices

SAFRR requires a manure management plan for the spreading of manure on the land. The requirement is that the area of manure spread land is equal to crop nutrient

requirements although a soil analysis is not required to meet these requirements[6]. There is no ongoing monitoring of manure-spread land by SAFRR. The lack of ongoing monitoring of manure-spread land may allow some beef producers to ignore their manure management plan details. For a number of reasons, there are significant incentives to apply manure above crop nutrient requirements.

Firstly, there is a delayed crop response from cattle manure. Most of the yield benefits come in the first or second years after application so over-application may occur in order to obtain a heightened yield response in the year of application. Secondly, manure and inorganic fertilizer are imperfect substitutes. The composition of manure may cause a specific nutrient deficiency and inorganic fertilizer would be required to compensate for the deficiency. There may be an incentive to compensate for the specific nutrient deficiency by over-applying manure (Parr and Colacicco (1987) as cited in Nagy et al, 1999).

It is assumed in this project that eco-consumers of environmentally responsible beef products will demand manure management monitoring as part of the process of verifying the environmental value of their beef products. These eco-consumers will demand environmental sustainability. Professional agrologists have the knowledge to develop sustainable manure management strategies. There are many services provided by agrologists in developing and monitoring the manure management plan.

Agri-Trend Agrology Ltd.[7] has developed the Strategic Crop Plan™ which is a long-term comprehensive nutrient management plan for crop rotations. One part of the

---

[6] Karen Bolton and Wendy Dehod, SAFRR, Personal Communication, Sept. 3, 2002.
[7] Robert Saik, P.Ag., C.A.C., President of Agri-Trend Agrology Ltd., Personal Communication, October 24, 2002.

Strategic Crop Plan™ is the manure resource management process. The first step is assessing the available land base where manure is to be spread. A soil and surface analysis is performed in order to determine crop nutrient requirements. Records are checked to examine where manure has been applied in the past. Manure stockpiles are also tested to examine nutrient composition. A multi-year crop rotation is developed based on these results.

The second step is analyzing the geography of the land and determining setback areas to protect riparian zones and eliminate nuisance concerns. Once the manure has been spread, two or three manure samples per field are taken to determine usage coefficients. Usage coefficients are needed to determine the nutrient levels that will be available to the crop in the current year and the years following manure application. In the third step, soil samples are taken at the end of each year to determine the level of nitrogen in the soil along with phosphorus and accumulating sodium.

All of the data calculated by Agri-Trend Agrology Ltd. is managed on-line with MySCP Netware™. This program allows both professionals at Agri-Trend Agrology and the producer to have access to their updated Strategic Crop Plan™ at any time. Quality assurance is also guaranteed because the program allows multiple professionals to audit all their clients' crop plans with ease. It is assumed in this project that the continuous monitoring component of the manure management plan will satisfy one aspect of eco-consumers' concerns for environmentally responsible beef production.

4.6 The proposed labeling system for environmentally responsible beef feedlots

4.6.1 Introduction

This section details the labeling system that would be in place in order to provide a reliable internationally recognized environmentally responsible beef product. It is designed on the assumption that there will be a dedicated environmentally responsible beef supply chain. This means that a feedlot operator would have to decide whether to opt in or out of the dedicated system as it is not possible to establish two environmental programs for the same feedlot. The labeling system proposed here could possibly be coordinated with the Canadian Cattle Identification Agency (CCIA). This system will be used for each of the four possible environmental standards tested in this project. The labeling system includes radio frequency identification (RFID) for individual animals and an online data management system.

4.6.2 Cattle Identification

In order to supply "gate to plate" information for the consumer an ex ante verification system must be established. Currently, the Canadian Cattle Identification Agency (CCIA) maintains a mandatory cattle identification system to promote food safety. It is an ex post system in that it can trace back and contain serious animal health and food safety problems. The program is regulated and enforced by the Canadian Food Inspection Agency (CFIA). All cattle and bison permanently leaving the herd of origin or any point beyond the herd of origin must be tagged[8]. Each animal is assigned a unique nine-digit tag number and the tag contains a barcode or electronic chip for

[8] Canadian Cattle Identification Agency, 2002. www.canadaid.com

automatic reading. The individual identification is not associated with the original herd. Barcode tags range from $1.00 to $2.00 CDN per tag. Electronic tags such as AgInfoLink's® are $4.00 USD per tag but come with data management software[9].

It is possible that a dedicated private beef supply chain could supply ex ante information that would complement the CCIA system. Such is the case in Australia where Meat Standards Australia (MSA) has developed a brand that uses the national trace-back electronic tags to identify its' livestock (Lawrence, 2002). In order to establish the system the dedicated environmentally responsible beef supply chain would first have to obtain a block of identification numbers from the CCIA. At this point beef producers wishing to enter this supply chain would have to waive certain confidentiality conditions that exist under the CCIA system. This is necessary to supply eco-consumers with the audited information needed to obtain an eco-premium.

The environmentally responsible beef supply chain could use electronic tags or radio-frequency identification (RFID) tags to gain information efficiencies in the system. These tags allow livestock to be processed faster which is important in a large feedlot. An RFID reader is a wireless device that reads the RFID tags using radio frequencies. AgInfoLink's ® RFID reader or TagTracker™ costs $995 USD. It is likely that two RFID readers would be needed for a 10,000 to 30,000 head feedlot. The TagTracker™ has the ability to send wireless information to a personal computer.

A computer program called BeefLink2™ records the tag information. BeefLink2™ is designed to store various information with the tag number which could include audited environmental practices in the feedlot. The program includes Share

[9] Personal communication with Glenn Smith, AgInfoLink,® October 14, 2002.

Data™ which is a program that sends information over the internet to other participants in the supply chain. A more sophisticated program called the Pony Express Relay Database™ has the ability to send information up and down the beef supply chain. The BeefLink2™ software is included in the price of the electronic tags. AgInfoLink's ® system can also be ISO compliant. It complies with ISO 11784/11785 which is the ISO standard for electronic animal identification (Eradus, 2001).

4.6.3 Beef Product Identification

In the previous section, audited environmental information was passed to the packer through an on-line animal identification system. Once the animal is slaughtered though the audited environmental information must continue to move to the consumer. From the plant, the environmentally responsible beef product would be boxed and shipped to distributors. The packaging would detail the audited environmental practices that were used in the creation of the environmentally responsible beef product. At the retail level, this information could be passed on to consumers through information brochures in grocery stores or through restaurant menus.

4.7 The methodology in designing the standards

Four possible international environmental standards are developed in this project. These standards are developed by the author and are based on an extensive literature review. It is important to note that a feedlot operator wishing to adhere to any one of the standards must also continue to adhere to provincial environmental regulations. This means that the feedlot must incur the environmental protection costs noted in the section above and the additional environmental protection costs the standard prescribes.

Four objectives are developed to design the standards. The first objective is to create standards that would encourage global eco-consumers to buy beef products labeled as environmentally responsible. This means that even the least costly standard for the feedlot to implement might be stringent enough to convince eco-consumers that the environment is being protected.

The second objective is to compare a performance standard to a process standard. A performance standard would demand a specific end result but the means to achieve the result would be left to the feedlot operator. For example, a performance standard may state that the surface water near a feedlot may not have more than thirty parts per million of phosphorus. The performance standard would not detail how feedlot operators could meet the phosphorus limit. A process standard would detail what environmental practices feedlot operators must implement to improve the local environment. For example, a process standard may state that feedlots must compost their manure before it can be spread on neighbouring cropland. A process standard would be similar to an ISO system in that a framework or a process is provided to achieve specific objectives.

The third objective used to develop the standards is to compare the costs of different technologies available to a feedlot to improve the local environment. One example is the development of a wetland to reduce nutrients and bacteria in feedlot runoff. The fourth objective is to compare the costs of manure spreading based on nitrogen limits versus phosphorus limits. Currently, Alberta's Agricultural Operation Practices Act (2001) legislates nitrogen limits per hectare for manure spreading.

However the USEPA has stated that phosphorus limits may be more appropriate in certain geographical areas (USEPA, 2001a).

4.8 Four proposed international environmental standards for cattle feedlots

4.8.1 Independent monitoring – Standard #1

In addition to adhering to provincial regulations, this standard requires local environmental monitoring by an independent third party as stated in section 4.5. This includes annual groundwater monitoring and annual monitoring of soil nutrients levels where manure has been spread. Manure and effluent is spread on a nitrogen limiting basis and this is determined by crop nitrogen requirements in an irrigation district. If a significant environmentally responsible beef premium exists, a feedlot operator will implement the labeling system in section 4.6.

4.8.2 Phosphorus limits as a performance standard – Standard #2

This standard is a performance standard therefore the feedlot operator may or may not implement new technologies to adhere to the standard. There are two differences from the base case in section 4.3.2. Firstly, feedlots are required to spread manure and effluent based on phosphorus limits which has been suggested by the USEPA. These limits are determined by crop phosphorus requirements in an irrigation district. Secondly, this standard also includes the monitoring provisions in section 4.8.1 above. If a significant environmentally responsible beef premium exists, a feedlot operator will implement the labeling system in section 4.6.

4.8.3 An ISO based process standard with nitrogen limits – Standard #3

This standard is a process standard therefore the feedlot operator will have to implement new technologies to adhere to the prescribed plan. This process standard could be ISO based. The ISO 14000 series provides a basic framework or process to improve the local environment. On this basis, a feedlot operator along with an independent monitoring party could design a tailored environmental plan surrounding the feedlot. This also may occur under the Canadian APF which prescribes environmental farm plans however it is unclear how this would be accepted internationally. This standard also includes the monitoring provisions in section 4.8.1 above. If a significant environmentally responsible beef premium exists, a feedlot operator will implement the labeling system in section 4.6.

There are several relatively new technologies evaluated in this project under this standard and the standard in section 4.8.4. They include composting, modifying manure application practices, and establishing wetlands. The objective under this standard is to spread compost and effluent based on nitrogen limits using new technologies.

Windrow composting is the process of turning manure rows with a tractor-drawn windrow turner for a three-month period (Freeze et al, 1999). Windrow composting is explored as an environmentally responsible technology because manure volume, moisture content, and nutrient composition changes to create a stable agricultural fertilizer. Compost is nearly odourless therefore compost can be spread near communities without creating a public nuisance. Secondly, the composting process kills weed seeds in the manure, which makes compost a more desirable fertilizer for farmers than dried manure (Freeze et al, 1999). Thirdly, the volume of compost is significantly

less than the volume of dried manure. Compost volume is 40% less than dried stockpiled manure (AAFRD and ACFA, 2002).

The process of composting means there is less livestock waste to transport which significantly reduces waste transportation costs. However the reduction in transportation costs must be compared to the considerable costs of composting. The costs to consider include the initial cost of a windrow turner, the operating costs of a tractor, and labour.

The reduction in volume means that significantly more nutrients will be in one tonne of compost as compared to one tonne of dried manure. Composting alters the nutrient ratio. Thirty percent of nitrogen is lost during the composting process through ammonia volatization (Freeze et al, 1999) as dried manure volume decreases by 40%. The result is that one tonne of compost will have slightly more nitrogen than one tonne of manure. However no phosphorus is lost during the composting process (Freeze et al, 1999). This means that the phosphorus to nitrogen ratio is higher in compost than in dried manure. It is very important to note that nutrient content varies significantly in cattle manure. The author has chosen the nutrient values used in the model by examining literature composed by SAFRR, AAFRD, Freeze et al, and the USEPA.

Another technology which can reduce runoff nutrient content or eliminate runoff is wetlands. The process of reducing nutrient content or eliminating runoff starts with the runoff moving into a catch basin. The catch basin separates the solids from liquids. The solids or sludge will remain in the catch basin for a number of years until the sludge accumulation must be removed. The liquids or the effluent are continuously drained into a holding pond. At that point, the effluent is gradually drained from the holding

pond into the wetland. If some treated effluent remains, it is drained from the wetland into a clean water storage pond to be used for irrigation (O'Byrne, 2002).

It is possible that the effluent will be absorbed and evaporated until it completely disappears in the wetland. This means there will not be any effluent discharge from the wetland. However if there is treated effluent draining from the wetland, the quantity and the nutrient content of the effluent will be reduced. Effluent drained from wetlands has phosphorus levels reduced by 44% and nitrogen levels by 90%[10]. Wetland establishment and maintenance costs must be compared to the cost of centre pivot irrigation. A wetland will either eliminate or reduce the cropland area needed to spray effluent. This result could eliminate or reduce the need for centre pivot irrigation.

In order to create an international environmental standard that is sustainable, manure or compost application practices must also be considered. In the base case in section 4.3.2, manure was spread once every two years at 200% of crop requirements in order to minimize transportation costs. This could potentially lead to excess nutrients contaminating water supplies. In this standard, it is assumed that compost will be spread every year so as to just meet crop nutrient requirements every year. With this practice, there will be no excess nutrients. The compost transportation costs in this standard are modified to reflect this assumption.

This assumption may be heavily criticized for two reasons. It is possible that annual compost or manure land application could lead to soil salinity (Chang, Sommerfeldt, and Entz (1991) as cited in Unterschultz and Jeffrey, 2001). Secondly, annual compost application could lead to a higher risk of water contamination by

[10] Personal communication with Sandi Riemersma, AAFRD, December 10, 2002.

Escherichia coli O157:H7 bacteria due to the frequency of application. From a nutrient perspective, annual compost land application prevents excess nutrient accumulation however possible salinity and bacteria effects must be considered.

Transportation costs are calculated based on the land area needed to spread manure or compost due to crop nutrient requirements, the nutrient content of the compost or manure, the soil type, and the fact that the land is under irrigation. The number of hectares needed to spread manure or compost are then converted to a hauling distance (kilometers) using a transportation formula provided by the USEPA (2001b). The custom hauling rates are provided by Freeze et al (1999). Transportation costs are also altered if manure or compost is land applied annually or bi-annually.

4.8.4 An ISO based process standard with phosphorus limits – Standard #4

This standard is identical to the standard in section 4.8.3 with the exception that feedlots are required to spread compost and effluent based on phosphorus limits or crop phosphorus requirements. The objective under this standard is to spread compost and effluent based on phosphorus limits using new technologies.

5. RESULTS AND ANALYSIS

5.1 The costs in complying with the four possible international environmental standards

5.1.1 Standard #1 - an independent monitoring standard

The cost estimates in Table 5.1 below are for ongoing manure management monitoring on manure-spread land and ongoing groundwater monitoring on-site. These are the requirements to comply with this standard in addition to adhering to provincial regulations. These estimates for 2003 are adjusted for inflation for further years in the model. These costs would be fees paid to engineers and agrologists.

Table 5.1 - Ongoing environmental monitoring costs for feedlots.

Item	10,000 head lot	20,000 head lot	30,000 head lot
Annual manure management monitoring	$3500 CDN	$4000 CDN	$4500 CDN
Annual groundwater monitoring	$900 CDN	$900 CDN	$900 CDN

Sources: Personal communication with Rosemary Keutzer, agricultural projects manager, EBA Engineering Consultants Ltd. Oct. 22, 2002 and Robert Saik, President of Agri-Trend Agrology Ltd., Oct. 24, 2002.

The costs to initially develop the manure management plan and to drill the initial groundwater monitoring wells are not unique to this standard. These costs are already required by SAFRR in the base case model (SAFRR, 1999).

5.1.2 Standard #2 – phosphorus limits as a performance standard

This standard includes the monitoring provisions in section 5.1.1. The only difference between this standard and Standard #1 is that feedlot operators must comply with phosphorus limits based on crop phosphorus requirements. Standard #1 was based on nitrogen requirements. This means that an increased land base is needed to spread manure based on crop phosphorus requirements due to the nutrient composition of manure. It is assumed that feedlot operators will continue to minimize manure transportation costs by spreading 200% of crop nutrient requirements on a hectare of land once every two years. Manure transportation costs are based on the assumption that manure is custom hauled. Custom hauling rates are from Freeze et al (1999).

This standard does not mandate any specific technology use or process standard such as composting so the costs for this standard are based on no change in technology or process. In Tables 5.2 and 5.3 below, the relevant capital and annual operating costs for 2003 in complying with this standard are compared to the base case. All other costs remain constant.

Table 5.2 - A comparison of capital costs between Standard #2 (phosphorus limits) and the "base case" (nitrogen limits).

	Item	10,000 head lot	20,000 head lot	30,000 head lot
Base Case	Centre pivot irrigation for effluent.	$90,880 CDN	$98,152 CDN	$106,975 CDN
Standard #2	Centre pivot irrigation for effluent.	$103,146 CDN	$131,514 CDN	$170,261 CDN

Source: Author's estimation based on USEPA formula (2001a).

Table 5.3 - A comparison of annual operating costs between Standard #2 (phosphorus limits) and the "base case" (nitrogen limits).

	Item	10,000 head lot	20,000 head lot	30,000 head lot
Base Case	Centre pivot irrigation for effluent.	$4,355 CDN	$8,630 CDN	$11,131 CDN
Standard #2	Centre pivot irrigation for effluent.	$10,218 CDN	$14,494 CDN	$16,995 CDN
Base Case	Manure transportation costs	$35,937 CDN	$95,502 CDN	$173,055 CDN
Standard #2	Manure transportation costs	$53,396 CDN	$145,992 CDN	$277,452 CDN

Sources: Author's estimation based on AAFRD and ACFA (2002), Freeze et al (1999), and USEPA formulas (2001a and 2001b).

Referring to Tables 5.2 and 5.3 it is evident that manure and effluent disposal based on phosphorus limits costs significantly more than disposal based on nitrogen limits. These results are highly sensitive to the nutrient content of manure. The nutrient content of manure used in this project is 5.2 kilograms of available nitrogen per tonne and 5.6 kilograms of available phosphate (P_2O_5) per tonne (AAFRD and ACFA (2002) and Livestock and Poultry Environmental Stewardship Development Team, 2002). This is the amount of nutrients available for crop nutrient requirements in their useable form over a two-year period.

5.1.3 Standard #3 – an ISO based process standard with nitrogen limits

This standard is an ISO based process standard therefore the feedlot operator will have to implement new technologies to adhere to the prescribed plan. This standard also includes the monitoring provisions in section 5.1.1 above. The new technologies implemented in this standard include composting, modifying manure application

practices, and establishing wetlands. The modification of manure application practices includes spreading compost annually at 100% of crop nitrogen requirements instead of spreading manure once every two years at 200% of crop nitrogen requirements. Custom hauling of manure is assumed. The objective of establishing wetlands is to eliminate effluent release into the environment or to at least release a safer, reduced quantity of effluent into the environment. Wetlands allow for the elimination or a reduction in the investment required for centre pivot irrigation.

The objective under this standard is to spread compost and effluent based on nitrogen limits using new technologies. In Tables 5.4 and 5.5 below, the relevant capital and annual operating costs for 2003 in complying with this standard are compared to the "base case." All other costs remain constant.

Table 5.4 - A comparison of capital costs between Standard #3 (nitrogen limits) and the "base case" (nitrogen limits).

	Item	10,000 head lot	20,000 head lot	30,000 head lot
Base Case	Centre pivot irrigation for effluent.[1]	$90,880 CDN	$98,152 CDN	$106,975 CDN
Standard #3	Centre pivot irrigation for effluent.[1]	Not required due to wetland.	Not required due to wetland.	Not required due to wetland.
Standard #3	Wetland establishment[2]	$71,652 CDN	$71,652 CDN	$71,652 CDN
Standard #3	Windrow composter[3]	$40,000 CDN	$40,000 CDN	$80,000 CDN (2)

Sources: [1] Author's estimation based on USEPA formula (2001a).
[2] Personal communication with Sandi Riemersma, AAFRD, Dec. 13, 2002.
[3] Basset et al (2002).

Table 5.5 - A comparison of annual operating costs between Standard #3 (nitrogen limits) and the "base case" (nitrogen limits).

	Item	10,000 head lot	20,000 head lot	30,000 head lot
Base Case	Center pivot irrigation for effluent.[1]	$4,355 CDN	$8,630 CDN	$11,131 CDN
Standard #3	Center pivot irrigation for effluent.	Not required due to wetland.	Not required due to wetland.	Not required due to wetland.
Base Case	Manure removal	$69,533 CDN	$139,065 CDN	$208,598 CDN
	Manure transportation costs	$35,937 CDN	$95,502 CDN	$173,055 CDN
	Manure revenue	$69,533 CDN	$139,065 CDN	$208,598 CDN
	Net loss ($) - manure management[2]	($35,937) CDN	($95,502) CDN	($173,055) CDN
Standard #3	Composting cost	$67,124 CDN	$134,247 CDN	$201,371 CDN
	Manure removal	$69,533 CDN	$139,065 CDN	$208,598 CDN
	Compost transportation costs	$11,501 CDN	$34,290 CDN	$62,747 CDN
	Compost revenue	$113,552 CDN	$227,103 CDN	$340,655 CDN
	Net loss ($) – compost management[2]	($34,605) CDN	($80,499) CDN	($132,060) CDN
Standard #3	Wetland maintenance[3]	$7,000 CDN	$7,000 CDN	$7,000 CDN

Sources:
[1] Author's estimation based on USEPA formula (2001a).
[2] Author's estimation based on Freeze et al (1999), USEPA formulas (2001a and 2001b), AAFRD and ACFA (2002).
[3] Personal communication with Sandi Riemersma, AAFRD, Dec. 13, 2002.

Referring to Tables 5.4 and 5.5, it is evident that wetland technology is cheaper than using centre pivot irrigation to dispose of effluent. The wetland cost above is based

on a two-hectare wetland[1]. The wetland provides effective nitrogen removal from effluent to eliminate the need for centre pivot irrigation. Wildlife habitat benefits were not considered but this benefit would give further merit to wetland establishment.

Table 5.5 indicates that compost transport is significantly cheaper than manure transport for each feedlot. This is due to the volume reduction but this effect is partially offset by the nutrient concentration comparison. Based on the nutrient content of manure in section 5.1.2, it was calculated by the author that compost contains 6.1 kilograms of available nitrogen per tonne and 9.3 kilograms of available phosphate (P_2O_5) per tonne. These calculations were based on work by Freeze et al (1999). This is the amount of nutrients available for crop nutrient requirements in their useable form over a two-year period.

While compost transportation is cheaper than manure transportation, the cost of composting must also be considered. Table 5.5 indicates that the combination of the cost of composting and the cost of compost transportation exceeds the cost of manure transportation. Manure removal ($3.81 per tonne, Freeze et al (1999)) must be included for both scenarios. However compost revenue ($10.37 per tonne, Freeze et al (1999)) exceeds manure revenue ($3.81 per tonne, Freeze et al (1999)). The decision to compost or to use traditional manure management practices for a 10,000 head feedlot results in almost identical costs. However the 20,000 and 30,000 head feedlots will realize a net savings due to composting.

[1] Personal communication with Sandi Riemersma, AAFRD, Dec. 13, 2002.

5.1.4 Standard #4 – an ISO based process standard with phosphorus limits

As in section 5.1.3, this standard is an ISO based process standard therefore the feedlot operator will have to implement new technologies to adhere to the prescribed plan. This standard also includes the monitoring provisions in section 5.1.1 above. The new technologies implemented in this standard include composting, modifying manure application practices, and establishing wetlands. The modification of manure application practices includes spreading compost annually at 100% of crop nitrogen requirements instead of spreading manure once every two years at 200% of crop nitrogen requirements. Custom hauling of manure is assumed.

The objective under this standard is to spread compost and effluent based on phosphorus limits using new technologies. In Tables 5.6 and 5.7 below, the relevant capital and annual operating costs for 2003 in complying with this standard are compared to Standard #3.

Table 5.6 - A comparison of capital costs between Standard #4 (phosphorus limits) and Standard #3 (nitrogen limits).

	Item	10,000 head lot	20,000 head lot	30,000 head lot
Standard #3	Centre pivot irrigation for effluent.	Not required due to wetland.	Not required due to wetland.	Not required due to wetland.
Standard #4	Centre pivot irrigation for effluent.[1]	$93,952 CDN	$106,002 CDN	$121,307 CDN
Standards #3 and #4	Wetland establishment[2]	$71,652 CDN	$71,652 CDN	$71,652 CDN
Standards #3 and #4	Windrow composter[3]	$40,000 CDN	$40,000 CDN	$80,000 CDN (2)

Sources: [1] Author's estimation based on USEPA formula (2001a).
[2] Personal communication with Sandi Riemersma, AAFRD, Dec. 13, 2002.
[3] Basset et al (2002).

Table 5.7 - A comparison of annual operating costs between Standard #4 (phosphorus limits) and Standard #3 (nitrogen limits).

	Item	10,000 head lot	20,000 head lot	30,000 head lot
Standard #3	Centre pivot irrigation for effluent.	Not required due to wetland.	Not required due to wetland.	Not required due to wetland.
Standard #4	Centre pivot irrigation for effluent.[1]	$6,642 CDN	$10,917 CDN	$13,418 CDN
Standard #3	Composting cost	$67,124 CDN	$134,247 CDN	$201,371 CDN
	Manure removal	$69,533 CDN	$139,065 CDN	$208,598 CDN
	Compost transportation costs	$11,501 CDN	$34,290 CDN	$62,747 CDN
	Compost revenue	$113,552 CDN	$227,103 CDN	$340,655 CDN
	Net loss ($) – compost management[2]	($34,605) CDN	($80,499) CDN	($132,060) CDN
Standard #4	Composting cost	$67,124 CDN	$134,247 CDN	$201,371 CDN
	Manure removal	$69,533 CDN	$139,065 CDN	$208,598 CDN
	Compost transportation costs	$20,960 CDN	$59,869 CDN	$109,538 CDN
	Compost revenue	$113,552 CDN	$227,103 CDN	$340,655 CDN
	Net loss ($) – compost management[2]	($44,065) CDN	($106,078) CDN	($178,852) CDN
Standards #3 and #4	Wetland maintenance[3]	$7,000 CDN	$7,000 CDN	$7,000 CDN

Sources: [1] Author's estimation based on USEPA formula (2001a).
[2] Author's estimation based on Freeze et al (1999), USEPA formulas (2001a and 2001b), AAFRD and ACFA (2002).
[3] Personal communication with Sandi Riemersma, AAFRD, Dec. 13, 2002.

Referring to Tables 5.6 and 5.7, wetland technology does not eliminate the need for centre pivot irrigation when effluent is disposed based on phosphorus limits in Standard #4. This is because wetlands reduce nitrogen content in effluent by 90% but

phosphorus content is reduced only by 44% (O'Byrne, 2002). Standard #3 is significantly cheaper than Standard #4 when referring to effluent.

Referring to Table 5.7, it is more costly to distribute compost based on crop phosphorus requirements than crop nitrogen requirements. However a comparison of Table 5.3 to 5.7 must be made. When comparing these two tables it is possible to see the difference in waste disposal costs between phosphorus and nitrogen limits is smaller using compost technology as compared to traditional manure disposal for all feedlot sizes.

5.2 The environmentally responsible beef premium and the associated labeling costs

5.2.1 The environmentally responsible beef premium

Based on Volpi (2002) and Grannis and Thilmany (2000), two scenarios are proposed in this project regarding an environmentally responsible beef premium. The first scenario assumes that an environmentally responsible beef premium over normal cattle prices does not exist. This means that the four possible international environmental standards are calculated for each feedlot size with the assumption that a premium does not exist. This would be the case if compliance with the standards is mandatory. The second scenario assumes that a 1.6% premium per hundredweight (live weight basis) exists. This premium is assumed to be available to a feedlot at the time of sale to a meat processing facility.

5.2.2 The associated labeling costs

If an environmentally responsible beef premium exists it is assumed that feedlots will incur cattle labeling costs in addition to the environmental compliance costs in order to obtain the premium. Therefore the models including a premium also include cattle labeling costs. The cattle labeling costs in Table 5.8 below are based on a feedlot throughput of 14,450, 28,900, and 43,350 head per year for the 10,000, 20,000, and 30,000 head lots respectively. The electronic cattle tag needed for this system costs $6.00 CDN per head. This cost includes the price of software.

Table 5.8 – Cattle labeling costs for an environmentally responsible beef premium.

	10,000 head lot	20,000 head lot	30,000 head lot
Electronic tag cost ($)	$86,700 CDN	$173,400 CDN	$260,100 CDN

Source: Personal communication with Glenn Smith, AgInfoLink,® October 14, 2002.

5.3 Financial results

5.3.1 Introduction

In order to compare the effects of the four possible international environmental standards and the environmentally responsible beef premium to the different feedlot sizes, several key indicators must be examined. The indicators in the next four sections should allow for accurate conclusions to be drawn from this project.

5.3.2 Capital investment

In order to start any feedlot a significant capital investment is required. Tables 5.9, 5.10, and 5.11 indicate the capital investment required in 2003 to start a feedlot for all five scenarios. The scenarios include the "base case" to adhere to provincial regulations and standards #1 to #4. It is important to note that any difference in capital

investment between scenarios for the same feedlot size (for example 10,000 head) is solely attributable to the environmental compliance and labeling costs of the international environmental standard.

Table 5.9 – Capital investment ($ CDN) for a 10,000 head lot by varying possible international environmental standards.

	Equity	Credit Line	Debt	Total
Base Case	$2,000,000	$4,000,000	$3,500,000	$9,500,000
Standard #1	$2,000,000	$4,000,000	$3,500,000	$9,500,000
Standard #2	$2,000,000	$4,000,000	$3,500,000	$9,500,000
Standard #3	$2,000,000	$4,000,000	$3,500,000	$9,500,000
Standard #4	$2,000,000	$4,000,000	$3,500,000	$9,500,000

Source: Author's estimation based on Basset et al (2002).

Table 5.10 – Capital investment ($ CDN) for a 20,000 head lot by varying possible international environmental standards.

	Equity	Credit Line	Debt	Total
Base Case	$3,500,000	$8,000,000	$5,000,000	$16,500,000
Standard #1	$3,500,000	$8,000,000	$5,000,000	$16,500,000
Standard #2	$3,500,000	$8,000,000	$5,300,000	$16,800,000
Standard #3	$3,500,000	$8,000,000	$5,300,000	$16,800,000
Standard #4	$3,500,000	$8,000,000	$5,300,000	$16,800,000

Source: Author's estimation based on Basset et al (2002).

Table 5.11 – Capital investment ($ CDN) for a 30,000 head lot by varying possible international environmental standards.

	Equity	Credit Line	Debt	Total
Base Case	$5,000,000	$12,000,000	$7,000,000	$24,000,000
Standard #1	$5,000,000	$12,000,000	$7,000,000	$24,000,000
Standard #2	$5,000,000	$12,000,000	$7,500,000	$24,500,000
Standard #3	$5,000,000	$12,000,000	$7,500,000	$24,500,000
Standard #4	$5,000,000	$12,000,000	$7,500,000	$24,500,000

Source: Author's estimation based on Basset et al (2002).

The investment structure is assembled as follows. Equity capital must encompass 50% of the capital budget. The credit line is used to purchase cattle as it is an inexpensive method to finance cattle as opposed to using equity capital. As indicated by Table 5.9, no further capital is required to finance compliance with any environmental standards for a 10,000 head feedlot. Referring to Tables 5.10 and 5.11, the 20,000 head and 30,000 head lots require $300,000 and $500,000 (CDN) respectively in additional debt capital in order to finance compliance with Standards #2-4. More investment is required to comply with a phosphorus limit and to implement process standards such as composting and wetland establishment.

5.3.3 Environmental investment per head

Tables 5.12, 5.13, and 5.14 indicate the initial environmental investment per head that is required under all five scenarios. This includes the "base case" to adhere to provincial regulations and the four possible international environmental standards. This investment is calculated based on the number of cattle finished over a ten-year period.

Table 5.12 – Environmental investment per head ($ CDN) for a 10,000 head feedlot.

	Base Case and Standard #1	Standard #2	Standard #3	Standard #4
Effluent irrigation system	$0.63	$0.71	$0	$0.65
Geo-technical fees	$0.12	$0.12	$0.12	$0.12
Effluent storage pond	$1.65	$1.65	$1.65	$1.65
Groundwater monitoring	$0.02	$0.02	$0.02	$0.02
Manure management plan	$0.02	$0.02	$0.02	$0.02
Composter	$0	$0	$0.28	$0.28
Wetland	$0	$0	$0.50	$0.50
Total	$2.45	$2.53	$2.59	$3.24

Source: Author's estimation.

Table 5.13 – Environmental investment per head ($ CDN) for a 20,000 head feedlot.

	Base Case and Standard #1	Standard #2	Standard #3	Standard #4
Effluent irrigation system	$0.34	$0.46	$0	$0.37
Geo-technical fees	$0.09	$0.09	$0.09	$0.09
Effluent storage pond	$1.64	$1.64	$1.64	$1.64
Groundwater monitoring	$0.01	$0.01	$0.01	$0.01
Manure management plan	$0.02	$0.02	$0.02	$0.02
Composter	$0	$0	$0.14	$0.14
Wetland	$0	$0	$0.25	$0.25
Total	$2.09	$2.21	$2.14	$2.51

Source: Author's estimation.

Table 5.14 – Environmental investment per head ($ CDN) for a 30,000 head feedlot.

	Base Case and Standard #1	Standard #2	Standard #3	Standard #4
Effluent irrigation system	$0.25	$0.39	$0	$0.28
Geo-technical fees	$0.08	$0.08	$0.08	$0.08
Effluent storage pond	$1.63	$1.63	$1.63	$1.63
Groundwater monitoring	$0.01	$0.01	$0.01	$0.01
Manure management plan	$0.01	$0.01	$0.01	$0.01
Composter	$0	$0	$0.18	$0.18
Wetland	$0	$0	$0.17	$0.17
Total	$1.98	$2.12	$2.08	$2.36

Source: Author's estimation.

The results indicate that economies of size is achieved for all items except effluent storage pond construction as its' size is directly linked to the number of head.

5.3.4 Annual operating costs per head for environmental protection

Tables 5.15, 5.16, and 5.17 detail the annual operating costs per head for a feedlot to ensure environmental protection under all five scenarios. This includes the "base case" to adhere to provincial regulations and the four possible international environmental standards. These costs are based on cattle throughput for a feedlot in a one-year period.

Table 5.15 – Annual operating costs per head ($ CDN) for environmental protection for a 10,000 head feedlot.

	Base Case	Standard #1	Standard #2	Standard #3	Standard #4
Maintenance for effluent storage pond	$0.81	$0.81	$0.81	$0.81	$0.81
Manure removal cost	$4.81	$4.81	$4.81	$4.81	$4.81
Composting cost	$0	$0	$0	$4.65	$4.65
Manure or compost transportation cost	$2.49	$2.49	$3.70	$0.80	$1.45
Effluent irrigation cost	$0.30	$0.30	$0.71	$0	$0.46
Groundwater monitoring	$0	$0.06	$0.06	$0.06	$0.06
Manure management monitoring	$0	$0.24	$0.24	$0.24	$0.24
Wetland maintenance	$0	$0	$0	$0.48	$0.48
Total	$8.41	$8.72	$10.33	$11.85	$12.97

Source: Author's estimation.

Table 5.16 – Annual operating costs per head ($ CDN) for environmental protection for a 20,000 head feedlot.

	Base Case	Standard #1	Standard #2	Standard #3	Standard #4
Maintenance for effluent storage pond	$0.81	$0.81	$0.81	$0.81	$0.81
Manure removal cost	$4.81	$4.81	$4.81	$4.81	$4.81
Composting cost	$0	$0	$0	$4.65	$4.65
Manure or compost transportation cost	$3.30	$3.30	$5.05	$1.19	$2.07
Effluent irrigation cost	$0.30	$0.30	$0.50	$0	$0.38
Groundwater monitoring	$0	$0.03	$0.03	$0.03	$0.03
Manure management monitoring	$0	$0.14	$0.14	$0.14	$0.14
Wetland maintenance	$0	$0	$0	$0.24	$0.24
Total	$9.22	$9.39	$11.34	$11.87	$13.13

Source: Author's estimation.

Table 5.17 – Annual operating costs per head ($ CDN) for environmental protection for a 30,000 head feedlot.

	Base Case	Standard #1	Standard #2	Standard #3	Standard #4
Maintenance for effluent storage pond	$0.81	$0.81	$0.81	$0.81	$0.81
Manure removal cost	$4.81	$4.81	$4.81	$4.81	$4.81
Composting cost	$0	$0	$0	$4.65	$4.65
Manure or compost transportation cost	$3.99	$3.99	$6.40	$1.45	$2.53
Effluent irrigation cost	$0.26	$0.26	$0.39	$0	$0.31
Groundwater monitoring	$0	$0.02	$0.02	$0.02	$0.02
Manure management monitoring	$0	$0.10	$0.10	$0.10	$0.10
Wetland maintenance	$0	$0	$0	$0.16	$0.16
Total	$9.87	$9.99	$12.54	$12.00	$13.39

Source: Author's estimation.

As feedlot size increases the annual operating cost per head for environmental protection increases in Tables 5.15 - 5.17. This is in contrast to Tables 5.12 - 5.14 where the environmental investment per head decreased as feedlot size increased. Tables 5.15 - 5.17 indicate that cost savings occur for some items such as wetland maintenance or effluent irrigation as feedlot size increases. However, there is an increased transportation cost of hauling manure or compost greater distances as feedlot size increases. The transportation cost effect overwhelms all of the other effects which results in annual operating costs for environmental protection increasing with feedlot size.

For the 10,000 and 20,000 head lots, standards #3 and #4 have higher costs per head than standards #1 and #2 due to the composting cost component. The exception is the 30,000 head lot where standard #3 is cheaper than standard #2. This result occurs

because the manure transportation costs in standard #2 are very high for the 30,000 head lot.

5.3.5 The debt to asset ratio

The hypothetical feedlot models in this project are highly leveraged as is the case in the industry (Iowa State University Extension, 2001). Any additional costs such as environmental compliance costs may have a severe impact on a feedlot's daily operations due to cash flow problems. In order to examine this possibility this section provides the debt to asset ratio for each feedlot size by comparing the four possible international environmental standards to the "base case." Additionally, there are two scenarios for each environmental standard; the first scenario assumes that no environmentally responsible beef premium exists while the second scenario assumes that a 1.6% per hundredweight premium exists for environmentally responsible beef. Tables 5.18 - 5.20 compare the debt to asset ratio for each year over a ten-year period for the 10,000, 20,000 and 30,000 head feedlots respectively while varying the environmental standard and the environmentally responsible beef premium.

Table 5.18 – The debt to asset ratio for a 10,000 head feedlot over a ten year period.

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Base Case	0.84	0.84	0.83	0.79	0.74	0.68	0.62	0.57	0.52	0.46
Standard #1 – no premium	0.84	0.84	0.83	0.79	0.74	0.69	0.62	0.57	0.52	0.46
Standard #2 – no premium	0.84	0.85	0.84	0.80	0.75	0.70	0.63	0.57	0.52	0.46
Standard #3 – no premium	0.84	0.84	0.83	0.79	0.74	0.69	0.62	0.57	0.52	0.46
Standard #4 – no premium	0.84	0.85	0.84	0.81	0.75	0.70	0.64	0.57	0.52	0.46
Standard #1 – 1.6% premium	0.83	0.82	0.79	0.75	0.70	0.64	0.60	0.56	0.51	0.46
Standard #2 – 1.6% premium	0.84	0.83	0.81	0.76	0.71	0.65	0.60	0.56	0.51	0.46
Standard #3 – 1.6% premium	0.83	0.82	0.80	0.75	0.70	0.65	0.60	0.56	0.51	0.46
Standard #4 – 1.6% premium	0.84	0.83	0.81	0.76	0.71	0.66	0.60	0.56	0.51	0.46

Source: Author's estimation.

Table 5.19 – The debt to asset ratio for a 20,000 head feedlot over a ten year period.

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Base Case	0.81	0.78	0.74	0.70	0.64	0.61	0.58	0.55	0.51	0.47
Standard #1 – no premium	0.81	0.78	0.74	0.70	0.65	0.61	0.58	0.55	0.51	0.47
Standard #2 – no premium	0.82	0.79	0.76	0.71	0.66	0.62	0.59	0.55	0.51	0.47
Standard #3 – no premium	0.81	0.78	0.75	0.70	0.65	0.62	0.59	0.55	0.51	0.47
Standard #4 – no premium	0.82	0.78	0.75	0.71	0.66	0.62	0.59	0.55	0.51	0.47
Standard #1 – 1.6% premium	0.81	0.76	0.72	0.67	0.62	0.60	0.57	0.54	0.50	0.46
Standard #2 – 1.6% premium	0.81	0.77	0.73	0.69	0.63	0.61	0.58	0.55	0.51	0.46
Standard #3 – 1.6% premium	0.81	0.77	0.73	0.68	0.63	0.61	0.58	0.54	0.51	0.46
Standard #4 – 1.6% premium	0.81	0.77	0.73	0.68	0.63	0.61	0.58	0.55	0.51	0.46

Source: Author's estimation.

Table 5.20 – The debt to asset ratio for a 30,000 head feedlot over a ten year period.

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Base Case	0.81	0.77	0.74	0.69	0.64	0.61	0.58	0.55	0.51	0.47
Standard #1 – no premium	0.81	0.77	0.74	0.69	0.64	0.61	0.58	0.55	0.51	0.47
Standard #2 – no premium	0.82	0.79	0.75	0.71	0.66	0.62	0.59	0.56	0.52	0.47
Standard #3 – no premium	0.81	0.78	0.74	0.70	0.65	0.62	0.59	0.55	0.52	0.47
Standard #4 – no premium	0.82	0.78	0.75	0.70	0.65	0.62	0.59	0.55	0.52	0.47
Standard #1 – 1.6% premium	0.81	0.76	0.72	0.67	0.62	0.60	0.57	0.54	0.51	0.47
Standard #2 – 1.6% premium	0.82	0.77	0.73	0.68	0.63	0.61	0.58	0.55	0.51	0.47
Standard #3 – 1.6% premium	0.81	0.77	0.72	0.67	0.63	0.61	0.58	0.55	0.51	0.47
Standard #4 – 1.6% premium	0.81	0.77	0.73	0.68	0.63	0.61	0.58	0.55	0.51	0.47

Source: Author's estimation.

The results in Tables 5.18 - 5.20 indicate that the debt to asset ratio is affected very little by imposing the environmental standards. However the ratio does slightly increase when there is no environmentally responsible beef premium. The presence of the premium can result in a lower debt to asset ratio than the base case. One interesting result is that the 10,000 head feedlot has a lower debt to asset ratio for Standard #2 (phosphorus limit – performance standard) than Standard #4 (phosphorus limit – process standard). The 20,000 head feedlot results indicate that the debt to asset ratio for these two standards is the same. However the 30,000 head feedlot results indicate that the debt to asset ratio is lower for Standard #4 than Standard #2. The technology imposed in Standard #4 benefits the 30,000 head feedlot, is neutral for the 20,000 head feedlot, but is a disadvantage to the 10,000 head feedlot.

5.3.6 Investment indicators

This section provides the investment indicators for each feedlot size by comparing the four possible international environmental standards to the "base case." Additionally, there are two scenarios for each environmental standard; the first scenario assumes that no environmentally responsible beef premium exists while the second scenario assumes that a 1.6% per hundredweight premium exists. The investment indicators include the internal rate of return and the net present value for each feedlot model. Table 5.21 compares the internal rate of return (IRR) and the net present value (NPV) for the 10,000, 20,000, and 30,000 head feedlots while varying the environmental standard and the environmentally responsible beef premium.

Table 5.21 – Investment indicators by varying feedlot size, the environmental standard and the environmentally responsible beef premium.

	10,000 head lot		20,000 head lot		30,000 head lot	
	IRR	NPV (CDN $)	IRR	NPV (CDN $)	IRR	NPV (CDN $)
Base Case	22.6%	$1,190,823	29.5%	$4,265,563	30.2%	$6,546,907
Standard #1 – no premium	22.5%	$1,173,469	29.4%	$4,247,436	30.1%	$6,526,930
Standard #2 – no premium	21.8%	$1,069,292	29.1%	$4,063,911	29.6%	$6,176,384
Standard #3 – no premium	22.3%	$1,147,552	30.2%	$4,346,114	31.2%	$6,744,023
Standard #4 – no premium	21.3%	$1,011,173	29.3%	$4,133,420	30.2%	$6,440,080
Standard #1 – 1.6% premium	26.2%	$1,706,078	32.6%	$5,145,953	33.3%	$7,875,639
Standard #2 – 1.6% premium	25.0%	$1,552,566	32.4%	$4,975,033	32.9%	$7,525,092
Standard #3 – 1.6% premium	25.5%	$1,631,111	33.5%	$5,244,631	34.5%	$8,092,732
Standard #4 – 1.6% premium	24.4%	$1,495,285	32.5%	$5,038,610	33.5%	$7,788,789

Source: Author's estimation.

Referring to Table 5.21, the most significant variable affecting the returns is the environmentally responsible beef premium. If the premium exists it will more than compensate for any of the environmental standards' costs proposed in this project. The 10,000 head lot is the most negatively affected if Standard #4 (phosphorus limits – process standard) is implemented. The 10,000 head lot is also negatively impacted from Standard #2 (phosphorus limits – performance standard) but the impact is less severe than with Standard #4. Standard #3 (nitrogen limits – process standard) also has a negative impact on returns for a 10,000 head lot. The conclusion drawn is that implementing new technology or these standards does not result in higher returns for a 10,000 head lot unless an environmentally responsible beef premium exists.

The results for the 20,000 head lot are very different to the 10,000 head lot. If the 20,000 head lot implements Standard #3 (nitrogen limits – process standard) the feedlot will have higher returns than with the base case or the status quo. This result holds even if an environmentally responsible beef premium does not exist. Secondly, the 20,000 head lot is the most negatively affected if Standard #2 (phosphorus limits – performance standard) is implemented. The 20,000 head lot is also negatively impacted from Standard #4 (phosphorus limits – process standard) but the impact is less severe than with Standard #2. This result is in contrast to the 10,000 head lot.

The results for the 30,000 head lot are similar to the 20,000 head lot. If the 30,000 head lot implements Standard #3 (nitrogen limits – process standard) the feedlot will have higher returns than with the base case or the status quo. It is a larger improvement than the 20,000 head lot (30.2% to 31.2% for the 30,000 head lot compared to 29.5% to 30.2% for the 20,000 head lot). This result holds even if an

environmentally responsible beef premium does not exist. Secondly, the 30,000 head lot is the most negatively affected if Standard #2 (phosphorus limits – performance standard) is implemented. The 30,000 head lot is not impacted from Standard #4 (phosphorus limits – process standard) when compared to the base case whereas the 10,000 and 20,000 head lots were both negatively impacted by Standard #4.

The conclusion drawn for the 20,000 and 30,000 head lots is that implementing new technology to spread manure based on nitrogen limits will benefit the feedlot even if an environmentally responsible beef premium does not exist. This is based on the comparison between the base case and Standard #3. Compost revenue and new technology result in higher returns for feedlots of this size. In the base case scenario, manure transportation costs and effluent disposal costs per head are very high for feedlots of this size. Any technology such as composting or wetlands that reduces these costs will benefit feedlots of this size. A very important variable is compost revenue. If compost cannot be sold at a premium to manure then the higher returns for Standard #3 for the 20,000 and 30,000 head lots will disappear entirely unless an environmentally responsible beef premium exists.

5.4 Conclusion for Part I

The environmentally responsible beef premium is the most critical variable in the analysis. If the premium exists at the level proposed in this project (1.6% per hundredweight) then it will more than compensate for any of the international environmental standards. The gains range from 1.8% to 3.6% (IRR) compared to the status quo. Even if the premium does not exist imposing Standard #3 (nitrogen limits – process standard) will result in slightly higher returns for the 20,000 and 30,000 head

lots. This result occurs because of compost revenues and new technology that significantly reduces manure transportation costs and effluent disposal costs.

Imposing Standards #2 and #4 (phosphorus limits) will result in slightly lower returns for the hypothetical feedlots. Phosphorus limits will decrease returns (IRR) ranging from 0.1% to 1.3% for all of the scenarios proposed unless an environmentally responsible beef premium exists. The debt to asset ratio will rise slightly if any of the environmental standards are implemented. It is unclear if this increase results in any more feedlot investment risk than the "base case" or the status quo.

PART II – Legal aspects of marketing environmentally responsible, "super-safe" food products internationally

6. INTRODUCTION

As suggested in part I, in recent years there has been increased public policy interest in the food safety and environmental standards utilized in beef production, largely due to increases in consumer awareness and concern. This increased interest has signalled the beginning of a regulatory change, both domestically and internationally, that has the potential to greatly affect the industry.

As outlined in part I, the Canadian government has recently identified a new "Agricultural Policy Framework" for Canadian agriculture that, among other things, promises to improve environmental stewardship and on-farm food safety. The government's objective is to allow Canadian beef to be "branded" as "the safest in the world" due to the environmentally sustainable and safety-conscious regulations or standards that beef producers must follow in its production (Agriculture and Agri-Food Canada, 2002). Internationally, at the 2001 WTO ministerial meeting in Doha, it was agreed that the environment would be an important part of the agenda in subsequent negotiations. With these goals identified, it is key for all stakeholders to adopt a proactive approach and to prepare for voluntary standards and mandatory regulations that could be put in place to implement these goals.

Regulatory changes may involve mechanisms such as traceability systems, or legislation in the form of voluntary standards or mandatory regulations. It is, therefore, of utmost importance to address liability questions that arise when regimes such as these are utilized. Traceability systems raise questions about the effectiveness of *ex post* liability as a motivation to use sound production practices, as well as the difficulty of establishing or apportioning fault. Regulatory regimes involving strict codes of practice,

or combining tracking systems with *ex ante* regulation such as mandatory HACCP use, raise questions over how the system will be monitored and enforced and who will bear liability if this is not done adequately. An incentive is needed to encourage beef producers to practice due diligence in their production practices, without creating unbearably high enforcement and implementation costs. Part II of this report will provide a thorough review of current international and domestic law regarding food safety and environmental standards and will address forthcoming changes to these existing regulatory regimes. Possible points of liability for players in beef supply chains will be discussed, including how liability functions as beef moves across borders in international trade relationships.

7. CANADIAN LAW

7.1 Traceability and Food Safety

Due to rising consumer concerns regarding the safety of food, as well as recent outbreaks of disease in livestock, the Canadian government has become focused on providing mechanisms to increase consumer confidence and protect the domestic beef industry. As part of its new Agricultural Policy Framework (APF), five pillars of policy have been identified. Food Safety is one of these pillars, selected despite Canada's reputation as a producer of safe food products largely because the government desires to protect this reputation in the face of changing expectations. Regulatory changes are inevitable, and will likely involve development of more extensive policy in the areas of traceability and beef production.

Currently, the *Health of Animals Act*[1] and the *Health of Animals Regulations*[2] govern the handling and care of animals in Canada, including cattle. The Act empowers the government to protect the health of animals and humans by regulating the transport, importation and handling of animals, with a particular focus on establishing methods for eradication and control of disease in animals. The *Canadian Food Inspection Agency Act*[3] establishes a federal government body, the Canadian Food Inspection Agency, responsible for the enforcement of these regulations regarding food products and animal health. Thus, there is extensive regulation regarding methods to detect and deal with harmful properties of food, especially the presence of pathogens, beyond the farm gate,

---

[1] 1990, c.21
[2] C.R.C., c.296; SOR/91-525
[3] 1997, c.6

but there is little if any regulation outlining standards of production producers can use to ensure a safe beef product free of contamination.

The APF strives to address this policy gap. It concentrates on facilitating the integration of Canadian farms into an increasingly competitive global marketplace, aiding parties in meeting changing international food safety standards through the use of on-farm and on-site food safety systems (Agriculture and Agri-Food Canada, 2002). The introduction of Hazard Analysis Critical Control Points (HACCP) systems for control and monitoring of safety in food production has been discussed. Use of a HACCP system tailored for use on-farm, that addresses potential problems that could arise on-farm, could allow many food safety problems to be prevented through the use of industry-developed prevention points, instead of merely detected at a later stage. This could provide a quality assurance and equivalence mechanism to satisfy the domestic and international desire for safer food, allowing new markets to be identified and existing markets to be maintained.

Recently, the CFIA has developed a Food Safety Enhancement Program that encourages the development and use of HACCP programs in all federally registered meat establishments (CFIA, 2001). The goal is to incorporate the 7 principles of HAACP outlined by Codex Alimentarius[4] into these programs, using a HACCP decision tree to analyze control measures to be used for hazards that are likely, and unlikely, to occur (FDA, 2001). The CFIA plans to have the use of HACCP-based Food Safety

[4] The seven principles of HACCP include analyzing hazards, identifying critical control points, establishing preventative measures with critical limits for each control point, establishing procedures to monitor critical control points, establishing corrective actions to be taken when monitoring shows that a critical limit has not been met, establishing procedures to verify that the system is working properly, and establishing effective record-keeping to document the HACCP system (FDA, 2001).

Enhancement Programs in federal meat inspection establishments mandated under the federal *Meat Inspection Act*[5] by 2003 (CFIA, 2001).

The APF also seeks to devise mechanisms to prevent economic disasters such as that which occurred within European beef markets following the BSE scare in the late 1990's. The mechanism which has been looked at most favourably to control outbreak situations such as this is the tracking or tracing system. By introducing a form of identity preservation[6] to the beef production system, a consistently applied traceability system could allow affected products to be identified and removed from the market quickly (Agriculture and Agri-Food Canada, 2002). As more than 50% of Canadian beef is exported, a health or safety hazard in meat that reaches consumers could significantly affect markets for beef. By being able to trace back through beef supply chains to the source of the hazard or outbreak, affected animals can be pinpointed, saving many unaffected producers from being caught in a widespread quarantine or market failure.

Currently in Canada, a traceability system exists for beef products. The Canadian Cattle Identification Plan (CCIP), developed by the Canadian Cattleman's Association (CCA), utilizes ear tags applied to cattle before leaving their herd-of-origin to provide an individual identification code to each animal that follows that animal until its time of slaughter, at which point the code is entered into a national database (CCA, 2001b). This database is accessed by the CFIA, who provides enforcement of the program through

---

[5] R.S. 1985, c.25 (1st Supp.)

[6] "Identity preservation" is an umbrella term that generally refers to the ability to trace products from their place of origin to their end user through the process of separation from other products. In the context of the beef supply chain, a traceability system could facilitate identity preservation, as it would not only allow products to be traced back for quality verification or contamination control, but also to be traced forward for the purpose of branding beef as possessing certain characteristics desirable to an end user.

routine inspection. If a health or safety concern regarding a beef product is identified, the CFIA can trace the beef forward from its herd of origin or backward from the last location of the animal to find the problem's source (CCA, 2001a). This system, which is maintained by the Canadian Cattle Identification Agency (CCIA), became mandatory for all cattle producers in July of 2002 under the federal *Health of Animals Regulations*[7].

Although the CCIP may be an efficient and cost-effective method of tracking cattle, and a good first step to meeting the traceability goals that the federal government envisions, the system only traces up to the point of carcass inspection. This may be sufficient for tracing in the event of an outbreak of disease, but would likely not be sufficient in the event of a catastrophic food contamination problem, the majority of which are discovered after the point of carcass inspection (CCA, 2001a). This leaves it up to the subsequent parties in the beef supply chain to keep some form of record of all beef products purchased and distributed to provide a method of tracing the contaminated meat forward from the point of carcass inspection. There is no government-supported mechanism with which to assist parties in the beef supply chain in doing this, as there is for the upstream portion of the supply chain[8]. This leaves two separate tracking systems of different levels of formality, which may or may not work efficiently together or pinpoint hazard sources as accurately as possible.

---

[7] Sections 172-189 of the Regulations support the utilization of an identification system such as the CCIP.

[8] The CCIP program used by upstream parties in the beef supply chain is supported by government in that its enforcement is provided by the CFIA, a government organization, and in that it received funding from various levels of government in its initial developmental stages to assist the program in its commencement (CCA, 2001a).

Under the current system, there is not a seamless "farm-to-fork" traceability system for beef products, and often, as beef moves through its supply chain its source becomes more difficult to pinpoint. As tracing systems become the norm in countries worldwide, a much more extensive system than the current CCIP will be required to distinguish Canadian beef products from their exporting competitors and enable producers to fetch market premiums based on food safety attributes. A tracing system that is applied to an entire supply chain, from primary producer to individual consumer, will be even more effective, and is the type favoured in the APF (Agriculture and Agri-Food Canada, 2002).

Traceability systems can come in several forms and can be used to achieve different ends. "Country-of-origin" labeling systems, similar to the one recently legislated in the U.S., allow consumers and importers to know what country the beef they are purchasing was produced in, and concerned parties to track beef back to the country where it was produced, but not necessarily any further, in the event of an outbreak. "Herd-of-origin" systems, similar to the Canadian CCIP or the EU "Cattle Passport" systems in which each animal has an individual ID number, allow contaminated carcasses to be traced back to the herd in which they were raised to identify the source of the contamination and prevent it from spreading further. The systems can utilize bar codes on ear tags, Radio Frequency Identification (RFID) tags, or even genetic tracking[9] (AgInfoLink, 2002).

[9] An example of the use of genetic tracking in beef supply chains is the voluntary Meat Standards Australia (MSA) grading program, in which blood samples are taken from each carcass and used for DNA analysis to genetically track beef, if necessary, in Australia (Lawrence, 2002).

The possibility also exists to utilize tracing systems such as these to serve an additional purpose. The current systems allow information about the origin of the beef to be obtained for the containment of outbreak situations from a food safety perspective. However, these systems could be modified to allow additional information (credence attributes) about the beef product to be obtained, such as the methods used in producing the beef on-farm, whether or not the beef was inspected in a HACCP-employing facility, and if the beef production methods were environmentally responsible. The possible use of traceability systems to provide access to production information will be discussed in more detail in a later section.

7.2 Environmental Planning and Labeling

In response to the recognition of the environment as a key issue for discussion at the next round of WTO negotiations, as well as recent environmental disasters such as the Walkerton, Ontario water contamination tragedy[10], the APF has chosen the environment as another key pillar of its agenda. In response to growing consumer and industry concern over the state of the global environment and its protection, the Canadian government has focused on agriculture, and instituted an as yet indefinite plan to increase the sustainability of agricultural practices. The goal is a consistent, nation-wide approach to improving the environmental performance of farms in Canada to provide concerned domestic and international consumers of Canadian products assurance that they have been produced in an environmentally sustainable way

[10] In Walkerton, Ontario in 2000, many people became ill or died from *Escherichia coli* O157:H7 bacteria present in the water supply. It is believed that the primary source of the contamination in this case was the entrance of manure that had been spread on farm land adjacent to a local well into the water supply (O'Connor, 2002).

(Agriculture and Agri-Food Canada, 2002). The belief is that by providing environmentally responsible products to environmentally conscious consumers and buyers, Canadian producers could maintain or increase their share of existing markets, and secure a place in emerging markets for agricultural products.

To meet goals of sustainability, the APF proposes that reductions need to be made in agricultural risk to water, soil and air, and that compatibility between agriculture and biodiversity must be increased (Agriculture and Agri-Food Canada, 2002). To institute change under this pillar, it has been proposed that farming practices be modified to include environmental farm plans; nutrient, pest and nuisance (emissions) management plans; and land and water management plans (Agriculture and Agri-Food Canada, 2002). It is unclear whether the government plans to institute these modifications to farm practice through legislation, or through the creation of a body of voluntary standards.

At present, extensive legislation regarding the environment does exist in Canada, at both the federal and provincial level. The *Canadian Environmental Protection Act*[11] and the *Canadian Environmental Assessment Act*[12] (both federal Acts) together allow members of the government to establish regulations, guidelines or codes of practice to protect the health of the environment and humans, identify toxic substances and pollutants, specify methods of assessment of environmental practices, and outline penalties for non-compliance. In addition, there are Acts such as the *Pest Control Products Act*[13] and the *Fertilizers Act*[14] that are narrow in scope, providing rules for the

[11] 1999, c.33
[12] 1992, c.37
[13] R.S., c.P-10, s.1

use of specific agricultural inputs instead of general pollutants. However, these Acts contain virtually no provisions regarding standards of practice to be met on farms to protect the environment, as the bulk of legislation in this area is found in the provincial portfolio. Each province may pass legislation regarding the environment, and due to unique environmental circumstances and considerations in each province, the provincial legislation therefore varies widely from one province to another, demonstrating an obvious lack of uniform or even consistent standards in Canada.

To market Canadian agricultural products as environmentally responsible, a consistent set of production standards or code of practice is necessary, and the federal government has recognized this in the APF. An environmental policy change is therefore inevitable, but it is unclear whether the new policy will be in the form of voluntary industry-based standards that are optional, but recommended, for producers, or mandatory legislation that must be followed to avoid penalty. One possible system that could be used is a certification system based on environmental assessment. The Ontario Ministry of Agriculture and Food has developed a voluntary program for farmers in which producers can develop an Environmental Farm Plan tailored to their farm that would enable them to meet environmentally responsible "goals" (Ontario Ministry of Agriculture and Food, 2002). Publications outlining Best Farm Practices for consideration in developing the plans are available to the producers for reference. The plan is then submitted for peer review, with some technical expertise and funding provided by the Ministry (Ontario Ministry of Agriculture and Food, 2002). There is no *per se* "environmentally responsible" certification given to the participating farm, but

---

[14] R.S., c.F-9, s.1

the farm may market itself as a farm that has and follows an Ontario Environmental Farm Plan.

If implemented as a voluntary certification program, use of a program like this could enable Canadian farmers interested in gaining access to markets concerned with environmental practices to achieve the certification necessary to brand themselves as environmentally responsible and enjoy a competitive advantage. A mandatory system set up in this way would ensure all farmers met the environmentally responsible requirements necessary to maintain access to markets concerned with foreign environmental stewardship.

In order to use environmental responsibility as a selling feature of Canadian products, it is necessary to raise awareness in the international community that these practices are being used. The APF talks about "branding" Canada and its products as environmentally responsible to secure new markets (Agriculture and Agri-Food Canada, 2002). A globally used tool that could enable producers to do just that is the use of environmental, or "eco", labeling. Producers would be required to demonstrate the use of environmentally responsible practices, which are set out by an independent third party or a government body, on their farm. If they can successfully demonstrate the use of these practices, they would obtain "certification", as they would then be allowed to attach an eco-label stating the environmentally responsible aspects of their product or production methods to the product. A mandatory certification system for all producers, used in conjunction with a traceability system for verification and information access, would be necessary to truly brand Canada as an environmentally responsible agricultural community.

In Canada, at present there is no legislation outlining a mandatory eco-labeling program, nor a set of standards that should be met to achieve a voluntary certification of food generally or beef products in particular. Canada does, however, have an eco-labeling program called the Canadian Environmental Choice Programme, founded in 1988 by Environment Canada (OECD, 1997). The programme is administered by an independent third party, Terra Choice Environmental Services Inc. under license with Environment Canada. Products seeking an eco-label under this program submit information regarding their product to the organization, where it is determined if the product is environmentally preferable to similar alternative products on the market based on guidelines developed by a product-specific review committee made up of business, academic, consumer and government representatives (OECD, 1997). If the product is deemed so, it can carry an "EcoLogo" certification that identifies it as environmentally responsible to the consumer. At present this program has been most widely used for certification of household products such as cleaning and laundry materials, but the possibility exists to use this program as a model for development of an environmental certification system for Canadian agricultural products. Certified products could carry an eco-label, making their environmentally responsible production visible to the Canadian public and potential foreign markets.

8. INTERNATIONAL LAW

8.1 Traceability and Food Safety

Currently, there is no international legislation or convention in place regarding traceability systems or food safety for beef products. Each country has unique standards for monitoring the safety of their food supply, and these standards often cause uncertainty and trade distortion. It is largely for this reason that the issues of food safety and traceability have become a concern to the international community and a topic of vital importance in future trade negotiations.

Codex Alimentarius, an international standards body, has addressed food safety and quality issues through the development of the Codex "decision tree" and 7 principles of HACCP, to be used by food industries (FDA, 2001). Use of these standards enables a party in a food product supply chain to closely monitor all production practices and identify hazards and solutions to assist in the avoidance of food safety related problems. This set of standards has become widely adopted by food industries in North America and beyond as a way of minimizing food-borne illness and contamination, but is not mandatory for international sale and trade of beef or other food products. In international trade disputes, Codex international standards have been used to examine equivalency of products between importing and exporting countries, in order to determine if there is any basis to non tariff trade barrier concerns over import bans.

There is no international standard, voluntary or otherwise, existing for traceability systems, although many countries have instituted their own voluntary or mandatory traceability systems. The U.K. has a national cattle identification system known as the "passport" system, as well as a private-sector based voluntary tracking

system called TraceSafe to be used for beef products within the country (Hobbs, 2001). Australia has a voluntary traceability system called the National Livestock Identification Scheme (NLIS) that is administered through the use of a national database in which information about cattle is stored, similar in structure to the CCIP in Canada (Meat and Livestock Australia, 2002). Even private companies are emerging to meet the growing desire consumers are showing for accountability in beef production through the use of tracing systems. An American company called AgInfoLink has developed complex tracking systems for cattle and beef products from "conception to consumption" using a variety of mechanisms, including RFID tags and genetic tracking. AgInfoLink markets beef products successfully based on the ability to trace any adverse effect of their beef back to its source in the event of illness or contamination, providing an assurance of quality verification to concerned consumers (AgInfoLink, 2002). The growing importance of these systems in assisting in the prevention of outbreak and economic disaster is clear, but as food moves across borders, traceability systems differ and there is no seamless system to track food across the globe.

8.2 Environmental Planning and Labeling

International legislation or multilateral agreement regarding environmental farm practices or labeling does not currently exist. Each country maintains its own set of environmental laws to govern the activities of its citizens, as each country's environment is truly unique and therefore needs to be individually and locally addressed. However, due to the increase in development of international conventions and protocols addressing environmental issues of international concern, trade and environment has been identified as a key topic of discussion for the Trade and Environment Committee of the WTO at

the next round of WTO negotiations. The potential effects of eco-labeling and multilateral environmental agreements regarding environmentally sustainable production on trade and market access will be considered (WTO, 2001). It is probable that some international initiatives to facilitate and manage the operation of international environmental stewardship and labeling programs will be discussed and commenced.

The International Organization for Standardization (ISO)[1], has developed a series of environmental management standards for use in countries around the world. The 14000 series outlines several hundred general criteria for monitoring air, water and soil quality, as well as Environmental Management System (EMS) standards for use in all industries, including agriculture, as a means to minimize effects of production on the environment (ISO, 2001a). These standards provide a basic framework which may be tailored to the needs of specific businesses or industries, and can be used for certification of conformity with prescribed environmental standards by an independent certifying body. Use of ISO standards could be useful in programs employed to administer or award eco-labels and other forms of environmental certification.

[1] The ISO is a non-governmental organization that seeks to establish international standardization to facilitate efficient trade flows and understanding between countries. It is a global federation of national standards bodies from over 140 countries, and the international standards it develops are the published form of international agreements (ISO, 2001b).

9. POLICY INSTRUMENTS

9.1 Mandatory Guidelines (Regulation/Statute)

In beef supply chains, liability can be borne by any party who is required to adhere to regulations governing aspects of their production practices. If a standard of practice is set by regulation enacted under an enabling statute, and a party fails to meet that mandatory standard, that party can be liable for the commission of a regulatory offence[1]. All levels of government have the jurisdiction to enact legislation that specifies regulations that must be followed by the public. Jurisdiction is only limited to the federal government if the offence created is a criminal one covered by the *Criminal Code*[2].

For a party to be subject to criminal/statutory liability for the commission of a regulatory offence, two elements of an offence must be proved. It must be proved that the *actus reus*, or guilty action, contained in the offence was committed by the accused (Roach, 1996). For example, if under the *Canadian Environmental Protection Act* it was an offence to allow cattle manure to enter the water supply and a cattle producer did allow this to occur, he would have committed the guilty act specified in the offence.

Secondly, it must be proved that the necessary *mens rea*, or guilty mind, was present during commission of the offence. The *mens rea* required to be shown varies with the type of offence. Offences can require proof, beyond a reasonable doubt, of a subjective fault element such as willfulness, intent, recklessness or knowledge.

---

[1] A regulatory offence is an offence or crime created by statute that is not contained in the Criminal Code. This type of offence is minor and is created under statute to facilitate the effective regulation of a type of conduct to protect public welfare. A financial penalty is most commonly applied for these types of offences, although imprisonment is possible for some regulatory offences.

[2] R.S., c.C-34, s.1

However, regulatory offences are often part of a regime created to meet a certain objective in the public interest, and requiring a fault element such as these, which are often difficult to prove, frustrates that objective, causing the regulatory regime to be ineffective (Roach, 1996).

To allow easier prosecution for these minor offences, regulatory offences are often treated as absolute or strict liability offences. An absolute liability offence requires proof only of the commission, or doing, of a prohibited act, allowing liability to be imposed without proof of a fault element (Roach, 1996). No defence is available to a party accused of this type of offence. The more commonly used strict liability offence requires proof of the commission of the prohibited act, but bases its fault element on negligence. After the *actus reus* is proved beyond a reasonable doubt, negligence is presumed and a reverse onus is created in which the accused party must prove he was not negligent on a balance of probabilities. This allows the accused to raise a defence of due diligence in which he may show that he took all reasonable care to fulfill his legal obligation, proving he was not negligent.

Going back to the previous example, if the *Canadian Environmental Protection Act* specified that in order for a party to have committed an offence, the party must have willfully or recklessly allowed manure to contaminate the water supply, then it must be proved that this subjective fault, or *mens rea*, was present when he allowed the manure to enter the water. If on the other hand, the offence does not specify a mental element required, the offence would likely be either absolute liability, in which the accused will be found guilty regardless of whether or not he knew of the runoff, or one of strict

liability, in which it would have to be shown that the accused was negligent in allowing the runoff to occur and did not take reasonable steps on his farm to prevent it.

Regulation can be "command and control", or "incentive market-based", in which either limits are set and standards are met by inspection, or in which compliance allowances are apportioned and are exchangeable[3], encouraging parties to achieve compliance using the smallest amount of allowances (Boyer and Porrini, 2002). Depending on the form of the regulatory regime, more or less discretion may be given to the regulator or enforcement officer. In strict command-and-control regimes, such as those commonly used in food safety and traceability legislation, a "one-size-fits-all" model is used, subjecting all parties to the same standards, regardless of individual considerations or distinguishing factors (Edgell, 2000). Less strict regimes can allow regulations to be tailored to different parties, providing for more liberal interpretation of rules in the regime by regulators and often a greater ability to avoid liability.

When the goal of the legislation is to ensure a safe food supply, a clean environment, and a consistent, traceable product, it needs to serve a two-fold purpose. Unfavourable practices must be deterred, and a penalty must be provided to provide compensation and punishment for wrongs committed (Boyer and Porrini, 2002). A regulator achieves these purposes by setting mandatory standards, thus providing an *ex ante* set of precautions to limit risk, and by monitoring compliance and applying

[3] An example of compliance allowance is a "carbon-credit" scheme, in which parties are allotted a number of credits for measures taken to compensate for greenhouse gases such as carbon dioxide that they have released into the atmosphere. Under a scheme such as this, a party may comply with legislation requiring that party to reduce his carbon dioxide emissions by paying a farmer to use a zero-till operation on his farm to sequester carbon in the soil. This practice is sometimes called "emissions trading", and allows a party to be in compliance by exchanging "credits", or allowances for compliance, with those who can assist him in meeting his regulatory requirements.

penalties, thus providing an *ex post* method of compensation for harm caused. Beef producers, under this type of policy framework, must recognize both aspects of the legislation, and manage their liability by utilizing systems designed to meet any mandatory standards applicable to them.

It is imperative that all parties in the beef supply chain, from producer to consumer, inform themselves as to what federal, provincial and municipal laws apply to them and their practices and adhere to these regulations diligently. By keeping informed as to the state of the law, parties can minimize their liability by taking steps to prevent breaches of legislation. Although statutes are the supreme source of law and override all other sources of law, compliance with a statute does not automatically result in relief from liability. Compliance only results in relief from statutory liability, as civil liability has a different focus. Establishing statutory liability requires the parties involved to meet very specific criteria outlined in the applicable statute, whereas establishing civil liability requires parties to meet much more general criteria. Often, when a criminal suit fails, an aggrieved party will bring a civil suit to obtain compensation for an injurious action that may not be defined enough to meet statutory specifications, but meets civil standards of conduct expected of reasonable persons (Osborne, 2000). The standard of proof required for statutory or criminal actions is often much higher than that of civil actions.

Legislation is tailored for application to a defined group of people or organizations, whether it is farmers, abattoirs, retailers, exporters or consumers. On-farm environmental planning legislation is specific to farmers, and if enacted would require compliance with terms applicable to beef producers, such as regulations governing land

use and herd size. Eco-labeling, traceability, and food safety legislation may or may not be less party-specific and would likely involve several different regulations aimed at different parties involved in the process. For example, the federal *Meat Inspection Act* establishes regulations governing activities of federal meat inspection establishments, by requiring these parties to obtain an operating license, but it also establishes regulations governing persons who export meat, by requiring these parties to store meat for export under prescribed conditions. Therefore, although legislation may not be specific to one particular party, it is always tailored to the governance of a specific area of public concern. Legislation sets out defined standards regarding that area that must be met by all affected parties. This allows liability to be anticipated and planned for, and economic losses minimized through various management practices.

9.2 Civil Liability

If no legislation exists regarding practices employed by beef producers, the result is not an exemption from possible liability for these producers. All parties remain subject to civil liability, in which they can be found obligated to pay civil compensation or damages for non-criminal acts that "injure" or "cause damage to" others. Although a party may be held jointly liable under both criminal and civil law principles, the two are separate actions with distinct criteria that must be satisfied. Civil liability is the form of liability being referred to in references to contractual liability, tort liability and products liability – all of which may affect different parties at different stages of the beef supply chain.

Tort liability can affect all parties in the beef supply chain in a variety of situations. In the case of food safety, parties may be liable in the tort of negligence for

failure to meet an adequate standard of care in production and preparation of a product, even if there are no explicit statutory rules surrounding the process. This is also known as products liability, as it refers to the manufacturer's responsibility to consumers to provide a product that meets industry standards, or standards that a reasonable person would expect the product to meet (Edgell, 2000). This duty was established in the infamous *Donoghue v. Stevenson*[4] case, in which the "neighbour principle"[5] was discussed, a principle that clearly encompasses consumers, as manufacturers intend a product to reach a consumer, and therefore must take reasonable care in its preparation (Edgell, 2000). This neighbour principle could also apply to any person whose actions are likely to injure a party directly affected by this person's act, making it relevant to all other supply chain members, as all members of the supply chain are directly affected by damaging acts of other supply chain members due to the fact that they are all working in tandem to produce a product bound for the same use.

Several key principles are involved in establishing tort liability, particularly negligence. First, a duty of care owed to the innocent party, or plaintiff, by the accused party, or defendant, must be demonstrated. If a defendant owes a duty of care to the plaintiff, he is said "to be under a legal obligation to exercise reasonable care in favour of the plaintiff" (Osborne, 2000). Whether or not a duty of care exists is determined by looking at two factors – the proximity or neighborhood between the two parties involved

---

[4] [1932] A.C. 562 (H.L.)

[5] This principle requires all persons to "take reasonable care to avoid acts or omissions which [they] can reasonably foresee would be likely to injure [their] neighbour…persons so closely and directly affected by [their] act that [they]ought to have had them in contemplation as being so affected when directing [their] mind to the acts or omissions [in] question". See *Donoghue v. Stevenson* [1932] A.C. 562 (H.L.)

in the action[6] that would allow a defendant to reasonably foresee that he may cause damage to the plaintiff by his actions, and social policy considerations (societal costs and benefits) regarding whether or not there should be duty of care recognized between parties.

Once a duty of care is established, it is important to determine what standard of care the defendant must meet in taking care for the plaintiff's safety. To ascertain the standard of care the defendant must meet in his actions, the defendant's conduct is measured against the *objective* standard of a reasonably careful person in circumstances similar to those of the defendant (Osborne, 2000). Subjective individual characteristics or skills of the defendant are not taken into account when examining if he or she met the requisite standard of care. However, the standard of care can be influenced by evidence that a defendant's actions were consistent with an established set of practices or customs used by reasonable people carrying out activities and tasks similar to those of the defendant (Osborne, 2000).This means that in the defendant's situation, a reasonably careful person would have foreseen the risk he was causing to others, the likelihood that damage would result from his risky actions, and the severity of harm or damage these actions could result in. If a reasonable person in the defendant's situation would have foreseen that he was likely to cause a serious risk of damage to others through his actions and therefore would have chosen not to act in this risky way, then a defendant's failure to meet this standard of care can result in a finding of negligence.

Even if it can be shown that the defendant owed a duty of care to the plaintiff and failed to exercise the expected standard of care in his actions, two other elements are

---

[6] See *Donoghue v. Stevenson*, [1932] A.C. 562 (H.L.) and *Anns v. Merton London Borough Council*, [1978] A.C. 728 (H.L.) for further discussion.

necessary before negligence will be established. The plaintiff must prove that the defendant's negligent actions were the cause of the damage or loss he or she sustained (Osborne, 2000). To prove this, it must be shown that *but for* the defendant's negligent act, the plaintiff would *not* have suffered the loss in question. This shows that the defendant's act was the "cause-in-fact", and proves that the defendant's negligence probably caused the plaintiff's loss. It does not have to be proved that the defendant's action was the *sole* cause of the plaintiff's loss, only that it was *a* cause. A material contribution on the part of the defendant to the plaintiff's loss will be sufficient to establish causation (Osborne, 2000).

Despite the fact that a defendant's action may have caused the plaintiff's loss, the defendant is only liable for all reasonably foreseeable consequences of his negligent act (Osborne, 2000). If the loss is too remote from the negligent act of the defendant, there is no proximate relationship between the defendant's act and the plaintiff's loss and hence no liability. Therefore, for a defendant to be liable in negligence to a plaintiff, he must owe a duty of acre to the plaintiff, fail to meet the standard of care a reasonable person would be expected to meet in his actions regarding the plaintiff, his actions must have caused the plaintiff's loss, and the loss that the plaintiff suffered must have been foreseeable by the defendant as at least possible to result from his actions (Osborne, 2000).

If the defendant is held liable to the plaintiff, a remedy will be offered to the plaintiff. This is most commonly in the form of damages intended to compensate the plaintiff for his or her loss by putting the plaintiff back in the position he or she would have been in if loss had not been suffered due to the defendant's actions. Additional

aggravated or punitive damages are also possible, but are usually awarded only if the plaintiff suffers extreme distress due to the defendant's actions (aggravated), or if the defendant's actions are so outrageous that severe punishment is warranted (punitive). If a party suffered personal injury as a result of contaminated meat or water, for example, a lump sum or structured settlement in which periodic payments are made could be awarded to him or her (Osborne, 2000). This money is intended to compensate the plaintiff for present (non-pecuniary) and future (pecuniary) losses resulting from the damage the defendant's actions caused. A plaintiff's loss of earning capacity, due to inability to work because of the injury suffered, can also be included in pecuniary losses awarded by allowing a sum to compensate the plaintiff for what he or she would have earned but for the accident (Osborne, 2000).

Looking to another example, tort and contractual liability may allow for recovery of damages for loss of profits or market value if a plaintiff retailer is unable to sell beef due to contamination of the product supplied by a distributor, or due to damage to the plaintiff's reputation as a retailer of quality, safe products caused by the unsafe product supplied to it. The plaintiff may be able to claim the sum he or she has lost due to inability to sell the affected property or product (Klar, et. al, 1995). However, it is important to note that due to the nature of transactions between parties such as suppliers and retailers, contracts of sale between them may contain clauses limiting the liability of parties should a situation like this arise. A supplier's contract for sale of beef to a retailer may contain a clause that specifies that the supplier cannot be held liable if a problem surfaces with the product after sale.

In the case of environmental planning, beef farmers can be found liable in negligence for failing to maintain their cattle operation up to a reasonable standard of care if their lack of care results in harm to the environment or harm to humans. If negligent manure management results in contamination of a local water supply, or if a farmer's regime of animal health management fails to meet the standard of care necessary to detect or prevent harmful diseases, that farmer could be found negligent and be required to pay damages if the result of his negligent act was some form of harm. This standard of care may be voluntary guidelines set out by a producer association that are commonly followed by beef producers, or it may be proven traditional practices of beef producers in a particular geographic area.

In this way, a voluntary standard could, in some ways, serve as a mandatory standard, as it could serve as the standard of care that must be met in order to avoid a penalty. However, it is important to note that failure to comply with most laws or mandatory standards of this type results in a penalty regardless of whether or not negligence or damage is proven. A mere commission or omission results in penalty. Failure to comply with a voluntary standard results in penalty only if, first of all, that standard is proven to be the one commonly used by reasonable, careful parties in a situation similar to that of the party in question. If this is proven, then failing to meet the standard would mean that the party failed to meet the standard of care of a reasonable person in similar circumstances, possibly resulting in the establishment of negligence by that party and hence civil liability, providing that other components of negligence such as foreseeability are also established. Meeting the standard of care expected by a reasonable person becomes essential, because if a producer is not doing what a

reasonable producer in his situation would be expected to do, he opens himself up to liability if a causal connection his actions and the resulting harm or damage is established (Osborne, 2000).

Contractual liability in the beef supply chain is also an important consideration. At each point in the beef supply chain, an exchange of a good is made. Some of these exchanges will involve formal contracts of sale, and some will not. Nonetheless, all of these exchanges that involve some variation of an offer and an acceptance, from the sale of a heifer through an auction mart, to the sale of a package of ground beef by the local supermarket to a consumer, can be viewed as contracts. If a contract of sale specifies that one party will be selling a specific product to another, then that is a term of the contract and it must be adhered to (Samuel, 2000). For example, if a meat packer contracts with a supermarket to supply the store with a shipment of safe, inspected beef, then the packer must do so or he can be held to be in breach of contract and liable in damages.

Representations made in the course of sale are also important, as a party who misrepresents some aspect of his beef product to entice another party to purchase it can be found liable in damages. For example, if an eco-label stating that the beef contained in the package was produced on a farm using only environmentally preserving manure management techniques is adhered to the package, and this is found to be untrue, the party who made the claim can be liable in damages for misrepresentation.

The difficulty with many claims in civil liability is that fault is often arduous to determine (Boyer and Porrini, 2002). A specific harm-causing party, or tortfeasor, is often difficult to isolate, particularly when integrated supply chains such as those seen in

the beef industry are involved. As a product passes through many hands, it is difficult to determine which set of hands caused the damage. It is possible that the harm caused by the product was the result of several acts of negligence by different parties in the supply chain. Provided that there is some evidence that a tortfeasor was negligent or failed to meet a standard of care, or that the tortfeasor is a contributor to the negligence that caused a loss, that party can be at risk for liability. Even if one tortfeasor or party in the supply chain is largely at fault for a loss, another contributing party can be held liable also. When multiple tortfeasors are involved it is common to apply the concept of joint and several liability, in which each party involved in the negligence is entirely liable for the whole of the damage (Freedman, 1987). This means that the damages paid out may be split among negligent parties, or if some parties lack the resources to pay out the compensation, the other parties will be required to pay their own share plus the share the less lucrative parties failed to pay.

When an indivisible harm occurs to an innocent party, or plaintiff, all tortfeasors that contributed to the harm, whether they acted in concert to produce a harm (joint tortfeasors) or independently to concurrently cause the same harm (several concurrent tortfeasors), can be held jointly and severally liable. This can occur in situations where more than one party has committed a tortious act, and it has been proven that only one of them actually caused the harm in question, but it is unclear which party's tortious act caused the harm (Freedman, 1987). In this scenario, all negligent parties can be joined as defendants in a single claim, and the burden of proof can be reversed. Instead of the plaintiff being required to prove that one of the particular defendants caused the damage in question, each defendant is now presumed to have been negligent and is held jointly

and severally liable unless he or she can prove, on the balance of probabilities, that he did not cause the plaintiff's loss (Osborne, 2000).

With several defendants involved in loss-causing negligence, the challenge then becomes to apportion liability between them. This is necessary in order to determine what portion of the total damage award each defendant is responsible for. Rules of contribution commonly applied allow courts to apportion responsibility for loss, or damages payable, according to the degree to which each defendant is at fault (Osborne, 2000). The degree of fault is often determined by the probability that a particular defendant, relative to the other defendants, was the cause of the plaintiff's loss. The degree of risk that the defendant created to the public can also be considered. Fault can also be distributed according to market share held by a particular defendant if all defendants named in the suit are competitors in a certain market[7]. However, this method has not been used in Canadian courts, and is often limited to less immediate injuries derived from products such as pharmaceuticals (Osborne, 2000).

Monitoring and certification is an important part of the beef supply chain. These activities can be carried out by independent (private) bodies, or governmental (public) bodies, each of which are also exposed to liability in the supply chain in the event that defect in a beef product is not identified. If a public governmental body is established to monitor and certify beef product quality, its activity is most often carried out under an enabling statute[8], which outlines actions a particular body *may* take in achieving the

---

[7] See *Sindell v. Abbott Laboratories* 607 P.2d 924 (Cal. 1980) and *Hymowitz v. Eli Lilly & Co.* 539 N.E.2d 1069 (N.Y. 1989).

[8] For example, the *Canadian Food Inspection Agency Act* establishes a body, the CFIA, responsible for maintaining a safe food supply in Canada. The Agency has authority to

purpose for which they were established (Osborne, 2000). With statutory authority granted to these bodies, they may use it to make political and operational decisions regarding the way in which their services and resources are distributed and used.

If the actions of a government fail to protect a party from a loss in a beef supply chain, the government could therefore be held liable in negligence, as the government may have breached its duty of care to protect public welfare. However, liability would depend on the type of government activity the plaintiff claimed was negligent. Administrative functions of government, or policy decisions, such as decisions by high levels of government involving the allocation of resources are not usually subject to a duty of care (Osborne, 2000). Hence, it is unlikely that an aggrieved party could successfully hold the federal government liable in negligence for failing to provide enough funding for the establishment of an administrative body to monitor a traceability systems in beef supply chains. Conversely, operational decisions, often made by lower levels of government, regarding the use of available resources are commonly subject to a duty of care (Osborne, 2000). This means that it is possible that the provincial government could be held liable in negligence for failing to set effective quality standards for use in a traceability system the federal government granted them funding to implement.

If a private body is established to monitor and certify beef product quality, and is required to do so according to standards of conduct outlined in statute, then failure to do so could result in liability for breach of statutory duty (Osborne, 2000). If this body is not given authority under statute, then any failure of monitoring or certification it

---

conduct certain actions necessary to achieve this purpose, and this authority is granted by this Act, the CFIA's enabling statute.

provides is unlikely to render them liable unless the body held themselves to be experts in the area of beef quality certification, or represents themselves with terms such as "government-approved" or "the industry standard" to unsuspecting parties in the beef supply chain. Further, a producer will likely not be found negligent for failing to meet monitoring or certification standards of a body such as this unless that particular body's monitoring and certification model is established to be the industry standard.

Traceability systems have the potential to address the dilemma of determining fault. A traceability system allows meat to be tracked throughout a supply chain, providing a mechanism to trace illness caused by meat contamination back to its source. This *ex post* function of traceability systems means that if a consumer becomes ill from eating an *E.coli* contaminated hamburger, that hamburger can be traced backwards to the packing plant, slaughterhouse, and farmer involved in its production (Hobbs, 2001). Production records and such may be examined, and it may then be possible to determine which of the parties contaminated the hamburger and therefore pinpoint fault for easier assessment of civil liability. However, one complicating factor in assessing fault in products liability cases involving beef is the fact that preparation by the consumer is involved in the chain. What the consumer does with the meat upon purchase, including storage or preparation techniques, is often unclear and can be a contributing factor in contamination and resulting illness, making it difficult to pinpoint fault despite an intricate, efficient traceability system. This can also introduce the possibility that a defendant may raise a defence of contributory negligence, which can be used if the plaintiff, or party who suffered a loss, is found to have contributed in some way to the negligence that caused his or her injury. If this defence is raised successfully, it results in

a decrease in the amount of fault attributed to the defendant and therefore the amount of damages recoverable (Osborne, 2000). In fact, if no solid evidence of negligence on the part of the defendant(s) can be supplied, establishment of a possibility that the consumer contaminated the beef could serve to relieve any defendant of liability.

Civil liability, like legislation, results in a penalty – in this case monetary compensation. Whether or not liability has the effect of deterrence, however, is debatable. Without clear guidelines outlining required practices or actions, what is classified as harm remains somewhat unclear and the deterrent effect depends largely on the likelihood that a party will be "caught" causing harm. If a party believes that the harm he is causing is undetectable, due to lack of a tracking system for example, then it is unlikely that he will be deterred from conducting the harm-causing activity, as without any apparent harm caused, no liability can be attached to him. This is especially complicated by the fact that determining fault in many situations is very difficult, as it is often unclear exactly what role, or the extent of a role, a party had in causing harm when several parties are involved in a chain leading up to damage[9].

If traceability systems are used in an *ex ante* role, allowing credence attributes[10] often used in eco-labeling schemes to be identified to the consumer upon selection of the beef product, the consumer may assess these attributes as an aid in deciding whether or

---

[9] See *Cook v. Lewis* [1951] S.C.R. 830, in which a plaintiff was injured by a gunshot wound. In the chain of events leading up to his injury, two different hunters separately but simultaneously fired a gunshot in his direction. The plaintiff was unable to prove which of the hunters' bullets had struck him and therefore caused his loss. Each of the defendants claimed the other defendant was the cause of the plaintiff's injury.

[10] Characteristics of a product that a consumer cannot detect or evaluate before purchase of the product, or after consumption of the product. A good example is foods that claim to be "environmentally responsible". See Hobbs, 2001.

not to purchase the beef product – a form of quality verification (Hobbs, 2001). Combining *ex ante* and *ex post* functions of civil liability systems may enhance its deterrent effect, as the consumer has a way of being informed prior to his purchase. If this information is made available at the point of sale through display on label or scanning a bar code, it becomes a factor in the consumer's choice to purchase the beef. If the information is false, the party making the statement could be held liable in misrepresentation. If the product is unsafe, the identity of all producers involved can be discovered through the tracking system. Accountability is thus established, enhancing a deterrent effect.

Factors such as these make it necessary for all members of the beef supply chain to be vigilant regarding the source of the beef products they purchase. Even with traceability systems to help establish liability, fault is not guaranteed to be clear. Ignoring or failing to inquire about the production practices of the upstream parties in the supply chain can factor into liability (Edgell, 2000). It is largely for this reason that many retailers have long-standing supply contracts with reputable meat packers and suppliers. This allows the retailer to provide a consistent product to the consumer, and to be assured that the meat they are selling was produced under industry standards. If a retailer ignores the fact that the meat they are purchasing was likely contaminated by a supplier's unhygienic production practices, and purchases it because it is less expensive, he could be held jointly liable for any harm the meat causes to the consumer (Freedman, 1987). It is not always clear, even with the use of tracking systems, who caused the harm.

A contract of sale between the supplier and the retailer specifying quality or inspection methods used helps to relieve a retailer of his liability if harm is caused. Representations made in the course of contractual negotiation by suppliers regarding the quality of meat products they supply can be enforceable, and in the event that a harm occurs due to the meat involved in these contracts, retailers could be released from liability if it can be proved that they acted on the faith of suppliers' representations in purchasing the meat from them. However, relief from liability will likely occur only if the retailer did their part and used due diligence in ensuring the meat sold was safe for consumption.

10. CONFLICT OF LAWS

Before any liability can be established, statutory or civil, a forum to hear the case must be established. As more than half of Canadian beef is exported, many foreign parties purchase and consume Canadian beef. As sales of beef cross borders, the applicable law is not always clear. The bulk of this paper has discussed Canadian legal principles, but in some situations, foreign law may govern the action. A claimant, or injured party may have a strong basis for an action of negligence or breach of contract against a Canadian beef producer, but unless the claimant is also Canadian, the sales transaction involved was an international one, and the principles of private international law must be applied to determine which law governs the contract.

The majority of international sales contracts contain a "choice of forum" clause specifying the choice of law. The clause will often state which country, or state/province's, law will govern the contract. If this clause is unambiguous and unchallenged, then the action involving the beef product is brought in the courts of the jurisdiction specified in the contract, and the law of that jurisdiction is applied to interpret the contract and the legal claim arising under it.

If the contract does not contain a clause of this kind, or if a party to the contract has cause to challenge the clause for vagueness or inexclusivity, the situation becomes more complex. The claimant/plaintiff bringing the action involving the beef product will likely bring the action in the court of the jurisdiction that is more favourable to him or her, for reasons of location or legal principles (limitation periods, etc.). If the defendant does not challenge this choice of court, the case may be heard in that jurisdiction, as the intent of the parties will be clear from the acquiescence of the parties in allowing their

case to be heard there without contest (Baer, 1997). If, however, the defendant does challenge the plaintiff's action based on jurisdiction, a separate action ensues for a stay of proceedings.

In this independent action brought by the defendant, the court in which he has brought the action must determine if they have jurisdiction over the matter brought forward by the plaintiff in another court, or if the alternative court desired by the plaintiff has jurisdiction. To analyze a conflict of laws situation, courts must look at three things: choice of law, jurisdiction, and recognition.

Choice of law in tort actions is often determined using the *lex loci delicti* doctrine (Tetley, 1999). This is the "place-of-the-wrong" rule, and it essentially means that the law that will apply to the action is the law of the place where the wrong or tort was committed (Baer, et al., 1997). Therefore, if a consumer became ill from eating contaminated beef in China and brought an action against the Canadian beef producer involved in the production of the beef she consumed, the law of China would govern the action under this rule. In *Tolofson v. Jensen*[1], however, LaForest J. made the important finding that in some circumstances, this rule will require flexible interpretation, allowing exceptions to be made to it.

These exceptions become clear when jurisdiction is considered. The general rule is that the presence of a real and substantial connection must be demonstrated in the case for the suit to be heard in a particular jurisdiction. In *Morguard Investments Ltd. v. DeSavoye*[2], LaForest J. stated that an action can be heard in a jurisdiction if the suit is permitted where there is a real and substantial connection with the action. The

[1] [1994] 3 S.C.R. 1022
[2] [1990] 3 S.C.R. 1077

jurisdiction in which the party wishes the action to be heard must be connected with the parties' transaction or the subject matter of the suit[3]. In other words, if the law of the desired jurisdiction is the law most closely connected to the parties, the real and substantial connection test has been met and the case may be permitted to proceed in that jurisdiction (Baer, et al., 1997). This test is often guided by principles of fairness rather than a list of requirements that must be met for the test to be satisfied.

The principle of *forum non conveniens* may also have a bearing on jurisdiction. This doctrine was founded on the real and substantial connection test, and serves as a method of interpreting it (Tetley, 1999). The principle was discussed in *Amchem Products Inc. v. British Columbia (Workers' Compensation Board)*[4], in which Sopinka J. outlined that the current test to establish *forum non conveniens* is whether there is clearly a more convenient and appropriate jurisdiction for the pursuit of the action than the one in question. The onus lies on the party seeking the stay of proceedings to establish this. One factor to be considered in deciding if this test is met is whether the party would be deprived of some personal or judicial advantage if his choice of forum was not respected (Baer, et al., 1997). Where no one forum is shown to be more appropriate than the other, the court should give effect to the plaintiff's choice of forum (Tetley, 1999). Mere

---

[3] An example of a connection between the jurisdiction and the parties or suit can be found in *Hanlan v. Sernesky* (1998), 38 O.R. (3d) 479 (Ont. Ct. App.) , in which it was found that although the plaintiff was injured in Minnesota (the *lex loci delicti*), the suit would be governed by the law of Ontario, as this law was most closely connected to the parties involved in the suit. Ontario law was "most closely connected" because the plaintiff and defendant were both residents of Ontario, and the motorcycle on which the plaintiff was riding at the time of his injury was registered in Ontario (Tetley, 1999).

[4] [1993] 1 S.C.R. 897

inconvenience is not enough to invoke the doctrine[5]. It is essential to consider the losses to both the plaintiff and the defendant, bearing in mind the connection of the foreign court to the facts and each of the parties.

If the decision of a foreign court to assume jurisdiction over a suit based on their own principles is consistent with the Canadian principles of *forum non conveniens*, then the foreign judgement will be recognized by Canadian courts (Tetley, 1999). Therefore, if a Canadian beef producer was found liable for damages in a foreign court, the Canadian judicial system would recognize the foreign judgement and honour it in Canada, requiring the producer to pay damages to the foreign plaintiff even though he resides in another jurisdiction. The Canadian courts would enforce the foreign court's judgement, regardless of how much it may differ from the value likely to be awarded in a Canadian court, in this situation. "Full faith and credit"[6] will be given to foreign judgements as long as the rendering court properly exercised its jurisdiction (Tetley, 1999).

It is necessary to examine if an injustice would result for the party if the action proceeds in a foreign jurisdiction, as granting many anti-suit injunctions would indicate that Canada is not honouring foreign proceedings, therefore contradicting the principle of comity[7], an essential principle in international legal relationships that is honoured by

---

[5] See Lamborghini (Canada) Inc. v. Automobil Lamborghini S.P.A. [1997] R.J.Q. 58 (Que. Ct. App.).

[6] The "full faith and credit" doctrine recognizes the responsibility of Canadian courts to give full recognition and enforcement to judgements issued by foreign courts.

[7] Mutual recognition of legislative, executive and judicial acts by political entities. It is the "golden rule among nations" , as each must give the respect to laws and policies of others as it would have others give to its own in the circumstances (Kindred, 1993).

the majority of countries around the globe. International treaties based on this principle, which are widespread among trading countries, allow for the enforcement of damage awards across borders when accompanied by domestic legislation ratifying the treaty. In the event that treaties and legislation of this type do not exist between the countries involved, however, damage awards from a foreign jurisdiction may not be enforceable and may never be paid out to the plaintiff (Annand, 2002).

Using these concepts, the determination of which court has the authority to hear a case becomes a seemingly simple process. However, these principles are open to judicial interpretation, even in civil law jurisdictions where they are codified, and the outcome depends on the exact facts and circumstances of each individual action. Parties in the beef supply chain would be wise to follow principles such as those outlined in their provincial *Sale of Goods Act*[8] and the *Convention on the International Sale of Goods* to govern their international dealings. The uncertainty that results when matters such as "choice of forum" are not clearly contracted for can be largely avoided by planning ahead. By contracting for a specific forum to apply to a contract, any action, including a tort action, that arises under that contract can fall within the jurisdiction of that forum. How a particular forum decides a case will depend on the principles of law recognized in that jurisdiction. Types of liability that may be a concern to a party in the beef supply chain in Canada may not be recognized in some foreign jurisdictions and therefore may not apply to a contract governed by the law of one of these jurisdictions. For example, joint and several liability is a legal concept that is not recognized by all jurisdictions, and therefore if a case is tried in a country that does not determine joint and several liability,

[8] R.S.S. 1978, c.S-1 (Saskatchewan)

it is not an issue in the case and will not affect Canadian producers even though it is an established concept in Canadian law.

11. CONCLUSION TO PART II

As the agriculture sector moves into the forefront of concern surrounding food safety and the environment, parties in beef supply chains will be affected by a range of regulatory instruments. Policy that currently exists in environmental protection and food safety sectors is inadequate if the goal of Canadian government is to facilitate production of the consistent, high quality product likely to be requested by international export markets. In order to plan for future changes in market demand and composition, regulators will need to develop changes to the existing regulatory regime.

A multifaceted system of enforceable environmental standards for agricultural producers and processors will likely be key, but will need to be implemented in such a way that the standards are unambiguous, yet flexible enough to meet the unique environmental needs of individual parties or groups in varying geographic, climatic or soil zones. A similar regime would be required for food safety standards . Without consideration to individual concerns and considerations of different parties in agricultural supply chains, regulations become very difficult to obey and do not achieve their intended objectives.

Though liability can arise from a variety of sources, all sources have similar objectives. To truly protect the environment and human health, parties must be deterred from the use of practices that endanger or negatively effect these important matters. To adequately protect a “brand”, or provide an incentive to produce superior high quality products, parties who supply these unique products must have a mechanism to ensure false claims regarding product characteristics are punishable. These are the goals of liability. Whether liability is created through the use of legislation, or standards are set to

encourage civil responsibility, parties in beef supply chains must be aware of and understand their obligations.

If the goal of traceability systems is to assist in determination of liability, they must be designed to establish which party is at fault. One, and perhaps the most important, component of liability is the legal proof of responsibility. To prove that a particular party was at fault, or responsible, for a loss or injury suffered by another party, the traceability system would need to supply very detailed information about each party in the chain it is tracking. The system would need to have complex and accurate information about the production practices, monitoring regime and quality control system utilized by each party in the supply chain. If this information is available by way of the traceability system then it may be established with a reasonable degree of certainty who caused the loss. The system, if utilized in the correct way, has potential to determine legal responsibility by showing that "but-for" the action of the negligent party, the innocent party would not have been injured or suffered a loss.

When parties are held accountable for the actions they choose, responsibility is better achieved. If complex liability systems exist, the cost to those affected can be high. Balancing the needs and costs to each party is key to select a basis for liability that will achieve maximum effectiveness. If the cost of implementing a liability regime is too high, it will not be effective. Likewise, if the cost of following or adhering to a regime is too high in comparison to the corresponding losses incurred if it is not adhered to, there will be no incentive to following the regime and it will not be effective.

To compete in the dynamic world marketplace, Canada and its beef producers must produce a product that is as safe, equivalent and consistent as possible. As

transactions cross borders, so does liability. The international trade environment is an important consideration in developing regulatory systems for products that are highly exported, but it cannot be the only consideration. Producers in each country have distinct environments in which to work, and will thus require regulation tailored to that environment. Food safety regulation will also need to be tailored to the unique production systems that exist within individual countries. Although it can be said that many countries desire common objectives of protection of animal and human health, and of the environment, it cannot be said that the same way of meeting those objectives will be effective in all countries.

12. REPORT CONCLUSION

Both at the World Trade Organization and in Canada's new Agricultural Policy Framework (APF), systems to differentiate agricultural products on the basis of environmental friendly production are being considered. In the APF, international differentiation of Canadian food products on the basis of food safety is also being considered. Both the Canadian government and industry must be aware that an ex ante monitoring system and a labeling/branding system must in place to verify credence attributes to consumers in the future. Either a government agency or an independent third party must monitor the agricultural industry's practices. A high level of co-operation and integration will be required to build these supply chains.

Part I indicated that a premium for environmentally responsible beef is the most critical variable in the project analysis. If the premium exists at the level proposed in this report (1.6% per hundredweight) then it will more than compensate for any of the proposed international environmental standards. The results indicate that as feedlot size increases the benefits of implementing an ISO process standard based on the technologies examined in this report also increase. The costs associated with adhering to any of the proposed international environmental standards vary greatly due to feedlot location. The environment pillar of the Agricultural Policy Framework is voluntary therefore feedlots that are located where environmental protection is already sufficient due to natural surroundings would likely enter the environmentally responsible beef supply chain. The feedlots in areas with less natural environmental protection would not be likely to join the environmentally responsible beef supply chain due to the high costs involved.

The analysis in Part II suggested that being able to pinpoint the origin of a systems breakdown will reduce the liability risks of firms because, in the absence of a clear culprit, a finding of joint liability may arise – meaning a firm will be required to pay a portion of the liability award even if it was diligent in its activities. As a result, firms may be deterred from joining attempts to produce and market "environmentally friendly" or "super safe" food. Further, a poor traceability system may encourage free riding because the full cost of failing to act diligently is not bourn by the individual firm.

Different legal systems determine and value liability in different ways. In some jurisdictions, particularly the US, awards tend to be significantly higher than in Canada. The conventions of private international law, however, suggest that Canadian courts are bound to enforce judgments of foreign courts. A number of activities firms and or supply chains can take to reduce these high liability risks were outlined. They included prespecifying legal jurisdictions, contractual arrangements with supply chain partners, documenting due diligence, independent monitoring, etc. It is clear, however, that ex ante actions cannot ensure freedom from liability in complex food systems that involve a large number of firms in supply chains and when those supply chains cross international borders.

Both economic and legal factors should inform the decision to participate in the production of "environmentally friendly" or "super safe food". While the shape of the international and domestic regimes to allow product differentiation on the basis of environmental or food safety attributes is not yet clear, players in the agricultural industry considering long term investments in new facilities should do so within the broad parameters outlined in this report.

LIST OF REFERENCES

AgInfoLink Global Inc. 2002. "Technical Information." Available on-line at: (www.aginfolink.com/webpages/technical_frames.html)

Agriculture and Agri-food Canada. 2002. *Putting Canada First: An Architecture for Agricultural Policy in the 21st Century*. Ottawa, Ontario. Government of Canada.

Akerlof, G.A. 1970. "Market for 'Lemons': Qualitative Uncertainty and the Market Mechanism." *Quarterly Journal of Economics* 84(3): 488-500 (August).

Alberta Agriculture, Food and Rural Development and Alberta Cattle Feeders' Association. 2002. *Beneficial Management Practices – Environmental Manual for Feedlot Producers in Alberta.* Edmonton, Alberta: Government of Alberta.

Alberta Agriculture, Food and Rural Development. 2001. *A Review of the Competitive Position of Alberta's Primary Beef Production Sector.* Edmonton, Alberta: Government of Alberta.

Annand, M. 2002. Barrister and Solicitor. Personal Communication.

Annand, M. 2001. "Intensive Livestock Operations: Hog Wild or Chicken Little?" Presented at the Canadian Bar Association Annual Meeting. August 15, 2001. Centre for Studies in Agriculture, Law and the Environment, University of Saskatchewan.

Baer, M., J. Blom, E. Edinger, N. Rafferty, G. Saumier, and C. Walsh, 1997. *Private International Law in Common Law Canada: Cases, Text and Materials*. Toronto: Edmond Montgomery Publications Limited.

Basset, J., D. Latendresse, T. Russell, and J. Veness. 2002. "Northwest Feeders Ltd." College of Commerce/College of Agriculture, Agribusiness Venture Management Business Plan. University of Saskatchewan.

Beghin, John and Mark Metcalfe. 2000. "An international perspective on environmental regulation and competitiveness in the hog industry." *Choices* 15(1): 28-33 (First Quarter 2000).

Bergström, M., R. Hellqvist and M. Ljung. 1999. "Farm Certification: Implementing and using quality and environmental management systems in Swedish agriculture." Proceedings of the conference for Adding Value through Environmental Marketing: Opportunities for Food Producers, Processors and Retailers. Madison, Wisconsin: December 6-7 1999.

LIST OF REFERENCES (Cont'd)

Boardman, A.E., D.H. Greenberg, A.R. Vining, and D.L. Weimer. 1996. *Cost-Benefit Analysis: Concepts and Practice.* Upper Saddle River, NJ: Prentice Hall.

Boyer, M. and D. Porrini. 2002. "The Choice of Instruments for Environmental Policy: Liability or Regulation?" CIRANO: Scientific Series. Forthcoming in Timothy Swanson (ed.), "An Introduction to the Law and Economics of Environmental Policy: Issues in Institutional Design", 2002, Research in Law and Economics Series Vol. 20, Elsevier Science Ltd. Available on-line at: (www.cirano.qc.ca/pdf/publication/2002s-17.pdf)

Brethour, C., P. MacGowan, A. Mussell and H. Mayer. 2002. "Proposed New Environmental Legislation Affecting Canadian Agriculture." George Morris Centre. Guelph, Ontario. (www.georgemorris.org)

Bridges – Daily Update. 2001. Issue 1. Doha, Qatar: International Centre for Trade and Sustainable Development. November 10, 2001. (www.ictsd.org)

Bureau, J.C. and W. Jones. 2000. "Issues in Demand for Quality and Trade." Proceedings of the conference for Global Food Trade and Consumer Demand for Quality. Montreal, Quebec: June 26, 2000.

Cameron, M. and C. Trenouth. 1999. *Resource Management Act: Practice and Performance – A Case Study of Farm Dairy Effluent Management.* Wellington, New Zealand: Ministry for the Environment.

Canadian Cattleman's Association. 2002. "Canadian Meat Inspection: An Overview." Available on-line at: (www.cattle.ca/INDUSTRY)

Canadian Cattlemen's Association. 2001a. "Canadian Cattle Identification Agency." Available on-line at: (www.cattle.ca/CCIA)

Canadian Cattleman's Association. 2001b. "Voluntary On-farm Food Safety Verification for the Cow-Calf Producer: What's It All About?" Available on-line at: (www.cattle.ca/QSH/safety.htm)

Canadian Food Inspection Agency. 2001. "Food Safety Enhancement Program." Available on-line at: (www.inspection.gc.ca/english/ppc/psps/haccp)

Carruthers, G. 1999. "Environmental Management Systems and ISO 14000 in Australia – on and off-farm implementation and policy development." Proceedings of the conference for Adding Value through Environmental Marketing: Opportunities for Food Producers, Processors and Retailers. Madison, Wisconsin: December 6-7 1999.

LIST OF REFERENCES (Cont'd)

Cason, T.N. and L. Gangadharan. 2002. "Environmental Labeling and Incomplete Consumer Information in Laboratory Markets." *Journal of Environmental Economics and Management* 43(1): 113-134 (January).

Castelnuovo, R. 1999. "Environmental Management Systems in Agriculture." Proceedings of the conference for Adding Value through Environmental Marketing: Opportunities for Food Producers, Processors and Retailers. Madison, Wisconsin: December 6-7 1999.

Centre for Studies in Agriculture, Law, and the Environment. 1996. "Expanding Intensive Livestock Operations in Saskatchewan: Environmental and Legal Constraints." Final Report to the Saskatchewan Agricultural Development Fund and the Saskatchewan Department of Agriculture and Food. University of Saskatchewan. Saskatoon, Saskatchewan.

Clarke, A., M.L. Harvey and D.J. Kane. 1999. "Attitudes and behavior: Are produce consumers affected by eco-labels?" Social Sciences Institute, Natural Resources Conservation Service, United States Department of Agriculture. Washington, DC. (www.ssi.nrcs.usda.gov)

Coleman Natural Beef. 2002. "What makes Coleman Natural Beef different?" (www.colemannatural.com)

Colorado Agricultural Protection Act. 1981. Article 3.5 – Nuisance Liability of Agricultural Operations. (www.law.utexas.edu)

Colorado Department of Public Health and Environment. 1999. Regulation No. 81. Confined Animal Feeding Operations Control Regulation. Water Quality Control Commission. 5 CCR 1002-81.

Edgell, D.F. 2000. *Product Liability Law in Canada*. Toronto: Butterworths Canada Ltd.

Eradus, W. 2001. "Keeping a tab on livestock; Standardization of electronic animal identification." ISO Bulletin. January 2001. (www.iso.ch)

Food and Drug Administration. 2001. "HACCP: A State-of-the-Art Approach to Food Safety." Available on-line at: (www.cfsan.fda.gov/~lrd/bghaccp.html)

Freedman, W. 1997. *Joint and Several Liability: Allocation of Risk and Apportionment of Damages*. Boston: Butterworth Legal Publishers.

LIST OF REFERENCES (Cont'd)

Freeze, B., J. Height, F.J. Larney and A.F. Olson. 1999. "Economics of Windrow Composting and Land Application of Manure." Manure Management: Proceedings of a tri-provincial conference on Manure Management: p.311-320. June 22-25, 1999. Saskatoon, Saskatchewan.

Gaisford, J.D. and W.A. Kerr. 2001. *Economic Analysis for International Trade Negotiations: The WTO and Agricultural Trade*. Northampton, MA: Edward Elgar Publishing Ltd.

Golan, Elise, Fred Kuchler and Lorraine Mitchell. 2000. *Economics of Food Labeling*. Economic Research Service, United States Department of Agriculture. Agricultural Economic Report No. 793.

Grannis, J. and D. Thilmany. 2000. *Marketing Opportunities for Natural Beef Products in the Intermountain West.* Fort Collins, Colorado: Department of Agricultural and Resource Economics. AMR 00-02. (dare.agsci.colostate.edu/extension/pubs.html)

Hacker, R.R. and Z. Du. 1993. "Livestock Pollution and Politics.**"** Proceedings of the First International Symposium on Nitrogen Flow in Pig Production and Environmental Consequences. Wageningen, The Netherlands: June 8 - 11 1993. EAAP Publication No. 69.

Hobbs, Jill E. 2001. "Information Asymmetry and the Role of Traceability Systems." Working paper: Department of Agricultural Economics, University of Saskatchewan.

Hodgins and Company. 2002. *Market Intelligence – Organic Beef.* Saskatoon, Saskatchewan. Report prepared for Saskatchewan Agriculture, Food, and Rural Revitalization.

Howard, A.E. 2001. *Agronomic limits for soil phosphorus in Alberta: A Review*. Edmonton, Alberta: Alberta Agriculture, Food and Rural Development.

Iowa State University Extension. 2001. "Comments regarding EPA's proposed rules concerning the National Pollutant Discharge Elimination System Permit Regulation and the Effluent Limitations Guidelines and Standards for Concentrated Animal Feeding Operations." Ames, Iowa, United States. (extension.agron.iastate.edu)

Iowa State University Extension. 1999. "Quality Assurance Programs in Beef Production: A Study Tour of Denmark, Holland and the United Kingdom." Ames, Iowa, United States. (www.ibc.iastate.edu)

LIST OF REFERENCES (Cont'd)

International Organization for Standardization. 2001a. "The Magical Demystifying Tour of ISO 9000 and ISO 14000." Available on-line at: (www.iso.ch)

International Organization for Standardization. 2001b. "What is ISO?" Available on-line at: (www.iso.ch)

International Organization for Standardization (ISO). 1998. "ISO 14000 – Meet the whole family!" Discussion Paper. (www.iso.ch)

Isaac, Grant. 2001. "Regional Trade Agreements: Food Safety and Eco-labeling Regulations." Final Report to the International Trade Policy Unit – London School of Economics and the European Commission DG-I (Trade).

Isaac, Grant and Steven Woolcock. 1999. *Green labels: Consumer interests and transatlantic trade tensions in eco-labeling*. London, England: Consumers International.

Kindred, H.M. et al. 1993. *International Law: Chiefly as Interpreted and Applied in Canada*. 5th ed. Toronto: Edmond Montgomery Publications Limited.

Klar, L.N., A.M. Linden, E.A. Cherniak, P.W. Kryworuk and L.D. Rainaldi. 1995. *Damages and Remedies in Tort*. Toronto: Thomson Canada Ltd.

Lammers-Help, Helen. 2001. "Manure rules drive Dutch farmers to Canada." *Country Guide* (January 2001).

Lawrence, J.D. 2002. "Quality Assurance "Down Under": Market Access and Product Differentiation." Ames, Iowa: Midwest Agribusiness Trade Research and Information Center, Iowa State University. MATRIC briefing paper 02-MBP1. (www.matric.iastate.edu)

Livestock and Poultry Environmental Stewardship Development Team. 2002. *Livestock and Poultry Environmental Stewardship Curriculum***.** Ames, Iowa: MidWest Plan Service. (www.lpes.org)

Manitoba Agriculture and Food. 2000. "Livestock Stewardship 2000." Discussion Paper. Winnipeg, Manitoba. (www.gov.mb.ca)

Maverick Ranch Beef. 2002. "Certified Organic Beef from Maverick Ranch High Meadows Brand Beef." (www.maverickranch.com)

Meat and Livestock Australia. 2002. "National Livestock Identification Scheme." Available on-line at: (www.mla.com.au/content.cfm?sid=131#)

LIST OF REFERENCES (Cont'd)

Meat and Livestock Australia. 2000. *National Beef Cattle Feedlot Environmental Code of Practice.* North Sydney, New South Wales, Australia: Meat and Livestock Australia Ltd.

Metcalfe, Mark. 2002. "Environmental Regulation and Implications for Competitiveness in International Pork Trade." *Journal of Agricultural and Resource Economics* 27(1): 222-243 (July).

Ministry for the Environment. 1999. *A guide to preparing a basic assessment of environmental effects*. Wellington, New Zealand. (www.mfe.govt.nz)

Ministry of Agriculture, Fisheries and Food. 2001. *Guidelines for Farmers in NVZs*. London, England. (www.defra.gov.uk)

Ministry of Agriculture, Fisheries and Food. 1998. *Code of Good Agricultural Practice for the Protection of Soil*. London, England. (www.defra.gov.uk)

Minnesota Pollution Control Agency. 2001. *Revised Feedlot Rules at a Glance – Minnesota Rules chapter 7020*. St. Paul, Minnesota. (www.pca.state.mn.us)

Moe, Mogens. 1995. *Environmental Administration in Denmark.* Copenhagen, Denmark: Ministry of Environment and Energy, Danish Environmental Protection Agency.

Mureau, Niels. 2000. "The Concept of 'License to Produce': Definition and Application to Dairy Farming in the Netherlands." Proceedings of the European Rural Policy at the Crossroads conference. University of Aberdeen, Scotland: June 29 – July 1, 2000.

Nagy, C.N., J.J. Schoenau, and A. Schoney. 1999. "Economic Returns and Hauling Distance of Hog and Cattle Manure." Manure management: Proceedings of a tri-provincial conference on manure management: p.489-499. June 22-25, 1999. Saskatoon, Saskatchewan.

National Agricultural Statistics Service. 2002. *Cattle on Feed.* July 19, 2002. United States Department of Agriculture.

O'Byrne, T. 2002. "Treating feedlot runoff water lowers phosphorus levels." *Canadian Cattlemen* 65(10): 24-25 (Fall 2002).

O'Connor, D.R. 2002. "Report of the Walkerton Inquiry Part One: The Events of May 2000 and Related Issues." Queen's Printer for Ontario. Available on-line at (www.walkertoninquiry.com)

LIST OF REFERENCES (Cont'd)

Ontario Ministry of Agriculture and Food. 2002. "Ontario Environmental Farm Plan." Available on-line at: (www.gov.on.ca/OMAFRA)

Ontario Ministry of Agriculture and Food. 2002. "Ontario signs on to Agricultural Policy Framework." News release: June 28, 2002. (www.gov.on.ca/OMAFRA)

OECD. 1997. "Eco-Labeling: Actual Effects of Selected Programmes." OECD/GD(97) 105. Available on-line at: (biodiversityeconomics.org)

Osborne, P.H. 2000. *Essentials of Canadian Law: The Law of Torts*. Toronto: Irwin Law.

Outlaw, Joe L., David P. Anderson and Daniel I. Padberg. 1997. "Relationships Between Market Price Signals and Production Management: The Case of Fed Beef." *Journal of Agricultural and Applied Economics* 29(1): 37-44 (July).

Phillipson, M., and M. Bowden. 1999. "Environmental Assessment and Agriculture: An Ounce of Prevention is Worth a Pound of Manure." *Saskatchewan Law Review* 62(2): 415.

Raynaud, E. and L. Sauvee. 1999. "Common Labeling and Producer Organizations: A Transaction Cost Economics Approach." Proceedings of the 67th EAAE Seminar: The socio-economics of origin labeled products in agrifood supply chains: spatial, institutional and co-ordination aspects. Le Mans, France: October 28 – 30, 1999.

Roach, K. 1996. *Essentials of Canadian Law: Criminal Law*. Toronto: Irwin Law.

Samuel, G. 2000. *Sourcebook on Obligations and Legal Remedies*. 2nd Ed. London: Cavendish Publishing Ltd.

Saskatchewan Agriculture, Food and Rural Revitalization and Saskatchewan Environment and Resource Management. 2001. *Environmental Review Guidelines for Intensive Livestock Operations*. Regina, Saskatchewan. (www.agr.gov.sk.ca)

Saskatchewan Agriculture, Food and Rural Revitalization. 2000. *Manual for Developing a Manure and Dead Animal Management Plan*. Regina, Saskatchewan. (www.agr.gov.sk.ca)

_____. 1999. *Holding pond site selection and design.* Farm Facts series. Regina, Saskatchewan.

LIST OF REFERENCES (Cont'd)

_____. **1998.** *Intensive Livestock Operations (ILO) Review and Approval Process*. Regina, Saskatchewan. (www.agr.gov.sk.ca)

Smith, G.C. 2000. "Providing Assurances of Quality, Consistency, Safety and a Caring Attitude to Domestic and International Consumers of U.S. Beef." Proceedings of the 49th Annual Montana Nutrition Conference. Bozeman, Montana: April 25, 2000.

Statistics Canada. 2002. *The Daily.* Tuesday, February 19, 2002.

Tetley, W. 1999. "Current Developments in Canadian Private International Law." 78 Canadian Bar Review 152-199.

United States Environmental Protection Agency. 2001a. *Cost Methodology Report for Beef and Dairy Animal Feeding Operations*. Office of Water. Washington, DC. EPA-821-R-01-019.

_____. **2001b.** *Cost Methodology Report for Swine and Poultry Sectors*. Office of Water. Washington, DC. EPA-821-R-01-018.

_____. **2001c.** *Economic Analysis of the Proposed Revisions to the National Pollutant Discharge Elimination System Regulation and the Effluent Guidelines for Concentrated Animal Feeding Operations*. Office of Water. Washington, DC. EPA-821-R-01-001.

_____. **2001d.** *Environmental and Economic Benefit Analysis of Proposed Revisions to the National Pollutant Discharge Elimination System Regulation and the Effluent Guidelines for Concentrated Animal Feeding Operations*. Office of Water. Washington, DC. EPA-821-R-01-002.

_____. **2001e.** *Proposed Regulations to Address Water Pollution from Concentrated Animal Feeding Operations*. Office of Water. Washington, DC. EPA-833-F-00-016.

Unterschultz, J.R. and S.R. Jeffrey. 2001. *Economic Evaluation of Manure Management and Farm Gate Application; A Literature Review of Environmental and Economic Aspects of Manure Management in Alberta's Livestock Sectors.* Edmonton, Alberta: Department of Rural Economy. Faculty of Agriculture and Forestry, and Home Economics. University of Alberta.

Van Os, M. 1999. *Quality marks for organic, sustainably produced beef.* Wageningen, The Netherlands: Research Institute for Animal Husbandry. RSP Publication 149.

LIST OF REFERENCES (Cont'd)

Volpi, R. 2002. "IP System for Beef Production." Paper presented at the AAEA Visions 2002 Conference. Red Deer, Alberta. May 2 - 3, 2002.

Waskom, R.M. 1994. *Best Management Practices for Phosphorus Fertilization.* Fort Collins, Colorado: Colorado State University Cooperative Extension. Bulletin #XCM-175.

World Trade Organization. 2001. *Draft Ministerial Declaration*. Doha, Qatar: Fourth Ministerial Conference. November 14, 2001. (www.wto.org)

World Trade Organization. 1994. *Agreement on Technical Barriers to Trade.* Uruguay Round Final Act. Geneva, Switzerland. (www.wto.org)

Yiridoe, E.K., J.S. Clark, G.E. Marett, R. Gordon and P. Duinker. 2002. "ISO 14001 EMS Standard Registration Decisions Among Canadian Organizations." Working paper: Department of Business and Social Sciences, Nova Scotia Agricultural College.

TABLE OF STATUTORY INSTRUMENTS

Agricultural Operations, Part 2 Matters Regulation. Alta. Reg. A-7 RSA 2000 257/2001.

Agricultural Operations, Standards and Administration Regulation. Alta. Reg. A-7 RSA 2000 267/2001.

Agricultural Operations Act, s.s. 1995. c. A-12.1.

Agricultural Operations Practices Act, 2001. c. A-7 RSA 2000 (Alberta).

*Agricultural Operations Regulations***.** Sask. Reg. A-12.1. Reg. 1.

Canadian Environmental Assessment Act, 1992, c.37

Canadian Environmental Protection Act, 1999, c.33

Canadian Food Inspection Agency Act, 1997, c.6

Environmental Assessment Act, s.s. 1979-80. E-10.1.

Environmental Planning and Assessment Act, 1979. State Environmental Planning Policy No.30 – Intensive Agriculture, 2000. New South Wales.

Environment Protection Act, 1993. Schedule 1. South Australia.

Health of Animals Regulations, C.R.C., c.296; SOR/91-525

Health of Animals Act, 1990, c.21

Protection of the Environment Operations Act, 1997. New South Wales.

Sale of Goods Act, R.S.S. 1978, c.S-1