An Evaluation of the Canadian Quality Milk Program: an On-farm Food Safety Program for Dairy Producers

by

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ABSTRACT

Dairy Farmers of Canada developed the Canadian Quality Milk (CQM) program, an on-farm HACCP-based food safety program. This thesis evaluates the material, costs and time commitments, effects on milk and meat safety, and dairy producers' opinions of the program.

Fifteen volunteer dairy producers were trained, and implemented the program. Questionnaires, interviews and participant observation were used to gather producers' opinions of the program. Most of the data collected was qualitative, therefore, the results do not reflect numbers of people with the same opinion but rather the range of opinions that the participants expressed.

One farm discontinued the trial, but 14 farms were audited (evaluated on adherence to the program's requirements). Five passed, 5 conditionally passed (had minor food safety problems, e.g. milkhouse cleanliness) and 4 failed (had critical food safety problems, e.g. non-potable water). On average, producers spent 11 hours writing initial records and 10 minutes maintaining daily records. The average initial program cost was $1,068 and annual costs were estimated at $1,404.

Some producers felt that the program was positive, but others thought it was unnecessary. Most wanted the program simplified and had difficulty understanding the new concepts of HACCP. Everyone wanted compensation for implementing the program, and some were concerned that this program and other programs being developed (e.g. Nutrient Management) would become too expensive to maintain.

Some common themes that emerged from the trial were producers' resistance to change their practices and ways of thinking, antibiotic administration, extralabel veterinary prescriptions and lack of concern for meat safety. Furthermore, it was felt that the program needs to add pesticide storage procedures, annual equipment checks, and veterinary treatment protocols. On-farm auditors need extensive training and an audit protocol.

In conclusion, the CQM program needs to work with all stakeholders in the industry (e.g. veterinarians and equipment dealers), be implemented uniformly across Canada and develop a communication plan from producers to consumers. Furthermore, the CQM program has potential to be an effective tool to reduce food safety risks; however, its implementation needs more work to reduce inconsistencies, gain producer acceptance and ensure credibility from the farm to the consumer.

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1.0 Introduction

Food: we depend on it every day for subsistence, nutrition, social interaction, comfort and often, our livelihood. As humans, we feast on many living organisms from bacteria to complex plants and animals and every time we eat, we take the risk of becoming sick. Food safety concerns have always been present but today various strategies and programs have been developed to reduce risk and provide safe food to consumers.

1.1 History of Food Safety Concerns and Food Inspection

Food safety has always been integral to our survival and success, and food preservation has helped sustain us through times of abundance and times of scarcity.

Preservation techniques, such as cooking, canning, drying, fermenting, salting or pickling and refrigeration were all developed to ensure a dependable and safe food supply. Louis Pasteur developed pasteurization in 1864 when he discovered that heating wine to 122-140°F would prevent it from spoiling, which led to the pasteurization of milk (Berry and Reynolds, 2001). However, despite efforts to keep food safe, food has been purposely contaminated or tampered with for centuries (Food and Agriculture Organization of the United Nations and World Health Organization, 1999).

Deliberate food contamination was rampant in the Middle Ages, as venders tried to make more money by volume of food sold by adding water to wine and clay to flour. Many individual

European countries passed laws regarding the quality and safety of eggs, sausages, cheese, beer, wine and bread during this period and some of them still exist today (Food and Agriculture Organization of the United Nations and World Health Organization, 1999).

In the mid 1800's, the UK passed a number of general laws to prevent food fraud and by 1862 they began to develop a system of meat inspection by veterinarians in response to public demand for safe meat. Robert Van Ostertag developed a rigorous scientific inspection program in Berlin in the 1890s that is still employed as the basis for meat inspection today (Fabiansson and Cunningham, 2000). The Pure Food and Drug Act and Meat Inspection Act, introduced in the United States in 1906, sparked the beginning of meat inspection in the United States by demanding that all meat and meat products moving between states be inspected (Food Safety and Inspection Service, 2000). In the early 1900's, Canada followed suit and enacted legislation to regulate meat inspection in processing plants (Manitoba Agriculture and Food, 2000).

The Food and Agriculture Organization (FAO) was founded in 1945 and part of its mandate included international food standards associated with nutrition. Three years later the World Health Organization (WHO) was founded with the mandate of human health and establishing food standards. Austria created a regional food code called the *Codex Alimentarius Europaeus* in 1954-1958, which was taken over by FAO and WHO and made into the Codex Alimentarius, commonly called Codex, in 1963 (Food and Agriculture Organization of the United Nations and World Health Organization, 1999). Codex is referred to as the international food code and its purpose is to protect the health of consumers, facilitate international trade and resolve trade disputes in international law. Codex brings many countries together to develop and agree on food standards and presently, the 165 member countries represent 97% of the world's population.

Food safety problems have recently become a large concern for consumers. Consumers are increasingly concerned about what is in their food, how it is produced and how safe it is. Food safety is considered to be a consumer's right and a producers' and processors' responsibility (Todd, 2000). As a result, food safety and quality assurance programs have been developed to assure consumers that the food they are purchasing is as safe as it possibly can be.

1.2 Development of HACCP

The Hazard Analysis Critical Control Point (HACCP) concept evolved from a number of philosophies. George Edwards and Walter Shewhart began to change the concept of quality during the 1920's while they were working for Bell Telephone's research laboratories. Shewhart looked at inconsistencies in products, categorized events as controlled or uncontrolled and decided that uncontrolled events had to be eliminated to produce a consistent product. Edwards, however, coined the term "Quality Assurance" and the idea of quality management (Fabiansson and Cunningham, 2000). Further developments from the United States included the publications "Total Quality Control" by Armand Feigenbaum in 1951 and the "Quality Control Handbook" by Joseph Juran in 1979. In the 1950's, Dr. W.E. Deming and his colleagues developed the Total Quality Management approach, a "total systems' approach" that improved quality and lowered costs, leading to the development of HACCP (Canadian Food Inspection Agency, 2001b).

In the 1960's, the Pillsbury company was asked to produce the first space foods for the Mercury flights (the first manned space program for the United States). Along with the National Aeronautics and Space Administration (NASA) and the US Army Natick Research and Development Laboratories, they began to develop a system of food production to ensure the end product was safe for astronauts to eat. The existing food safety programs relied on end-product

testing which did not guarantee a safe product and destroyed much of the production lot for testing. They eventually developed a system to manufacture food with almost zero defects by continually monitoring the raw materials, process steps, environment, staff and Critical Control Points (CCPs) during the process. They continued to strengthen the program until HACCP was fully developed and they implemented the program across their processing plants by 1971 (Bauman, 1992).

HACCP was not introduced to the rest of the processing industry until 1971. In 1974, HACCP principles were included in the low acid canned food regulations by the U.S. Food and Drug Administration, and in the 1980's other major food companies began to adopt HACCP principles as well. In 1985, the U.S. National Academy of Science wrote "the Green Book," encouraging all food processors to implement HACCP principles (Canadian Food Inspection Agency, 2001b) because they felt that the Food Safety Inspection Service (FSIS) should reduce their reliance on organoleptic (sight, smell, taste) inspection and employ prevention-based systems. By 1997, FSIS was considering HACCP for slaughter inspections as well (Cates et al. 2001).

In 1993, Codex Alimentarius created the "Guidelines for the application of the Hazard Analysis Critical Control Point (HACCP) System" which represented full international acceptance of HACCP as a food safety management system, and four years later, Codex named HACCP as the preferred quality management system (Codex, 1997). In December 1999, the Canadian Food Inspection Agency stated that they would require HACCP in all federally registered meat and poultry slaughtering facilities registered under the Meat Inspection Act (Hovey, 2001a).

Currently, dairy processing plants are also implementing HACCP programs but the process is slow and approximately half of the federally registered processing plants across Canada are

accredited. Processors have begun to implement HACCP in order to satisfy customers but also to avoid recalls and food-borne disease outbreaks. Bacterial contamination in a Japanese milk plant resulted in 15,000 people becoming sick (Maulsby, 2000). All 20 plants were shut down and the company had to seek over $280 million in emergency credit to re-open. This incident illustrates how expensive recalls and food-borne illness outbreaks can be for processing plants; HACCP programs are designed to minimize food safety problems. Furthermore, HACCP programs should reduce operations' liability by demonstrating due diligence and, thereby, protecting farms and processors from lawsuits from consumers (Moore, 2000). As processors implement HACCP, they examine the safety of all raw products coming in. Since they cannot control the safety of these inputs, they need the supplier or the farmer to provide guarantees of safety. For the first time, farmers are being asked to guarantee the safety of their products.

HACCP programs are also surfacing in grocery stores and restaurants and HACCP is being considered for the transportation industry that ships both raw and finished products; hence the phrases "gate to plate," "farm to fork," "stable to table," "paddock to plate," and "hook to cook" have emerged. In the United States, Albertson's Inc (the second largest food retailer) requires all of its produce suppliers to have their Good Agricultural Practices verified by a third party. In Canada, Safeway was asking the same from its lettuce and pepper suppliers (Moore, 2000), although they have recently relaxed these requirements. In the United Kingdom, retailers must comply with food safety regulations and as a result, they have placed greater pressure on their suppliers to have audited programs in place. Tesco (United Kingdom's biggest food retailer) demands all of its primary suppliers to be on a HACCP program. Furthermore, United Kingdom retailers subject food businesses in the Netherlands, Sweden and Canada to audits (Todd, 2000). This may lead to those food businesses being required to extend their programs back to farms.

Increased regulations may also impact HACCP adoption. The European Union recently revised its food safety and hygiene regulations to include primary producers for the first time (Todd, 2000). Australian farmers experience pressure to implement food safety programs from processors, retailers and government. Two Australian dairy processors will not collect milk unless the farm is accredited under a recognized HACCP program. As a result of this commercial and regulatory push, the majority of dairy farmers in Queensland and all dairy farmers in New South Wales' are accredited (Juffs, 2000).

International markets are also starting to demand food safety, traceability, animal welfare and environmental stewardship assurances. In order to compete, a producer or processing plant will have to meet international requirements in various areas. The media and others (e.g. People for the Ethical Treatment of Animals, Greenpeace) also play a role in food safety concerns by highlighting scares and possible hazards to consumers, and often distorting the problem.

1.3 HACCP Defined

HACCP is a systems approach that focuses on reducing food safety risks. It is based on the concept that "prevention is better than cure" (Moore, 2000).

True HACCP programs are split into 2 parts: prerequisites and the HACCP plan (Canadian Food Inspection Agency, 2001b). Prerequisites are the foundation that a HACCP plan is built on. They are also referred to as Best Management Practices (BMPs), Good Production Practices (GPPs) and Good Agricultural Practices (GAPs), which are generally accepted procedures that demonstrate an operation has complete control of everyday activities. BMPs are not necessarily critical to food safety but support food safety initiatives. The 6 prerequisite categories are:

1. **Premises.** Buildings, property, equipment sanitation and water source are designed to prevent contamination of food.
2. **Transportation and Storage.** Incoming ingredients and finished products are transported and stored safely.
3. **Equipment.** Equipment is designed, installed and maintained to prevent contamination of food.
4. **Personnel.** Staff are trained in proper food handling techniques and hygiene.
5. **Sanitation and Pest Control.** Adequate equipment sanitation and pest control programs are in place.
6. **Recalls.** A written procedure is maintained that explains how to remove contaminated product from the market if a food safety problem occurs.

Once the prerequisites are complete, the HACCP program is developed, and this process includes 12 steps (Canadian Food Inspection Agency, 2001b). The first 5 steps are:

1. **Assemble the HACCP Team.** A team of people is established to implement the program and ensure commitment from all levels of management.
2. **Describe the Product.** The product description includes ingredients, incoming ingredients, packaging and storage specifications. This information guides the team in assessing all the possible hazards associated with the particular product.
3. **Identify the Intended Use.** The intended use specifies the expected use of the product by consumers or end-users (e.g. restaurants, processors).
4. **Construct Process Flow Diagram and Plant Schematic.** These diagrams show all the steps in the production of the product and where each step occurs in the operation. They help identify potential areas of cross-contamination.

5. **On-site Verification of Flow Diagram and Plant Schematic.** The diagrams must be checked with the operation to make sure they are accurate.

The next steps in implementing a HACCP-based program are the 7 HACCP principles:

6. **Hazard Analysis.** The hazards are any input or process that could affect the safety of the end product. Hazards are determined and the risks associated with them are assessed (e.g. a chemical hazard would be antibiotic residues).
7. **Identify Critical Control Points (CCPs).** A CCP is any point or process where a loss of control (or deviation) may result in an unacceptable health risk to the consumer. For example, milk temperature in the farm holding tank is a Critical Control Point because if it rises above a certain temperature, the bacteria begin to multiply and cause a food safety concern.
8. **Establish Critical Limits.** Every HACCP program must determine how to ensure/test that each CCP is controlled. For example, the temperature of the milk in the farm holding tank must be between 0°C and 4°C.
9. **Monitor CCPs.** Each CCP must be monitored to ensure adequate control is maintained and records must be kept to allow for the investigation and correction of any problems. For example, milk tank temperatures are recorded after every milking.
10. **Set Protocols for Corrective Actions.** Contingency plans should outline the steps needed if a CCP is found to be out of control. For example, if the milk temperature is higher than it should be, the plan should outline the necessary steps a staff member should take to ensure it is cooled down or, if the milk is contaminated, the steps to ensure it does not enter the food supply.

11. **Verify.** Verification testing assesses the effectiveness of the program. For example, milk tank receivers measure the temperature of every tank of milk to make sure it is cool enough before they pump it into the truck and then every truck of milk is tested at the processing plant for bacteria. If the milk temperature was too high before pick-up, the bacteria count will be high, indicating that the producer's program is not effective and needs to be revised.
12. **Establish a Record-Keeping System.** Records provide a reliable, clear and concise source of information to any staff member, at any time.

The 6 prerequisites categories and 12 steps of HACCP are the tools any organization needs to guide them through developing their own HACCP program.

On-farm food safety programs are HACCP-based, because, unlike a processing plant, producers cannot achieve full control of hazards or sterilization on a farm. A farm is not a closed system and an animal is a metabolic unit, which results in fluctuating conditions (e.g. seasonal variation, animal traffic, disease). A HACCP-based program applies HACCP principles and reduces hazards and risks as much as possible. Furthermore, processing plants have to create their own HACCP plan by following the HACCP principles, but many of the national producer associations have gone through those steps and created generic programs for producers that outline the mandatory food safety concerns, how to address them and the required records.

1.4 Current Dairy Legislation, Quality Parameters and Inspection Systems

Dairy is one of the most regulated industries in Canadian agriculture. Complying with regulations is a prerequisite for any HACCP program. Statistics from the United States show

that the introduction of farm inspections reduced the incidence of milk-borne infections from roughly 25% of all food-related infections in 1938 to less than 1% today (Anderson, 2000). Dairy farmers across Canada must be licensed to ship milk because milk is a perishable product and strict standards of sanitation and equipment design must be adhered to in order to make sure that the milk is produced and stored safely.

The inspection programs are similar across all provinces with some variation due to the number of farms and available government resources. For example, in Ontario, Dairy Farmers of Ontario run the inspection program and inspect each farm every 2 years. Additional inspections are carried out if quality problems occur. Saskatchewan, on the other hand, only has one government inspector who is responsible for many other tasks as well; therefore, the province's inspection program is limited. In British Columbia, producers must be inspected by the British Columbia Ministry of Agriculture, Food and Fisheries and score 95% or higher to obtain their Certificate of Approval (license to ship milk). Once in operation, they are subject to random periodic inspections by the provincial government dairy inspector and quality problems or infractions trigger additional inspections. Producers must score 80% or higher on an inspection. If they score lower than 80%, they are subject to a re-inspection and if their areas of non-compliance are not corrected, their Certificate of Approval is suspended until the problems are rectified (British Columbia Ministry of Agriculture, Food and Fisheries, 2001a).

In B.C., like other provinces, milk is regularly tested for antibiotic residues, bacteria (Standard Plate Count), Somatic cells (Somatic Cell Count, SCC) and added water (Cryoscope Test), as each of these could affect food safety and/or quality. The Tank Milk Receiver (truck driver) takes a sample from each producer's tank every time the milk is picked up and each truck is tested for antibiotics. The minimum standard is 16 mm (diameter of the zone of inhibition) or

0.01667 IU (International Units) of Pen G (one International Unit of penicillin is equal to 600 parts per billion). If the result is positive, each individual producer sample is tested to determine who shipped contaminated milk. Individual producer milk samples are also tested for antibiotics at least once a month. A positive sample results in a penalty.

High Standard Plate Counts (SPCs) indicate that milk contains elevated bacterial populations. Most, but not all, bacteria in milk are killed through pasteurization at the processing plant; however, high bacteria counts in raw milk decrease shelf life and flavour of the final product, and provide risk of cross-contamination in processing plants (Levesque, 1998). The SPC is a technique that estimates the number of colony forming units (cfu; a cfu is a bacterial cell or clump of cells giving rise to a colony on SPC agar) and is indicative of a farm's overall cleanliness, including equipment, cows, barn and milking practices. Every farm is tested for SPC once a month. The legal limit for SPC, in Canada, is 50,000 cfu/ml and a count greater than 50,000cfu/ml constitutes an infraction (British Columbia Ministry of Agriculture, Food and Fisheries, 2001a).

The Somatic Cell Count measures the number of epithelial cells and leukocytes in a millilitre of milk. Leukocytes are part of the body's defence mechanism to fight infection; therefore, a high SCC often indicates that an animal has an udder infection. High SCC's affect flavour and reduce shelf life and cheese yield; they also indicate a higher potential to pass on food-borne illnesses caused by pathogenic micro-organisms in the udder (British Columbia Ministry of Agriculture, Food and Fisheries, 2001a). Furthermore, high SCC herds result in increased antibiotic administration and a greater risk of antibiotic residues in the product (Smith and Hogan, 2001). Farm holding tanks are tested for SCC once per month. The legal limit is 500,000 cells/ml.

Every B.C. farm is tested for added water 4 times a year using the Cryoscope Test. Results must be equal to or lower than 1.8 percent or –0.535 degrees Hortvet (-0.512 degrees Celsius). If the results are higher, the producer is penalized (British Columbia Ministry of Agriculture, Food and Fisheries, 2001a). Degrees Hortvet is the scale of measurement that the Cryoscope test equipment uses, and Hortvet was the name of the man who helped set up control standards during the development of milk cryoscopy. Normal cow's milk exhibits a relatively narrow freezing point range, and any water added to the milk dilutes it and raises its freezing point. Added water and freezing point elevation have a linear relationship; therefore, 1 percent added water raises the freezing point of milk by 1 percent (Parkin, 1981). Water freezes at 0.000 degrees Hortvet, but normal milk will freeze at –0.545 degrees Hortvet, on average.

The National Dairy Code (Canadian Food Inspection System, 2002) was created to provide provinces with national guidelines in an attempt to harmonize dairy inspection systems across the country. Most provinces adopted the Code, and provinces are continuing to work towards achieving equivalency. At the same time, Canadian dairy farmers must comply with a number of Acts such as the Milk Industry Act, the Feeds Act and the Waste Management Act (British Columbia Ministry of Agriculture, Food and Fisheries, 2001a). However, the Canadian Food Inspection Agency (CFIA) and Health Canada pushed to consolidate federal food and agricultural inputs legislation and created the Canada Food Safety and Inspection Act. This new Act deals with the Canada Agricultural Products Act, Meat Inspection Act, Fish Inspection Act, Seeds Act, Feeds Act and Fertilizers Act and all food related parts of the Food and Drugs Act and the Consumer Packaging and Labelling Act. The Canadian Food Inspection Agency enforces it. The new act should increase the efficiency of food inspection and cover everything from production to consumer purchase (Canadian Food Inspection Agency, 2001c).

1.5 Current Players in Canada

Since Canada adopted the HACCP approach for the agricultural industry, various programs and funding sources have sprung up to encourage HACCP development.

Agriculture and Agri-Food Canada launched the Food Safety Enhancement Program (FSEP) in response to the Department's Agriculture Policy Review in 1989, which emphasized the importance of food safety to consumers. FSEP's purpose is to encourage federally registered processing plants and shell egg grading stations to develop, implement and maintain HACCP principles. The Canadian Food Inspection Agency took the program over in 1997 and has been extending it to include on-farm programs (Canadian Food Inspection Agency, 2001a).

The Canadian Adaptation and Rural Development (CARD) program was developed in 1997 to further address food safety across the agricultural industry and two funds were set up. The National HACCP Adaptation Contribution Program was set up with $11.4 million to assist small and medium-sized processing plants. The program covered more than 800 processing plants, thus the fund provided about $10,000 per plant, representing 10-15% of the total implementation cost per plant (Todd, 2000). In May 1997, national producer organizations and Agriculture and Agri-Food Canada established the Canadian On-Farm Food Safety (COFFS) program, as a food safety program for farms consistent with Codex Alimentarius' HACCP and CFIA's FSEP. COFFS was given a $5 million grant from the CARD program and the grant is administered by the Canadian Federation of Agriculture (Canadian On-Farm Food Safety Program, 2000). The purpose of the COFFS program is to help national commodity groups develop their own programs and to ensure that the programs are consistent with international standards, such as ISO standards.

ISO, the International Organization for Standardization, is a worldwide federation of national standards bodies from 140 countries (ISO, 2002). It was established in 1947 and it promotes standardization to facilitate trade. ISO has developed a number of internationally accepted standards, such as the ISO 9000 series which deal with Quality Management Systems and ISO/IEC Guide 62:1996 General requirements for bodies operating assessment and certification/registration of quality systems and ISO/IEC Guide 65: 1996 General requirements for bodies operating product certification systems. The COFFS programs are being based on the ISO 9000 series and Guides 62 and 65.

Currently, the Working Group on Accreditation (formed by the Canadian On-Farm Food Safety Program) is working with CFIA to develop a recognition protocol for national on-farm food safety programs (Raw Foods of Animal Origin Secretary, 2001). CFIA has drafted their protocol and they piloted it in the winter of 2001-2002 with Chicken Farmers of Canada's Safe, Safer, Safest program. They are now making any necessary revisions before they open the process to other applicants. CFIA is going to recognize only one national program for each commodity and producers will have to belong to a CFIA-approved program to be accepted internationally.

1.6 Other Programs or Countries Implementing HACCP

Dairy Farmers of Canada (DFC) is one of many national producer associations that is developing an on-farm, HACCP-based, food safety program to assure domestic and international consumers that the food they are buying is safe. Dairy Farmers of Canada's program, Canadian Quality Milk (CQM), has been developed but not fully implemented yet. Many other national commodities are at various stages of development as well. The Canadian Bison Association and

Canadian Sheep Federation are in the process of writing their programs. The Canadian Cattlemen's Association has written the "Quality Starts Here" Reference Manuals and is now developing requirements and evaluation protocols. The Canadian Pork Council has written and implemented its program called "Canadian Quality Assurance" (CQA). The Canadian Egg Marketing Agency has created the "Start Clean – Stay Clean" program and Chicken Farmers of Canada has developed the "Safe, Safer, Safest" program. The Canadian Horticulture Council oversees their "On-Farm Food Safety Program for Fresh Fruits and Vegetables," but other versions are being developed for tomatoes, peppers, lettuce, mushrooms and berries provincially.

As of April 2001, 6,526 Canadian hog farmers had registered with the Canadian Quality Assurance (CQA®) Program and 2,202 hog farmers were actually recognized. That means 57.8% of the marketed hogs in Canada were raised by registered farmers and 22.7% of the marketed hogs in Canada were raised by CQA®-recognized farmers. To date the program has 239 recognized on-farm auditors (Canadian Pork Council, 2001).

On-farm HACCP-based programs are being implemented on farms across the world as well. The United States has a program called Dairy-BTM (Breakthrough Management) which is based on the 12 principles of HACCP (Cullor, 2001). Due to government facilitation, customer drive and regulatory demands, food safety and Quality Assurance (QA) programs have proliferated in Australia as well. Queensland has over 155 different QA programs (Fabiansson and Cunningham, 2000). The Australia New Zealand Food Safety Council has been trying to amalgamate the different programs and they have approved 3 of the 4 "national" Food Safety Standards. Queensland producers are required to have an approved food safety program in place to produce milk (Juffs, 2000) and New South Wales is implementing the Quality Plus^{2000} Initiative, which is based on HACCP principles and 'cow to consumer' food safety coverage

(New South Wales Dairy Corporation, 2001). Western Australia's government has implemented the SQF 2000^{CM} (Safe Quality Food) food safety program. The program is a HACCP-based food safety risk management system that includes all food chain stakeholders (Western Australia Government, 2000).

New Zealand has developed a quality assurance program called AMFARM that strives to reduce or eliminate the weaknesses in the current QA programs. Many of the current systems in New Zealand focus on ISO 9000 requirements with intimidating manuals and extensive records, whereas the AMFARM system attempts to be more practical, effective and user-friendly. The program also plans to add areas, such as the environment and animal welfare, and new quality concerns as they arise (Pedley, 2001).

Various European countries have been introducing QA programs on farms, such as Scotland, Germany, Italy, France, and the United Kingdom. The United Kingdom launched the National Dairy Farm Assured Scheme in September 1999; it covers all levels of the milk supply chain. The standards cover hygiene and food safety, housing and facilities, plant and equipment, feedstuffs and water, herd health, stockmanship and training, and contingency procedures (National Dairy Farm Assured Scheme, 2001). Even retailers and butchers are implementing HACCP. In the UK, over 7,000 butchers had to be trained in HACCP in order to meet the licensing requirements (Horrox, 2001).

1.7 Literature Evaluating HACCP and Quality Assurance Programs

Accreditation and certification programs are growing in popularity. Establishments from farms to grocery stores are being audited for compliance to standards, be it ISO 9000, HACCP or

individual Quality Assurance programs. Companies need to know how much time and money these programs will require and how they are going to benefit, before they decide to implement a program. Various research trials have strived to answer these questions in order to develop points of reference for businesses considering accreditation in one form or another.

One study measured the impact that implementing HACCP in meat and poultry processing plants would have on the economy as a whole. The study constructed a Social Accounting Matrix (SAM) model to extend the costs-benefit analysis of a HACCP program to include producers and consumers. Two models (one for the benefits of reducing food-borne illness and one for the costs of implementing HACCP) were run. The first model resulted in an economy-wide gain of $1.92 for every dollar saved through preventing premature deaths from food-borne illness; however, an economy-wide loss of $0.35 occurred for every dollar spent on HACCP implementation. Furthermore, the study found that the implementation costs were passed on to the consumer and their spending power decreased accordingly (Hovey, 2001b).

Motarjemi and Kaferstein (1999) explored the apparent paradox of the increase in food-borne illnesses in recent years and the corresponding implementation of HACCP. They found that HACCP was not failing but instead there was a widespread misunderstanding of what the system is designed to do. Furthermore, they found that changes in the food supply system have impacted food-borne illness incidents. Because of mass production and distribution, more people are affected when one company or product line has a problem. The food chain is also longer due to urbanization, and food-service establishments have grown dramatically and do not necessarily have employees trained in food hygiene. Other factors Motarjemi and Kaferstein found included: the health and demographic situation (e.g. population growth, increase in

number of vulnerable groups), social situations and lifestyles (e.g. more food consumed outside the home) and decreased resources and training in health.

Various trials and studies have evaluated HACCP's effectiveness and acceptance in processing plants. In the United States, the Food Safety Inspection Service (FSIS) encourages food processors to adopt HACCP programs because the FSIS is convinced that HACCP systems are superior to traditional inspection. Two studies tested this hypothesis in chicken and dairy processing plants and both concluded that HACCP models at least maintain and sometimes improve food safety and they are often superior to traditional inspection. These studies also found that the advantages of the HACCP programs were everyone (management and staff) had a better understanding of the operation, and employees were better trained and had an increased awareness of their impact on public health. They also found that HACCP programs require extra training for everyone involved (United States Food and Drug Administration, state and industry people) and a considerable commitment of money and time (Cates et al., 2001; Dersam, 2001).

Another study done with 33 Nebraskan processing facilities identified a number of challenges. The processors were faced with high time requirements for developing programs for large numbers of products and not enough staff to maintain records. They also suffered from a lack of technical expertise, scientific data, knowledge of regulations, surveillance data and understanding of the relationship between Good Manufacturing Practices and Standard Operating Procedures, and HACCP. These problems emphasized the need for outside assistance or training. The processors also found that too many Critical Control Points made the plan unmanageable and the processors did not know where to set their critical limits since there were no standards or regulations, or how to decide on monitoring and corrective action procedures. On the other hand, the processors noticed positive changes in monitoring of Critical Control

Points, employee hygiene, and record keeping, and the HACCP system resulted in decreased total bacteria loads on carcasses during slaughter (Brashears et al., 2001).

Two other studies explored the advantages and disadvantages of HACCP by looking at the dairy processing sector in the UK. The first one found that staff time spent keeping records was the largest cost. Eighty percent of the processors took 12 months or less to implement HACCP, 12% took longer than 18 months, and 54% found that the time required was greater than they had expected. This study also exposed some economies of scale, as costs increased for 53.5% of processing plants with 50 or fewer employees, but for only 32.1% of plants with more than 50 employees (Henson et al., 1999).

The other study found 4 key motivating factors for HACCP implementation: internal efficiency, commercial pressure, external requirements and good practice. There was wide-spread consensus that the most effective way to control food safety was through risk assessment and process control rather than end-product testing. However, the motivation for implementing HACCP seemed to hinge on regulatory pressure or market requirements. The major customers of 74% of the participating processors required HACCP from their suppliers (Henson and Holt, 2000).

Some of the benefits observed from the two studies were reduced product wastage, improved product quality, lower microbial counts, and an ability to retain existing customers and gain new customers. Only 5.3% of participants claimed they experienced no benefits with HACCP, and no one had major difficulties implementing or maintaining the program. However, the study highlighted the need for retraining and motivating staff.

Panisell et al. (1999) also studied HACCP implementation after it had been done in Europe for 3 years. Of the companies they surveyed, 50% implemented HACCP to increase the safety of their products, 37% due to customer pressure, 31.3% to meet legal requirements, 15.6% to fit into new trends and 3.1% because they had read about it and liked the idea. The main benefits the participants identified were evidence of safe food production, confidence of safety of their products, customer satisfaction, regulatory compliance, and improving quality management system. The main problems or barriers were convincing staff that HACCP is important and gaining commitment from management and allocating necessary resources to implement and maintain the program. Another major problem was a lack of knowledge and expertise. Companies tended to miss potential hazards, inaccurately consider risks and not put correct preventative measures in place due to a lack of understanding of the process. The study also found that small businesses were less likely to implement a HACCP program; especially those with fewer than 50 employees, and those supplying supermarkets were more likely to have a program in place. Typically, small companies lacked knowledge, expertise, resources (time, money, staff and management commitment) and understanding of HACCP.

Another study (Taylor, 2001) on small or single-owner businesses concluded that the burdens involved with HACCP implementation were change, expertise, time and money. Companies had little motivation to change because they believed they were producing a safe product already and they were not convinced that HACCP was effective or practical for their operations. They also needed more training, better access to information and follow-up support. Paper work was a time drain. Finally, the single-owner businesses found the verification or maintenance of a plan pointless as the owner is always on site and knows what is going on at all times. On the other hand, the study did discover some benefits such as confidence in products, a better understanding of food safety problems, reduced costs (less waste and more efficient utilization of staff), team

building, organizational development, legal protection and trading opportunities. The benefits, however, were not enough to outweigh the burdens, according to the owners.

Studies with scientific laboratories also shed light on concerns with accreditation systems. Large laboratories become more competitive with accreditation and, therefore, more profitable but smaller laboratories often do not reap the same benefits. A smaller laboratory in Texas did a 'gap' analysis comparing its current quality system with ISO Guide 25 requirements (Jones, 1998). The staff found that they met the requirements in many areas but two of the most deficient areas were (1) internal audits and (2) document (records) development and control. Both of these items required considerable time and effort from management and technical staff. Staff calculated that it would take 6 more full-time positions to obtain accreditation in 2 years plus more office space, equipment, furniture, training, and seminar and travel expenses. The program itself would require assessment, costing about $11,000 for 2 years. The grand total was about $300,000/year with roughly $215,000/year for each subsequent year to maintain the program. The staff determined that they could also implement the program with the existing staff but it would take up to 10 years, instead of 2. The conclusion was that the costs outweighed the benefits, particularly since accreditation would not increase their confidence in their analytical work. The staff decided to implement bits and pieces of ISO 25 and reconsider accreditation in the future when it may be more beneficial to the company.

Evaluations of on-farm HACCP programs are more difficult to find. The on-farm programs in Canada are relatively new and official trials have not been published. However, discussions of the potential benefits, challenges and concerns have occurred, as these programs are being implementing on farms around the world.

Cullor (1997) thought that implementing HACCP-based programs on dairy farms may be difficult due to a lack of science to determine Critical Control Points. He believed it would be difficult to improve food safety substantially by implementing an on-farm HACCP program. However, he thought that a HACCP-based program would enable government inspectors to expand their current scope of inspections and gain a detailed understanding of what producers are doing on a continual basis. Overall, he felt that records and education were the best areas for continuous improvement of food safety on the farm.

In the European Union, the food industry is concerned that small businesses and producers will be overwhelmed with too many requirements. Local authorities are also concerned that the staff required to assist producers and audit food safety programs will be too large. Producers generally accept the concepts but are wary of the increased record keeping and other requirements (EU Food Law News, 2001). Others have had difficulty determining Critical Control Points because the results are either technically infeasible or too expensive (Powell et al., 2001).

In conclusion, evaluations of HACCP and HACCP-based programs have yielded mixed results.

1.8 The Canadian Quality Milk Program

Dairy Farmers of Canada began strategizing on the development of the Canadian Quality Milk (CQM) program, an on-farm HACCP-based food safety program, in 1996. In July 1997, the delegates approved the concept and Dairy Farmers of Canada received funding from the Canadian On-Farm Food Safety program. A Technical Committee was set up to write the Reference Manual and a Steering Committee oversaw the whole program. Both committees were composed of industry experts, veterinarians, consultants and dairy producers from across

Canada. During the Reference Manual's development, 3 drafts were reviewed across the country by industry specialists, agriculture educators, researchers, veterinarians and dairy producers.

The program's objective is to improve milk and meat safety on dairy farms through improved management practices and an effective and practical "HACCP-based" program. For the CQM program, producers are required to:

- **write what they do** through Standard Operating Procedures (SOPs) (written instructions explaining how a particular task, such as milking, should be carried out) and emergency plans (written instructions outlining what staff should do if something goes wrong, such as who to call if the milk is warm),
- **do what they write** through the application of Best Management Practices and education of staff and family regarding daily tasks,
- **prove it** by keeping records, monitoring and verifying what they are doing,
- **improve it** by regularly updating and reviewing their plans.

Records, Standard Operating Procedures and emergency plans have to be maintained for the 5 mandatory Critical Control Points identified by the CQM program which are:

CCP1 – Use of livestock medicines and other chemicals

CCP2 – Cooling and storage of milk

CCP3 – Equipment sanitation (cleanliness)

CCP4 – Use of water for cleaning of milk contact surfaces

CCP5 – Administration of livestock medicines by injection (Dairy Farmers of Canada, 2001a).

Once the program is in place, a producer will be visited by an on-farm auditor who reviews records and the program's effectiveness. The on-farm auditor will decide whether or not the producer meets all of the program's objectives and then make a recommendation to the provincial body. The provincial body then decides whether or not to certify the producer. A third party will audit the national program regularly to ensure the program's credibility to international and domestic consumers.

By the fall of 2000, the Technical Committee had re-drafted the Reference Manual (Dairy Farmers of Canada, 2001a) and created a Workbook (Dairy Farmers of Canada, 2001b) which guided producers through implementation by outlining the program's mandatory requirements and providing sample records for them to follow. It soon became clear that the program needed to be tested and evaluated on actual dairy farms. British Columbia was chosen as the site for the pilot trial, with the trial commencing in October 2000. A group of volunteer producers implemented the program on their farms and evaluated the program through their experiences.

The goals of this study were to: evaluate the practicality and accuracy of the program according to the producers' experience, estimate the costs and time commitment for producers and trainers, improve milk and meat safety, and work alongside the producers to learn what opinions and assumptions they held about the program and how its implementation would affect their lives and businesses.

2.0 METHODS

I employed the methodology of cultural anthropology, specifically participant observation and in-depth interviews (see Appendices 1 and 2), in combination with quantitative methods, to gather data for this study. Participant observation techniques were employed whenever I came in contact with the producers on the trial, during the initial and final interviews, workshops and casual meetings. The interview schedules are in . Quantitative methodologies were employed for collecting data on water quality and milk quality.

2.1 Rationale

The qualitative methods enabled me to examine, in-depth, the various understandings, values, and beliefs the producers held about the CQM program and the dairy industry, which are socially and politically charged topics. It also enabled me to understand the meanings behind the producers' perspectives of the program.

As a participant observer, I used questionnaires and structured as well as unstructured interviews to gather data from the producers on the trial. Field notes were my primary method of recording data. Interviews and casual conversations were not taped. Taping would have led to more accurate documentation and precise phrasing of producers' thoughts, but many of the meaningful conversations would not have occurred in the presence of a tape recorder. The topics being discussed were highly sensitive, both politically and personally; hence, producers did not feel comfortable being taped.

Although the structured interviews were an important part of data collection, the majority of my research time was spent "hanging out with the natives," developing a relationship of trust and an understanding of their concerns and beliefs through informal conversations. The process thus more closely resembled building friendships rather than collecting data. A typical meeting was casual, occurring at the kitchen table over a cup of tea or in the barn. I usually received more honest comments while walking through the barn, walking back to my car or once the official part of a meeting was over. Often, we would not talk directly about the program but the conversations and observations I made regarding their farms gave me insight into their lives. I learned what their past experiences had been, who influences their decisions and what they think the future for the dairy industry holds. This knowledge helped me understand and more accurately interpret the meanings behind their opinions.

> "Even though perfect understanding is impossible, a measure of assurance about understanding can be gained from 'standing in the shoes of another'...
>
> There is a need to move beyond the traditional academic understanding that knowledge can be created in a vacuum, and begin to claim and incorporate the personal and political context from which the knowledge springs as part of the data gathering process" (Kirby and McKenna, 1989).

At the beginning of the trial, some of the participants did not think their involvement would impact the end result because they had seen other studies conducted on different projects and the projects continued regardless of their voiced opinions. However, as they became more

comfortable with the research style and confident in me, they became more willing to participate and trusted that their opinions would be heard.

Usually, the meetings were scheduled only with the owner or manager (my key informants) but often other family members or staff would be around and I began to know some of them quite well. Many of the producers' wives were usually in the background during a meeting, but they would often offer their opinions as well and I could see how they influenced farm decisions.

Often, my meetings were interrupted by staff with questions (e.g. how to work a new dehorning device), phone calls, feed representatives, fertilizer sales people and other activities. I always made sure that the trial moulded around the producers' schedules, as a result, I would patiently wait or reschedule to return at a better time. Occasionally, I would arrive for a meeting and the producer would not be there or would have forgotten completely. One producer had forgotten our appointment and was busy moving a pile of manure. The manure won and I went home. Dairy producers are extremely busy people, therefore, scheduling interviews or casual meetings was a challenge and I had to make sure that I saw them during a convenient time. I also met a few veterinarians and equipment dealers during my travels and these situations provided excellent opportunities to discuss the program and the effects it had on other people dealing with the program and its participants.

Gilling et al. (2001) followed qualitative methods to research HACCP impressions by conducting a series of in-depth telephone interviews to determine the barriers that existed to implementing HACCP programs. They felt it was necessary to conduct numerous interviews to gain the participants' trust because "perceptions and attitudes toward HACCP are complex and some of the barriers identified may have implications of personal failure and be guarded

against." Although these researchers gleaned more information from the participants than they would have from a mailed survey, they did not gain the same perspective as I did by meeting face-to-face with producers on their own farms over a period of time. However, my producers were also being educated in a new area and being evaluated on their performance on the implementation process. Without a trusting relationship, they may have been concerned that their thoughts would make them appear uneducated or incapable. During the first interview, some producers were nervous that they had not answered the questions correctly. It took some time before they realized that there was no right answer, just an honest reply of what they actually did or thought. They became comfortable not understanding what something meant, as they realized that they had to communicate these items to make the program more effective for producers in the future.

Another major benefit of using the participant observation technique was that the producers were followed through the entire 6-month period as changes occurred around them. For example, in the middle of the trial, DairyWorld (the major producer co-operative in British Columbia) almost went bankrupt and was forced to sell to a massive international company called Saputo. Many of the producers on the trial were members of the co-op and their whole world was tossed into a state of upheaval after the buy-out. Their attitudes towards milk safety changed dramatically, as many of the support people they relied on for milk safety were DairyWorld employees. If the trial participants had not been followed through this time, valuable information would have been lost. This method also follows producers through regular changes or events that happen on a dairy farm. A few producers were undergoing major renovations or expansions during the trial, which affected their outlook on the program and some of its requirements.

I believe that my sometimes conflicting roles had a significant influence on the form and nature of discussions. It was in my favour that I was considered to be an "inside" observer, as producers quickly became aware that I had worked in the dairy industry for a number of years. The fact that I could "speak the language" and understand their pressures and daily tasks helped me gain their trust and respect quickly. On one occasion, I arrived to audit a farm and the producers were in the middle of an emergency situation with a cow bloating in their parlour (accumulation of gas in her stomach that eventually puts pressure on the heart and can be fatal). I spent an hour helping shove a piece of garden hose down her throat to release the gas and leveraging my body against hers in order to keep her from lying flat. At that point in time, my experience working on dairy farms came in handy and strengthened my credibility with those producers. Furthermore, they shared some humorous stories of other emergency situations they had faced in the past and how they had dealt with them, effectively accepting me as someone who would appreciate and understand them. As the producers became more comfortable, they also began to share items that would normally only pass between neighbours. They felt more comfortable treating me as "one of the guys" or on their side. Often, nuggets of information came out of these aside conversations and a producer's true motivation, influence or thought would come through.

My age, gender status and personality also had some benefits. The majority of the producers on the trial were middle-aged men (either single or married with families) and they may have been more lenient due to my age and agreeable or non-confrontational personality. The program involved some emotional issues and producers could easily have quit the trial at any point. I believe they persevered longer because I was easy to talk to, a good listener, sympathetic, non-threatening and genuinely interested in their thoughts.

Complicating my role was the fact that I was working for the British Columbia Ministry of Agriculture, Food and Fisheries and using the trial as an opportunity to conduct research for my Master's degree. These were two potentially intimidating and antagonizing roles. Fortunately, the producers recognized that I was relatively inexperienced as an academic and a ministry representative; therefore, I was able to minimize those roles. I represented the government, higher education, dairy producers and, at some level, "the farmer's daughter" all in one.

2.2 Design

The trial design involved recruiting volunteer producers, having producers implement the program on their farms, collecting data and evaluating the results.

2.2.1 Recruitment

Farms were chosen on a voluntary basis. Producers were encouraged to volunteer for the trial through a number of venues. An article was printed in the British Columbia Milk Producers Newsletter (June, 2000), which reaches about two thirds of the producers in B.C., outlining the trial and encouraging producers to volunteer. One producer volunteered as a result of the article. Also, a booth explaining food safety programs was displayed at the UBC Dairy Education and Research Centre's Open House on June 23, 2000. Many dairy producers attended the Open House and about nine of them left their phone numbers to be contacted once the trial began. The advertisement was repeated at the UBC Dairy Centre's Official Open House on November 1, 2000, and then at a BC Ministry of Agriculture, Food and Fisheries industry meeting held on November 3, 2000 to explain the trial, after which 3 more producers volunteered.

In September and October, the trial supervisor and I began contacting the producers who had expressed interest in the trial. Some started right away, others were not interested anymore and still others declined after the first meeting. Some of the producers were aware that other commodity groups were developing on-farm food safety programs and they suspected the CQM program would become mandatory. They wanted to gain an inside perspective, a head start, and ensure that the program was manageable. Some were also interested in learning how they could improve their milk safety and management style. Those that declined the opportunity to participate in the trial either did not think they had time, or they did not want the program to succeed. They thought the program would be too much work, and hoped that their lack of participation would prevent the program from continuing.

We tried to target a range of farms representing as many different management styles as possible because the trial was supposed to represent producers across Canada. Unfortunately, British Columbia has few stanchion barns (where animals are housed and milked in their individual stalls, compared to group housing with a milking parlour) whereas many operations in Eastern Canada are stanchion barns. We decided it was essential to have at least one stanchion operation on the trial, consequently, we phoned stanchion producers to try to convince them to join the trial. Eventually, one agreed to participate in the study.

Fifteen producers started on the trial with 10 producers considered the core group and 5 considered spares. We thought we would only have enough time to focus on 10 producers but we wanted to have 5 extra in case people dropped out, due to the many time pressures producers face daily. Over the course of the trial, only 2 producers left the trial due to personal reasons, one after the first interview and the other after the on-farm audit.

An equipment manufacturer donated 10 chart recorders to the trial and the core producers were given them as a small incentive to participate in the trial and remain in it for the entire 6 months. Five were installed in farm holding tanks to continually measure milk temperature and 5 were installed in return wash lines to continually measure wash water temperature. The local equipment dealers donated their time and expertise and installed them free, charging only for extra equipment expenses.

Farms ranged in size from 25 to 230 lactating cows with 2 producers expanding to 300 and 500 cows, and one selling his quota and finishing the trial with one cow. Parlours included a 5-unit stanchion, a 16-unit trigon and a double 12 parallel, but the majority had herring bone parlours. Barns were mostly free-stall, but two farms had pack barns (where animals are housed in an open area without individual stalls) and one was a full stanchion. The trial had organic and conventional shippers. Participating farms had from zero to five employees, with up to 5 family members involved as well. Average milk production ranged from 14-41kg/cow/day and the average farm size was 330 acres (owned and leased) with a range of 70-1000 acres.

2.2.2 Steps

The project was reviewed and approved by the University of British Columbia's Behavioural Research Ethics Board. Next, an initial meeting was held with each producer to introduce him/her to the trial supervisor and myself and explain the project's goals and purpose. The producers were given the outline of the trial, including what was expected of them, how much it would cost and how much time it would take. The consent form was explained and their individual confidentiality assured. Those who wanted to continue signed the consent form and proceeded to the first interview. Each participant was assigned a number (code) and the data were identified according to that number and kept in a locked drawer at all times.

The first interview gathered information about producers' current farm practices, resources employed, perceptions of HACCP and on-farm food safety programs, and opinions of the current state of the dairy industry. Farm statistics, such as water source, number of lactating cows and years of experience dairy farming were collected as well.

Producers received a 2-hour workshop, introducing HACCP principles and explaining the CQM program's requirements (see Appendix 3). They were also given a Workbook, Reference Manual and Standard Operating Procedure poster to help them implement the program. The Standard Operating Procedure poster consisted of a plasticized sheet of paper and stickers with pictures that depicted various steps in the milking procedure. Producers could choose the stickers that showed their milking procedures and place them on the poster to pictorially express their milking Standard Operating Procedures. Five separate workshops were held and 3 different workshop formats were employed, as we discovered how to communicate more effectively. Workshops 1 and 2 followed the first format; workshop 3 followed the second; and the last 2 workshops followed the third. The 3 styles of training followed were:

1. Time was spent on introduction and "philosophy" of HACCP to explain why on-farm food safety programs are gaining momentum and how to evaluate each farm's milk safety hazards. The Self-Evaluation form in the workbook was reviewed, emphasizing the principles and the 5 minimum CCPs. The producers were supposed to understand the concepts and then evaluate their farm's hazards.
2. Less time was spent on introduction and HACCP philosophy, and more time was spent on the Self-Evaluation form - both minimum and mandatory questions. The 5 mandatory CCPs and the required records were described, but were not extensively reviewed.

3. Minimal time was spent on introduction and HACCP philosophy. The mandatory questions were emphasized and the 5 mandatory CCPs and required records were extensively reviewed. Everyone went away with a "to-do" list.

The first workshop had 3 farms represented and 6 people present (2 owners, 1 manager and 3 staff). The second workshop had 3 farms represented and 5 people present (1 individual owner, 1 couple and 1 father and son team). The third workshop was done on the producer's farm with 4 employees and the owner present. The fourth workshop had 6 farms represented with 2 employees. The last workshop was conducted at a producer's kitchen table with only the manager.

After the workshops, I helped producers implement the program by helping them develop records and plans, and further understand the program's expectations. Some producers needed a few visits or phone calls, whereas others did not need any.

A drug inventory was taken on each farm to determine which drugs were being administered and to evaluate the condition of the bottles (e.g. clean, clear labels), the storage facility and expiry dates of the products (see Appendix 5). The inventory included any product that was applied on or to animals (e.g. antibiotics, salves, creams, pesticides).

I also collected from each farm 2 samples of the water used to wash equipment: one at the beginning of the trial and one at the end. I used 100ml plastic bottles provided by Norwest Labs and removed any hoses from the taps and let the water run for 5 minutes before collecting the sample. Then, I packed the samples in a cooler with ice and delivered them to Norwest Labs within 24 hours. Two farms' samples were couriered overnight. The water samples were

assessed for fecal coliforms, total coliforms and total bacteria counts using Enzyme Substrate Test, 9223 B, Enzyme Substrate Test, 9223 B and Heterotrophic Plate Count – Pour Plate Method, 9215 B, respectively (American Public Health Association, 2000). These 3 testing parameters were chosen because the Municipal Health Authorities employ them to determine if drinking water is safe for human consumption.

Producers gave me permission to access their quality records (somatic cell counts, standard plate counts, antibiotic residues, cryogenic points (freezing points) and time of last inspection) through the Ministry of Agriculture, Food and Fisheries' Health Management and Regulatory Unit's grade reports. The somatic cell count is determined through the Flow Cytometry for Somatic Cells in Milk Method (Bentley Instruments, 1995). The standard plate count is determined through the Standard Plate Count (Class O) procedure. Antibiotic residues are measured using the qualitative *Bacillus stearothermophilus* var. *calidolactis* Disc Assay[22, 33] (Class A1 for penicillin G; Class B for other inhibitors). The freezing point of milk is measured using a Thermistor Cryoscope (Class A1) (Marshall, 1993). Quality records for 10 months prior to and 6 months during the trial were collected to show the range of milk quality profiles amongst the trial participants.

Once producers had developed their records and trained their staff, I visited the farms as an on-farm auditor to determine how well they were following the program and to identify areas of non-compliance. An on-farm audit protocol was developed for the study. The protocol was based on a one-page checklist (see Appendix 4), the Self-Evaluation form and the current inspection process in British Columbia. An on-farm audit consisted of an evaluation of records, emergency plans and Standard Operating Procedures for completeness and accuracy; and a walk through the operation to verify that best management practices were being followed (e.g. milking

equipment clean, lactating herd's udders clean). The temperatures of the milk in the bulk tank and the hot water (from the tap) were measured with a calibrated manual thermometer to verify the records. The milking equipment cleanliness was verified visually with a focusable flashlight and the back of a Swiss army knife was utilized to scrape equipment to check for deteriorating rubber and milk residue. I wore clean coveralls for every visit and disinfected my rubber boots with "Ascend" (a germicidal detergent) after every farm.

Non-compliances were rated according to the seriousness of the risk to milk or meat safety. At the end, each producer was graded. The evaluations were based on:

- **Pass** – producers satisfied all the mandatory Critical Control Points and records, and applied the required Best Management Practices. If producers only had a few minor deviations that were not direct risks to milk or meat safety, they still passed. Producers would have received certification that day.
- **Conditional pass** – producers had a few major but not critical non-compliances that were risks to milk or meat safety (e.g. cluttered treatment storage area). Producers would have to provide proof to the on-farm auditor that the necessary items were rectified within a mutually agreed time frame.
- **Fail** – producers had a serious deviation from one of the 5 Critical Control Points resulting in a direct food safety risk, for example, a failed water test, medications in unmarked bottles or pesticides not approved for dairy use stored in the milk house. Producers would have to have another full or partial audit (only look at previous non-compliances).

The trial did not aim to have everyone pass, but to see how much they could accomplish on their own, how they would score the first time through (with minimal assistance) and what items they would have to change in order to pass.

Time spent implementing the program and maintaining the day-to-day records was recorded for both the producers and the on-farm auditor. Producers also estimated the monetary costs that they would have faced in order to meet the program requirements.

Throughout the trial, I had various interactions with agri-business professionals (e.g. veterinarians) and their comments and concerns about the program were noted.

2.3 Analysis

After the trial was complete, I analyzed my field notes and looked for re-appearing themes across the producers and different situations. Then, I explored the possible meanings behind the themes keeping the context of the situation and the personal experience of each producer in mind.

The producers' milk quality data were summarized as medians to show the range of quality results and profiles of the producers on the trial. Medians were calculated for each farm's Standard Plate Counts (measure of bacteria in the milk, an indicator of sanitation) and Somatic Cell Counts (measure of white blood cells in the milk, an indication of udder health/infections) for the 10 months before the trial and 6 months during the trial.

3.0 QUANTITATIVE RESULTS AND DISCUSSION

Quantitative data were collected during the trial for the producers' farm statistics, water quality analysis results, milk quality and infraction results, and on-farm audit results. The amount of time producers spent implementing and maintaining the program, and the amount of money they would have had to spend to be compliant with the program was estimated as well.

3.1 PRODUCER PROFILES

The trial encompassed a wide variety of management styles, herd sizes, facility designs, and employee profiles (Table 1). Employees were responsible for all tasks, including milking, treating, and managing the herd. Every employee was responsible for tasks either directly or indirectly relating to milk and meat safety.

Because the producers' confidentiality was assured throughout the trial, the data presented in the tables do not necessarily follow a pattern (e.g. producer 1 in one table is not producer 1 in another). The trial also does not follow each individual producer's story from start to finish but blends the experiences and opinions to ensure the producers' privacy.

Table 1: Farm Statistics: number of acres, number of milking and dry cows, average production (litres/cow/day), parlour and barn design, and number of full and part-time family members and employees working on the farm.

Farm	Acres (own&rent)	Milking herd	Dry cows	Average production	Parlour (# of milking units)	Barn	Family		Employees	
							Full	Part	Full	Part
1	150	110	20	35	2x6 hb	112 free	1	3	1	1
2	110	66	8	31	11 in a row-hb	74 free	1	2	0	2
3	240	130	20	38	2x8 hb	180 free	2	0	2	2
4	70	30	3	40	2x4 hb	50 free	2	0	0	0
5	110	60	7	30	2x4 hb	60 free	1	5	0	3
6	80	35	6	29	36 stan, 6 units	39 free	2	2	0	0
7	225	230	50	36	4/side (16 tot)	240 free	2	0	3	1
8	80	65	6	34	2x6 hb	69 free	2	0	0	0
9	70	62	6	39	2x4 hb	75 free	2	1	0	3
10	105	36	1	14	5 unit stan	37 stan stalls	1	2	0	0
11	350	200	40	35	2x12 para	288 free	0	0	6	0
12	900	160	30	30	2x6 hb	480 free	1	2	3	0
13	190	220	45	34	2x10 hb	260 free	1	3	2	0
14	520	150	12	27	2x8 para	30'x220' pack	1	0	4	0
15	?	31	24	34	4 unit stan	65' x 30' pack	0	0	1	2
Avg	**213**	**106**	**19**	**32.4**			**1.3**	**1.3**	**1.5**	**1**

Note: para=parallel free=free stall stan=stanchion hb=herringbone tri=trigon pack=packbarn

3.2 WATER RESULTS

Fecal coliforms are indicators of gastrointestinal disease risks in water due to fecal contamination. *Escherichia coli* is the predominant fecal coliform. Total coliforms include a number of bacteria that are not necessarily of fecal origin. Total bacteria indicate if a bacteria problem other than coliforms (e.g. *Listeria*) is present.

Water samples must contain less than 1MPN (Most Probable Number) of fecal or total coliforms per 100ml of water to pass the potability standards. A total coliform count between 1 and 10 MPN/100ml is a conditional pass. Total bacteria counts or standard plate counts (SPC) must be below 500 CFU (colony forming units)/ml. The results of the water samples are in Table 2.

Table 2: Water Analysis Results for Equipment-washing Water on Farms

Farm #	First Set of Samples			Second Set of Samples		
	Total Coliforms (MPN/100ml)	Fecal Coliforms (MPN/100ml)	Total Bacteria (CFU/ml)	Total Coliforms (MPN/100ml)	Fecal Coliforms (MPN/100ml)	Total Bacteria (CFU/ml)
1	<1	<1	2	<1	<1	2
2	<1	<1	6	<1	<1	<2
3	5.3	2	2	<1	<1	<2
4	<1	<1	4	<1	<1	45
5	<1	<1	4	<1	<1	4
6	59.1	<1	15	50.4	<1	15
7	<1	<1	4	<1	<1	34
8	<1	<1	<2	<1	<1	<2
9	<1	<1	10	<1	<1	10
10	<1	<1	2	<1	<1	26
11	<1	<1	28	7.5	<1	83
12	<1	<1	>738	4.2	<1	287
13	<1	<1	<2	<1	<1	<2
14	<1	<1	124		<1	
Pass	12	13	13	10	14	14
Conditional Pass	1	N/A	N/A	2	N/A	N/A
Fail	1	1	1	1	0	0

In the first set of water samples, 3 farms failed. Farm #3 was probably due to a collection error and farm #12 may have resulted from poor refrigeration during overnight courier transportation (allowing the bacteria to multiply). However, the other sample couriered with #12 passed, suggesting #12 legitimately failed.

In the second set of water samples, one farm failed and 2 conditionally passed with 2 repeat offenders. Farm #6 had high total coliforms in both samples. This particular farm has had water

quality problems in the past and they had to dig a new well to correct those problems. They were not surprised that their tests did not pass and had a good idea of where the problem was. Farm #12 had high bacteria counts the first time but conditional total coliform counts the second time. Farm #3's second sample was clear but farm #11 had a conditional pass for total coliforms.

The results indicate that water quality is a problem on dairy farms and producers with contaminated water will have to rectify the problem.

3.3 QUALITY AND INFRACTION RESULTS

Eleven producers had at least 10 provincial milk samples tested before the trial, one had 9 and two had 8. Ten producers had 6 provincial milk samples tested during the trial, 3 had 5 and one had 4. The medians calculated for each farms' standard plate counts (SPCs) and somatic cell counts (SCCs) before and during the trial are summarized in Table 3.

Table 3: Producers' Quality Records for SPC and SCC

	Median Quality Values			
	SPC(cfu/ml*1000)		SCC (somatic cells/ml*1000)	
Producer	Before	During	Before	During
A	2.5	1.0	72.0	59.0
B	1.0	2.5	125.0	172.0
C	1.0	2.0	131.0	147.5
D	1.0	1.0	19.5	10.0
E	1.0	5.0	134.5	233.5
F	1.0	1.0	41.5	11.5
G	1.0	1.0	110.5	156.5
H	1.0	1.0	74.5	61.0
I	1.0	1.0	40.5	83.0
J	4.0	1.0	142.5	148.0
K	2.5	2.0	82.5	75.0
L	10.0	5.5	274.0	213.0
M	2.5	9.5	210.0	266.0
N	2.0	1.0	201.0	156.5

The median standard plate counts before the trial ranged from 1.0 to 10.0 cfu/ml*1000, but most farms had counts around 1.0 or 2.0 cfu/ml*1000 and during the trial the results were similar. The median somatic cell counts between farms ranged quite widely. Before the trial, they ranged from 19.5 to 274.0 somatic cells/ml*1000 and during the trial, they ranged from 10.0 to 266.0 somatic cells/ml*1000.

Table 4 shows the number of infractions incurred before and during the trial. No one had a cryogenic infraction (addition of water to the milk) before or during the trial. Only one producer had an antibiotic residue infraction in the 10 months before the trial and no one had one during the trial. Two producers had standard plate count infractions before the trial and two other

producers had them during the trial. Since the infraction incidence was so low, the trial did not have any obvious effect on infractions.

Table 4: Producers' Water, Antibiotic and SPC Infraction Records

	Number of Infractions					
	Cryogenic*		Residues*		SPC*	
Producer	**Before**	**During**	**Before**	**During**	**Before**	**During**
A	0	0	0	0	0	0
B	0	0	0	0	0	0
C	0	0	0	0	0	0
D	0	0	0	0	1	0
E	0	0	0	0	0	1
F	0	0	0	0	0	0
G	0	0	0	0	0	0
H	0	0	0	0	0	0
I	0	0	0	0	0	0
J	0	0	0	0	1	0
K	0	0	0	0	0	0
L	0	0	0	0	0	1
M	0	0	0	0	0	0
N	0	0	0	0	0	0
Total	**0**	**0**	**1**	**0**	**2**	**2**

Note: Cryogenic scores at 1.8%, antibiotic residues at 16 mm or 0.01667 IU of Pen G, and SPC counts above 50,000cfu/ml are infractions.

3.4 TIME AND COST

The trial estimated the time and financial commitments of the producers and the on-farm auditor.

3.4.1 Producers

Some producers found that the program took up too much of their time; however, others found the time commitment minimal. The amount of time producers spent on the program is summarized in Table 5. The average time spent setting up the program was 11 hours; ranging from 45 minutes to 5 days (included reading the manual). However, the median was only 3 hours because most of the producers implemented the program in a minimal amount of time whereas a few producers took extensive time. The average time spent keeping the daily records was about 10 minutes per day, ranging from 1 minute to an hour for the producer who did more than the mandatory items and the median was 5 minutes. Producers will be expected to keep at least 3 months of complete records before they are validated; therefore, the total time the trial participants would have invested in implementing the program would have averaged 30.9 hours with a median of 17.8 hours.

Table 5: Initial Producer Time Commitment

	Time					
Producer	Workshop (hr)	Travel for Workshop (hr)	Initial set-up (hr)	Keeping records (min/day)	Keeping records (hr/3months)	**Total (hr)[1]**
1	2.0	1.50	2.50	5	7.5	**13.5**
2	2.0	1.50	2.00	5	7.5	**13.0**
3	2.0	0.75	3.00	30	45.0	**50.8**
4	2.0	0.75	11.00	1	1.5	**15.3**
5	2.0	1.50	2.00	10	15.0	**20.5**
6	2.0	1.00	3.00	5	7.5	**13.5**
7	2.0	0.50	12.00	10	15.0	**29.5**
8	2.0	0.50	5.00	3	4.5	**12.0**
9	2.0	1.00	40.00	10	15.0	**58.0**
10	2.0	1.50	3.00	5	7.5	**14.0**
11	2.0	10.00	0.75	5	7.5	**20.3**
12	2.0	10.00	40.00	30	45.0	**97.0**
13	2.0	0.50	32.00	20	30.0	**64.5**
14	1.5	0.00	1.00	5	7.5	**10.0**
Average	**2.0**	**2.20**	**11.00**	**10**	**14.5**	**30.9**
Median	**2.0**	**1.00**	**3.00**	**5**	**7.5**	**17.8**

[1]Total = sum of Workshop (hr), Travel for Workshop (hr), Initial set-up (hr), and Keeping records (hr.3months).

The most frequent question I received throughout the trial was, "How much time is it going to take." Most producers wanted to know how long each visit would be and how much time the program would take away from other priorities. The amount of time the trial demanded depended on their current style of management, level of HACCP understanding and personal situation. Those who already kept records found the program relatively easy to adopt, but those who did not, recommended that the recording time had to be kept to a minimum to make it easier to convince producers to do it. One producer stated,

"If I can write it down quick and easy, I will do it."

For producers with employees, the time investment consisted of training employees and checking up on them. A number of trial members expressed difficulty in gathering staff together for a meeting to discuss and implement the program. Producers without employees had to find spare time to implement it themselves. Most producers were concerned that small operators would not be able to meet the program demands; however, the small operators on the trial did exceptionally well and most of them implemented the program in minimal time and with minimal difficulty.

Producers found the initial program set-up the biggest struggle. Once the program was implemented, they felt the time pressure ease and, as they became comfortable with the routine, some found the extra work minimal. Dairy Farmers of Ontario's Board members implemented the program, and some of them also found that once they were accustomed to the records, the records were quite easy to maintain (Dimmick, 2001a).

The producers did not have to make any changes or spend any money during the trial; however, they estimated the costs they would have incurred if they were to be certified and these costs are summarized in Table 6.

Table 6: Initial Producer Cost Estimated to Meet Program Requirements

	Producer													
Description ($)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**11**	**12**	**13**	**14**	**15**
Build chicken coop					500									
Cover lights in milk house	500			50				50						
Change liners					150									
Hot water tank						1500								
Pesticide storage								200						
Safety switch					175									
On-farm audit ($100/hr)	400	325	475	500	350	425	400	400	375	350	400	400	400	325
2nd On-farm audit		100			100	100		100						
Water sample	40	40	40	40	40	40	40	40	40	40	40	40	40	40
2nd water sample			40			40					40	40		
Labour (@$12/hr)	162	156	609	183	246	162	354	144	696	168	243	1164	774	120
Total ($)	**1102**	**621**	**1164**	**773**	**1561**	**2267**	**794**	**934**	**1111**	**558**	**723**	**1644**	**1214**	**485**

The average initial program cost was $1,068, ranging from $485 to $2,267. If the two chart recorders were made mandatory, they would cost about $2,000 and increase the average initial cost to $3,068. On-farm audit costs were based on $100/hr and did not include travel or office time (reviewing records took ~2 hours of office time). The CQA program has veterinarians auditing farms and they are charging about $105/hour and an average on-farm audit takes about 3 hours (Leblanc, 2001). In the horticulture industry, SGS (an auditing company) charges $850 a day. Farms that failed were assigned the cost of an hour-long, partial audit and those with failed water samples were assigned the cost of an additional water test. Costs of rectifying a contaminated water supply were not estimated. During the trial, it was decided that producers would have to write full treatment protocols with their veterinarians and these costs are not represented either; however, some of the trial veterinarians estimated they would charge about $100/hour or $25 for the first prescription and $5 for any additional ones.

Since producers will be faced with annual costs once the program is implemented, the data were extrapolated to give an indication of what a producer may face on an annual basis. Table 7 summarizes the estimated annual costs after a farm is certified.

Table 7: Estimated Annual Producer Costs After Certification

	Producer													
Description ($)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**11**	**12**	**13**	**14**	**15**
Annual equipment check	300	300	300	300	300	300	300	300	300	300	300	300	300	300
On-farm audit	267	217	317	333	233	283	267	250	267	233	267	267	267	217
Water sample	40	40	40	40	40	40	40	40	40	40	40	40	40	40
Administration (program)	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Time-Daily records (1yr @ $12/hr)	360	360	2160	72	720	360	720	216	720	360	360	2160	1440	360
Total	**1027**	**977**	**2877**	**805**	**1353**	**1043**	**1387**	**866**	**1387**	**993**	**1027**	**2827**	**2107**	**977**

Annual costs were estimated to be about $1,404, ranging from $805 to $2,877. The median cost was $1,035. If chart recorders become mandatory, pens and paper would cost about $85 annually, increasing the overall average cost to $1,489. The annual equipment check was estimated to cost about $300. The on-farm audit cost was based on the producers' estimated initial audit cost and an audit interval of 18 months. The annual administration costs reflect the sum that the Canadian Quality Assurance (CQA) program currently is charging producers; however, the CQA program also has a portion of the producers' check-off allocated to it (costs not available) (Leblanc, 2001). The table does not account for repeat audits, which will be an added cost for some producers. Furthermore, treatment protocols may need to be up-dated annually at added cost. The national and provincial administration and program audit costs are not represented either.

The program's cost is difficult to evaluate because the cost of implementing the program on a national and provincial basis is unknown. The number of staff required (on-farm auditors, administration staff, national coordinator and provincial coordinators) is not known and the division of cost between the producer, the consumer, and other stakeholders has not been determined. CFIA has stated that they will be contributing $50,000 per program towards program recognition and third party audits, and individual provincial producer associations may be able to apply for government funding. However, recently, CFIA has decided that an external company, such as SGS, has to perform the program audits and it is not clear what the total and continuing bill will be.

The Federal/Provincial/Territorial On-Farm Food Safety Sub-Committee prepared a Generic Costing Model (2000) which estimated the annual costs of an on-farm food safety program to be $825/producer/year plus variable producer implementation costs. The $825 included about $100

for CFIA program recognition, $565 for an on-farm audit, $85 for administration and some miscellaneous expenses. However, this model was based on all farms implementing the program and a mandatory implementation of the CQM program is not planned. Furthermore, the trial shows that some producers may face significant costs to make their operations meet requirements and the Generic Costing Model does not account for these costs. The Dairy-BTM (Breakthrough management) system in the United States is based on the HACCP principles and it is implemented in 'modules.' Each module is estimated to cost between $500 and $2,500 to implement and there appear to be at least four modules: animal health and well-being, public health, environmental health and financial well-being (Cullor, 2001).

Many producers wanted to see their milk cheque reflect their extra work. Two producers' comments were:

> "If I am going to be certified, I need to see a spin off [financial reward]."

> "If I got $500/month for a spotless farm, my farm would be spotless. But, I would rather foot trim instead [of cleaning if I'm not getting paid more for it]."

They felt that if consumers and processors wanted "assured" milk, they should pay for it because the producers' bottom line was constantly shrinking as their input costs increase.
One producer stated:

> "I wouldn't touch it, voluntary or mandatory, unless a paid benefit was attached to it. Consumers should pay for it. If they aren't going to pay for it, they don't want it."

Some of the producers on the trial thought that if producers did not receive a premium, producer acceptance would be an "uphill battle" and some would possibly try to undermine the program. If they were not going to receive a premium, producers felt that the program would have to somehow affect their bottom line. One producer stated it was "more work with no return" and that was not acceptable to him.

Another producer was convinced the program would result in increased management costs, but would make money in the long run by generating records that provided better management tools for items such as staff performance, drug management, and efficiencies of equipment and housing requirements. He also felt that the bigger the farm, the better it would work and the more financial benefit it would have.

Producers also face other production costs, programs and regulations. One producer stated,

> "This is like quick sand. Every time we get into these programs, we get sucked into paying more money."

Some of the trial producers expressed fear that the increasing pressures would put them out of business. They had difficulty seeing the financial benefits of the CQM program, through reduced product wastage, better management and consumer confidence. However, those producers who welcomed the program believed that it would improve the image of dairy products and encourage consumers to continue to buy or increase their consumption of dairy products. Furthermore, if the CQM program is implemented across the industry, the associated costs will be added to producers' Cost of Production.

3.4.2 Researchers

The amount of time my supervisor and I spent on each task is summarized in Table 8.

Table 8: Time Researchers Spent Assisting Producers Implement the CQM Program and Evaluating Producers' Responses to the Program

Description of task	Total Time Spent on Tasks (hr)	Average/Farm or Visit (hr)
Initial meeting (15 producers)	13.00	0.87
First interview (15 producers)	26.00	1.73
Reviewing requirements (14 producers)	27.00	1.93
On-farm audit (14 producers)	27.25	1.95
Reviewing on-farm audit reports (14 producers)	11.50	0.82
Final interviews (13 producers)	31.50	2.42
Total travel time (85 visits)	145.20	1.71
Phone calls arranging visits/ volunteers (15 producers)	20.00	1.33
Producer training workshops (includes travel) and staff training (15 producers)	68.00	4.53

Extensive time was spent working with each producer, holding workshops and auditing producers. Approximately 2 hours were spent helping each producer implement the program and a large amount of time, an average of almost 2 hours per visit, was spent traveling from farm to farm. The spread of farms mimicked the travel time an on-farm auditor would experience, as a long trip may be needed to certify only one or two producers. The travel time closely resembled what the British Columbia provincial dairy inspector experiences (Pannett, 2001).

On average, an initial on-farm audit took 2 hours to complete and 2 hours of travel time. Additional duties that on-farm auditors would have to perform would be repeat visits for farms

that failed and office time for conditional passes, drug reviews and paperwork. Producers have to be present during an audit to explain records, answer questions and guide the auditor around the farm; consequently, if a producer is involved in daily farm activities, the on-farm audit is restricted to the time period that the producer is available. I found that producers' schedules limited the number of validations that I could conduct in a day.

3.5 ON-FARM AUDIT RESULTS

Of the 14 farms audited, 5 passed immediately, 5 conditionally passed and 4 failed. The trial's goal was not to have everyone pass but to evaluate why some did and some did not. The on-farm audit results are summarized in Table 9.

Table 9: On-farm Audit Results

	Producer													
Non-Compliance	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Milk house														
Uncovered lights	✓			✓				✓						
Cobwebs and dusty	✓		✓		✓									
Cluttered		✓												
No safety switch on wash line					✓									
Parlour														
Dirty sanitary traps	✓	✓		✓	✓	✓		✓						
Equipment dirty	✓				✓				✓					✓
Other														
Treatment shelf needs organizing	✓												✓	
Other items stored with medicines	✓		✓			✓								
Some incomplete records	✓	✓	✓	✓	✓	✓		✓	✓	✓			✓	
Many incomplete records							✓							✓
Not on NLID[1]													✓	
Milk temperature (°C)[2]	Nm	3	3	nm	3	nm	2.5	3	nm	3	2.5	nm		nm
Hot water temperature (°C)[3]	80	76	78	78	78	72	74	76	74	74	76	73	80	74
Automatic conditional pass														
Conditional pass on water results			✓											
Non-dairy pesticides stored adjacent to and within access to the milk house								✓						
Automatic Fail														
Medication bottle with incorrect label		✓												
Non-dairy pesticides/equipment in milk house					✓									
Poultry in dairy barn					✓									
Failed water test						✓						✓		
On-farm Audit Score	**CP**	**F**	**CP**	**P**	**F**	**F**	**CP**	**CP**	**P**	**P**	**P**	**F**	**P**	**CP**

Note: P=pass CP=conditional pass F=fail nm=no milk, milk was picked up that day before the audit; therefore, the tank was empty

[1]National Livestock Identification Program

[2]Milk temperature must be between 0°C and 4°C

[3]Hot water temperature should be at least 71°C at the source

The conditional pass farms could have passed easily with some cleaning (removing cob webs and equipment sanitation) and organizational changes (e.g. treatment storage). Those that failed needed more extensive cleaning, organizing, reviewing best management practices and some specific changes (e.g. pesticide storage location, commercial hot water tank, installation of a safety switch). None of the farms that automatically failed would have been immediately shut down by a provincial inspection, but 3 producers were not compliant with the current provincial regulations. These producers would have received a strong warning or second visit to ensure corrective action was taken.

Generally, bulk tank temperature or treatment records were complete, but weekly equipment checks were not done on the majority of farms or they had not written it down. Those that did usually started during the week when they knew they were going to be audited. Sanitary traps, milk meters and gaskets were common problem areas. One producer passed even though he had dirty sanitary traps because the contamination was minor, and the rest of his system was extremely clean. However, he passed with the agreement that he would clean his sanitary traps immediately. Many did not have all the lights covered in the milk house (a current regulatory requirement) and not one producer had a veterinary prescription for every drug administered extralabel. Extralabel drug usage refers to any part of the drug administration that does not follow label directions, for example, giving a larger dose than recommended, treating for a longer period of time, using drug on an unapproved species (e.g. Banamine is approved only for horses and Lincospectin for turkeys), or administering intramuscularly instead of intravenously.

4.0 QUALITATIVE RESULTS AND DISCUSSION

Within the qualitative data, the results do not always reflect specific numbers or percentages of people who held the same opinion, but rather the depth of understanding or range of opinions and responses that this program will face.

4.1 RESPONSE TO THE OVERALL PROGRAM

The producers' responses to the program varied. Producers had widely divergent opinions on the program's impact and acceptance, government and support structures available, and the program's benefits and resource material.

4.1.1 Program Impact and Acceptance

Surprisingly, the producers' opinions on the impact that the CQM program may have on the dairy industry did not change from the beginning to the end of the trial, but their opinions did range widely. Some producers saw the program as the way of the future and a positive direction for the industry to take, and some saw it becoming "the rule of the road" in a short period of time; therefore, "if you don't do it, you won't make it." Most of the producers wanted to learn about the program and to participate in the development rather then having something foreign "stuffed down their throats." They believed that it was "...going to happen. McDonald's wants it, so [we] have to do it. It is going to go all the way down the line and [we have] no choice." One producer summarized the CQM program as "doing everything you are supposed to do, [and] just making sure you're doing it."

Some producers were convinced that the program was not necessary, because the current regulations are strict and producers have the records (Standard Plate Counts and Somatic Cell Counts) to prove that quality is high. One producer did not like the program because he felt it would force producers to pay for a program when they are already doing an excellent job of producing a safe product. Another producer stated that the programs would have no impact on his milk safety; it was a "waste of money" and totally unnecessary. Another thought it an overall inconvenience that required "more walls, rooms, cupboards and staff."

One producer on the trial chuckled and muttered that HACCP stood for "Have Another Cup of Coffee and Pray." He implied that he was expecting the program to be cumbersome, somewhat out of producers' control and yet another pressure that their businesses are facing.

Some felt the CQM program would be positive for their farm but if the program did not satisfy consumers, they were concerned about future demands and whether they would be able to afford the program. Some felt that the program would improve the industry by shutting down the "bottom end" producers.

Producers who were more connected to their consumers tended to be more accepting of the program. The organic producers were accustomed to keeping records and being inspected regularly. Furthermore, organic and some independent producers are often the sole suppliers to a particular processor. Their milk stands alone and their consumers are more directly linked to the farm. Their entire market depends on consumer confidence and they saw value in the program through the extra level of confidence it brought them.

4.1.2 Government and Industry Support

Some producers thought that the CQM program was owned and supported by government because of its emphasis on food safety. The federal government has encouraged the development of on-farm food safety programs by making money available to the industry; however, each on-farm food safety program is owned by the individual industry. One of the producers joked that HACCP stood for "How Ag Canada Created Paperwork," suggesting that the program is another unnecessary government paper exercise that is going to take up their time. Throughout our trial, some producers kept on blaming the government and asking what the government was going to push on them next. We had a difficult time making them understand that the provincial government was not a key player.

A number of comments centered on how little support dairy farmers have had since the major government cutbacks in British Columbia in 1997 when the inspection and extension staff were cut considerably. Over the course of the trial, producers' opinions on the support structures available to them in the dairy industry worsened. British Columbia went through an upheaval in February 2001 when Saputo bought DairyWorld Foods (75% of British Columbian producers were members of this cooperative). Nine of the producers on the trial were Co-op members and saw their member services and field staff cut. One producer expressed his frustration by saying,

> "Who's going to take care of quality? That little book [CQM manual] out there [in the barn] sure isn't going to do it."

His comment displayed his frustration with the current system and his lack of confidence that the CQM program would make any difference on his farm or benefit him. He ended up selling his

farm because he saw too many changes leading the dairy industry into difficult times and he was not prepared to "weather the storm."

4.1.3 Benefits

Some of the benefits the trial producers experienced included peace of mind, finding problems before they occurred, increased efficiency, improved communication, and consumer trust. Others found that the records, particularly the treatment records, were a great tool for managing and training staff. One producer liked the "proof of what I have done." Another producer enjoyed the responsibility that the program instilled in his staff and he noticed their awareness of milk and meat safety problems increase. He thought that,

> "The best benefit to the producer [is] the worker will be more aware and feel more connected to the task."

One producer claimed it was an excellent communication tool for staff in emergency situations when the boss was away, and others noted that it helped them keep track of their businesses as they expanded. The program also increased accountability as everyone (staff and industry people) understood the importance of food safety. One producer said,

> "[The program] is not far removed from what I did before but now I write it down, so I am more conscious of it."

When asked about the value the program could have to the industry, producers suggested expanded and guaranteed markets, greater consumer confidence and a positive image for the

industry. However, most producers were not concerned about export markets and did not think they were a good reason to start the program. They were more interested in domestic consumers.

4.1.4 Resource Material

Producers were asked to evaluate the Reference Manual and the Workbook during a structured interview but other opinions were offered and noted throughout the trial.

4.1.4.1 Reference Manual

Producers thought the Reference Manual was accurate; however, only one producer actually read it from cover to cover. Generally, they thought it was complete and practical. "It's like a tractor's manual," one producer said, "It has everything in it so that you can look it up if you need it." Others thought it was too technical and obviously written by "bureaucrats, not farmers." Another producer thought it was unnecessary and suggested that producers only need the Workbook; however, others stated that the Reference Manual was handy for new producers or for training staff.

The manual was intended to be used as a reference, to clarify the program's principles and expectations; however, the trial participants (being accustomed to extension or field staff) preferred personal communication and either called me or waited for me to visit their farms. Possibly, they may have read the manual more if they had to pay for my extension help.

4.1.4.2 Workbook

Overall, the producers wanted the Workbook to be as simple as possible and the records clarified and designed to reflect only the mandatory requirements of the program. From the workshops

and follow-up extension meetings, it became obvious that producers were confused as to what was mandatory, recommended or simply another option for the same record. As a result, the producers were faxed a Mandatory Checklist, outlining what they had to do, with the appropriate records referenced. Soon after that, the Workbook was consolidated to contain only the mandatory records. Producers found it easier to follow and understand. They could work through it from cover to cover and know they had implemented all the requirements.

Half of the producers used the sample treatment record sheets provided and half created their own. The common items missing from most of the homemade record sheets were broken needles and meat withdrawals. The CQM program insists on having a column or mention of broken needles somewhere on each record sheet, but some producers found this difficult to incorporate and one refused, as he felt broken needles were unnecessary to address.

4.2 REQUIREMENTS

The program's requirements included records, Best Management Practices and Critical Control Points, and some additional requirements were added as a result of the trial findings.

4.2.1 Records

One common comment from producers was, "I already do most of this stuff, I just don't write it down." The majority of the producers felt they were keeping some of the records already – particularly antibiotic records, but the records were not necessarily permanent or complete (e.g. records did not include meat withdrawal times).

Table 10 outlines which records producers were keeping before the trial. "Full" records include all the mandatory items for the program, "partial" records include some of the mandatory items, and "none" means that no permanent written records were kept at all.

Table 10: Producer Records Kept Before Trial

Record	Full	Partial	None
Antibiotics	0	9	5
Milk Temperature	0	0	14
Equipment Check	0	0	14
Broken needles	0	0	14
SOPs	0	2	12
Emergency plan	0	7	7
Drug Inventory	0	0	14
Cleaning Chart	0	0	14
Water records	2	0	12

Many of the producers saw the immediate benefit of keeping permanent antibiotic records but many of them found the weekly equipment check and bulk tank temperature records a nuisance. They felt that they checked the cleanliness of their equipment daily and checked the temperature of the bulk tank every time they walked by it. As a result, they could not see the advantage of recording that they were doing it. They did understand that they had to prove that they were doing it, but the benefits to their farms were not as tangible as the antibiotic records.

None of the producers felt they had any written Standard Operating Procedures. Some of them had posters or written instructions in some form posted in their dairy or barn offices, but they did not recognize them as adequate for the program. Some producers liked the idea of writing Standard Operating Procedures and wrote other procedures for training and farm reference;

however, others thought they were unnecessary. This could be a reflection of the training because many producers did not understand why the Standard Operating Procedures were important, especially on family-run farms.

In general, the producers felt that the Standard Operating Procedures made them feel more organized about their daily tasks. One producer had an employee who could not read English; consequently, he preferred to use the Standard Operating Procedure poster to illustrate his milking techniques. The posters were given to the producers as an option to visually explain their milking procedures by choosing stickers that depicted the different milking steps, arranging them on a poster and then hanging it on the wall. Only two producers used the posters and the majority were not willing to pay $25 for the posters.

4.2.2 Best Management Practices

Best Management Practices were a source of confusion and controversy for many producers. Best Management Practices are the foundation of on-farm food safety programs. Producers must show that they are controlling certain aspects of their farm operations (such as facility cleanliness and manure management) before they proceed to address the Critical Control Points set out by the program. However, it is difficult to assess if the Best Management Practices are being met and to decide how many must be implemented correctly to pass an on-farm audit. The Reference Manual discusses Best Management Practices and the Workbook identifies which ones producers must comply with; however, some of the requirements are vague. For example, a producer has to develop a Standard Operating Procedure for milking but there are many correct ways to milk a cow, and the program does not dictate what is acceptable and what is not. It simply states that teats must be clean and dry before milking; it does not dictate how a producer

has to achieve it. As another example, the program requires animals to be kept 'clean.' Cleanliness is a relative term and it is difficult to assess animals' cleanliness. The producers did not understand some of the Best Management Practices, perhaps because the Workbook did not outline the concepts clearly or group Best Management Practices and Critical Control Points into separate categories. Furthermore, the producers did not understand why some of the requirements were there; therefore, they did not understand the goal they were trying to achieve.

4.2.3 Critical Control Points

The 5 Critical Control Points (CCPs) are the main focus of the CQM program and the trial participants and other industry people responded differently to each one.

4.2.3.1 Critical Control Point 1 – Use of Livestock Medicines and Other Chemicals

The trial highlighted problems with extralabel prescriptions, farm practices versus label requirements, drug storage, testing new animals, regulatory antibiotic residue testing, and meat safety.

4.2.3.1.1 Extralabel Prescriptions

One of the program requirements for the first Critical Control Point is that producers must obtain veterinary prescriptions indicating the appropriate withdrawal times for any extralabel drug treatments they administer, because extralabel drug use can affect withdrawal times. Both veterinarians and producers resisted this requirement.

Veterinarians on the CQM trial were reluctant to write extralabel prescriptions for a number of reasons. First of all, they felt excluded from the program development process. Even though

veterinarians have been included in the manual review since the beginning, the trial participants' veterinarians did not feel that they themselves had had enough input and were concerned that the program was going to negatively impact their businesses. They did not fully understand why the program was requesting prescriptions and they were concerned about liability and someone looking over their shoulder. One veterinarian did not think producers would be willing to pay him for his extra expertise and time and he explained that he would be reluctant to sign an extralabel prescription if he:

- did not have a valid client-patient relationship with a producer;
- was not comfortable with the management style of the producer (i.e. not certain the producer would follow the advice);
- did not agree with the treatment for which a prescription was being requested.

However, legislation points to a veterinarian's responsibilities. The Food and Drug Act is the main legislation that covers veterinary drugs and all veterinary drugs are licensed by Health Canada, Veterinary Drugs Directorate (Health Canada, 2002). Drugs are classified into restricted drugs (only dispensed by a veterinarian) and over-the-counter drugs. Restricted drugs require a Veterinary Client Patient Relationship (VCPR). A VCPR means that a veterinarian is familiar with the farm and the producer's practices, takes responsibility for making clinical decisions, trusts the client will follow instructions, and will make follow-up evaluations (Wetzstein, 1995). This means that veterinarians should be writing prescriptions for extralabel drug usage and producers should follow their advice, as the program requires.

Some producers did not want to address extralabel antibiotic usage, because they did not want to obtain a prescription every time they needed to administer a drug. They were afraid of becoming

like some of the countries in the European Union, such as the United Kingdom, where producers cannot give any drug unless a veterinarian is actually present.

Furthermore, the trial did show that extralabel usage was a problem. One producer treated "everything" extralabel, as he gave his animals either a larger or longer dose than the label recommended. He kept their milk out of the tank for as long as he thought was necessary but he did not have a veterinary prescription; therefore, he was guessing. While taking drug inventories, I came across drugs that had expired over 10 years ago and drugs that producers did not know the purpose of because they had not administered them in years. Others did not know the withdrawal times of certain medications they were administering, or they were surprised when they read the label (e.g. Oxytocin – 24 hour milk withdrawal). Dairy Farmers of Ontario is requiring at least one person from each dairy farm in Ontario to take a Livestock Medicines Course to ensure their producers understand how to administer medicines responsibly (Dairy Farmers of Ontario, 2000). The CQM program gives producers a similar depth of knowledge as the Ontario course through the Reference Manual, but relies on producers to educate themselves.

I also found some surprising differences in prescriptions. A number of producers on the trial were using Gentamicin for mastitis treatment even though it has been shown to be ineffective (Jones and Ward, 1990; Erskine et al., 1992). Furthermore, two producers had obtained veterinary prescriptions, but one veterinarian recommended a 10-day withdrawal period for meat with intramammary infusion of Gentamicin, and another veterinarian recommended 18 months. According to research, if Gentamicin is administered intramammarily, it readily crosses the milk/blood barrier and residues are found in the serum and urine of cows, suggesting it accumulates in the kidneys (Erskine et al., 1991). A further study calculated that it would take 14-19 months to eliminate 99.9% of the residues from the renal tissues of the cows (Erskine et

al., 1992). Kidney tissue usually has higher concentrations of antibiotic residues than other edible tissues; therefore, the kidneys have to be clean before an animal can be slaughtered (Payne et al., 1999). The first prescription underestimated the meat withdrawal, and the other was accurate.

One veterinarian told a producer that he did not know what the withdrawal time was for Gentamicin. When I asked the producer if that made him nervous and if he would test his milk before shipping, he just shrugged and said no to both questions. He was not concerned about these apparent differences of opinion and trusted his veterinarian. It is interesting to note, however, that one study on antibiotic residues found that in the cases where the responsible party was determined, the producer took the blame 80% of the time and veterinarians took responsibility only 12.5% of the time and shared responsibility with the producers only 8.3% of the time (Van Dresser and Wilcke, 1989).

4.2.3.1.2 Farm Practices versus Label Requirements

Another problem that surfaced during the trial was that some drug labels do not reflect current farm practices. For example, the majority of farmers who administer Oxytocin, the hormone that encourages milk let down, do not follow the label recommendation of a 24-hour milk withdrawal. The majority of farms would have potentially failed the on-farm audit due to this problem alone. During the trial, the normal farm practice was accepted; however, Oxytocin is an example of how the program must solve contradictions between its requirements and actual farm practice in order to gain credibility. There is an increasing push to harmonize Maximum Residue Limits (the allowable levels of each chemical in a food product that is still considered safe) globally through Codex Alimentarius; therefore, perhaps some of the contradictions between label requirements and farm practice will be addressed at an international level (Codex, 1999).

4.2.3.1.3 Drug Storage

Drug storage conditions were a problem on about 5 of the farms. Either drug cupboards were messy and dirty or there were expired, unknown or unlabelled products. There were also pesticides, cat de-wormers, tractor oil and toilet bowl cleaners stored with treatments. These items were easy to correct but were an indication of producers' casual attitudes towards drug administration and their lack of knowledge of, or attention to, proper drug storage requirements.

4.2.3.1.4 Testing New Animals

The CQM program requires producers to test milk for antibiotics from new animals entering the herd from an outside source before shipping the milk, and the majority of producers were resistant to this. They were comfortable relying on their neighbour's word that a cow was untreated and would rather not be inconvenienced with collecting samples and sending them to a laboratory. A few producers had just bought 50-100 animals and they quickly calculated that it would be expensive to test each animal. Furthermore, they felt that the availability of testing services is decreasing. Producers belonging to DairyWorld previously sent samples with the truck driver but they did not think that service still existed. Depending on where a producer is located, driving a sample to the lab can also take a significant amount of time. Only one producer routinely tested his own treated cows with test kits at home before shipping their milk.

4.2.3.1.5 Regulatory Antibiotic Residue Testing

The current system of checking for antibiotic residues is another potential problem. Currently, every truckload is tested only for the common drug families (e.g. penicillin). Other drug families, such as the macrolids and amino glycosides, are only checked on a random basis. The CQM program does not require any further end-product testing. It relies on honest, conscientious producers to record antibiotic administration and adhere to Best Management

Practices. One producer thought that milk samples should be tested on the farm before the milk is actually pumped out of the tank. Other producers mentioned that some farmers are well aware of which drug families are tested for, and will ship milk with other potential residues, knowing that their chances of being caught are slim. The same attitude was held for cull animals. Some suggested that some marginal producers treat their cull animals before sending them to the auction or slaughter in order to receive a better price, knowing full well that they will not be implicated if a residue is found. Perhaps the National Livestock Identification (NLID) program will decrease the incidence of this practice but it is still a problem that the program needs to address.

One producer was adamant that on-farm testing should be done. Presently, a truck may pick up milk from a few farms but the truck is tested as a whole. If the test is positive, the individual farm samples are tested. Through this process, a contaminated tank may be diluted in uncontaminated milk and not be detected. The producer thought that the extra costs of individual farm testing would be worth it in the long run for both consumers and producers and that it was time for the common attitude of "dilution is the solution" to be rejected.

4.2.3.1.6 Meat Safety

A final concern was producers' attitudes towards meat. Slaughterhouses test meat for antibiotic residues by selecting random carcasses and "suspect" carcasses such as downed cattle, carcasses with visible injection sites, condemned carcasses, and animals from repeat violators. Samples of muscles, kidneys and injection sites (if possible) are tested (Canadian Cattlemen's Association, 2000). However, cull dairy cows are consistently the single largest source of antibiotic residue violations in cattle. The most frequent causes seem to be failure to observe the proper withdrawal time, usually due to the individual not knowing what it was, failing to keep adequate records and,

on occasion, using drugs for unapproved purposes (Van Dresser and Wilcke, 1989). The trial substantiated these findings because many producers did not keep records of meat withdrawal times for treatments given. Many did not keep records of treatments given to young stock at all. Young stock are often shipped if they become sick or injured, and, without records, producers had to rely on their memories to determine if those animals were safe to ship or not.

4.2.3.2 Critical Control Point 2 - Cooling and Storage of Milk

The program, if fully implemented, would have saved 2 full tanks of milk during the trial. Both situations resulted in tanks dumped because of temperature problems (one cooling system and one agitator not turned on). Both farms had not yet implemented their daily record keeping but both quickly required the chart recorders to be signed every day. One producer had a chart recorder installed but the milker did not look at it for 2 days and did not notice that the cooling system was off. If he had signed it, he would have noticed that something was wrong after the first milking and saved the tank of milk, worth about $1200, emphasizing that the chart on the temperature recorder must be signed after every milking. The other producer's agitator had broken and did not mix the milk. He did not check the temperature and, therefore, did not notice that the milk was warmer than usual. When the truck arrived, truck driver rejected the tank.

Both temperature recorders (farm holding tank and return wash line) were helpful tools for producers and the on-farm auditor, and the producers were happy with the results. They used them to check the temperature of the milk and the various wash cycles, and even to check when their milkers started milking each day and whether the power had gone off. Two producers discovered that when the power failed, the needle would track to the middle of the wheel, making it appear that a huge jump in temperature had occurred. One producer liked this feature because it alerted her in the morning that the sanitation cycle had not run. The recorders also

made on-farm audits easy, as the chart history could be checked to see if any water or milk temperature problems had occurred.

However, although the chart recorders were helpful, they are expensive and not the latest technology. Both milk and water temperatures can be monitored as effectively by hand or by more advanced equipment. Some provinces (e.g. Ontario) are making the recorders mandatory; however, with the other potential costs that the program may bring, the cost of the chart recorders may be overwhelming, particularly for small farms.

4.2.3.3 Critical Control Point 3 – Equipment Sanitation (cleanliness)

Producers felt that they were checking their equipment every day, but that recording it weekly was unnecessary and impractical. They thought that every 2 weeks was adequate and more manageable. Some farms had equipment flaws that caused certain areas to be dirty every time they were checked (i.e. meters and bottom of weigh jars) and these producers stated that their bacteria counts remained exceptionally low (e.g. 2000 cfu/ml); therefore, they would not waste their time cleaning those areas every week.

Many producers had household hot water heaters that could not produce hot enough water or enough volume to adequately clean the system. Milk pick-up sometimes complicated the problem and some transporters were unable to change routes. If pick-up happened shortly after milking, then the hot water supply was already exhausted from washing the parlour and there was not enough left to adequately wash the milk tank. Cost was a problem, as commercial or industrial hot water heaters can cost around $1,500, and some producers could not afford them, particularly those with small farms, tight budgets or large debts.

4.2.3.4 Critical Control Point 4 – Use of Water for Cleaning of Milk Contact Surfaces

The program currently requires producers to test their equipment washing water once a year. Only one producer on the trial had his water tested annually and one other producer had tested his water in recent years because he had had well problems in the past. Everyone was curious to see how their water would score but did not know what they would do if it was contaminated. One producer stated his neighbours had been having bacterial problems with their water and he was nervous that his would be contaminated too. Although he was aware of the hazard, he did not act on it because of three concerns: he did not know where to find information on how to correct it, he was concerned that it would be expensive and difficult to correct, and he did not want his production to be shut down by the health authorities in the meantime. Interestingly, the Ministry of Health processing plant inspectors were not concerned about the water data.

The Technical Committee debated who should collect water samples. They thought that the producer should take one and then the on-farm auditor should verify those results by taking another sample during an on-farm audit. Extra samples add to the program's costs (~$40/sample in British Columbia); furthermore, water samples must be dropped off at a lab within 24 hours or the results will not be valid (bacteria will grow). This adds travel time for the on-farm auditor or shipping and handling costs (plus ice packs and Styrofoam containers). Courier costs were $12.86 per container for an overnight delivery during the trial or $1.05/km for a same day delivery. In Ontario, the milk truck driver has been designated to collect the water samples - a viable and cheap alternative.

4.2.3.5 Critical Control Point 5 – Administration of Livestock Medicines by Injection

Broken needles were a concern that surfaced at every workshop and throughout the trial. "Have you ever broken a needle [in a cow]?" producers would ask each other in disbelief when the

topic was introduced. The typical response was, "never heard of it." Some producers did not want to include broken needles in their treatment records because it cluttered the sheets and they felt it was unnecessary, "it never happens." Some producers found it difficult to understand how they could pass on information on a broken needle. Many cows are transported to slaughterhouses out of the province or the country; therefore, producers do not know whom the next buyer will be. Furthermore, transporters can be unwilling or not interested in dealing with the information and may not pass it on to the slaughterhouses (i.e. there are no protocols in place beyond the farm). One producer and a veterinarian were concerned that simply addressing broken needles would send a message to consumers that the industry has a problem with them and they did not believe it did. They felt it would create an unnecessary concern.

However, according to Canadian Cattlemen's Association, there were 13 instances of broken needles found in meat in the year 2000 and four of them occurred in beef. It is not known whether those animals were from the beef or dairy industry, but it proves that the situation does occur in cattle. Furthermore, dairy cattle constitute 25% of the beef industry, which is a significant portion. As a result, the CQM program addresses broken needles because one found at the consumer level is too many.

New needles are being designed to allow processing plants to more effectively identify broken needles. New needles made of a special alloy that metal detectors identify better than stainless steel have been developed for the pork industry and will also be utilized in the cattle industry (Dimmick, 2001b). However, these new needles are more expensive than current needles, and as long as the older ones are still legal, some producers will always choose the cheaper option and the CQM program will have to address broken needles.

4.2.4 Additional requirements

Some mandatory requirements were added to the program after the trial such as a yearly equipment check and written veterinary protocols for treatments. The study also showed that pesticide concerns need to be addressed further, and some producers wanted additional items, such as checking the vacuum gauge, added to the program.

The Technical Committee decided that it was essential for producers to have a professional review their equipment, because they saw out-dated or incorrect records. With the producers who actually had regular equipment checks done, some had out-dated forms and testing protocols that did not meeting current National Mastitis Council standards. One producer had equipment problems noted on the form and he was unaware if the equipment dealer had corrected the problems, indicating a need for accountability by the equipment dealer or more initiative by the producer to make sure the job was done thoroughly. Often equipment dealers are not properly trained and they may begin to charge more for the extra expertise required by the CQM program.

Producers were required to obtain extralabel prescriptions from their veterinarians; however, the producers on the trial decided or determined which drugs they needed prescriptions for, and it became apparent that they did not have the knowledge to make these decisions. The new protocols would require a veterinarian to review the treatment plans and develop protocols and prescriptions. The committee felt that if producers discussed their treatment plans with their veterinarian, it would resolve both parties' reluctance to comply with the extralabel requirement and lead to more responsible antibiotic administration. Neither of these items was tested with the producers on the trial; therefore, the current results do not reflect their opinions on them.

The trial also identified some pesticide concerns that the program should address. Many producers had their pesticide work done by a private company and the company supplied their own water; therefore, the process was self-contained and independent of the farm. However, one farm used the high-pressure hose from the parlour to fill the pesticide tank. This presents the risk of pesticide residues being introduced into the parlour during clean up. A few pesticide storage problems arose as well. Two producers kept their pesticides in a room beside the milk house, but the pesticides had to be brought out through the farm holding tank room when needed. The risk of a spill was a hazard, and the proper clean-up procedures were not known. Another producer had various unknown substances in unmarked bottles, which were a potential hazard. Again, the only exit from the room was through the parlour itself.

Some producers wanted other items made mandatory, such as checking the vacuum gauge at every milking, writing Standard Operating Procedures for bedding and feeding, and keeping herd inventories (why and which animals leave or enter the herd). They wanted the program to require more, but others wanted it to require less. The Freedom Food program in England noticed the same phenomenon, as the early adopter producers wanted the program stricter, others were happy with it as it was (Unger and Huddart, 1999).

4.3 CHANGE

One participant summed up a common theme throughout the trial by saying,

> "People don't like to change."

The CQM program required the producers to change their production methods. For example, all of the producers on the trial had to change or add to the records they were keeping. Some agreed that the changes would organize them and give them better peace of mind, but others were resistant to change, as they were happy and comfortable with their own systems. These people had to be convinced that the changes were valid, necessary and helpful. One producer found that adding all the required information made his records too complex and confusing. Another producer was resistant to add broken needles to his records, as it did not fit in his current format and he thought it was not a problem on his farm.

One of the biggest stumbling blocks was just becoming accustomed to the program. Most producers found it quite manageable once they fully understood and implemented it. One producer stated,

> "Once in the habit, it takes a blink of an eye to do it. Just takes discipline, not much time. It has to become part of your routine."

However, another producer did not want to become accustomed to it. He did not want to be "like sheep and just accept it." He felt that dairy producers have been too complacent and accepting in the past, and he felt it was important to express the initial frustration that he had felt with the program. He had seen other programs and ideas quickly adopted by the industry (such as the environmental guidelines) and he did not want the CQM program to become an added pressure due to lack of producer resistance.

A number of producers experienced resistance from family or staff members to change their current methods. A few staff members were adamantly opposed to even trying a new system of

records and argued that it was unnecessary and too much work. However, once they had accepted their new role, implemented the program and tailored the records to their own needs, they did not find it too onerous.

The CQM program also involves a change of philosophy and other people have seen HACCP programs cause similar attitudinal and cultural changes in food businesses as well (MacDonald, 2001). The CQM program's pivotal concept is that producers must monitor Critical Control Points every day to enable them to quickly pinpoint problems or catch them before they become problems. However, the current British Columbia government inspection system is outcome-based. Outcome-based systems evaluate a product or operation by measuring the safety and quality of the end product. For example, if the milk in the bulk tank of a farm has a low bacteria count, it does not matter what methods the producer employed to put it in there. The weakness with outcome-based systems is that they look for solutions after problems have occurred, instead of preventing the problem from happening in the first place. Some producers on the trial had not been inspected in 5 years because they had not had quality problems to trigger an inspection. As a result, some of them felt that if their operation was producing high quality milk, it was nobody's business whether they used good or poor practices previous to the milk arriving in the tank. They did not want anyone looking over their shoulder or telling them what to do unless they had sustained an infraction. One producer stated,

> "The program can come up to my milk tank but that's it. As long as it's a quality product in there, [it is no one's] business how it got there."

The CQM program, however, insists on regular visits from an on-farm auditor to assess a producer's performance regardless of their quality results. This made some producers

uncomfortable, whereas others easily accepted it. For those resistant to the concept, it was a change that they did not understand the need for and were not willing to pay for.

4.4 UNDERSTANDING HACCP

Producers' understanding of HACCP was gauged from the initial and final interviews as well as through the workshops and implementation process.

4.4.1 General Comprehension

At the beginning of the trial, the producers' understanding of on-farm food safety programs ranged from extensive to vague. Some producers had never thought about their farms as having "hazards." Others had an extensive understanding of HACCP. Views of HACCP varied from "quality control" to "accountability" to a marketing or management tool. Some other comments were:

> "I don't know...never heard of it."
>
> "Protection for farmers...if something goes wrong, you can track back and prove it is not us."
>
> "Hassles."
>
> "Responsibility... a program to make everyone aware of their responsibility."
>
> "Procedural thing to make sure that the processor has a quality product and the consumer is satisfied with you as a producer."

By the end of the trial, all producers demonstrated a clear understanding of what HACCP meant, describing it as "quality control," "audit trail," "drugs out and quality in," and "another level of management." One producer described it as having "records to back up what we say we've done, which we do now" and as keeping track of everything and making sure that the milk was as good as it possibly can be from producer to processor. One producer admitted,

> "At first I thought HACCP was pointing the finger at the farmer to blame but now I think it's assuring a better product to the consumer and that's a must."

The producers also had varied opinions about the program. Some thought it was "a must" for the industry, others stated that it increased awareness of risks and hazards and others saw it as "just another thing we have to do" and "more rules and regulations that I don't like." One producer called it a "make-work program."

In my opinion, the producers' understanding of the principles of the CQM program was more specific at the end, proving that they had absorbed some of the major concepts well.

4.4.2 Producer Training

Almost all of the producers felt the 2-hour training workshop was helpful. A number said that they would be "lost" without it, although one producer stated, "If I hadn't had the training, I don't think I would be any more lost than I am now;" however, he had attended the first workshop, which the trainers later improved. Even so, many found the training overwhelming because they were being introduced to new concepts and acronyms (e.g. HACCP, SOPs, BMPs, and CCPs) and being told how to implement the program, all in 2 hours. Unfamiliar jargon is an

impediment by itself. Some producers became quite confused during the workshop because they were trying to digest the principles and requirements of the program, and the accompanying new terminology and how it related to the requirements. We quickly discovered that it was best to refrain from using the acronyms to facilitate learning and minimize frustration.

Brashears et al. (2001) evaluated HACCP implementation in 33 Nebraskan processing facilities. They found that the workers displayed a 75% increase in knowledge, and that they changed their behaviour and attitudes towards food safety, after going through a workshop. Staff became more aware of possible hazards and food safety problems. Furthermore, those who viewed HACCP as a cumbersome regulatory requirement discovered that it had definite benefits for protecting them from food safety problems. They needed to understand the program in order to accept it fully, and the B.C. trial producers showed similar tendencies. Studies have found that training is essential to properly implement HACCP and that training must be effective to make sure that everyone understands what the purpose of the program is, where they are starting from, and where they will end up (Mortimore, 2001; Fuhrmann, 2001).

All participants agreed that a maximum of 10 people should be in each workshop. The small group size was effective and enjoyable and it encouraged questions and discussion amongst participants. The program addresses sensitive issues, such as producers' antibiotic and sanitation practices, which are easier to discuss in a smaller group. Everyone thought the workshop should not be more than 2.5 hours due to waning attention span, information overload and other time commitments (e.g. milking).

The third style of workshop appeared to be the most effective as the last producer to be trained understood the program, implemented it and was audited in the shortest amount of time from

workshop to on-farm audit (one week). Each workshop had slightly different results but some overall themes emerged.

Many of the producers from the first 2 workshops did not have a clear understanding of what the program was asking them to do. Some became confused with the sample records provided for them and did not realize that some were mandatory, some were recommended and some were different versions of the same record. Only when the mandatory items were listed clearly on a "to do" list and the records simplified did the producers truly understand what was expected of them. At the end of the day, all they wanted to know was what they "had to do."

In some ways, the producers' desire to have all the requirements outlined clearly for them, illustrated one of the largest differences between the processing plant sector and the on-farm sector approaches to HACCP. Processors are required to go through the 12 steps of HACCP and actually create their own plans. The national commodity groups have done this for producers to make the program easier to implement, but, inadvertently, they may have created programs that producers may never truly understand. Perhaps, if producers had to go through the entire process themselves, they would realize the reasons behind each requirement. However, HACCP programs take processors at least 18 months to develop and implement and often require hiring additional staff. National commodity associations recognized that producers would find the time and cost unbearable; consequently, perhaps they have traded understanding for acceptance.

4.4.3 Implementation

Most producers took longer to implement the CQM program on their farms than we originally anticipated. No implementation deadline date was given to the first group (3 farms) during the

workshop in order to assess how fast they would respond on their own. No producers called and by the middle of November (3 weeks after the workshop) they were contacted and no one had begun. Six more farms were trained and given a 3-week deadline; only one had almost completed the requirements within that time. Most producers tried to implement the program as soon as possible but the trial was a low priority compared to other farm tasks. The producers were volunteers and unclear of what was expected of them due to the complexity of the program principles and philosophy, and the training approach. As a result, many tried to implement the program, became confused and waited for further direction from me. Unfortunately, the trial was testing both the training materials and the implementation; therefore, the producers' difficulty in implementing the program reflected both the challenging concepts they were learning and the imperfect workshops. The program also required record keeping, which many producers did not enjoy, or feel comfortable doing; therefore, they procrastinated.

Only one producer had the majority of tasks completed for the first visit, and the rest of the producers needed prompting and further explanation. I quickly realized that I had underestimated how much time it would take to assist producers (explain the program requirements and clarify records), travel to and from farms, and accommodate everyone's schedule. Most producers on the trial worked full-time on their farms; therefore, the window of opportunity for meetings was the short period between milking times (basically between 10:00am and 3:00pm), which placed further restrictions on their availability.

Some producers found that the program was more intense than they had originally thought. Five of the producers either partially or completely delegated the program's implementation to staff members. Three of them handed the book over to an employee and made them responsible for understanding it and doing the work. One producer had his CQM-designated employee leave,

and the owner did not know how to pass the information on to the next employee. Others found it difficult to train staff: both finding time to do it and gathering staff together in one place at one time. A few producers also found it difficult to convince some staff members to do it because the program was too overwhelming or staff were resistant to change.

Most producers on the trial felt that they needed someone to help them implement the program and answer their questions. One producer said he would have given up after the workshop if I had not been there to help him. The majority of producers utilized my one-on-one help to become organized; however, when asked if they would pay for that time, they were not sure that they would and thought they would spend more time trying to do it on their own. My help was free; therefore, they took advantage of it, but once the program is officially implemented, producers may be required to pay for someone to help them. Some suggested that it would be easier if they could "start small" (introduce one Critical Control Point at a time), if it was kept practical, and if there was an incentive to do it.

4.5 ON-FARM AUDITS AND AUDITORS

This study evaluated the producers' response to their audit results, the on-farm audit procedure, the skills and training required for an effective on-farm auditor, and the credibility of the CQM program.

4.5.1 Producer Response

The producers' response to the on-farm audit procedure was mixed. Some agreed with the suggestions made; others did not know how to rectify the non-compliances, and some did not

think it was necessary or fair to make the suggested changes. Some producers were resistant to change some practices (e.g. young stock bedding and pesticides storage) that had simplified their work and saved them money, and other producers were defensive about their present systems. Perhaps they did not realize the cost or difficulties associated with a potential problem, such as cleaning up a pesticide spill. The cost of rectifying a problem could be much more expensive than preventing it (e.g. providing a separate pesticide storage area). Cost was a common explanation for not doing something and many claimed they would do more if the cost were reflected in their milk cheque. When one producer was told that his heifer housing was too dirty he stated,

> "It all comes down to economics. If you pay me more for my milk, I will do everything; otherwise, sawdust and time are expensive."

Another producer felt that the program was starting to impinge on her lifestyle when it looked too closely at items unrelated to milk safety, such as calf housing. She compared it to a hypothetical situation with a Health Inspector coming to her home to certify her to sell baked goods and she said,

> "It's like inspecting my kitchen and saying it is clean and sanitary but looking in the bedrooms and saying they are a mess."

Dirty calf/heifer housing was noted in a few producers' on-farm audit reports to prompt discussion. Producers agreed that the stalls should be cleaner but they thought it was beyond the scope of the program to comment on those areas. Others thought it was fair to comment on but not fair to mark a producer down or fail him/her for young stock housing or condition. No one

viewed calves and young stock as potential beef sources; therefore, they did not think it was important to keep them as clean as possible to minimize carcass contamination.

Some producers started noting similarities between the on-farm audit and current dairy inspections and were quite annoyed. They did not appreciate someone reviewing their tasks and looking at problems they felt were a barn inspector's job and none of an on-farm auditor's business. When their non-compliances with regulations were noted on the on-farm audit reports, they felt it was beyond the mandate of the program. If it was not perceived as a problem directly related to the lactating herd, they thought it was unfair for the on-farm auditor to comment on (e.g. cobwebs on the milk tank, chickens in the calf barn and dirty heifer housing). These instances illustrated how important it is for regulators and on-farm food safety programs to work together.

4.5.2 On-farm Audit Procedures

During the trial, the Technical Committee met in Abbotsford, B.C. for 3 days to review the on-farm audit procedure. They actually audited 2 farms, and during this exercise it became clear that each person was depending on their experience to complete the audit, not on the protocol provided. This resulted in tremendous variation between on-farm auditors and illustrated that the program needs descriptive guidelines for on-farm auditors and in-depth training to:

- determine compliance with the program
- determine what requires a follow-up visit and what does not
- ensure consistency across on-farm auditors.

The trial also illustrated a number of improvements that could be made to the audit procedure. First of all, I could not verify that staff were following the producers' written Standard Operating Procedures because staff were not present during my audit. If staff had been present, I could have interviewed them to determine their level of understanding and compliance. Staff training is an integral element of a HACCP-based program, so staff should be present for the on-farm audit. Secondly, one producer on the trial had animals at 4 different locations and another producer had dry cows housed at a neighbour's farm and I did not know if I should include each site in my audit. I only audited the facilities on one site because looking at all locations adds time and cost to an on-farm audit. However, the CQM program addresses meat safety; therefore, all animals and locations should be audited. During the trial, I checked wells but I did not know what to look for because the program does not specify requirements. One producer's wellhead was 40 feet below his garden and another was a mile out in the middle of a field and many wells on the trial had not been inspected for years. To rectify this problem, the program needs to clarify what on-farm auditors need to look for and train them accordingly.

Because of incomplete records on some farms, I had to make multiple visits before an actual on-farm audit could occur. Eventually, I decided that the trial producers did not need complete records to pass the audit because producers took longer than anticipated to implement the program and the trial began to run out of time. However, the official program will require complete records before an on-farm audit. The Canadian Quality Assurance (pork) program requires producers to submit at least 3 months of complete records before an on-farm auditor visits their farms. This shows that producers are in the habit of keeping records and that they will continue to do so after the on-farm audit.

A final issue was whether or not an on-farm auditor should advise a producer on how to solve non-compliances. In the Freedom Food program in the UK, auditors are not allowed to give advice because there are many ways to solve a problem and if they suggest something that does not work, they may be held liable (Unger and Huddart, 1999). True auditors are not consultants. Auditors gather facts, assess and report, and do not advise. Some on-farm programs (e.g. hogs, chicken and dairy) are already combining the roles of auditor, inspector and consultant to reduce costs, but if CFIA dictates that on-farm auditors have to follow ISO 9000 Guidelines (ISO, 2002), they will not be permitted to give advice.

4.5.3 On-farm Audits versus Inspections

Some of the trial producers thought that the dairy regulations and the CQM program would naturally become one and the same. In Queensland and New South Wales, the regulatory staff also audits quality programs. In essence, they have combined a dairy inspection and audit, and the differences between the two have become unclear (Juffs, 2000). Some of the trial producers were concerned about duplication and the associated cost and time investment for them. A study in the United States also found that the difference between inspections and HACCP programs needs to be clarified (Cates et al., 2001).

If the Canadian Quality Milk program were to take over inspections, on-farm auditors would not have enforcement power, unless the CQM program was incorporated in the regulations or the provincial producer associations were authorized to enforce regulations. The CQM program may have consequences, for example, processors may require their suppliers to be CQM-certified; therefore, producers may be unable to ship milk if they lose CQM-certification, but the program is not intended to be regulatory. Inspectors' and on-farm auditors' roles are different.

Inspectors provide on-site training and technical assistance, as well as inspection. On-farm auditors just audit. Inspectors enforce regulations and evaluate the safety of the end-product and what a producer is doing today. On-farm auditors look at how a farmer produces the end-product and how effective his/her management strategy is and has been through the previous on-farm audit period to ensure that the end-product is safe. The CQM program is designed to complement current regulations, and on-farm auditors and provincial inspectors have different roles. Furthermore, if the program replaces inspection, it will become mandatory and part of the regulations.

A study done in Florida measured the impact that regulations had on dairy farmers (Tefertiller et al., 1998). The researchers discovered that the average dairy farmer spent 22% of the work day complying with regulations from various ministries and that regulatory pressures had increased by 132% in the previous 5 years. Some of the regulations had been developed for other purposes but dairy farms had to comply as well, even though their compliance did not further the regulations' purpose. The majority of farmers felt that milk inspection was good for business (e.g. consumer assurance) but regulations as a whole were diminishing their land values, hurting their relationships with lenders and increasing their labour costs. Similarly, some of the producers in British Columbia were concerned that a mandatory or regulatory CQM program, while positive in principle, could increase their costs and negatively affect their businesses. Presently, producers have ownership of the CQM program and they can affect which requirements are added or removed. If the program becomes regulation, producers could lose that control and have a more rigid and cumbersome program forced on them.

In British Columbia, government cutbacks have reduced the province's inspection staff to one person, who, consequently, does not have enough time to inspect every producer each year. A

few operations on the trial showed evidence of slipping standards. Their grade reports were good, but their food safety risks were increasing. For example, one producer was storing a herbicide spreader in the milk house beside the milk outlet valve of the bulk tank, and another had unlabelled pesticide containers in a damp room beside his parlour. These problems suggest that the CQM program must have regular on-farm audits to ensure producers maintain the requirements. Furthermore, if producers have a license to ship milk but are not complying with the regulations due to infrequent provincial inspections, then the on-farm auditor has to audit the regulations to make sure the producer is compliant. Simply ensuring that producers have a license is not adequate if the inspection system is not adequate.

The trial also highlighted an ethical issue regarding regulations. If a farm is violating provincial regulations, the on-farm auditor must note it as a non-compliance because meeting regulations is a requirement for the program. However, should the on-farm auditor report this to the regulatory authorities, and, conversely, should the regulatory authority communicate any quality problems, infractions or suspensions on a CQM-certified farm to the program? If the two bodies decide to share information, producers must be made aware of it and agree to it or it could become a legal issue of confidentiality and sharing of personal information. The CQA (Canadian Quality Assurance) program requires hog producers to fax quality records regularly to the provincial coordinator. The CQM program may consider a similar approach.

4.5.4 On-farm Auditor Skills

According to Chambers (2001), a consultant from the Canadian Federation of Agriculture, on-farm auditors must have training in HACCP or auditing and the necessary skills to assess whether or not a farm is in compliance with the standards established in the program. They also

have to be able to review records, make observations and communicate with the responsible people to determine if the program is being implemented effectively. If a producer fails, on-farm auditors should indicate corrective actions, but not troubleshoot, and refer the producer to an appropriate resource person (e.g. program coordinator, industry specialist).

McKemie (1995) described effective auditors as having good interpersonal skills, efficient techniques, a balanced outlook between physical facility, equipment and food safety risks, proof to back up findings, and a helpful closing meeting to review details. Auditors should be courteous, role models in hygiene and biosecurity, professional, efficient and well prepared. They also need excellent interpersonal skills and need to be helpful, positive, able to negotiate, good listeners, knowledgeable, and able to distinguish between critical and non-critical items.

The trial substantiated both of these views, as producers tended to ask the on-farm auditor questions about quality, equipment, or general industry issues and they expected the on-farm auditor to either know the answer or be able to find the answer and report back. It quickly became clear to me that on-farm auditors will need diverse skills and knowledge.

During a group meeting, the producers indicated that they thought the on-farm auditors should be: dairy producers (or have extensive experience with dairy farming), equipment experts, veterinarians, inspectors, and quality consultants all in one, or have access to this expertise. The producers also wanted on-farm auditors to have farming experience so that they would be practical and credible and able to converse knowledgeably with them. Some producers on the trial quickly tested my knowledge to find out where they could cut corners or have some fun. My own working experience was essential and made the trial meaningful for both parties. The

producers also wanted on-farm auditors to have excellent communication and personal relations skills but they indicated that formal education was not essential.

The producers thought on-farm auditors should give advice and identify food safety risks, but not tell processors, inspectors or veterinarians about the problem. However, ISO 9000 rules do not permit auditors to give advice because then they can no longer objectively audit that operation. The producers did not want on-farm auditors connected to the farm in any other way, such as a veterinarian or Dairy Herd Improvement representative. Most producers were uncomfortable with their veterinarians auditing their farms due to the conflict of interest, as veterinarians make some of their income from drug sales and would be auditing producers' drug usage.

I quickly discovered that on-farm auditors will need extensive drug knowledge or a technical expert (e.g. veterinarian consultant) to be able to identify which drugs are being administered extralabel. Some producers on the trial had extensive treatment records and I did not know which treatments were according to the label. I had to read every label to determine whether they were in compliance or not, which takes too much time.

On-farm auditors will need to understand various milking equipment systems because every farm on the trial had a slightly different system. Each system has its own problem areas where milk residue tends to build up, and the on-farm auditor has to be aware of where to look and what to look for. Half of the Technical Committee wanted the on-farm auditor to do a complete equipment inspection and half wanted the on-farm auditor to ask the producers where the problem areas were and check only those spots. The difficulty with checking everything is that the auditor may inadvertently cause bacteria problems (e.g. by opening up pipelines). The risk with the latter is trusting that the producer will reveal his equipment's weak spots and then

feeling confident that the rest of the equipment is clean by only checking those areas. This level of training and experience will require a high level of professionalism and increase costs.

4.5.5 On-farm Auditor Training

The CQM program does not have an on-farm auditor-training package developed yet. CFIA contracted the Food Technology Institute at St. Hyacinthe to develop a 4.5-day cross-commodity on-farm auditor-training program for on-farm HACCP auditors. All potential on-farm auditors are required to go through this first and then the commodity-specific training course.

In Australia, a Working Group on Safety and Quality Systems Equivalence (2000) compared various food quality assurance programs. One of the key problems they found was inconsistencies in auditing approaches because different auditors had varying levels of experience, qualification and knowledge of the programs' guidelines. Auditors also relied on checklists too much and seemed to disguise their lack of experience or knowledge with checklists. Training on-farm auditors adequately and consistently will be a key initiative and challenge for the CQM program.

4.5.6 Credibility

Some producers also emphasized that the program must be able to identify non-compliances for it to be credible. They expressed suspicions that producers would cheat the system by "fudging" records, filling in boxes at the end of the week or tampering with water samples (taking samples from the neighbours' tap or boiling the water).

One comment from a workshop regarding records was:

> "Truckers have done this for years; it is called a log book."

Then, of course, the joke that followed was that truckers have multiple log books, one for the inspector and one for the mechanic. For the CQM program it would be: one for the on-farm auditor and one for the producer. One producer stated that if he was on the program and a cow had a problem, he would buy the drugs, not write them on the inventory, not obtain a veterinary prescription, treat the cow, and hope nobody would notice. He felt that this would happen with producers who were resistant to implementing the program and even with a few who support it. "It is obvious how easy it is to get away with stuff." Another producer had a similar view,

> "The further you go the more loop holes you create. He [a producer certified under CQM] is going to shoot 'em up with Oxytocin same as the rest of them."

Many producers do not follow Oxytocin's label withdrawal time for milk.

However, another producer said, "You can't make anything fool proof because idiots are so ingenious," implying that regardless of how hard you try, people will still find a way to cheat, even if it harms themselves and/or the industry.

Presently, the program's on-farm audits are designed to be by appointment only. The trial did demonstrate that producers cleaned up and filled in records prior to the on-farm audit. Unannounced audits would provide a clearer view of how producers are following the program; however, the on-farm audits are intended to be a learning experience for the producer, not an

exam. If producers are not following the program properly and are filling in records the week before the audit, it should become apparent to the auditor during interviews with staff that they have not implemented the program. Producers also are required to be present during the audit; therefore, it is more convenient and efficient for them to be notified.

The frequency of on-farm audits has not been finalized yet, but the Canadian Food Inspection Agency (CFIA) has suggested a maximum audit interval of 18 months, alternating between a simple record review and a full farm visit. The CQA (for pork) program follows this model by having a full on-farm audit (which includes a farm visit) for initial certification. Then, producers submit their records for review for the next 2 years and a full on-farm audit occurs during the third year. In Victoria in Australia, each main dairy company is implementing its own program and planning to do internal spot audits and then less regular third party audits. However, the experience in Queensland and New South Wales shows that this has not been successful and regular formal audits are essential to maintain the programs (Juffs, 2000). In California, researchers saw deviations from program protocols within 3 months of the initial audit (Moore, 2001). The CQM program was not implemented on farms long enough to determine if producers were deviating from it during the trial in British Columbia.

CFIA will augment the CQM program's credibility. CFIA will be granting official recognition to national on-farm food safety programs that meet their criteria; this will help the programs gain international acceptance and credibility. Australia has 155 different programs in one state because they did not have a system of recognition in place. As a result, programs built on each other, expanded and competed. Canada is starting to see the same trend. Already, Ontario has both a national (Start Clean-Stay Clean) and provincial (Beyond Clean) poultry on-farm food safety program, and British Columbia's Agri-Food Choice and Quality Act actually encourages

the development of certification programs (British Columbia Ministry of Agriculture, Food and Fisheries, 2001b). Australia is now trying to amalgamate programs to ease consumer (both international and domestic) confusion (Juffs, 2000). Canada has learned from Australia and is insisting on one national standard for each commodity, and the Canadian On-farm Food Safety program is attempting to convince the provinces to conform to the national approach. Through CFIA recognition, the CQM program will be externally audited and more credible for domestic and international consumers.

4.6 CONCERNS

Some concerns that were identified during the trial were biosecurity on the farm, producers' lack of recognition of their contribution to the meat industry, animal welfare and other programs, the CQM program's effect on safety, and mandatory or voluntary implementation of the program.

4.6.1 Biosecurity

About half way through the trial, Foot and Mouth Disease infected animals in the United Kingdom and the trial producers became acutely aware of biosecurity. They began to ask how the program addressed biosecurity and how I, as the on-farm auditor, was ensuring that I was not spreading diseases from farm to farm. Some producers started making special efforts to ensure the safety of their animals and expected the program to do the same. One producer put out footbaths and a few put up signs, such as:

"Stop Bio-Secure area

Authorized Personnel only"

Half of the producers ran closed herds, but the rest either bought cows occasionally or were expanding. Interestingly, none of the latter producers had biosecurity programs in place for their herds. CQM on-farm auditors must employ strict biosecurity measures such as disinfecting boots and wearing clean coveralls to every farm. I had 7 pairs of coveralls ($40/pair) and spent $160 on laundry and $25 on disinfectant to audit 15 farms, totalling $465 for 6 months - a significant but necessary cost.

4.6.2 Meat Production

One of the most interesting concerns that came out of the trial was the producers' lack of recognition that they are also major producers of meat. Even the program exhibits shortsightedness, as it does not mention "meat" in its name. The dairy industry produces 25% to 30% of the beef in Canada (McNabb, 2002) and producers must ensure that their animals are safe for human consumption.

One general misconception is that meat from cull dairy cows goes into hamburger, bologna and sausages. However, in the last 10 years, the industry has changed dramatically, and beef from market cows and bulls is being served as entrée items in first class meals on airplanes, beef jerky and sliced beef in fast-food sandwich places (Smith et al., 1999). Unfortunately, the dairy industry has a poor meat quality reputation because a large number of quality defects or downgrades come from dairy cattle. Hoard's Dairyman ran an article that stated that 71% of cull dairy cow rounds had injection lesions or scars, leading to downgrades and lower yields because affected sections were cut out and discarded (Larson, 2001).

The United States did a national 'slice audit' in 1998 and dairy cattle had twice the damage from injection site lesions as beef cattle. More than one-third of all dairy cattle outside round muscles were damaged by injection-site lesions resulting in extensive trimming and value losses (Roeber et al., 2001). However, dairy producers in the United States receive only 4% of their gross revenue from the cattle sales and 96% from milk sales; therefore, many of them do not focus their attention on meat quality and safety (Roeber et al., 2001). Thus, it can be difficult to convince producers of the importance of meat safety.

Heifers and young stock may, at any point, end up in the meat industry. If an animal becomes sick or injured or does not become pregnant it is often "beefed." Many producers on the trial were reluctant to accept criticism on heifers and young stock during an on-farm audit, because they felt that young stock were not directly related to milk safety. They did not recognize them as potential meat sources. When discussing this, one producer stated,

> "Inspectors used to hound producers for calves and heifer stalls. Not anymore, [the dairy inspector] is just a quality guy."

This producer was strictly referring to milk as a safety concern, not recognizing the meat potential of his young stock.

Escherichia coli O157:H7 is an organism that causes food-borne illness and is often associated with hamburger. A study done by Uhitil et al. (2001) showed that *E. coli* O157:H7 was found in the feces of 3.2% of dairy cattle. Another study found *E. coli* O157:H7 in 1.93% of fecal samples from cull dairy cattle (Murinda et al., 2002). Other studies have shown that feed and water troughs are often positive for *E. coli* O157:H7 and often are the most common vectors

(Hancock et al., 2001; LeJeune et al., 2001; Lynn et al., 1998). Another study showed that if cattle pens are contaminated with *E. coli* O157:H7, there is a high probability that the carcasses from that pen will be contaminated as well (Elder et al., 2000). The CQM program requires producers to keep their cattle clean to reduce the risk of fecal-contaminated carcasses.

Few producers on the trial kept permanent records of antibiotic treatments and none of them kept records for the meat withdrawal time (i.e. time before which an animal should not be sent to slaughter). Some of the producers could have consulted their treatment records with recorded milk withdrawals and calculated the meat withdrawal times before shipping an animal, but those who did not have any permanent treatment records relied on memory to determine when a cow was last treated and when she would be safe to ship. Meat withdrawals are usually longer than milk withdrawals and it is easier to forget or misjudge when an animal was last treated.

Further complicating the problem is that dairy producers often sell their animals at auctions; therefore, they do not receive direct market feedback regarding the condition or quality of their animals. Perhaps producers would be more concerned or conscientious if their animals went directly to a slaughterhouse. However, as HACCP grows in the industry, slaughterhouses and cattle buyers may begin to ask for "Certificates of Guarantee" from producers, as well as for proof that animals do not contain antibiotic residues because they have to address cattle as raw inputs in their HACCP plans.

Some producers on the trial suggested that beef should not be covered in the dairy program; in that case, however, dairy producers would have to follow both the Canadian Quality Milk program and the Quality Starts Here program (beef). Implementing both programs would

involve 2 sets of manuals and workbooks, 2 workshops to attend and, possibly, 2 separate audits. To reduce costs and avoid multiple audits, the CQM program addresses meat safety.

4.6.3 Animal Welfare and Other Programs

The CQM program does not specifically address animal welfare, although other programs do, such as the Quality Starts Here program (Canadian Cattlemen's Association, 2000). I specifically asked producers about animal welfare during the trial to spark discussion. It is important to note that the British Columbia Society for the Prevention of Cruelty to Animals has been developing an enhanced humane labeling program in British Columbia called the Farm Animal Program (BC SPCA, 2002). The dairy industry's response has been defensive and not supportive. The trial participants had varying levels of knowledge of this program and it influenced their opinions on whether animal welfare should be part of the CQM program. Those who supported the Farm Animal Program did not mind the CQM program addressing animal welfare, but those who were strongly against the Farm Animal Program did not want the CQM program to address animal welfare.

One producer definitely did not want animal welfare factored into the program, whereas another producer seemed to think that it was crucial that it be included, as he reflected on the conditions and requirements in Europe. A few felt it was not anyone's business; however, others thought that consumer perception was important and that the dairy industry had to become more aware and connected to their consumers, not only to the dairy processing plants. These producers thought that it was important to assure consumers that the dairy industry ensures excellent animal care, particularly for young stock, because if consumers think that calves are suffering, they will not drink milk no matter how safe it is.

In other countries, such as the UK, some retailers are demanding that their suppliers' quality assurance programs address animal welfare. Furthermore, ethical concerns are gaining momentum in consumers' minds and influence their shopping habits (Todd, 2000). Retail stores in Canada, such as Safeway and Overwaitea, are reacting to consumer demands and expanding their organic produce sections and designating natural food sections. Various studies have been conducted to determine if consumers are concerned about animal welfare on farms but the results vary and seem to vary according to the purpose of the organization performing the survey. The Ontario Farm Animal Council conducted a survey in 5 Canadian cities (Vancouver, Calgary, Toronto, Peterborough and Halifax) and 86% of the participants thought that farmers take proper care of their animals, although 57% said that they would pay 5% more for humanely raised products and 11% would pay 20% more (AnimalNet, 2001). The Ontario Farm Animal Council is a non-profit organization funded by industry associations, and its mission is to promote responsible production and marketing of animal products. A study done by Dairy Farmers of Canada (the national producer association) indicated that 61% of consumers across Canada thought that dairy farmers treat their animals extremely or very well and 46% were not concerned about the treatment of farm animals at all (Mason, 2000). A survey done in British Columbia by the British Columbia Society for the Prevention of Cruelty to Animals indicated that only 34% believed that farm animals are treated humanely (BC SPCA, 2000). The British Columbia Society for the Prevention of Cruelty to Animals is generally critical of current animal production, and promotes alternative systems of raising farm animals.

During the trial, a few producers could see a financial incentive to be part of animal welfare programs, but more typically the producers were defensive about their own husbandry practices. Fraser (2001a) discusses the conflict between the "New Perception" (a strongly negative view

promoted by critics of animal agriculture) and agriculture industry defenders regarding animal welfare. The New Perception criticizes conventional agriculture for its alleged detrimental effects on animal welfare, the environment and various other issues, whereas conventional agriculture responds by defending everything it does and denying all the accusations. Fraser (2001b) suggests that conventional agriculture needs to admit some of the complexities of animal welfare concerns and then deal with them head on.

However, some of the producers became nervous at the implication that the CQM program could be expanded into many different areas, such as animal welfare or environmental stewardship. Such ideas made the program look formidable and impractical from a time and financial point of view. It is also important to note that CFIA presently is concerned only about programs addressing food safety.

Other on-farm programs, such as environmental farm plans, are being developed and designed to be audited programs (British Columbia Ministry of Agriculture, Food and Fisheries, 1999). Many of the trial producers were concerned about how many different programs they could handle and afford. Each program potentially will require external audits that are user-pay. Producers on the trial wondered if these audits could be combined to reduce time and costs. Other countries and industries already have multiple audits. In the US, some food ingredient suppliers were undergoing multiple audits every year from various customers. As producers here fear, they eventually found that they could not sustain the system and created the Food Safety and Quality Systems Supplier Audit Program, a standardized auditing program, to combine audits (Rathbone, 2001). In Australia, a Working Group on Safety and Quality Systems Equivalence (2000) found that one business was audited 3 times on 3 consecutive days by the same auditor but for different customers. Another business tried to incorporate all of the various

standards it had to follow into one manual, but the certifying agencies told them the audits would take longer and they would still need multiple audits because individual customers employed different agencies. However, if the training programs are flexible, on-farm auditors could be trained for organic, SPCA and CQM programs and offer combined services.

4.6.4 Effect on Product Safety

Most producers wanted to know what the CQM program would do for them and how it would improve the safety of their milk. The trial did not have enough data to look at milk safety; however, the standard plate count infractions a few producers sustained before and during the trial would have been eliminated if the producers had fully implemented the CQM program and had staff sign the bulk tank chart recorder or record the milk temperature. One producer had an antibiotic infraction before the trial; however, he already had a residue prevention program in place and he did not need to make any changes to it when he implemented the program. His situation showed that a residue program does not eliminate hazards; however, hopefully the CQM program will help reduce the risk of a reoccurrence. The program encourages producers to review their Standard Operating Procedures when a deviation occurs and make any necessary changes to strengthen them.

Some producers were not convinced the program would make a difference on their farms. They were already producing high quality and safe milk and were confident in their present systems. Another producer thought it would help milk safety by increasing awareness and understanding of the risks involved, for both himself and his staff. Others thought the program offered "better peace of mind" and improved staff efficiency.

Opinions seemed to reflect the current level of management. Those who already had excellent systems either completely accepted the program, as it was easy for them to implement, or doubted the program's effectiveness. Those who had lower levels of management found the program set-up more difficult but saw more benefit from it than producers who were already keeping many records.

In the United States, *Salmonella* contamination of raw meat and poultry products was measured before and after the mandatory implementation of HACCP. The researchers chose *Salmonella* because it is a good indicator of overall sanitation and it is one of the leading causes of food-borne illness. They concluded that HACCP reduced contamination (Sperber, 2000).

4.6.5 Mandatory or Voluntary Implementation

The trial producers were divided on whether they thought the program should be implemented as a mandatory or voluntary program. One producer summed up his opinion by saying:

> "I want to keep records for myself not for someone else. I don't like the invasion of privacy. Don't be invaders of 'my castle.'"

He believed that the program was good but was adamant that how he ran his operation was his business as long as his milk quality was maintained. He was strongly opposed to making it mandatory, but suggested that it was an excellent educational tool for producers with quality problems. Another producer thought that the CQM program could become a requirement for producers with a bad quality history. The program could be a "stick" or education tool to make them improve. Another producer thought it was time for the dairy industry to address safety

further and thought it should be implemented across the industry. Some thought it might eliminate a few poor producers but did not think that everyone should be put through the program in order to eliminate those producers. One producer stated, "If he is going to ship bad milk, nail him, but don't make the rest of us suffer for it." Motarjemi and Kaferstein (1999) found that mandatory implementation did little to encourage businesses to accept HACCP, understand it, take ownership of it and commit management and staff to it. The trial producers showed similar resistance to being forced to implement the program and they felt that forcing or intimidating producers into implementing the program would strengthen their resistance.

However, it is unclear who would have the jurisdiction or authority to make the program mandatory. Dairy Farmers of Canada is a producer association; they do not have the mandate to require producers to implement it. Processors could make program certification a criterion for pick-up and then the producer incentive would be simple: do it or go out of business. Since milk is a pooled product, processors would have to demand all of their suppliers to be CQM-certified; a select few would not be worthwhile. Dairy processing plants across Canada are in the initial stages of implementing their own HACCP plans and have not demanded their raw inputs to be HACCP-certified yet. However, part of the HACCP program of a processing plant is to ensure the raw materials coming into the plant are safe; therefore, they may demand producers to guarantee the safety of the milk and meat entering the processing plants. Processors in the hog industry have demanded a quality assurance program depending on the supply. Hogs are in oversupply in the Eastern provinces; therefore, processing plants have been asking for CQA-certified hogs. In the western provinces, hogs are in demand; therefore, processors are competing for the available hogs and are not placing restrictions on the suppliers. The dairy industry is a supply management system; therefore, total supply does not fluctuate and processors may find it difficult to make demands.

Processing plants could encourage program implementation through a quality bonus. Extrapolating from the direct annual producer costs estimated through the trial, producers in British Columbia would need a breakeven premium of $0.17/hectalitre [(717 farms x $1404)/600,000,000L per year x 100]. This does not include any program implementation or auditing costs; therefore, it is a low estimate of the actual costs. In the United Kingdom, a dairy processor paid a 0.4 pence/l premium ($0.85/hectalitre with an exchange rate of 2.13) to producers who were on the Freedom Food program (Unger and Huddart, 1999). One Canadian processor representative stated that they had to pay for their HACCP program; therefore, producers should have to pay for theirs, indicating that he had no interest in offering a quality bonus or premium. For consumers, a $0.17/hectalitre increase in the price of milk equals $0.002 per litre, an unnoticeable change.

Another producer warned that people would be wary of how far the program will go and what will follow. It is a "fear of the unknown. What's down the road?" Once it is mandatory or included in the regulations, the program can quickly be expanded to include more Critical Control Points and he was afraid that producers would lose control of it and be faced with a demanding and unrealistic program.

Some producers on the trial were even sceptical of the program being voluntary because they have seen similar programs in British Columbia introduced as voluntary or suggested guidelines that have quickly turned into regulation (e.g. the Environmental Guidelines for Dairy Producers in British Columbia). Even if the CQM is approached from a voluntary basis, producers may be sceptical and fear impending regulation. Many European farmers share the same sentiment. The European Commission has expanded its food hygiene rules to include small and medium-sized

food enterprises, and small producers fear that the regulations could represent the beginning of further and more restrictive standards in the future. They also fear they will not be able to comply with or afford more stringent standards (Rathbone, 2000).

The advantages of a mandatory program would be that every producer in Canada would be following the same standards and a consistent, national program would assure international consumers that Canadian milk and meat is safe and of good quality. The disadvantages would be producer opposition and the resources (people and money) needed to implement and maintain the program. If producers are forced to do it, they may undermine the program out of anger and take advantage of its weak spots. The CQM program is not designed to be enforced; it is designed to be a voluntary system based on honesty and a desire to improve. Producers could easily not record data (such as extralabel drug usage) or fill records in just before an on-farm audit and not be caught. Eventually, the producers would suffer the consequences of an ineffective program, but the CQM program's credibility may also suffer.

The advantages of a voluntary program would be that willing producers would join the program and hopefully portray a positive image of it. Producers could be gradually introduced to it, and might more easily accept it. A voluntary implementation would also make it easier to improve the program as it is implemented and as the industry gains experience. The disadvantages of a voluntary program would be that most milk is pooled in Canada, making it difficult to distinguish CQM-certified milk from non-certified milk. Furthermore, if international customers required HACCP-based standards, Canadian milk may not meet those requirements. Also, producers may not readily accept the program or they may take a long time to fully implement the program. The United States experienced this when the industry introduced a voluntary 10-point residue-prevention plan called the Milk and Dairy Beef Quality Assurance Program

(MDBQAP), and 5 years after it was introduced only 10% of the herds had implemented it (Gardner, 1997).

4.6.6 Equivalency

Equivalency is another concern that came up during the trial. Each province has different government support, inspection protocols, producer associations, extension services and testing requirements. For example, quality parameters are measured using different techniques from province to province. Due to these differences, each province will be faced with unique challenges in implementing the national program. These differences will raise questions of equivalency, which will impact producer and provincial acceptance as well as international trade.

One of the equivalency concerns will be cost to producers. Ontario, for example, may include the CQM on-farm audits in their inspection process with no additional charge to producers. Other provinces will need to hire on-farm auditors and producers will pay. If producers fail the audit, they will have to pay for a second on-farm audit. Furthermore, producer associations in some provinces may receive provincial funding. Dairy Farmers of Ontario has received $2.7 million from the Healthy Futures Fund from the Ontario Ministry of Agriculture, Food and Rural Affairs (Dimmick and Hemming, 2002), but producers in British Columbia may receive a much smaller sum of money from their provincial government.

4.7 INDUSTRY RESPONSE

It became clear through the trial that the veterinary profession and other industry stakeholders should be included in the program's implementation to make sure that they understand it.

Some of the veterinarians who serviced the producers on the trial viewed the CQM program as threatening, although it could also be viewed as an opportunity to enhance their role with producers and processors. On-farm HACCP-based programs are already happening and producers are going to need knowledgeable, helpful veterinarians to assist them in implementing and maintaining their programs. Slaughterhouses also may look to veterinarians for assurance that the incoming animals are residue-free or from a veterinarian-verified program. With animal identification programs, slaughter plants may begin to provide information back to the farmer on carcass safety and quality, and veterinarians could help producers manage and react to this information (Buntain, 1997). Some of the dilemmas veterinarians may face with this new business opportunity include: making the decision to add to current services, making time to actually deliver those services, and receiving payment for those new services (Day, 2001).

With antibiotic usage becoming an increasing consumer concern due to fears such as antibiotic resistance, animal treatments are being scrutinized closely (Tollefson, 2000). Now, many practices that have been routine and widely accepted are open to challenge. The EU, as a drastic example, has banned hormone growth promoters, beta-agonists, bovine somatotrophin (BST), Genetically Modified Organisms (GMOs) and various antibiotics. Whether veterinarians like it or not, consumers, producers and processors want responsible administration of medicines and veterinarians will have to be prepared to explain and justify what they do (Lawrence, 2001).

One producer on the trial illustrated growing producer demands. He began asking equipment suppliers, feed salesmen and his veterinarian to complete certain records for him. He felt that agri-business was a large component of the program and that they had as much responsibility as he did to make the program work. However, he found that the other people he dealt with on his

farm (e.g. equipment dealers, veterinarians) were not happy about what they were being asked to do. He gave them no choice. If they wanted his business, they had to do it. He felt the program made them more accountable and he felt more in control of what happened on his farm. However, it is important to note that he had a large farm; smaller producers may not be able to demand the same response.

4.8 CONSUMERS

The trial producers were quite polarized in their opinions of consumer food safety demands. They either thought consumer demands were over-rated (unrealistically inflated by the media) or pro-active. Some felt that milk is safer and of higher quality than it ever has been; therefore, consumers have no business being concerned about it. Others felt the industry has been fortunate to not be hit with a major food disaster yet (such as something equivalent to *Escherichia coli* in hamburger), and that consumers have every right to be concerned. There was a general disdain for the media and for the few outspoken individuals who tend to sway consumers. One producer, however, stated that:

> "We [he and his family] are consumers. We'll be watching to make sure the stuff we buy has the same [standards]."

The opinions varied from consumers having a right to good food and knowing how that food is produced, to consumers being influenced by many factors and generally not being educated or connected enough to agriculture to make proper decisions.

Based on public response to food concerns, consumers appear to be increasingly worried about their food. Recently, the threat of terrorist attacks on food and water supplies has amplified the public's fear and mistrust. Powell (2000) describes the next consumer phase as being the 'clean food era.' He claims that we are moving from the nutraceutical era with the focus on prolonging life, to the clean and safe food era. Furthermore, 'quality of life' issues are gaining attention and consumers are expecting more from their food (Markham, 2001). Consumers want nutritious, tasty, and quick-to-prepare foods that also promote health, provide comfort and pleasure, and meet social objectives and individual ethical values (Babcock, 2001; Dairy Farmers of Canada, 2001c). Todd (2000) refers to today's consumers as the 'emotion economy' because consumers make demands and choices based on their feelings and perceptions rather than on science or fact.

Some of the major food safety concerns that consumers are apprehensive about include pesticides, hormones, antibiotic residues and resistance, and emerging food-borne and water-borne illnesses (Hillers, 2000; Schroeter et al., 2001; Cullor, 1995). The Consumers Association of Canada (CAC) did a survey that showed that 25% of adults worry about food safety (Canadian Food Inspection Agency, 2001a). The main concerns are pollution, pesticides and sanitation. Unfortunately, consumers do have reason to be worried, as food-borne outbreaks do occur and the media quickly picks up the stories and distributes them widely. Recently, a dairy processing plant in Japan had a *Staphylococcus aureus* contamination of their powdered skimmed milk. Almost 15,000 people became ill as a result and the company lost more than $103 million in one quarter (Maulsby, 2000). In Europe, bovine spongiform encephalopathy (Mad Cow Disease) frightened many consumers away from beef and the beef industry experienced a 27% drop in beef consumption in the last quarter of 2000. At the same time, Greece reported a 50% decrease, Italy 40%, France 38% and Germany 33%. Even McDonalds noticed a 9% decline in EU sales (Animal Health News, 2001). Many consumers are sensitive about the food they are eating and

each time a food disease outbreak occurs, many consumers rethink what they are feeding to their families. Consumer concern may increase the demand for the CQM program. However, the overall cost of implementing the CQM program has not been determined, and if those costs are significant, Dairy Farmers of Canada has not determined whether consumers will pay more for the extra assurance the program brings.

5.0 RECOMMENDATIONS AND CONCLUSIONS

This study showed both the strengths and weaknesses of the CQM program and the producers' acceptance of it. The program increased communication and awareness of food safety problems for both staff and producers. The program also reduced food safety risks by improving producers' residue prevention plans and by milk temperature monitoring; however, whether it increased milk or meat safety was not determined by this study. Baseline studies are needed to determine the safety of milk and meat in the industry today, so that the industry can compare itself to the baseline after the CQM program has been implemented. Data collection for the baseline studies needs to be started as soon as possible. Dairy Farmers of Canada should coordinate the data collection to ensure that it is gathered consistently across the country, and the provincial coordinators for the CQM program could collect the data in their respective provinces.

Overall, the producers accepted the program positively; however, some were resistant to change their attitudes towards milk and meat safety, and the management systems they used on their farms. The study showed that the CQM program's benefits will have to be strong and tangible in order to convince certain producers to implement it.

The amount of time each producer spent implementing the program varied widely, but the average time spent was 11 hours. In order to minimize the producers' time commitment and to clarify the program requirements, the Workbook was simplified during the trial. The average initial cost producers would have incurred to comply with the program was estimated to be $1,068. The producers expressed a desire for the program costs to be passed on to the consumer or for producers to be offered a financial incentive, such as a premium or financial assistance (e.g. grants), to implement the program. Further research is needed to determine the overall program costs (including national and on-farm implementation, producer and on-farm auditor training, etc.) and to perform a cost-benefit analysis. Dairy Farmers of Canada also needs to determine how much producers are willing to pay for the program, as it will be user-pay.

As the CQM program evolves, it must be kept as simple as possible to ensure it is practical to implement and easy for producers to understand. Most of the producers thought that the workshops were essential to assist producers in understanding the program's principles and requirements. Because some producers had difficulty training their staff, owners should encourage employees and family to attend the workshop. Then, everyone would begin with the same basic understanding, and develop a feeling of ownership while taking part in the planning process. The trial also showed that Dairy Farmers of Canada will have to provide on-going support and extension to ensure that producers fully understand the program's requirements, implement them correctly and accept them. Other industry stakeholders, such as veterinarians and equipment dealers, need to be included in the communication plan as well, because they need to understand the program and their roles within it.

Five producers passed, 5 conditionally passed, and 4 failed the on-farm audit. Some of the compliance issues were equipment sanitation, pesticide storage, contaminated water, and hot water temperatures. The on-farm audits illustrated that antibiotic usage (extralabel) and storage are concerns that do need to be addressed on dairy farms. If producers and veterinarians do not prove that they are using drugs responsibly, Canada may, ironically, have strict drug use regulations imposed, similar to the United Kingdom. The study also showed a continued need for outcome-based testing and, perhaps, more in-depth antibiotic testing of milk, including CQM-certified farms to ensure that they have effectively implemented the program; however, this also would result in increased costs, which producers may be resistant to pay. Furthermore, a HACCP-based program should reduce the need for out-come based testing because an effectively implemented program should minimize the risk of shipping treated milk. The on-farm audit results also showed that certain requirements need to be strengthened, added or clarified. For example, the program should specify how pesticides for animals and crops should be stored, and an annual equipment check should be added to the requirements.

The CQM program providers must be able to help producers find solutions to problems the program may detect (e.g. water contamination). Otherwise, the program will seem impractical and lose credibility with producers, and potential food safety problems will not be corrected. Furthermore, CQM program staff and on-farm auditors need to be trained appropriately (i.e. be able to identify appropriate sources of expertise). British Columbia, as in some other provinces, has seen a decline in human resources and services available to help producers solve quality problems, both from industry and government. With limited extension people available, Dairy Farmers of Canada will have to build extension help into the program or, in provinces with stronger extension systems, recruit those already in the field to assist producers, or develop a consultant data-base.

An on-farm auditor-training program must be created to ensure that the program is consistently evaluated across the country and that the program is credible. The on-farm auditor training must adequately address pesticides and well evaluations, and clarify that all locations involved in an operation should be audited (e.g. producers who raise animals on different farms or in different barns). On-farm auditors must have excellent communication skills, industry experience, and access to producers' quality records; furthermore, they must follow strict biosecurity protocols.

An on-farm audit protocol must be developed and regular audits performed to ensure producers maintain the programs' standards. Furthermore, in my opinion, producers should be required to have 3 months of complete records before an on-farm audit. This requirement would indicate that producers have adopted the record keeping routine and are managing well.

The roles of, and relationship between, on-farm auditors, regulatory inspectors and consultants need to be clarified. The CQM program and regulatory agencies must work together because, currently, the CQM program does not have the authority to access producers' quality records. The Canadian Quality Assurance program (pork) requires hog producers to fax quality records regularly to the provincial coordinator. The CQM program should consider a similar approach or have a signed agreement between regulatory bodies and producers to facilitate information sharing. The distinction between auditing and consulting also must be made. I would suggest that on-farm auditors do not give advice on how to solve problems due to potential liabilities. On-farm auditors should be knowledgeable of the program, be able to explain the reasons for the requirements, and be able to refer producers to sources of technical advice, but not instruct producers on how to rectify problems. Producers should hire consultants or use provincial government resources or provincial CQM delivery agents to help them trouble-shoot problems.

Some of the concerns the study highlighted were biosecurity (with on-farm auditors spreading disease), and meat production. Many of the producers did not recognize themselves as major contributors to the beef industry; hence, meat safety was not seriously addressed. The CQM program should emphasize meat safety in producer training, and perhaps its name should be changed to the Canadian Quality Milk and Meat program to more accurately reflect the program's objectives. Many producers were also concerned about the combined impact of other programs that are being developed in other areas, such as animal welfare and the environment, and whether they could afford to implement everything. The dairy industry should explore combining auditor training and skills, so that one auditor could perform an audit for various programs at once. Cross-commodity program administration and auditing are other options to reduce costs.

Most of the producers wanted the CQM program to be implemented on a voluntary, not mandatory, basis. Although there are advantages and disadvantages with each option, I would recommend a voluntary implementation because HACCP-based programs are not designed to be enforced. HACCP-based programs are designed to be implemented by producers who believe in the principles and recognize the benefits of the program. If producers are forced to implement the CQM program, some will quickly find ways to cheat the system. Processing plants and retailers may make compliance with the program mandatory, but in the meantime Dairy Farmers of Canada should give producers a choice.

Equivalency was a final concern. Provinces need to work together to ensure equivalent implementation, so that the dairy industry has one Canadian Quality Milk program, not 10. Dairy Farmers of Canada's first challenge will be to implement a single national standard consistently

across the country, and their second challenge will be to gain recognition from the Canadian Food Inspection Agency to ensure that the program is accepted domestically and internationally.

The dairy industry must ensure that milk and dairy beef are safe to consume. Some producers on the trial did not look favourably on consumer demands, but producers are ultimately producing food for consumers, not processors. The CQM program is one mechanism producers can utilize to ensure consumers feel confident about the safety of dairy products and beef.

For future qualitative research projects on the CQM program, I would recommend that researchers extend the duration of the study to a minimum of one year. Within that year, producers should be encouraged to fully implement the program within 4 months, leaving 8 months to study the implemented program and producers' experiences. This schedule would allow researchers to evaluate whether the program improves milk and meat safety, and to determine if and when producers begin to deviate from the program. Producers should be encouraged to attempt to work through the program on their own, so that researchers can accurately determine which program requirements need to be clarified in the workshops. Finally, I would recommend a larger sample size, if possible.

The CQM program has the potential to be an effective tool to reduce food safety risks; however, its implementation needs to be improved to reduce inconsistencies, gain producer acceptance and ensure credibility from the farm to the consumer.

6.0 REFERENCES

American Public Health Association, American Water Works Association and Water Environment Federation (2000). Standard Methods for the Examination of Water and Wastewater – 20th edition. American Public Health Association, American Water Works Association and Water Environment Federation, U.S.A.

Anderson, G.R. (2000). Dairy inspections: the system works. *Hoard's Dairyman.* 145:831-832.

Animal Health News - National and International News for Livestock Producers. (March 20, 2001).

AnimalNet (2001). Farmers have public's trust with animal care and food safety. Press Release (April 20, 2001), Mississauga, Ontario.

Babcock, B. (2001). Extreme demands – extraordinary products: What's in it for midwestern agriculture? *Iowa Ag Review.* 7 (1):1-3.

Bauman, H.E. (1992). Introduction to HACCP. In *HACCP Principles and Application,* eds. Merle D. Pierson and Donald A. Corlett, Jr., Van Nostrand Reinhold, New York, 1-5.

BC SPCA (2000). Survey Highlights. BC Society for the Prevention of Cruelty to Animals, Vancouver.

BC SPCA (2002). Farm Animals. Available at BC SPCA website. www.spca.bc.ca/farm. Accessed March 22, 2002.

Bentley Instruments (1995). Combi Operator's Manual, Bentley Instruments, Inc., USA.

Berry, D.P and Reynolds, D. (2001). Reflections on my life - Louis Pasteur. Available at Woodrow Wilson National Fellowship Foundation website. http://www.woodrow.org/teachers/ci/1992/Pasteur.html. Accessed April 13, 2002.

Brashears, M.M., Burson, D.E., Dormedy, E.S., Vavak, L., McKee, S.R., Fluckey, W. and Sanchez, M. (January 2001). HACCP implementation and validation in small and very small meat and poultry processing plants in Nebraska. *Dairy, Food and Environmental Sanitation.* 21:20-28.

British Columbia Milk Producers Newsletter (June 12, 2000): 6(3).

British Columbia Ministry of Agriculture, Food and Fisheries (1999). Resource Management Information Sheet – Nutrient management plans. Agdex 590/540.

British Columbia Ministry of Agriculture, Food and Fisheries (2001a). *Meeting food quality and safety standards on the dairy farm.* British Columbia Ministry of Agriculture, Food and Fisheries, Abbotsford.

British Columbia Ministry of Agriculture, Food and Fisheries (2001b). Agri-Food Choice and Quality Act. Available at British Columbia Ministry of Agriculture, Food and Fisheries webpage. http://www.agf.gov.bc.ca/ministry/legsum/ACQA.stm. Accessed March 22, 2002.

Buntain, B. (1997). The role of the food animal veterinarian in the HACCP era. *Journal of the American Veterinary Medical Association.* 210:492-495.

Canadian Cattlemen's Association (2000). Good Production Practices for Cow-Calf Producers – Quality Starts Here. Canadian Cattlemen's Association, Calgary.

Canadian Food Inspection Agency (2001a). Canadian Food Inspection Agency, FSEP Implementation Manual Volume 1 – General Policy, 2nd Edition. Available at Canadian Food Inspection Agency webpage. www.cfia-acia.agr.ca/english/ppc/psps/haccp/manu/vol1/1-2e.shtml#ch2. Accessed December 3, 2001.

Canadian Food Inspection Agency (2001b). Canadian Food Inspection Agency, FSEP Implementation Manual Volume 2 – Guidelines and Principles for the Development of HACCP Generic Models, 2nd Edition. Available at Canadian Food Inspection Agency webpage. www.cfia-acia.agr.ca/english/ppc/psps/haccp/manu/vol1/1-2e.shtml#ch2. Accessed December 3, 2001.

Canadian Food Inspection Agency (2001c). Canada food safety and inspection bill backgrounder. Available at Canadian Food Inspection Agency webpage. http://www.agf.gov.bc.ca/ministry/legsum/ACQA.stm. Accessed August 29, 2001.

Canadian Food Inspection System (2002). National Dairy Regulations and Code (NDRC). Available at Canadian Food Inspection System webpage. http://www.cfis.agr.ca/english/regcode/codes_tbl_e.htm. Accessed May 26, 2002.

Canadian On-Farm Food Safety Program (January 2000). On-farm food safety newsletter. Agriculture and Agri-food Canada, Canadian Food Inspection Agency and the Canadian Federation of Agriculture.

Canadian Pork Council (2001). An overview of the Canadian Pork Council's CQM™ (Canadian Quality Assurance) program. Available at Canadian Pork Council webpage. http://www.cpc-ccp.com/QA.htm. Accessed on December 3, 2001.

Cates, S.C., Anderson, D.W., Karns, S.A., and Brown, P.A. (2001). Traditional versus hazard analysis and critical control point-based inspection; Results from a poultry slaughter project. *Journal of Food Protection.* 64:826-32.

Chambers, A. (Canadian Federation of Agriculture) (2001). Personal communication, April 3, 2001.

Codex (1997) Codex Alimentarius Commission. *Hazard Analysis and Critical Control Point (HACCP) System and Guidelines for its Application.* ALINORM 97/13A, Appendix II.

Codex Alimentarius (1999). Veterinary drug residues in food. Available at the FAO webpage. http://apps.fao.org/page/collections?subset=FoodQuality. Accessed March 10, 2002.

Cullor, J.S. (1995). Implementing the HACCP program on your clients' dairies. *Veterinary Medicine*. 90:290-295.

Cullor, J.S. (1997). HACCP (Hazard Analysis Critical Control Points): is it coming to the dairy? *Journal of Dairy Science*. 80:3449-3452.

Cullor, J.S. (2001). Breakthrough management: wave of the future. National Mastitis Council – Professional Dairy Producers of Wisconsin Conference Proceedings: 66-69.

Dairy Farmers of Canada (2001a). Canadian Quality Milk Reference Manual. Dairy Farmers of Canada, Ottawa.

Dairy Farmers of Canada (2001b). Canadian Quality Milk Workbook. Dairy Farmers of Canada, Ottawa.

Dairy Farmers of Canada (2001c). Dairy situation – Y2002 trends and issues. Marketing Plan 2002.

Dairy Farmers of Ontario (2000). Livestock Medicines Course for Dairy Producers – workbook.

Day, J.D. (2001). Implementing expanded services or working outside the box. *34th Annual Convention Proceedings – American Association of Bovine Practitioners*, Vancouver, British Columbia, Canada, September 13-15, 2001: 23-26.

Dersam, P. (2001). HACCP is working well in the dairy industry. *Hoard's Dairyman*. 146:339.

Dimmick, B. (2001a). Quality milk, eh! *Ontario Milk Producer*. 77(9):29-32.

Dimmick, B. (editor) (2001b). Needle offers safety boost. *Ontario Milk Producer*. 77(8):33.

Dimmick, B. and Hemming, J. (2002). Quality assurance. *Ontario Milk Producer*. 78(2):31-32.

Elder, R.O., Keen, J.E., Siragusa, G.R., Barkocy-Gallagher, G.A., Koohmaraie, M., Laegreid, W.W. (2000). Correlation of enterohemorrhagic *Escherichia coli* O157 prevalence in feces, hides, and carcasses of beef cattle during processing. *Proceedings of the National Academy of Science, U.S.A.* 97:2999-3003.

Erskine, R.J., Tyler, J.W., Riddell, M.G., and Wilson, R.C. (1991). Theory, use, and realities of efficacy and food safety of antimicrobial treatment of acute coliform mastitis. *Journal of the American Veterinary Medical Association*. 198:980-984.

Erskine, R.J., Wilson, R.C., Riddell, M.G., Tyler, J.W., Spears, H.J., and Davis, B.S. (1992). Intramammary administration of gentamicin as treatment for experimentally induced *Escherichia coli* mastitis in cows. *American Journal of Veterinary Research*. 53:375-381.

EU Food Law News (2001). Hygiene – second summary of progress on the consolidation and simplification of food hygiene legislation. Available at University of Reading webpage. www.fst.rdg.ac.uk/foodlaw/news/eu-01120.htm. Accessed on November 1, 2001.

Fabiansson, S. and Cunningham, D. (2000). Evolution of Australian food quality systems: A brief description of industry food safety system implementation. Bureau of Rural Sciences Australia, Canberra.

Feigenbaum, A. (1951). Total Quality Control. McGraw-Hill, New York.

Food and Agriculture Organization of the United Nations and World Health Organization (1999). Understanding the Codex Alimentarius. Editorial Group - FAO Information Division.

Food Safety and Inspection Service (United States Department of Agriculture) (2000). The US food safety system. Available at Food Safety and Inspection Service webpage. http://www.fsis.usda.gov/OA/speeches/2000/caw_eulaw.htm. Accessed on March 3, 2002.

Fraser, D. (2001a). The "New Perception" of animal agriculture: legless cows, featherless chickens, and a need for genuine analysis. *Journal of Animal Science*. 79:634-641.

Fraser, D. (2001b). Farm Animal Production: changing agriculture in a changing culture. *Journal of Applied Animal Welfare Science*. 4(3):175-190.

Fuhrmann, T.J. (2001). Monitoring the dairy herd. *Proceedings of the 5th Western Dairy Management Conference*, April 4-6, 2001, Las Vegas, Nevada.

Gardner, I.A. (1997). Testing to fulfill HACCP (Hazard Analysis Critical Control Points) requirements: principles and examples. *Journal of Dairy Science*. 80:3453-3457.

Generic Costing Model for Canadian On-farm Food Safety Programs (September 2000). Draft prepared by: The Federal/Provincial/Territorial On-Farm Food Safety Sub-Committee in Consultation with Industry.

Gilling, S., Taylor, E., Kane, D., and Taylor, J. (2001). Successful Hazard Analysis Critical Control Point Implementation in the United Kingdom: Understanding the Barriers through the Use of a Behavioral Adherence Model. *Journal of Food Protection*. 64:710-715.

Hancock, D., Besser, T., Lejeune, J., Davis, M., and Rice, D. (2001). The control of VTEC in the animal reservoir. *International Journal of Food Microbiology*. 66:71-78.

Health Canada (2002). The veterinary drugs directorate. Available at Health Canada website. www.hc-sc.gc.ca/vetdrugs-medsvet/e_home.html. Accessed on April 7, 2002.

Henson, S. and Holt, G. (2000). Exploring incentives for the adoption of food safety controls: HACCP implementation in the U.K. dairy sector. *Review of Agricultural Economics*. 22(2):407-420.

Henson, S., Holt, G. and Northen, J. (1999). Costs and benefits of implementing HACCP in the UK dairy processing sector. *Food Control*. 10:99-106.

Hillers, V. (2000). Pesticides in food: a look at the issues. Available at University of Maryland webpage. www.inform.umd.edu/EdRes/Topic/AgrEnv/ndd/safefood/. Accessed on December 6, 2001.

Horrox, N. (editor) (2001). Never too late for HACCP. *International Food Hygiene.* 11(7):9.

Hovey, L.K. (Managing Editor) (2001a). Updates: Mandatory HACCP implementation in all Canadian establishments registered under the meat inspection act. *Dairy, Food and Environmental Sanitation.* 21:240-241.

Hovey, L.K. (Managing Editor) (2001b). Tracing the costs and benefits of improvements in food safety: the case of the Hazard Analysis Critical Control Point program for meat and poultry. *Dairy, Food and Environmental Sanitation.* 21:411.

ISO (2002).What is ISO? Available at the International Organization for Standardization webpage. http://www.iso.ch/iso/en/aboutiso/introduction/whatisISO.html. Accessed on April 13, 2002.

Jones, G.F. and Ward, G.E. (1990). Evaluation of systemic administration of gentamicin for treatment of coliform mastitis in cows. *Journal of the American Veterinary Medical Association.* 197:731-735.

Jones, T.A. (February 1998). Is accreditation worth the effort and expense? *Inside Laboratory Management.*2(2):18-19.

Juffs, H. (Harley Juffs & Associates Pty Ltd) (2000). Personal communication, December 22, 2000.

Juran, J. (1979). Quality Control Handbook. McGraw-Hill, New York.

Kirby, S. and McKenna, K. (1989). Experience, Research, Social Change: Methods from the Margins. Garamond Press, Ontario.

Larson, S.A. (editor) (2001). We need a way to get more money for our "market" cows. *Hoard's Dairyman.* 149:334.

Lawrence, K. (2001). Developing responsible use of antibiotics protocols. *34th Annual Convention Proceedings – American Association of Bovine Practitioners*, Vancouver, British Columbia, Canada, September 13-15, 2001:10-13.

Leblanc, D. (Canadian Quality Assurance program) (2001). Personal communication, April 5, 2001.

LeJeune, J.T., Besser, T.E., Merrill, N.L., Rice, D.H., and Hancock, D.D. (2001). Livestock drinking water microbiology and the factors influencing the quality of drinking water offered to cattle. *Journal of Dairy Science.* 84:1856-1862.

Levesque, P. (1998). *Managing Milk Quality.* ITA de La Pocatiere, Quebec.

Lynn, T.V., Hancock, D.D., Besser, T.E., Harrison, J.H., Rice, D.H., Stewart, N.T., and Rowan. L.L. (1998). The occurrence and replication of *Escherichia coli* in cattle feeds. *Journal of Dairy Science.* 81:1102-1108

MacDonald, D.J. (2001). HACCP – Preparing for change. *International Food Hygiene.* 11(7):22.

Manitoba Agriculture and Food (December 2000). Food safety in livestock production. www.gov.mb.ca/agriculture/foodsafety/cfs01s02.html. Accessed on October 15, 2001.

Markham, R.H.P. (2001). Comment. *Food Control.* 12:201-202.

Marshall, R.T. (1993). Standard Methods for the Examination of Dairy Products, 16th Edition 1992. American Public Health Association, Washington.

Mason, S. (editor) (2000). The public image of the dairy industry. *Western Dairy Digest.* 2(1):3.

Maulsby, D. (2000). More tainted milk found at Snow Brand plant. Available on AgWeb webpage. www.agweb.com. Accessed on August 12, 2000.

McKemie, K.M. (1995). Food Inspection Performance Standards. *Dairy, Food and Environmental Sanitation.* 15:17-20.

McNabb, R. (Canadian Cattlemen's Association) (2002). Personal communication, May 27, 2002.

Moore, A. (2000). *BC Dairy Talk*: Dairy Farmers of Canada - Canadian Dairy Farm Milk and Meat Quality Assurance Program. BC Ministry of Agriculture, Food and Fisheries, Agdex #410.

Moore, A. (BC Ministry of Agriculture, Food and Fisheries) (2001). Personal communication, February, 6, 2001.

Mortimore, S. (2001). How to make HACCP really work in practice. *Food Control.* 12:209-215.

Motarjemi, Y. and Kaferstein, F. (1999). Food safety, Hazard Analysis and Critical Control Point and the increase in foodborne diseases: a paradox? *Food Control.* 10:325-333.

Murinda, S.E., Nguyen, L.T., Ivey, S.J., Gillespie, B.E., Almeida, R.A., Draughon, F.A. and Oliver, S.P. (2002). Prevalence and molecular characterization of *Escherichia coli* O157:H7 in bulk tank milk and fecal samples from cull cows: a 12-month survey of dairy farms in East Tennessee. *Journal of Food Protection.* 65:752-759.

National Dairy Farm Assured Scheme (2001). What is the Nation Dairy Farm Assured Scheme (NDFAS)? Available at the National Dairy Farm Assured Scheme website. www.ndfas.org.uk/index.htm. Accessed on October 15, 2001.

Nelson, K. (editor) (2001). Cattle in transit require ear tags. *Western Dairy Farmer*, July/August 2001:13.

New South Wales Dairy Corporation (2001). Quality Plus^{2000} Initiative. Available at New South Wales government webpage. www.dairy.nsw.gov.au/food%20safety/qa%20programs/bodyqp2000.htm. Accessed October 15, 2001.

Panisell, P.J., Quantick, P.C., and Knowles, M.J. (1999). Towards the implementation of HACCP: results of a UK regional survey. *Food Control.* 10:87-98.

Pannett, R. (BC Provincial Dairy Inspector) (2001). Personal communication, May 17, 2001.

Parkin, J. (1981). Laboratory Testing and Supplies. Available at Rhodia Dairy Ingredients website. http://www.rhodiadairy.com/marschall/proceed/pdf/81_25.pdf. Accessed April 30, 2002.

Payne, M.A., McBride, M.D., Utterback, W.W., Breitmeyer, R.E., Alberg, L., Martin, D., and Cullor, J. (1999). Specificity of assays used by regulatory agencies to detect antibiotic residues in tissues of culled dairy cows. *Journal of the American Veterinary Medical Association.* 214:1048-1050.

Pedley, M. (Quality Consultants New Zealand Ltd.) (2001). Personal Communication, February 1, 2001.

Powell, D.A. (2000). Reclaiming dinner: enhancing food safety and consumer confidence. *Dairy, Food and Environmental Sanitation.* 20:846-848.

Powell, M.R., Ebel, E.D., Hogue, A.T., and Schlosser, W.D. (2001). The promise and challenge of food safety performance standards. *Dairy, Food and Environmental Sanitation.* 21:582-590.

Rathbone, R. (2000). European Commission plans to extend HACCP to more food categories. *Inside Laboratory Management.* 4(10):9.

Rathbone, R. (2001). Food processors group plans to start pilot audit program in summer 2001. *Inside Laboratory Management.* 5(7):9.

Raw Foods of Animal Origin Secretary (September 7, 2001). Appendix D: The Canadian on-farm food safety program. *Recommendation for the Development of Policy Related to Raw Foods of Animal Origin: A Report to Health Canada from the Steering Committee of Raw Foods of Animal Origin.*

Roeber, D.L., Belk, K.E., Scanga, J.A., Field, T.G., Tatum, J.D., Hale, D.S., Henning W.R., and Cowman, G.L. (April 2001). Getting the most from your dairy beef. *Proceedings of the 5th Western Dairy Management Conference, Nevada*: 69-77.

Schroeter, C., Penner, K.P. and Fox, J.A. (July 2001). Consumer perceptions of three food safety interventions related to meat processing. *Dairy, Food and Environmental Sanitation.* 21:570-81.

Smith, G.C., Cannell, R.C., Belk, K.E., Tatum,J.D., Hale, D.S., Henning, W.R. and Cowman, G.L. (1999). Careful with that Market Cow!! The Next Time You See Her May be at Your

Favourite Restaurant. Presented at the 1999 DairyTech Forum in Madison, Wisconsin, September 27, 1999.

Smith, K.L. and Hogan, J.S. (2001). U.S. milk quality and safety: is our milk the best in the world? *National Mastitis Council – Professional Dairy Producers of Wisconsin Conference Proceedings*: 1-7.

Sperber, B. (editor) (2000). USDA sets Salmonella at forefront of HACCP. Available at Meat and Poultry Online webpage. www.meatandpoultryonline.com. Accessed on November 4, 2001.

Taylor, E. (2001). HACCP in small companies: benefit or burden? *Food Control.* 12:217-222.

Tefertiller, K.R., Jauregui, C. and Olexa, M.T. (August 1998). Impact of the Regulatory Environment facing Florida Dairy Farmers. University of Florida, the Institute of Food and Agricultural Sciences. Available at University of Florida webpage. http://edis.ifas.ufl.edu/BODY_DS169. Accessed on September 21, 2001.

Todd, B. (2000). From plate to paddock - turning the tables. Agriculture, Fisheries and Forestry, Canberra, Australia.

Tollefson, L. (2000). Antibiotic use in food animals: controlling the human health impact. *Journal of AOAC International.* 83:245-254.

Uhitil, S., Jaksic, S., Petrak, T., and Botka-Petrak, K. (2001). Presence of *Escherichia coli* O157:H7 in ground beef and ground baby beef meat. *Journal of Food Protection.* 64:862-64.

Unger, N. and Huddart, S. (1999). *Freedom Food Report.* British Columbia Society for the Prevention of Cruelty to Animals, Vancouver.

Van Dresser, W.R. and Wilcke, J.R. (1989). Drug residues in food animals. *Journal of the American Veterinary Medical Association.* 194:1700-1710.

Western Australia Government (2000). Safe Quality Food. Available at Western Australia Government webpage. www.sqf.wa.gov.au. Accessed on October 15, 2001.

Wetzstein, M. (1995). Use and storage of veterinary drugs on the dairy farm. B.C. Dairy Talk, BC Ministry of Agriculture, Food and Fisheries, Agex #410, 95-07.

Working Group on Safety and Quality Systems Equivalence (2000). Case studies as demonstration models for achieving equivalence. Agriculture Fisheries and Forestry Australia.

7.0 APPENDICES

Appendix 1: Dairy Producer Quality Management Interview Schedule
Interviewer:_____ **Date Completed:**_____

DAIRY PRODUCER QUALITY MANAGEMENT

INTERVIEW SCHEDULE
(for pilot trial evaluation)

This interview schedule in intended to be used as a guide for in-depth, open-ended interviews. Thank you for helping us with this test-run of the program package.

SECTION A. DEMOGRAPHICS

A1 FACTS ABOUT THE "INTERVIEWEE"

Name:	
Your position on the farm:	
Farm Name:	
Farm and resident Address (if different):	Street:
	Town:
	Province:
	Postal Code:
Phone and resident phone (if different):	Phone:
	Ph/Cell:
	Fax:
	Email:
Level of Education (high school, college, university):	
Age Group (20-40; 41-60, > 61):	
How long have you been dairy farming?	

A2 FACTS ABOUT THE FARM

Size in Acres:	
Barn type (pole, hip):	
Well or city water:	Barn:
	Dairy:

A3 FACTS ABOUT THE HERD

Heifers entering herd every yr (approximately):	Number Purchased:	Source:	Biosecurity measures:
	Number Homegrown		
Cows entering herd every yr (approximately):	Number Purchased:	Source:	Biosecurity measures:
	Number Homegrown:		

Other classes of livestock on farm:	Type:	Number:	Location:

Milking herd size today (milkers plus dry cows):	
Milking herd size 12 months ago (milkers plus dry cows):	
Average time cows spend in holding pen:	
Average production (litre/cow/day):	

Feeds:	List type:	Check for contamination (e.g. antibiotics, pesticides):		
		Always	Sometimes	Never

How many animals from the dairy herd are beefed per year (approximately)?	

A4 FACTS ABOUT YOUR FACILITIES

Number of free or tie stalls or size of loafing area:	

Parlor type (herring bone, rotary, etc):	
Number and Type of milking units:	
Milking equipment accessories (auto takeoffs, flow meters):	
Does the milking herd have access to pasture or dry lot?	
Sick bay / # of pens – location (describe in relation to milking herd):	
Segregation area – location (describe in relation to milking herd):	

A5 FACTS ABOUT YOUR MILK / MEAT QUALITY

Parameter	Historical Results from Date of Interview (monthly)												Frequency of any Additional Results
SPC (x1,000)													
SCC (x1,000)													
Antibiotics (+ / -)													
Water (>0.535°H)													
Broken needles													
Other													

A6 FACTS ABOUT SANITATION AND MILKING PROCEDURES

Method	**Do at every Milking Cycle**		**Frequency process checked (daily, monthly, etc)**	**Volume Chemical used per month**
	✓	**Chemical Used**		
Pre-wash				
Wash				
Acid Rinse				
Sanitize				

A7 FACTS ABOUT YOUR MILKING PROCEDURES

Method	Describe steps	Volume / Number /Frequency of use per month
Pre-Milking		
Milking		
Milking Treated Cows		# cows:_____ vol milk:_____
Post Milking		

A8 FACTS ABOUT YOUR INFORMATION SOURCES (specific to milk quality)

	✓		Freq. Used/ Visited (per wk, mos, or yr)	How many of your staff / family access these resources (%)	Comments
	As needed basis	Regular program visit /use			
People Resources					
Feed rep					
Nutritionist					
Veterinarian					
Consultant					
Processor rep					
Dairy inspector					
Dairy specialist (gov't)					
Dairy specialist (private)					
Equipment dealer/rep					
Other:_____					
Written sources					
Internet					
Popular press					
Scientific press					
Newspaper (farm)					
Industry paper/newsletter					
Gov't factsheets /newsletters					
Other (_____)					
Records used					

A9 FACTS ABOUT YOUR STAFF

Hrs work		Avg Yrs employed	Education Level (high sch / college / univ)	Communication		List assigned quality related tasks	Percent time spend on tasks
F T	P T			Method(s)	Freq (day / wk / mos)		
Family members							
Hired staff							

A10 PRODUCT INVENTORY

Product Name	Active ingredient	Container condition Good (G) Fair (F) Poor (P)	Product Approved for use in Dairy	Written Instructions Given	Number of purchases over past 6 months	Storage location
Drugs						
Medicated Feeds (includes feed not designated for dairy herd)						

SECTION B. APPROACHES TO FARM MANAGEMENT

Our interviewer will seek your attitudes and opinions about a number of farm management practices.

B1	What does HACCP mean to you?	
B2	How would you define the term Quality **Assurance** in relation to dairy farming?	
B3	How would you define the term Quality **Management** in relation to dairy farming?	
B4	Who is responsible for quality on your farm?	

SECTION C. DAIRY PRODUCERS AND THEIR FARMING PRACTICES

The interviewer will ask you to consider the following 5 scenarios of "things going wrong". Please describe how your operation would handle the situation.

C1 You have just been notified that your last shipment of milk contained antibiotics.

Immediate action:	
Tools used:	
Communication *within* the operation:	

Communication *outside* of the operation:	
Prevention plan:	

C2 Your bacteria count is normally around 1 to 2,000 cfu/ml but recently it has been fluctuating off and on around 10,000 cfu/ml. Your last test result showed the count to be at 48,000 cfu/ml.

Immediate action:	
Tools used:	
Communication *within* the operation:	
Communication *outside* of the operation:	
Prevention plan:	

C3 Your bulk tank somatic cell count is normally around 150,000 cells/ml, this week it jumped up to 450,000 cells/ml.

Immediate action:	
Tools used:	
Communication *within* the operation:	
Communication *outside* of the operation:	
Prevention plan:	

C4 Upon walking through the parlor you notice some milk build-up in the top of one weigh jar / meter.

Immediate action:	
Tools used:	
Communication *within* the operation:	
Communication *outside* of the operation:	
Prevention plan:	

C5 The abattoir called to say that in your last shipment of livestock, one animal was noted to have a broken needle in the flank.

Immediate action:	
Tools used:	
Communication *within* the operation:	
Communication *outside* of the operation:	
Prevention plan:	

SECTION D. YOUR OUTLOOK ON THE DAIRY INDUSTRY

We would like to ask you about your opinions on some aspects of the dairy industry. Below are some statements about dairy farming with a number rating. Please choose one number for each statement, which number is closest to how you feel.

D1 Your personal involvement in dairy farming:

Very **Little** 1 2 3 4 5 6 7 8 Very much **Involved**

D2 Your feelings about the change from milker/herdsman to manager/CEO:

Very Negative 1 2 3 4 5 6 7 8 Very Positive

D3 Your feelings about the support structure available to you in the dairy industry:

Very Negative 1 2 3 4 5 6 7 8 Very Positive

D4 Your feelings about the demands being made on dairy producers:

Very Negative 1 2 3 4 5 6 7 8 Very Positive

D5 Your feelings about the demands new quality programs may/will have on dairy producers:

Very Negative 1 2 3 4 5 6 7 8 Very Positive

D6 Your feeling about consumer demands with regard to food safety

Over rated **1 2 3 4 5 6 7 8** **Very pro-active**

D7 Comments:

D8 Below are some statements about dairy farming today. **Please choose ONE**, which is closest, to how you would respond.

✓	Statement
	Considering all that dairy producers have had to take on, it is too much to expect us to do even more with some quality management system that will probably never do us any good.
	If they want us to take on extra work on the farm for quality management, they should make sure we get paid enough to see some extra profit out of it.
	We are already very quality conscious, so I am not sure about any new quality management system, but if it did not take much more time, I would probably give it a go.
	Whether we want to or not, we have to take on quality management, or we will lose our export markets to those that have it, so I would be in it.
	I reckon quality management is going to benefit the whole industry, including the financial return to farmers so, I am all in favour of it, even if it takes a bit more work.

D9 Comments?

Appendix 2: Manual/Workbook Feedback

1. Manual/Workbook Feedback

Question	Yes	No	Comments/Suggestions
	√		
1. Did you feel the contents of the book (workbook and reference manual) were accurate?			
2. Was the book (workbook and reference manual) easy to follow?			
3. Did you find sufficient "linking" between different sections to be helpful in finding more information when needed?			
4. Was the reference manual useful?			
5. Was the workbook sample records (records, plans, SOPs) useful?			
6. Was separating the two books – reference book from the workbook – useful?			
7. Would you like to see anything changed in the book?			
8. Would you like to see more pictures in the reference manual?			
Your overall impression			

2. Training Session

Question	Yes	No	Comments/Suggestions
	√		
1. Did you find the training program useful?			
2. Were the visuals helpful?			
3. Were the additional handouts useful?			
4. Was the facility satisfactory			

for the session?			
5. What part of the session was of the greatest value to you?			
6. What part of the session was the least value to you?			
7. Any suggestions for future training sessions?			
8. Your overall comments			

3. Canadian Quality Milk Program – First Impressions

Question	**Comments/Suggestions**
1. Overall impression	
2. Time spent on the project to date (NOT including the training or interview sessions) – identify if others involved and how much.	
3. List estimates of any items/procedures/changes that would have to be done to satisfy the program mandatory req'ts -estimate labour and parts (quantity)	
4. Do you foresee any problems/difficulties with the program?	
5. What are the "plusses" / things you like about the program?	
6. Other comments	

Appendix 3: Mandatory Checklist

CCP1 – Use of Livestock Medicines and Other Chemicals

General:

- All cattle identified according to the National Livestock Identification for Dairy (NLID) program
- All cattle identified so treatment records can be maintained
- Livestock medicines used are approved for use in dairy cattle, and are used according to the label and/or according to written instructions from a veterinarian
- Recommended milk withdrawal times followed for medicines, pesticides and medicated feeds
- Recommended meat withdrawal times followed for medicines, pesticides and medicated feeds
- Livestock medicines are stored in a manner that will not contaminate milk, meat or feeds
- Milk from new animals entering the herd is tested for inhibitors
- Method of communicating which animals are treated to milkers or shippers

Records:

- Permanent, written record of all treatments (e.g. Chapter B, p 11)
- Valid medicated feed license for any medicated feed used on the premise (e.g. Chapter 6, p40)

Standard Operating Procedures:

- Procedures used when treating an animal with antibiotics (e.g. Chapter B, p 20)
- Procedures used when milking problem animals (e.g. treated cows) (e.g. Chapter B, p 21)

Plans:

- Written prescriptions from a veterinarian for all off-label use of medications (e.g. Chapter B, p 19)
- Written plan on how to deal with milk from treated animal(s) that have entered the bulk milk tank and compromised the safety of your milk and meat (e.g. Chapter B, p 14)
- Written plan on how to deal with treated cattle being shipped to slaughter before withdrawal dates are reached (e.g. Chapter B, p 14)

Validator Spot Checks:

- Drug inventory
- Drug storage conditions
- Program in place to minimize risk of contaminating bulk tank with treated milk (e.g. look for: notice boards, leg bands or body markings, written records housed in an accessible area)

CCP2 – Cooling and Storage of Milk

General:

- Method of communicating if milk is not cooled to between 1°C-4°C within the acceptable cooling period

Standard Operating Procedures:

- Procedures used to set-up equipment after milking (e.g. Chapter B, p 22)

Records:

- Farm holding tank temperature log or chart readings (e.g. Chapter B, p 12)

Plans:

- Written plan on how to deal with improperly cooled or stored milk (e.g. Chapter B, p 14)

Validator Spot Checks:

- Review records, check thermometer calibration.

CCP3 – Equipment Sanitation

General:

- Method of communicating visible milk residue build-up on milk contact surfaces

Records:

- Written record of a weekly equipment check (producer to determine key areas, sample record e.g. Chap B, p 13)
- Written record of return wash line temperature on a weekly basis, e.g. Chap B, p 13)

Plans:

- Written plan on how to deal with dirty milk contact surfaces (e.g. Chapter B, p 15)
- Written plan on how to deal with improper rinse water temperature (e.g. Chapter B, p 15)

Validator Spot Checks:

- Observe/review milking equipment and key areas to weekly check

CCP4 – Use of Water for Cleaning of Milk Contact Surfaces

General:

- Method of communicating if a water test result reveals a form of contamination

Records:

- Annual water test for fecal coliform, total coliform and total bacteria (standard plate count) (e.g. Chapter B, p17)

Plans:

- Written plan on how to deal with contaminated water (e.g. Chapter B, p15)

Validator Spot Checks:

- Review water sources, water use, related equipment (backflow devices) and record (test result)

CCP5 – Administration of Livestock Medicines by Injection

General:

- Abbatoir or next buyer informed if animal has broken needle in it
- Identification of animal and treatment of site whose treatment resulted in an unretrievable broken needle
- Method of communicating if needle has broken in an animal and is unretrievable

Records:

- Permanent, written record of all treatments and broken needle sites (e.g. Chapter B, p 11)

Plans:

- Written plan on how to deal with any contamination of milk or meat (e.g. broken glass, broken needles) (e.g. Chapter B, p 15)

Validator Spot Checks:

- Review restraining methods and location, injection techniques and above records.

Appendix 4: Best Management Practices Validator Training Sheet

As a validator, you will examine the facility and farm practices that relate to the questions on form B. The following list is designed to provide a mental checklist of items that must be observed in practice during your walk through the facility.

1. Pesticides/Fertilizers/Treated Wood/Treated Seed/Treated Feed

- ❑ safe / secure storage / use (away from livestock, feed and milk):
  1. pesticides,
  2. chemicals (includes sanitizers / detergents),
  3. fertilizers ,
  4. treated seed or feed
  5. treated wood

2. Animals and their Environment

- ❑ animals are clearly identified

  1.NLID if animals never leave facility

  2.leg bands or paint if treated)

- ❑ clean and dry environment
  1. restrict cattle access to manure, runoff, recently manured pasture, surface waters and muddy areas;
  2. stalls well bedded and maintained
  3. manure and nutrient management plan (where required)

3. Parlour / Milkhouse and Treatment Area or Office

- ❑ safety switch (swing pipe to bulk tank)
- ❑ general facility and external equipment surfaces are clean
- ❑ milk house exclusively used for
  1. tasks related to handling of milk
  2. approved chemicals / pesticides
- ❑ state of milking equipment cleanliness matches areas of choice on weekly record
- ❑ verify:
  1. temperature of wash
  2. milk house wash charts
  3. bulk tank temperature with current chart/thermometer
- ❑ ensure no mercury gauges
- ❑ SOPs posted for:
  1. post-milking
  2. treated animals
- ❑ records are in an accessible location (written records, notice boards)

- ❑ sanitation cleaning chart posted
- ❑ needles are used and stored properly (restraining area, sharps container, needle storage)
- ❑ chemicals (drugs, cleaners)
    1. stored in properly labeled containers;
    2. clean and maintained storage areas;
    3. dry and lactating drugs stored separately
    4. refrigerators maintained and working within Temp range
    5. drugs used match any written prescription records (e.g. prescription on record for drugs not recommended for dairy)
- ❑ proper drainage and ventilation
- ❑ protected lights over bulk tank
- ❑ vermin control program

4. Feed and Water

- ❑ manure stored properly in relation to
- ❑ well cover, cap and casing inspected and repaired regularly
- ❑ backflow devices used
- ❑ samples taken of all new feeds
- ❑ free of contamination (e.g. manure)

Appendix 5: Drug Inventory

DRUG	PRODUCER												
	1	2	3	4	5	6	7	8	9	10	11	12	13
absorbine	c												
acetylsalicylic acid	c			c		c				c	c		c
ADSPEC												c	
agarol (laxative)		c											
alphasept mint (udder balm)				c									
amprol (9.6% solution)													f
anafen (ketoprofen injection)				f									
astringent powder	f												
austovite forte (multi vitamin)		c		c									
B.B. jell (udder balm)				f									
banamine		c	c					f				f	c
barnfly spray	c												
bimotrim									f				
biosol (from neighbor-coliform concoction)			c										
biotin	c												
blood stopper (dehorning)	c						f						
blu-kote (spray for surface cuts)				c									
borgal									f				
boroform (spray for wounds)		c								c		c	
boss (pour on insecticide)												c	
bovine coronavirus E. coli antibody	f										f	f	f
bovine rhinotracheitis-virus-diarrhea-parainfluenza-				f					f			f	f
3-respiratory syncytial virus vaccine													
bug wacker			c										
cal drench			c							c			
cal mag phos						c							
cal magnesium	f									c			
cal nate 23%	c	c	c							c			
calcium borogluconate 23%				f		c					c	c	c
calcium plus	c		c	f							c	c	c
calf-lyte II												c	
calf scour tablets			c										
calf span tablets												c	
carmilax bolets (antacid and laxative)		c		c									
cattle purge (diarrhea)							c						
cefa dri			c									c	
cefa lak	f		c	c	c	c				c	c	c	f
clotol (hemostatic)													f
cornstarch (udder sores)	c												
covexin 8													f
crest toothpaste (ringworm)	c												
cronyxin							f						

cylence	f			c	c								
cystorelin					c					f		f	
deLice	c												
della-zap	c												
depocillin	f											f	
dettol	c	c											
dexamethasone		c		f					f	f			
dexamone 2			c										
dextrose 50%	c	c	c	f		c				c	c	c	c
dimethyl-sulfoxide (topical-reduce swelling & pain)				f									
dipyrone 50% (horses)									f				
domcol solution (prevents acetonemia)											c		
dopram-V (respiratory agent - good stuff)										f			
downer-D (chronic milk fever)										f			
dri kill (on calves)													
dry clox	f				c	c		c				c	
dry flex			c						f				
dry off													c
duplocillin LA													f
dynamint						c							
dystocil (calves)	f						f						
E.C.P.				c			f		f	c	c		
E. coli vaccine									f		f	f	f
ectiban (fly spray)										c			
electrate												c	
electrolytes												c	
entefur (scours)							f						
epinephrine							c			f	f		
eprinex					c								
estrumate			c	f		f		f	f	f	f	f	
excenel	c	c		f	c	f	c				c	c	
exhelm E (de-wormer)							c						
factrel	f	c	c	f		f				f			
fertiline				f		f	c				f		
flucort (feel good drug, makes cows eat)			c										
furacin	c		c										
furasone												c	
gentacin		c						f	f			f	
ginger (sick calves)	c												
glycol												c	
golden malrin (fly spray)	c												
haematone (mineral injection)	f												
hemostatic powder (dehorning)	c												
hibitane						c				c			
hydrogen peroxide			c										
iba cide (uterine flush)	c												

imaverol (antimycotic for horses & dogs)		c											
iodine	c					c							
iosal (swollen udders)	c												
isopropyl rubbing alcohol		c	c										
ivomec - eprinex (lactating)			c										
ivomec - ivermectin (heifers and calves)			c										
K R S (spray foam w Co-Ral - insecticide)		c	c									c	
kaopectate			c										
kelamycin												f	
ketamalt	c		c							c		c	
ketamycin										c			
keto-gel (tube)													c
ketol										c			
ketostix						c							
konk too (parlour fly spray)			c										
koppertox	c												
lasix (diuretic)							f	f				f	
leptospira canicola-grippotyphosa-hardjo-												f	
icterohaemorrhagiae-pomona bacterin													
levasole bolus (dewormer)	c						f						
lidocaine (freezing)							c	f					f
lincospectin	c		c	c	c			f			c		
liquamycin LA-200						c	f		f	f	c		
liquamycin LP		c		f	c	c	f						
liquid petrolanum	c												
longisil (foot rot)										f			f
louse powder			c										
lugol's solution (ring worm)	c		c										
lutalyse		c					f			f	f		
lutropin V										f			
lye (hard as rock)			c										
lysoff (don't use)			c										
maglucal plus		c											
magnesium sulfate	f												
micotil	f	c							f	c	f		f
mineral oil						c							
NaCl (to make cow thirsty if toxic)										c			
naquasone (diuretic) (udder edema)		c	c							c		c	
netricure												c	
neospan						c							
neo-sulfalyte boluses		c		c		c							
newcells (vitamins)							c					f	
novodry plus					c				f	c	c		
novolate										f			
nuflor		c							f	c			
number's up (fly spray)										c			
off	c												

oxamin (for bloat)	f			c		c					c	c	
oxymycine-LP			c	f	c	c					c	c	c
oxytocin	f	c	c	f		f	c	f	f	f	f	f	f
oxyvet 100LP										c			
oxyvet 200LA													c
PCE Glycol (propylene glycol)			c										
pen-aqueous			c	f									f
penicillin G procaine		c			c		f		f		c		
penlong XL				f				f		f		f	
penpro						f				f			
phenylbutazone injection									f	f			
phosphonortonic (ketosis and milk fever)				f	c	c				f		f	
pink eye guard				c			f						
pirsue		c			c						c		
poten D (vitamins)						f							f
pr citation (Banamine replacement)								f					
predef (ketosis)		c					f		f			c	
progesterone										f		f	
propen LA						f							
protokal (sick stomachs-quick E, aa's)	c												
protutor (fly tapes)										c			
respond super calcium supplement (oral tube)												c	
revibe (calves w diarrhea)				c									c
ringworm solution										c			
ripercol (didn't know what for)										f			
rompun							c						
Rumex (rumen stimulant bolus)				c								c	
Se plug			c										
selenium E									f	f			
selepherol (Se and vitamin E)													f
special formula 17900	f		c	c	c	c			f	c	c	c	
sulfa 25%										c			
sulpha urea cream (organic intrauterine treatment)										c			
sulfur	c												
sulfurea topical anesthetic	c												
synergistin (calves)	f			f									
teat dilators (cream)	f	c											
tempo (fly spray)										c			
tetrabol (for calves/uterine infections)				c						c			
tetracycline								f		c			
tetracycline 250 ([] soluble powder)				c	c								c
tramisol					c			f					
triangle vaccine							c				f		
trimidox													c
trivetrin	f	c		f	c	c	f		f	c	c	c	

tympanex (frothy bloat)				c					f	f			
udder budder	c												
UTR sept										c			
vetazide (udder edema)								f					
virkon	c												
vitamaster									f	f		f	
vitamin A and D								f	f	f			f
vitamin B complex				f									
vitamin mineral supplement MU-SE											c		
watkins linament									f				
wound and pink eye spray										c			
yeast			c										

Note: c=cupboard f=fridge