



# **From the Farm Gate to the Dinner Plate**

**November 2 to 4, 2003  
The Westin Edmonton, Edmonton, Alberta**

Hosted by the  
Agricultural Institute of Canada Foundation

**The Agricultural Institute of Canada Foundation supports and promotes the science of agriculture and the role that it plays in providing Canadians with a safe, affordable and nutritious food supply.**

The AIC Foundation is hosting this conference to provide a forum for the presentation of the best science-based approaches to food safety throughout the entire agri-food continuum. From the Farm Gate to the Dinner Plate will include presentations that address best production practices for on-farm food safety, approaches to hazard reduction, new technologies and process control systems, the importance of data collection and information exchange, risk analysis and decision-making tools, advances in tracking and tracing of all products and commodities, and the integration of agricultural policy and legislation at all government levels to ensure the integrity of Canada's food supply.

#### **Conference Co-Chairs**

Brenda Machin, PAg, Governer, Agricultural Institute of Canada Foundation  
Derrick Jamieson, PAg, Governor, Agricultural Institute of Canada Foundation

#### **Technical Program Committee**

Chair: Sandra Honour, DVM, MSc, Food Safety Division, Alberta Agriculture, Food and Rural Development

Susan Lutz, President, Canadian Institute of Food Science and Technology

Michael Cassidy, Coordinator, Food Safety Science Unit, Food Safety Policy Branch, Ontario Ministry of Agriculture and Food

Alison Speirs, Foods Safety and Quality Specialist, British Columbia Ministry of Agriculture, Food and Fisheries

Clay Switzer, PAg, FAIC, Governor, Agricultural Institute of Canada Foundation

Jean Sullivan, PAg, Manager, Agricultural Institute of Canada Foundation

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#### **Conference Administrator**

Elizabeth Muckle-Jeffs, The Professional Edge

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## Conference / Sponsors

The Agricultural Institute of Canada Foundation gratefully acknowledges the financial support provided to the conference by the following organizations:

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**Monday November 3** / Opening Plenary

**SESSION CHAIR:** Wayne Wickens, PAg, President, Agricultural Institute of Canada Foundation

8:30 AM

**Welcome and Opening Remarks**

*Wayne Wickens, PAg, President, Agricultural Institute of Canada Foundation*

8:45 AM

**Where Academia Fits in the Food Safety Continuum**

*Mansel W. Griffiths, NSERC/DFO Chair in Dairy Microbiology and Director, Canadian Research Institute for Food Safety, University of Guelph*

9:15 AM

**Food Safety Issues Facing the Industry – Marketing vs Safety**

*Joanna Karman, Senior Vice President and Managing Director, Agri-Food Practice, IPSOS-Reid*

9:45 AM

**Food Safety Perceptions vs Reality: Surveys on Consumer Confidence in Food Safety**

*Simone Demers-Collins, President, Food Safety Info Society*

10:15 AM

*Networking Break*

10:45 AM

**The Role of Governments in Food Safety Over the Next Decade**

*Ronald Doering, Partner, Gowling Lafleur Henderson LLP and former President, Canadian Food Inspection Agency*

11:15 AM

**Panel Discussion**

*Moderator: Sandra Honour, Head, Agri-Food Systems Branch, Food Safety Division, Alberta Agriculture, Food and Rural Development*

12:15 PM

*Luncheon*

*Luncheon Address*

**Farm Credit Canada**

BASELINE STUDIES AND MITIGATION STRATEGIES

**SESSION CHAIR:** Michael Cassidy, Coordinator, Food Safety Science Unit, Food Safety Policy Branch, Ontario Ministry of Agriculture and Food

1:30 PM

**Overview of Microbiological Baseline Studies of Raw Pork, Beef and Chicken Carcasses in Ontario Abattoirs**

*Pat Johnson, Ontario Ministry of Agriculture and Food*

1:50 PM

**The Alberta Food Safety Division Surveillance and Collaborative Research for Salmonella in Swine: Questions Addressed and Questions Remaining**

*Andrijana Rajic, Alberta Agriculture, Food and Rural Development*

2:10 PM

**Current and Future Baseline Studies on Ontario's Dairy Products**

*Bruce Keown, Ontario Ministry of Agriculture and Food*

2:30 PM

**Detection of Salmonella, Trichinella and Toxoplasma Antibodies in Alberta Wild Boars at Slaughter**

*Eva Chow, Alberta Agriculture, Food and Rural Development*

2:50 PM

*Networking Break*

3:20 PM

**Enterohemorrhagic *E. coli* in Cattle Production Environments: Advancements and Challenges**

*David G. Renter, Alberta Agriculture, Food and Rural Development*

3:40 PM

**Prevalence and Risk Factors of Pathogenic *E. coli*, Including O157:H7 in Western Canadian Cow/Calf Herds**

*Sheryl Gow, Western College of Veterinary Medicine*

4:00 PM

**Investigation of Acetic and Propionic Acids as Agents for Control of *E. coli* O157:H7 in Drinking Water for Livestock**

*Susan J. Bach, Agriculture and Agri-Food Canada*

4:20 PM

**DNA Fingerprinting Approach to Trace the Sources of *E. coli* Contamination from Farm to Ground Beef**

*Mueen Aslam, Agriculture and Agri-Food Canada*

5:00 PM

*Poster Session*

## ON-FARM FOOD SAFETY

**SESSION CHAIR:** David Chanasyk, PAg, FAIC, President, Agricultural Institute of Canada

1:30 PM

**The Canadian Approach to On-Farm Food Safety**

*Albert Chambers, Canadian On-Farm Food Safety Working Group*

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**The Development of the Canadian Quality Assurance (CQA) Program: Lessons Learned About On-Farm Food Safety Programs**

*Julia Keenlside, Alberta Agriculture, Food and Rural Development*

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*Joyce Van Donkersgoed, Alberta Beef Quality Starts Here*

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**On-Farm Food Safety Recognition Program**

*Rick Gammer, Canadian Food Inspection Agency*

2:50 PM

*Networking Break*

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**On-Farm Food Safety: Experiences of the PEI Horticultural Sector**

*Nancy Lovering, PEI Horticultural Association*

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**On-Farm Food Safety Pilot Project for BC Blueberry and Raspberry Growers**

*Raman Gill, BC Blueberry Council and Raspberry Industry Development Council*

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**Field-to-Fork On-farm Food Safety in Ontario**

*Beatrice Rinke, Ontario Ministry of Agriculture and Food*

4:20 PM

**The Challenges of Implementation**

*Dawn Leblanc, Canadian On-Farm Food Safety Working Group*

4:40 PM

**The Role of Professionals in On-Farm Food Safety**

*Moderator: Gord Mitchell, PAg, National Manager, Canadian Beef Industry Quality Assurance and Product Safety Program*

*This session will provide an opportunity for informal discussion about the role of the Professional Agrologist in On-Farm Food Safety Programs.*

5:00 PM

*Poster Session*

RISK ASSESSMENT AND ECONOMIC IMPACTS OF DISEASE

**Session Chair:** Susan Lutz, President, Canadian Institute of Food Science and Technology

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**The Food Safety Universe Risk Assessment and Risk Ranking Database**

*Michael Cassidy, Ontario Ministry of Agriculture and Food*

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*Denise Dewar, CropLife Canada*

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**Health Tradeoffs in Pesticide Regulation**

*Sean B. Cash, University of Alberta*

10:10 AM

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**SESSION CHAIR:** Peter MacLeod, Executive Director, CropLife Canada

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*Luis Garcia, Ontario Ministry of Agriculture and Food*

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**Toward Risk-Based Food Safety Policy: Rationale, Barriers and Solutions**

*Greg Paoli, Decisionanalysis Risk Consultants*

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*Laura Anderson, Canadian Grain Commission*

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**Strategy Towards a National Traceability System for the Swine Sector**

*Eric Aubin, Canadian Pork Council*

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## HACCP AND LEGAL ISSUES

**SESSION CHAIR:** Derrick Jamieson, PAg, Governor, Agricultural Institute of Canada Foundation

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**What You Should Know About HACCP**

*Brian Collis, Collis Consulting Inc.*

11:00 AM

**HACCP Systems and the Management of Medication Residues in Feed Manufacturing: A Practitioner's Perspective**

*Paul Brubacher, Flordale Feed Mill Limited*

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POLICIES AND PROGRAMS

**SESSION CHAIR: Cornelia Kreplin, Director, Food Safety Division, Alberta Agriculture, Food and Rural Development**

1:30 PM

**Federal-Provincial-Territorial Framework Agreement on Agricultural and Agri-Food Policy For the 21st Century – Food Safety**

*Sally Rutherford, Agriculture and Agri-Food Canada*

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**Building Partnerships Through the Food Continuum**

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**Ontario's Food Safety Programs – Providing Province-Wide Protection by Effectively Managing Risks**

*Michael Cassidy, Ontario Ministry of Agriculture and Food*

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**Alberta Agriculture, Food and Rural Development – Food Safety**

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**Ontario's Food Safety Decision Support System (FSDSS)**

*Joe Koza, Ontario Ministry of Agriculture and Food*

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**Outbreak of *E. coli* O157:H7 Gastroenteritis Associated with Consumption of Unpasteurized Gouda Cheese, Edmonton, 2003**

*Lance Honish, Capital Health*

2:10 PM

**Canadian Consumers' Choices for GM Food: Risk Attitudes, Perceptions, and Responses to Information**

*Michele M. Veeman, University of Alberta*

2:30 PM

**From Supermarket to Fork: Consumer Misconceptions Contribute to the Risk of *Salmonella heidelberg* Outbreak in British Columbia**

*Laura MacDougall, BC Centre for Disease Control*

2:50 PM

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**Can Advertising and Media Health Coverage Mitigate the Consumer Effects of Food Safety Occurrences? The Case of Meat in Canada**

*Ellen Goddard, University of Alberta*

3:40 PM

**Initiatives of the Canadian Partnership for Consumer Food Safety Education**

*Brenda Watson, Canadian Partnership for Food Safety Education*

4:00 PM

**InfoBasket – A One-Stop Shop for Agri-Food Information**

*George Geldart, BC Ministry of Agriculture, Food and Fisheries*



**Where Academia Fits in the Food Safety Continuum**

***Mansel W. Griffiths***

*NSERC/DFO Chair in Dairy Microbiology and Director, Canadian Research Institute for Food Safety  
University of Guelph, Department of Food Science, CRFS Rm 202, Guelph ON N1G 2W1  
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Canada has a wealth of talent devoted to food safety research. Research is being conducted in all parts of the country and on all aspects of the food supply chain from production and processing through to policy development. What is lacking is a way to harness these efforts in a meaningful way to resolve issues surrounding food safety. New initiatives have been instigated including the creation of the Canadian Research Institute for Food Safety (CRIFS) and the Canadian Research Coalition on Safe Food and Water. The latter was formed by the Institute for Infection and Immunity of the Canadian Institutes for Health Research (CIHR) in response to the recommendations of a CIHR workshop held in 2000. It is an attempt to develop partnerships between researchers and to expand the funding base for these ventures.

Food safety research has also benefited from funding opportunities such as that provided by the Canada Foundation for Innovation (CFI). This has led to the establishment of research chairs at Universities and provided money for significant research infrastructure. It was CFI and the Ontario provincial government that provided the funding to establish CRIFS. CRIFS is an attempt to bring together researchers from many disciplines and organizations to tackle fundamental problems associated with the safety of our food supply. These attempts to create research collaborations are admirable but what is needed is a truly national research network that builds on the strength of the participating organizations and benefits from the expertise that exists in the country. Canada needs to develop a national strategy for food safety involving partnerships between academia, industry and government at all levels. This is the right time to achieve this given the present concerns over the safety of our food and water supplies. I believe that academia needs to drive this initiative to maintain public confidence in the process.

**N O T E S**

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## Food Safety Issues Facing the Industry

### *Joanna Karman*

*Senior Vice President and Managing Director, Agri-Food Practice, Ipsos-Reid*

*9th Floor, 363 Broadway, Winnipeg, MB R3C 3N9*

*T: 204 949 3100 F: 204 942 5669 E: joanna.karman@ipsos-reid.com*

This presentation will discuss various marketing approaches towards food safety, in the context of consumers' perceptions of safety vs. safety itself. It will outline some of the specific concerns that consumers hold when they consider different parts of the supply chain, and examine who (and how many) seem to be driving the "food sensitivity" file.

### **N O T E S**

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**Food Safety Perceptions vs. Reality: Surveys on Consumer Confidence in Food Safety**

***Simone Demers Collins***

*President, Food Safety Info Society*

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Food-borne illness is a widespread public health, economic, and a consumer problem. While producers, government, the retail and processing industry all strive to develop programs that will ensure that Canadian food is as safe as possible, consumers who are unaware or unwilling to accept part of the responsibility for a gate to plate food safety continuum, challenge the safety of the food being served within private homes. Simone Demers Collins, as President of the Food Safety Info Society, will address some of the current consumer concerns, the questions that are being posed on the national toll-free telephone service, and what responsibility the industry can assume to increase consumer awareness of potential home food safety concerns.

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# The Role of Governments in Food Safety Over the Next Decade

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In spite of all the talk about HACCP and industry assuming greater responsibility for food safety systems all along the food chain from farm gate to dinner plate, the role of government has actually steadily grown. Enhanced consumer awareness, new emerging pathogens, issues of food security and trade protectionism are just some of the forces that have contributed to this phenomenon. Will these trends continue into the next decade? What are the implications for producers, processors, retailers, and consumers?

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## Overview of Microbiological Baseline Studies of Raw Pork, Beef and Chicken Carcasses in Ontario Abattoirs

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The prevalence and levels of indicator and pathogenic bacteria on hog, beef and chicken carcasses processed in Ontario's provincially licensed abattoirs were evaluated in a series of microbial baseline studies conducted between December 1998 and August 2002. The studies were designed to account for variations due to establishment processing volume, geographic location of plants and seasonal impacts. To minimize experimental error and ensure adequate representation, volume throughput data from the abattoirs was utilized as design criteria for stratifying abattoirs into high, medium and low volume groups for pork and beef, and large and small volume groups for chicken. Had a completely randomized design been used, as much as 80% of the samples would have originated from only 8% of the plants.

Randomized sampling plans were developed on a weekly basis, providing for a sampling frequency that was based on probabilities proportional to volume within stratum. Carcass selection at the plant, using random number tables, was done by meat inspectors trained in aseptic sampling methodology. For pork, carcass sampling was conducted 6-12 hours post-slaughter using sampling sponges with buffered peptone water as the diluent. Three sites on the carcasses were swabbed (belly, ham and jowl) using a 100 cm<sup>2</sup> template. Similar methodology was used for beef, sampling 12-36 hours post-slaughter, and swabbing rump, flank and brisket. Chicken carcasses were shaken for one minute using 400 mL buffered peptone water in sterile 3500 mL sampling bags. Information collected for beef included fed versus culled beef, beef class (steer, heifer, cow or bull), dressing method (bed or rail), dehiding method (manual or mechanical) and shrouding practices. For chicken, information was collected concerning processing methods: scalding method; chilling method; dressing procedure (full, UDP, Hong Kong); evisceration method; temperature of chill tank; and chicken weight. Samples were packed in chilled shipping containers, time and date stamped and shipped by courier to Laboratory Services Division, University of Guelph for microbial analysis. A strict set of sample acceptance/rejection criteria was implemented. Only samples which were received by the laboratory within 24 hours of collection, complete, uncontaminated, non-leaking and whose temperature was between 0° and 8°C (10°C for chicken) were accepted for microbial analysis.

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Pooled sponge swabs of 1557 hog carcasses and 1459 beef carcasses were submitted for microbiological analysis for: aerobic colony count (ACC), total coliform count (TCC), *Escherichia coli* count (ECC), *Listeria monocytogenes* (Lm), *Salmonella* spp. (S), *Campylobacter* spp. (C) and verotoxigenic *E. coli* (VTEC). The analytical methods used for *E. coli* count, *Salmonella*, *Listeria monocytogenes*, and aerobic plate count were those accredited by the CFIA and described in the Health Canada, HPB Compendium of Analytical Methods, volume 3. The *C. jejuni/coli* analytical method and the verocell assay for verotoxigenic *E. coli* were modifications of those described in the former Agriculture and Agri-Food Canada laboratory procedure manual. Serotyping of *Campylobacter* and *Salmonella* isolates was provided by participating Health Canada Laboratories in Guelph and Winnipeg. For chicken, samples from 1480 post-chill carcasses were analyzed for ACC, TCC, ECC, Lm, S, C and VTEC, and in addition, positive *Salmonella* and *Campylobacter* samples were enumerated using the Most Probable Number (MPN) procedures described by USDA.

Results were analyzed with SAS for associations with strata, geographical location, season and operational variables.

The contamination rates in the pork study were 61.3%, 39.5%, 10.7%, 4.8%, 26.7% and 2.1% for total coliforms, *E. coli*, *Listeria monocytogenes*, *Salmonella*, *Campylobacter* and VTEC, respectively. The analysis of the aggregate results for beef showed that contamination rates were 27.8%, 18.6%, 1.5%, 9.9%, 1.6%, 1.5% and 0.3% for TCC, ECC, L, S, C and VTEC, respectively. For chicken, contamination rates were 99.86%, 98.99%, 29.95%, 31.55%, 63.85% and 0% for TCC, ECC, Lm, S, C and VTEC, respectively, while the median log<sub>10</sub> cfu/ml for ACC, TCC and ECC were 3.95, 2.71 and 2.40, respectively; the median values for S and C were 0.64 and 0.63 log<sub>10</sub> MPN/mL, respectively. In all studies, processing volume was a significant factor influencing microbial findings: for pork, TCC, ECC, Lm and S were influenced (P<.001) by processing volume (71.3, 59.5 and 50.1 for TCC; 44.4, 40.2 and 32.0 for ECC; 16.6, 7.9 and 6.1 for Lm; and 9.0, 3.6 and 0.5 for S in high, medium and low volume plants, respectively); for beef, TCC (P<0.01), *Salmonella* (P<0.001) and C (P<0.05) were influenced by processing volume (32.1, 25.2 and 24.8 for TCC; 3.3, 0.2 and 0.9 for S and 2.5, 0.5 and 1.4 for C in high, medium and low volume plants, respectively). For chicken, carcasses from smaller volume plants had substantially less Lm and S than their large volume counterparts (14% vs. 47% and 20% vs. 45%, respectively (P<.001), but higher C contamination (70% vs 58%, respectively; P<.001).

The microbial findings of the studies will be used to establish microbial performance standards for meat and poultry processing in Ontario. Coupled with operational data the microbial results will be used to direct compliance and regulatory activities of the Food Inspection Branch towards the food processing activities of highest risk. The study findings will also be used as a statistical benchmark to assess future food safety intervention activities.

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## The Alberta Food Safety Division Surveillance and Collaborative Research for Salmonella in Swine: Questions Addressed and Questions Remaining

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Salmonella is found worldwide in swine and pork and may for many reasons be considered the most important swine-related zoonoses of today. Apparently healthy swine can carry a broad range of Salmonella serotypes and be a source of contamination throughout the pork production and processing systems. In many countries, including Canada, the relationship between human illness and Salmonella contaminated pork is unclear, except in the European Union where approximately 15–20% of human cases are related to pork. The public health aspect affects all segments of pork industry due to the economic impact of pork recalls and the impact of pork-related salmonellosis on human health. International trends indicate that major pork exporting countries are integrating Salmonella control programs into their broader pork quality assurance programs. Denmark and the Netherlands recently reported significant decrease of salmonella incidence in their pork using this type of program. It might be expected that other pork exporting countries, including Canada, will try to match their success.

Questions addressed: The Food Safety Division of Alberta Agriculture, Food and Rural Development (AAFRD) has

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conducted two baseline studies related to Salmonella in swine. In the first study, Salmonella prevalence, serotypes and resistance profiles were investigated in Alberta swine at slaughter. Salmonella spp. were recovered from 35% (211/602) of cecal samples. The most common serotypes, California, Infantis, Derby, Mbandaka and Worthington, comprised 68.4% of all isolates. Resistance to streptomycin, sulfamethoxazole and tetracycline was relatively frequent but multi-resistant isolates were less common.

The second study was conducted on 90 swine operations representing ~25% of the Alberta annual market pig production. The study objectives were to determine: Salmonella farm prevalence; serotype distribution in finishing swine and within the farm environment; risk factors associated with increased Salmonella farm levels; and to investigate antimicrobial drug use and resistance of Salmonella on these farms. Most of the farms (~80%) were consistently low or moderately (<20% within farm prevalence) contaminated with Salmonella suggesting that efforts targeted at those few farms (~20%) that were highly (>20% WFP) contaminated with Salmonella may be effective in reducing the risk of potential carcass contamination. Relatively high Salmonella recovery from the farm environment indicated that a Salmonella contaminated environment might contribute to the persistence of infection within a farm. The most frequent serotypes were Derby, Infantis and Typhimurium. More than 95% of the isolates belonged to the serogroups B, C1 or D1 indicating that serology based on the Danish ELISA test might detect most of the prevailing serotypes on these farms. Among the isolates of *S. typhimurium*, DT104 was the most common. The preliminary analysis indicated that the type of feed used within the farm might be associated with increased Salmonella farm levels. Reported antimicrobial use patterns in swine and resistance of Salmonella isolates are currently being examined and will soon be submitted for publication.

Questions remaining: Sampling protocols and laboratory tests for *Salmonella* surveillance in swine are not internationally standardized and harmonized, and are validated only to a small extent. As a result, comparison of prevalence estimates within and among countries is almost impossible. The classification of herds in existing *Salmonella* control programs in swine is often based on practical capacity constraints and not on scientific arguments.

The Food Safety Division of AAFRD, in collaboration with Alberta swine industry, other agencies and universities, has plans to undertake the following initiatives:

1. Salmonella laboratory tests (culture, serology and PCR assays) will be validated to gain a better understanding of their values and limitations as they relate to the development and feasibility of Salmonella surveillance programs in swine.
2. Epidemiological studies and risk assessments will be conducted to determine risks associated with increased

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## Current and Future Baseline Studies on Ontario's Dairy Products

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To meet its strategic objective of developing outcome-based food safety standards and regulations based on sound scientific principles, OMAF is currently conducting, and plans to conduct, a series of microbiological and chemical baseline studies on both raw and processed dairy products. Two microbiological baseline studies are currently underway and include pasteurized fluid dairy products produced in Ontario's licensed dairy plants and raw goat milk. In the next fiscal year, microbiological baseline studies will be conducted on soft unripened cheeses and mild cheddar cheese produced in Ontario. In future years, baseline studies to determine the prevalence of selected veterinary drug residues and various environmental chemicals in Ontario's raw milk supply will also be conducted.

### BACKGROUND

#### Raw Milk

The goat milk industry is likely the fastest growing livestock industry in Ontario. At the present time, about 200 goat milk herds produce approximately ten million liters of goat milk per year. About a third of the goat milk produced is processed and sold as fluid milk with the remainder being used in the production of yoghurt, cheese and ice cream. As well, the sheep milk industry is an emerging industry in Ontario. As this new commodity grows, standards and regulations to ensure the quality and safety of this product need to be developed. Microbiological standards, based on lengthy cow milk production practices may not be appropriate for goat milk production. However, the scientific literature concerning the microbiological quality and safety of raw goat milk is sparse. The current microbiological baseline study on raw goat milk will provide some of the much needed information.

As well, the prevalence and levels of veterinary drug residues and environmental chemicals in raw milk from all species are not well known. The data from the two proposed chemical baseline studies will help to focus on-farm management practices and verify the chemical safety of Ontario's raw milk supply.

#### Processed Products

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Ontario's *Health Protection and Promotion Act* mandates that all dairy foods produced in Ontario be manufactured from pasteurized milk. Pasteurization does not guarantee the safety of pasteurized dairy products. While pasteurization remains a critical control point in maintaining the safety of dairy products, it is only one step of many in manufacturing a safe product. Pasteurization may not destroy all pathogens and pasteurized products may be re-contaminated when exposed to unsanitary conditions downstream of the pasteurizer. Temperature abuse and lengthy periods of refrigerated storage may also provide the conditions for spore germination and growth of post-pasteurization contaminants. While pasteurized dairy products have an excellent safety record, the extremely large volumes consumed necessitate on-going scrutiny. As well, the current and proposed microbiological standards for pasteurized dairy products are not science-based and may not be entirely suitable in today's dairy processing industry (i.e. new products and technologies). The baseline studies on the processed dairy products will provide the necessary information to reveal any existing problems and issues and to develop science based regulations and standards.

**Objectives of the Current Microbiological Raw Goat Milk Baseline Study**

The objectives of this study are:

- 1. To determine the prevalence of *Listeria monocytogenes*, verotoxogenic *Esherichia coli* (VTEC), *Salmonella* spp. and *Campylobacter* spp. in raw goat milk.
- 2. To determine the correlation, if any, between the prevalence of the selected food-borne pathogens and the microbial indicators to determine the usefulness of the total aerobic plate count, coliform count, and *E. coli* count as indicators for the potential presence of food-borne pathogens.

**METHODS**

**Sampling Plan**

In this baseline study, the target population is 1) all raw goat milk producers; and 2) all sheep milk producers in the province. A statistical analysis of OMAF's monthly Bactoscan (total bacteria count) data for the past two years was used to determine the necessary sample size for the goat milk study. In determining the sample size of one thousand, two hundred samples, a 5% margin of error and a 95% confidence level were used. Producers are randomly selected and sampled by OMAF inspectors. Raw goat milk is sampled from the farm bulk milk cooler immediately before pick-up by the milk transporter. Raw sheep milk will be sampled at the producer's location immediately before the raw

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sheep milk is frozen. At the time of specimen collection, the sampler will fill out a sample submission form detailing the producer's' location and the temperature of the milk prior to sampling.

**Microbiological Analyses**

Pathogens: All samples will be tested for the presence of the food-borne pathogens *Listeria monocytogenes*, *Salmonella* spp., *Campylobacter* spp. and *Yersinia enterocolitica*. As well, all samples in which *E. coli* is detected will be further analyzed for the presence of verocytotoxigenic *E. coli*. All presumptive positives will be confirmed by further biochemical analyses.

Indicator testing: Mesophilic aerobic plate count, total bacteria count (Bactoscan), coliform, *E. coli* and somatic cell counts are performed on each sample.

All testing procedures are performed by an independent ISO-9002 certified laboratory using methods from the current Compendium of Analytical Methods published by the Health Protection Branch, Health Canada or the Bacteriological Analytical Manual published by the United States Food and Drug Administration.

**NEXT STEPS**

The data from this study will be analyzed and then examined in relation to farm management practices data being collected by the OMAF program so that appropriate standards and regulations may be developed and implemented to strengthen the growth of these new commodities.

**Objectives of the Current Pasteurized Fluid Dairy Products Baseline Study**

The objectives of this study are:

1. To determine the prevalence of specific pathogens and levels of indicator organisms in fresh pasteurized fluid dairy products.
2. To provide baseline data so that the effectiveness of intervention programs such as current Good Manufacturing Practices (cGMP) and Hazard Analysis Critical Control Point (HACCP) programs at the processing plant level may be evaluated

**METHODS**

The target population for the baseline study is all pasteurized and extended shelf life fluid dairy products (not

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# Detection of Salmonella, Trichinella and Toxoplasma Antibodies in Alberta Wild Boars at Slaughter

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Salmonella is detected worldwide in swine and pork and is considered one of the most important swine related zoonoses. The prevalence of Salmonella in swine and on carcasses has been investigated in many countries and regions, including Canada. Free-living wild boars have been implicated in the epidemiology and ecology of certain swine related zoonoses such as *Trichinella* spp. Information on prevalence and the distribution of other zoonotic agents such as Salmonella is lacking.

In 2000, the Food Safety Division (FSD), Alberta Agriculture, Food and Rural Development, conducted a survey to estimate the prevalence of *Trichinella* spp. in wild boars slaughtered in Alberta provincial abattoirs. In addition to *Trichinella*, samples were tested for the presence of Salmonella antibodies. Blood samples (n=183) were collected from wild boars slaughtered in 36 provincial abattoirs from June 2000 to June 2001. All samples were collected by provincial meat inspectors and submitted to the nearest FSD laboratory for further processing and storage. A commercial Salmonella covalent mix-ELISA test (Svanovir™, Sweden), commonly used for serological monitoring in swine, was utilized to evaluate the presence of Salmonella antibodies (serogroups B and C1). The test cut-off value OD%≥40, which is recommended for testing of intensive swine operations, was arbitrarily chosen to define the seropositive status of wild boars.

Among 183 sera, 20 had OD%>40 (10.9%) and all sera had OD% value >10. Our serological findings indicate that wild boars in Alberta might be exposed to *Salmonella* spp., most probably from the environment. However, this does not mean that these wild boars were shedding Salmonella before slaughter or that their carcasses were contaminated with this organism. Considerable caution must be exercised before attempting to generalize these results because the ELISA test utilized in the study has not yet been validated in wild boar population. Additional studies, based on sound epidemiological design, are required to validate this serological test in wild boar populations. Salmonella surveillance, based on well designed sampling protocols and valid laboratory tests is needed to understand

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## Enterohemorrhagic *E. coli* in Cattle Production Environments: Advancements and Challenges

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Enterohemorrhagic *E. coli* (EHEC), particularly the O157:H7 serotype, have become worldwide public health concerns. Cattle feces are often implicated as the source of these bacteria in human infections. Since EHEC are the most important bacterial food safety issue affecting the beef industry and beef consumers, there is considerable interest in controlling these bacteria from farm gate to dinner plate.

There are currently no validated critical control points or good production practices specifically aimed at reducing EHEC or other bacterial contaminants in live cattle. However, there appears to be a role for pre-harvest control of EHEC as incoming cattle can be a source of beef contamination and there is a significant association between pre-harvest prevalence and carcass contamination. Intervention or mitigation strategies such as vaccination, feed changes, bacteriophage treatment, competitive exclusion and others are being evaluated for their ability to reduce EHEC in live cattle (particularly O157:H7). Recent studies have shown promising results.

There has also been considerable interest in determining the epidemiology and ecology of EHEC in cattle environments in order to identify points of control at the farm level. EHEC are widely distributed and individual animal prevalence within a herd or pen is highly variable. The factors that influence the number of positive cattle are complex and often interrelated, but may include microbial, animal, herd, environmental and production factors. The widespread distribution, transitory nature of fecal shedding, multiple potential environmental sources, and age-, feed- and temporal-related differences in cattle prevalence have been documented. However, the significance and/or role of these factors in the epidemiology and ecology of EHEC remain unclear. Practical on-farm control may require an improved understanding of the seemingly complex system(s) and the factors involved in the multiplication, maintenance and transmission of EHEC.

Molecular techniques for genotyping or subtyping EHEC and other pathogens have been used to determine the source and distribution of organisms responsible for human disease and to investigate the epidemiology of EHEC in cattle production environments. Results from our studies and others show that genetically similar EHEC strains can be found in multiple herds, multiple domestic and wild animal species, water, and other environmental sources. In addition to O157:H7, we've found evidence of other serotypes, which cause human illness such as O111 and O26,

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can be detected relatively frequently in feces from pens of feedlot cattle. We've also found that several different serotypes and subtypes of EHEC can be detected on cow-calf operations. Some of the intervention strategies mentioned previously are specifically targeted at O157:H7 and may not be effective for other EHEC serotypes. It is widely believed that not all EHEC, or even all 'O157', found in cattle are equally virulent for humans so the public health implications of these different EHEC are unclear.

The lack of standardization and validation of diagnostic testing protocols has limited conclusions and comparisons of EHEC results within and between studies. Limitations in diagnostic strategies also have hindered the ability to correctly detect and predict the EHEC status of individual cattle, pens, or herds. This prevents the development of monitoring or surveillance programs for identifying 'high risk' animals or potential points of control. In addition, a validated testing protocol could be used in a HACCP-based approach as the necessary step for verifying pre-harvest interventions. We are currently validating diagnostic tests and testing strategies for such purposes.

There have been considerable advancements in the study of EHEC in cattle over the last ten years, yet there are still many challenges to pre-harvest control of EHEC. Surmounting these challenges should enable the industry to implement on-farm control strategies so that EHEC can be controlled from the farm gate to the dinner plate.

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## Prevalence and Risk Factors of Pathogenic *E. coli*, Including 0157:H7, in Western Canadian Cow/Calf Herds

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There is increasing concern about the potential impact of intensive livestock operations on the environment and the risk that they potentially pose to human health. The purpose of this project was to identify the prevalence of pathogenic *Escherichia coli* in calves at calving and the risk factors associated with infection. Fresh fecal samples were collected from 876 calves on 139 farms in the spring of 2002. The sample collection was a random sample from calves in the calving/nursery area. The fecal samples were scored on a scale of 0 to 3 (0= firm, 3=watery) to identify fecal consistency. Samples were submitted on ice to the laboratory. Data was collected to assess risk factors for shedding including, herd management factors, age, sex, breed, health status/clinical signs, and treatment history. The samples were cultured onto MacConkey agar plates at 37°C for 18 hours for isolation of *E. coli*. Five to 10 lactose fermenting, morphologically identical colonies were pooled and identified as *E. coli* using standard biochemical tests.

The isolates were examined for presence of shiga-toxin 1 (Stx1), shiga-toxin 2 (Stx2), and EAE (*E. coli* attaching and effacing factor) virulence factors using DNA hybridization. Positive isolates were O-serotyped by slide agglutination. From the 876 calves, 990 *E. coli* isolates were saved for further testing. Of these 8.7% (86/990) were positive for Stx2, 5.4% (53/990) were positive for Stx1 and 3.6% were Stx1/Stx2 positive. EAE was detected in 4.3% (41/990) of the isolates. Of the 139 farms 40.3% (56/139) were positive for Stx2, 25.8% (36/139) were positive for Stx1, 20.1% (28/139) were positive for Stx1/Stx2 and 18.7% (26/139) were positive for EAE. Eighty percent (709/876) of the samples were collected from calves 2-10 days of age. In calves 2 to 10 days of age 7.9% (56/709) were positive for Stx2, 4.3% (31/709) for Stx1 and 2.7% for EAE. Preliminary serotype results from 49 samples indicate that 55% (27/49) can not be typed. Two serotypes associated with human disease were found at 4.08% (2/49) for 0157 and 2.0% (1/49) for 0103. Serotypes implicated in calf septicaemia or diarrhoea that were isolated included; 6.1% (3/49) 08, 10.2% (5/49) 088, and 6.1% (3/49) 015. Final serotype results are pending. The association between management factors and the presence of various genotypes and serotypes were evaluated to aid in the development of farm level control strategies.

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## Investigation of Acetic and Propionic Acids as Agents for Control of *Escherichia coli* O157:H7 in Drinking Water for Livestock

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*Escherichia coli* O157:H7 has evolved as an important human pathogen since its initial description more than twenty years ago. Beef and dairy cattle are asymptomatic carriers of *E. coli* O157:H7. They have been identified as primary reservoirs of this organism and contribute to environmental contamination by shedding it intermittently in the feces. Survival of *E. coli* O157:H7 in bovine feces and in water has been demonstrated, and suggests that environmental replication and reinfection are factors in the epidemiology of *E. coli* O157:H7-related disease. Isolation of the organism from water and waterers for livestock implies that shared drinking water may serve as a means of transmission of *E. coli* O157:H7 among cattle penned or grazing together. Weak acids are known to exert antimicrobial effects on pathogens such as *E. coli* O157:H7, and have been administered in the drinking water to dairy cows (as short-chain fatty acid supplements) with little impact on voluntary intake. Thus, this study was undertaken to investigate the potential of including weak acids (acetic and propionic) in drinking water for livestock as a strategy to reduce persistence of *E. coli* O157:H7 in the animal environment.

Stock solutions of filter-sterilized 5% ( $v/v_{\text{aq}}$ ) acetic or propionic acids (Sigma Chemical Co., Oakville, ON) were added aseptically to sterile distilled water in 140-mL screw-capped glass (Gibco) bottles to produce 100-mL volumes of each acid at final concentrations of 0, 0.25 and 0.50% ( $v/v$ ). Treatments were designated as control

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(CON), A25, P25, A50, and P50. Nine bottles of each treatment were inoculated with  $10^7$  CFU of an ampicillin- and kanamycin-resistant strain of *E. coli* O157:H7 (strain 3081) and triplicate bottles were incubated aerobically at 4, 22 and 30°C for 14 d. After 0, 1, 3, 7 and 14 d, 1-mL subsamples were withdrawn aseptically, serially diluted in phosphate buffered saline, and plated in duplicate onto Tryptic Soy Agar amended with ampicillin and kanamycin, each at 100 Fg/mL. Colonies were enumerated after 18 to 24 h of incubation (aerobically) at 37°C. When growth was no longer detectable by spread-plating (i.e., < 10 CFU/mL), the presence of *E. coli* O157:H7 was assessed by enrichment and immuno-magnetic separation (IMS) using Dynabeads™ anti-*E. coli* O157 (DynaL, Lake Success, NY). Three independent 14-d incubations were conducted. Data were subjected to analyses of variance using the General Linear Model (GLM) procedure of SAS. Treatment effects were deemed significant at  $P < 0.05$  using the LSD test. Adding acetic or propionic acid to dH<sub>2</sub>O reduced the pH from 6.47 (CON) to approximately 2.73 (average across treatments).

Populations of *E. coli* O157:H7 str. 3081 in CON were relatively stable over 14 d at 4 and 22°C, and for 7 d at 30°C, declining to approximately 2.8 log<sub>10</sub> CFU/mL by d 14. In contrast, the inoculated strain was eliminated within 3 d at 22°C, and within 1 d at 30°C from all of the weak acid treatments. At 22°C, the decline in *E. coli* O157:H7 counts was slightly more rapid with 0.50% (v/v) acid than with 0.25% ( $P < 0.05$  for propionate). At 4°C, populations declined steadily in all of the weak acids over the 14-d incubation (CON > all treatments at d 14,  $P < 0.05$ ). On d 14, enrichment + IMS was necessary for detection of *E. coli* O157:H7 in the 0.50% solutions (A50 and P50 < A25 and P25;  $P < 0.05$ ). Incorporation of either acid into the drinking water at 0.50% (v/v), especially during the summer months, may be effective for controlling *E. coli* O157:H7 in water supplies for livestock. Further studies are required to assess the effects of these weak acid solutions on palatability and intake of drinking water, ruminal concentrations of VFA, development of acid-resistance by *E. coli* O157:H7, carriage of the organism in the mouths of cattle, and on frequency and intensity of shedding in the feces.

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# DNA Fingerprinting Approach to Trace the Sources of *E. coli* Contamination from Farm to Ground Beef

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Cattle are proven reservoirs of pathogenic *E. coli* without overt symptoms of disease. Human infections have been linked to pathogenic *E. coli* present in ground beef. Therefore, tracing *E. coli* contamination during beef cattle production and beef processing becomes an important consideration for developing intervention strategies to ensure meat safety. Unfortunately, there have been no comprehensive studies to trace the transmission of meatborne pathogens from pastured cattle through the various stages of the beef production continuum to the final consumer products. Thus, assumptions have been made on the animal origin of pathogenic *E. coli* in the absence of conclusive data.

DNA fingerprinting methods are powerful tools which can identify genetically related strains and therefore facilitate tracing of similar strains through various stages of beef production. This study was designed to use the Random Amplification of Polymorphic DNA (RAPD) method to characterize generic *E. coli* isolated from the entire beef production-processing continuum in a research beef cattle herd and at a federally inspected abattoir. DNA patterns generated from *E. coli* isolates were used to determine the genetically related strains that were recovered from animals or meat at various stages from pasture cattle to feedlot finishing and then at the time of slaughter and processing of beef in a research abattoir. DNA fingerprinting data showed that 1403 *E. coli* isolates (855 faecal, 320 hide, 153 carcass, and 75 ground beef) were grouped into 121 genetic subtypes. Some of the genetically related *E. coli* found in cattle faeces was also recovered from hides, dressed carcasses, chilled carcasses and ground beef produced from these animals. A genetically diverse *E. coli* population was present within each animal grazing on pasture and in the feedlot, and the genetic diversity changed over time. This study has established a link between faecal carriage of *E. coli* by cattle, hide and carcass contamination, and contamination of ground beef.

With the validation of the genetic typing method in a research abattoir, the study was extended to a commercial beef packaging plant to determine the distribution of *E. coli* and sources of contamination there. Generic *E. coli* were recovered from the hides, carcasses, beef trimming, ground beef and conveyers during the summer of 2001 (750

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## The Canadian Approach to On-Farm Food Safety

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The Canadian approach to on-farm food safety involves the development of national commodity-specific programs that are officially recognized, auditable, HACCP-based, and voluntary. It is a world leader. The presentation will cover its origins; its grounding in the internationally recognized HACCP approach; and, its linkages with up and downstream initiatives including official recognition. The roles of national commodity groups in leading the development of programs that currently cover 99 per cent of Canadian agricultural production and of the federal government (Agriculture and Agri-Food Canada and the Canadian Food Inspection Agency) in facilitating these 19 initiatives through funding and expert support will be highlighted. The presentation will also focus on the work of the Canadian On-Farm Food Safety Working Group which has resulted in a wide range of collaborative initiatives including the development of an on-farm auditor training program, the negotiation of the federal/provincial/territorial framework for the official recognition of on-farm programs, the development of common program elements and tools, etc.

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# The Development of the Canadian Quality Assurance (CQA) program – Some Lessons Learned About On-Farm Food Safety Programs

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In 1996, a national committee met to discuss building a HACCP based on farm food safety program for pork producers in Canada. Two years later, in the spring of 1998, the first manuals for the Canadian Quality Assurance (CQA) program were published. Approximately 150 producers signed up in Alberta. The first veterinarians were trained as program validators later that summer. Across Canada there are now 9850 producers enrolled, 5949 producers validated and 243 validators trained. Approximately 73% of Canadian market hog production is produced from enrolled farms and approximately 60% from validated farms. Most Canadian processors now require CQA enrollment or validation as a requirement for selling hogs or participating in a contract or premium program.

The CQA program is owned by the Canadian Pork Council (CPC). The CPC is funded by the check-off from each of the provincial producer associations. CPC coordinates two national committees to oversee program content and standards, and employs a full-time program coordinator. Each province funds its own delivery agency to enroll producers, distribute materials, train validators and keep a database of producers and their program status. Validators are practicing veterinarians that are trained under the program.

Achieving this degree of participation has been a challenge, requiring a tremendous amount of cooperation and hard work across Canada. Many lessons have been learned and many mistakes made. The following is a summary of some of the more important lessons learned.

**Lessons Learned**

1. The most important factor in the success of CQA is the commitment and hard work of the validators. These

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veterinarians often work beyond the call of duty to ensure the program is being done right on their client farms.

2. Producers are motivated by the pride of producing a quality product and proving it to the world. Having producers own the program and set the standards is preferable to enforcing regulations. The philosophy of producing a quality product cannot be enforced – people will do it if they believe in it.
3. Processor support is important for long term program success. By requiring program participation to qualify for bonuses or contracts, producers could get a financial return for their effort.
4. Everything must always be tested on farm. No matter how many experts helped write it, what works on farm is rarely the same as what looks good on paper.
5. Implementing this program has been larger and more complex than anyone on the original committee had ever envisioned five years ago. And more costly.
6. Program developers have to take risks and try things today, regardless of whether or not it is the “perfect” way. You may have to build the Chevy before you even know how to build the Cadillac.
7. Applying “pure” HACCP on farm may not always work as it is designed for a processing environment. Program developers must be flexible enough to balance HACCP protocols and practicality on farm.
8. What works for one livestock commodity group, might not necessarily work for another.
9. It can be very easy to fall into the "everything is a food-safety hazard" trap if we don't stay focused on the real hazards.
10. Sometimes being this far ahead of the other commodities, and the rest of the world can be a disadvantage as well as an advantage.

**Future Challenges**

1. Once a program is running and everyone is validated, then it is no longer worth a premium at the processor. How do you keep up motivation?
2. The complexity of the Canadian Food Inspection Agency (CFIA) recognition process.
3. Consistent application of the program across Canada and proving it.
4. The increasing bureaucracy. How do we prevent these programs from being killed by the weight of the

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**Alberta Beef Quality Starts Here**

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In 1994, the Canadian Cattlemen’s Association developed a program called “Quality Starts Here ✓”. The goals of this industry program are to improve beef quality and economic returns to beef cattle producers, while remaining a leader in beef production both domestically and internationally. Within this overarching beef quality program of producer extension and research, a focused initiative called “Quality Starts Here ✓ Verified Beef Production” was developed. This initiative is the national beef on-farm food safety program. The beef on-farm food safety program is HACCP-based and focuses on standard operating procedures to reduce biological, chemical and physical hazards in beef production on the farm. The beef on-farm food safety program follows the general guidelines as put forth by the Canadian On-Farm Food Safety Program (COFFSP). The Canadian Cattlemen’s Association has been a member of COFFSP since 1997. Within the next few months, the national beef on-farm food safety program will undergo technical recognition by the Canadian Food Inspection Agency.

In Alberta, the national beef on-farm food safety program is delivered to beef cattle producers by a part 9 corporation called “Alberta Beef Quality Starts Here”. This corporation is represented by various stakeholders in the beef industry, including beef cattle producers, veterinarians, feedmills/nutritionists, processing plants, the pharmaceutical industry, auctions markets, and the provincial agriculture department. The Board, with the help of its provincial coordinator and office manager, is responsible for the administration of the program, including producer training, on-farm audits to certificate beef operations, communications/marketing, and financial management. The program has received three years of core funding from the Alberta Livestock Industry Development Fund and the Ag & Food Council (CARD). As well, there has been financial support and in-kind support from beef check-off dollars from the Alberta Beef Producers, national CARD monies from the Canadian Cattlemen’s Association, and sponsorship by various pharmaceutical companies, veterinary clinics and feedmills for workshops and development of training and record keeping tools.

The beef on-farm food safety program began delivering producer workshops in January 2003 and has had good participation to date. The number of certified beef operations is as of yet small, but will continue to grow as producer awareness and interest increases. Veterinarians and nutritionists continue to play a supportive role in helping producers implement the standard operating procedures.

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Various challenges have been faced in trying to implement the program. These include lack of interest from some beef cattle producers, concerns that the standard operating procedures are too detailed and records require too much work and time, lack of financial support to help off set costs of on-farm audits, and concerns about confidentiality.

The recent case of BSE in Alberta has resulted in mixed reactions to the national beef on-farm food safety program. The reactions from beef cattle producers have included increased awareness of the need for the national verifiable beef on-farm food safety program to lack of interest in producer workshops because of greater concerns regarding survivability of their own beef operation due to closed US borders.

The Alberta Beef On-Farm Food Program will continue to deliver the national, HACCP based beef on-farm food safety program to beef cattle producers in Alberta. The goal is to get the majority of beef production certified on the program within the next few years. The beef on-farm food safety program will continue to work with beef cattle producers to find solutions to challenges identified in the implementation of the program and to ensure that it meets its business goals. These are to help producers continually improve on-farm food safety practices to reassure consumers of Canada's safe beef, whilst increasing economic returns to beef cattle producers.

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## On-Farm Food Safety Recognition Program

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During the annual federal, provincial and territorial agriculture minister's meeting in Whitehorse in June 2001, the Canadian Food Inspection Agency (CFIA) was identified to lead a process, with provincial and territorial participation, to provide government recognition for Canadian industry-developed on-farm food safety (OFFS) programs. The On-Farm Food Safety Recognition Program (OFFSRP), led by the CFIA with provincial and territorial participation, is a key program in support of the "Food Safety and Food Quality" element of the Agricultural Policy Framework, formally announced by the Honourable Minister Lyle Vanclief in June, 2002.

The OFFSRP is one part of a world-leading agricultural program, involving small-to-large-scale farmers and producers, the Canadian agriculture industry and all levels of government.

Growing safe food and protecting it from hazards on the farm before it passes through the farm gate is the primary focus of OFFS programs. Now in various stages of development and implementation by Canada's national producer organizations, CFIA-recognized OFFS programs are technically based on the internationally accepted food safety control system called Hazard Analysis Critical Control Point (HACCP). In addition, to gain and maintain official recognition, the national management components of OFFS programs are designed according to ISO-based government criteria. Government recognition of HACCP-based OFFS programs can enhance Canada's domestic and international reputation as a leader in food safety and quality. This, in turn, could mean expanded markets for Canadian products.

Responding to food safety concerns of consumers as well as foreseen international trade requirements, OFFS programs have been in development by food safety experts of Canada's national producer organizations since 1997. The Canadian On-Farm Food Safety (COFFS) Program provides national producer organizations with the opportunity to develop strategies and tools to educate producers and to implement the programs. The COFFS Program is administered by the Canadian Federation of Agriculture and is funded through the Canadian Adaptation and Rural Development (CARD) Fund of Agriculture and Agri-food Canada.

The CFIA recognition process is a multi-party examination of the technical soundness and administrative

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## On-Farm Food Safety: Experiences of the PEI Horticultural Sector

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On Prince Edward Island, farmers growing horticultural crops have been involved with various aspects of on-farm food safety for the past four years through projects sponsored by grower organizations. The first initiative taken by the PEI Horticultural Association with its members was in the area of production record-keeping and packer trace-back for one crop with one packer/shipper who represented 25 farms. Programs have since evolved to focus on whole-farm food safety plan implementation, using the Canadian Horticultural Council's On-Farm Food Safety Guidelines for Fresh Fruit and Vegetables as the basis for the plans. The emphasis in the current program is on proceeding at the grower's pace and on receiving one-on-one assistance from the project co-ordinator. A wide diversity of farms, packers and crops are participating. Smaller farms are experiencing difficulties in adopting and implementing the many facets of an on-farm food safety plan.

Some of barriers keeping small farms from participating include a lack of resources to learn about on-farm food safety and to make changes on the farm, and the perception that there are no benefits to applying a food safety plan. Several of the challenges for the future are to involve smaller farms, to simplify record-keeping, and to help growers integrate new practices smoothly into their day-to-day operations.

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# On-Farm Food Safety Pilot Project for BC Blueberry and Raspberry Growers

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The Fraser Valley of BC is the largest producer of raspberries, and high bush blueberries at a national level in Canada. The province region is the second largest producer of high bush blueberries in the world, and accounts for over half the national raspberry production, thus earning its name as, “the raspberry capital of Canada.”

Both the BC Blueberry Council and Raspberry Industry Development Council are committed to educating and training their growers in the prevention and/or reduction of food safety risks associated with berry production. Both groups are taking an extremely proactive role in trying to meet the ever-increasing demand for safe, tasty and wholesome berries.

These two commodity groups understand that they are dealing with many berry growers who generally do not have a science background, and therefore the two groups chose to adopt a practical approach. Various training sessions, in cooperation with packers and processors, were held during which growers were educated about the major food safety risks associated with production practices. The sessions were highly interactive and most growers found them extremely informative. Many field visits were made to better understand the particular issues and concerns of the growers and to provide on-site advice. All the interaction led to the development of basic and simple tools for the grower, these included various tools (posters, leaflets, picker card-holders) were developed to help the grower assess individual farm-site risks and tools to help educate and train those working in the industry.

One recent pilot project initiative that is still in its draft form is the On Farm Food Safety Project for BC Blueberry and Raspberry Growers. The project is intended to help growers assess the food safety risks associated with individual farm practices; to prove that the correct action is taken to minimize or prevent the possibility of a food safety risk occurrence; and to help growers keep records of their production practices.

Fifteen growers from both commodity groups volunteered to work through the draft form of the food safety program. With the blueberry and raspberry season close to an end, feedback is being received as to the content of the

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## Field-to-Fork On-Farm Food Safety in Ontario

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In 2002 the Ontario Ministry of Agriculture and Food (OMAF) developed a background document and held stakeholder discussions to determine how OMAF could better align itself to assist and support the on-farm food safety initiatives. The stakeholder feedback from this consultation was compiled and analyzed and is now ready for distribution and adoption.

The Ontario Ministry of Agriculture and Food strongly supports the implementation of field-to-fork food safety and the adoption of voluntary, industry-led on-farm food safety programs (OFFSPs) in Ontario. OMAF has hired two on-farm food safety specialists and has re-focused some of its resources to 5 key areas: food safety legislation; food safety standards; funding; research and technology transfer (including provision of HACCP expertise, training, and on-farm food safety and HACCP information).

Ontario, in collaboration with industry, is piloting the first comprehensive, provincial, HACCP-based broiler production chain that includes an Ontario feed mill, broiler egg hatchery, broiler producer and a provincially licensed and inspected processor, all of which have implemented HACCP or HACCP-based systems. The "Egg to Plate" video aired on TV in January 2003, and highlights Ontario's collaborative success and leadership in this field to fork food safety system.

The implementation of this voluntary, industry-led process across the various commodities and steps in the food chain, follows that of an adoption continuum that begins with the absence of any documented best management practices and moves progressively towards full implementation of full HACCP programs and complete traceability.

OMAF, in cooperation with the Chicken Farmers of Ontario, recently completed a chicken benchmark survey to gather valuable on-farm broiler production information. An OMAF-funded on-farm baseline study coordinated by the University of Guelph is in progress to determine the prevalence of Salmonella and Campylobacter in Ontario chicken barns and birds at time of placement and prior to catching. Results are expected within the next year. These studies are designed to provide valuable baseline information and eliminate some of the research gaps that currently exist at the farm level. They should provide critical information for performance measurement and impact analysis of on-farm programs.

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# The Challenges of Implementation

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According to the 2001 Canadian census, Canada has approximately 193,000 farms reporting more than \$10,000 in gross receipts and another 54,000 smaller operations. The implementation by each of these of one or more on-farm food safety programs may become a market requirement over the next decade. This presentation will explore the challenges that this major transformation of farm management presents for farmers and their organizations. The expected roles of governments and other stakeholders such a customers, professionals and service providers will also be reviewed. The presentation will also look down the road at the implications for all the participants of their involvement in on-farm food safety on a permanent basis.

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## The Food Safety Universe Risk Assessment and Risk Ranking Database

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Optimizing the use of finite resources is an important objective of food safety programs. Risk managers must strive to maximize (and equalize) the marginal return on investment across hazards and food types, in terms of reductions to food safety risks. Unfortunately, this is not easily achieved given the complexity of the food system. Nevertheless, systematically assessing and ranking food safety risks is an essential step to achieving this objective.

The Government of Ontario has called for the systematic application of principles of risk management to all programs within the Ontario Public Service, including food safety. The 2001 report of the Provincial Auditor specifically called for increased use of risk management in food safety programs. The Food Safety Policy Branch (FSPB) and the Food Inspection Branch (FIB) of the Ontario Ministry of Agriculture and Food (OMAF) are increasingly applying the principles of risk management to Ontario Food Safety System (OFSS) programs.

Food safety risk assessment involves systematically studying the likelihood and consequences of failures to food safety. Risk assessments may vary greatly in their level of detail, ranging from: a) "back of the envelope" qualitative opinions, rating risks as "low, medium or high", to b) well documented, systematic, qualitative assessments of the likelihood and consequence components of defined risks, to c) semi-quantitative scoring and ranking systems, to d) complex, detailed, quantitative mathematical models that include Monte-Carlo simulation and quantification of uncertainty. Resources required to conduct risk assessments vary directly with the level of detail. Text based qualitative assessments are easier to produce, but less useful for ranking and prioritizing risks. Unfortunately, many resources are usually required to obtain appropriate data and to develop detailed mathematical models for full quantitative risk assessments. There is a need for a "middle ground" risk assessment tool that facilitates systematic ranking of many risks, without the detail and resources required to develop full mathematical models.

The Food Safety Universe Data Base (FSUDB) is a semi-quantitative food safety risk assessment tool that has been developed by the Ontario Ministry of Agriculture and Food (OMAF). This tool is to be used in conjunction with other

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information to help optimize the allocation of food safety resources under the influence of OMAF.

Since different foods may be contaminated with various biological, chemical or physical hazards at different locations along the food chain, from production to consumption, each food-hazard-location-of-entry combination presents a different likelihood and consequence (risk) of harm to the health of consumers. In theory, every possible combination of food-hazard-location-of-entry could be defined and assessed in terms of its likelihood and consequence. This theoretical complete data set of all possible combinations could be thought of as the "universe" of food safety data. Therefore the database designed to capture and analyze these data was named the Food Safety Universe Data Base.

Risk is a function of the likelihood and consequences of an undesirable event occurring. A systematic method of assigning, recording and comparing scores for the likelihood and consequence components of risks from various hazards, in various foods, was needed to semi-quantitatively assess and rank risks to food safety. A database program was developed in Microsoft Access™ to facilitate systematic and repeated data capture, storage, searching, summarizing, counting, averaging, sorting, re-sorting, ranking and graphing. These functions are required to assess, prioritize and communicate food safety risks. The database was set up to capture and analyze likelihood and consequence risk scores of food borne hazards.

Since the data are captured in semi-quantitative scores, they can be summarized in graphs or tables of ranked risk scores. Also since the data are stored in a database, they can be summarized, tallied or ranked in essentially any manner analogous to taking any slice though the data entered in the system. This facilitates observing, comparing and ranking the recorded risk data in essentially any way desired. This could not be achieved if the data were stored in a word processing or spreadsheet format.

The FSUDB will be used to semi-quantitatively rank the risks of foodborne hazards to allow decision makers to effectively allocate resources and maximize benefits by risk.

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# Estimating the Total Health-Related Impact of Microbial Food-Borne Pathogens in Ontario, Using Monte Carlo Simulation to Characterize Uncertainty

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In order to quantify the impact of food-borne illness in Ontario, estimates were made of the total annual cases and consequent health-related economic impact resulting from selected food-borne pathogens.

Three classes of organisms or diseases were considered: a) reportable, b) non-reportable, and c) unknown.

Eleven reportable diseases and organisms that may be transmitted by food, were examined, including: *Campylobacter*, *Cryptosporidium*, Hepatitis A, *Listeria*, *Salmonella*, *Shigella*, verotoxigenic *E. coli* (VTEC) and *Yersinia*. All diagnosed cases involving reportable diseases are required to be reported through the Ontario Reportable Disease Information System (RDIS). Even so, reported cases likely represent only a fraction of the total number of food-borne cases from such organisms because, for instance, medical attention is not always sought by ill persons, and a laboratory diagnosis is not always ordered for those who do seek medical attention. To estimate the total number of cases from specific reportable organisms, correction factors were derived to adjust for the under-reporting of food-borne cases.

Sixteen non-reportable diseases and organisms were examined, including: *Clostridium perfringens*, Staphylococcal food poisoning, and the Norwalk virus group. There was even less data available for non-reportable organisms because only outbreak-associated cases involving these organisms are required to be reported through the RDIS database. Because of insufficient data, total case estimates for these pathogens were made by adjusting U.S. estimates made by the Centers for Disease Control (CDC) for the same pathogens.

"Unknown" organisms include food-borne organisms that cause disease but are not yet recognized as causes of disease (for example *E. coli* O157:H7 prior to 1982). A significant proportion of cases of gastroenteritis and other diseases remain undiagnosed today. Estimates for cases caused by as yet unknown or unappreciated organisms were made using U.S. estimates as a base, in a similar manner as for non-reportable pathogens.

Total case estimates for each pathogen were used as a basis to estimate the number of lost work days, doctor's visits, hospitalizations, deaths, and certain types of chronic sequelae cases associated with each pathogen. Data

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describing the average cost associated with each of these events was then used to determine the health-related economic impact incurred by each pathogen.

Preliminary findings from the analysis indicate that *Campylobacter* is the leading bacterial cause of food-borne illness in Ontario, followed by *Salmonella*. In terms of economic impact, *Salmonella* was found to have the highest annual impact of the bacterial pathogens, followed by *Campylobacter*, *Listeria monocytogenes*, and verotoxin producing *E. coli* (VTEC). *Salmonella* was found to have a higher economic impact than *Campylobacter*, in spite of fewer cases, because of higher associated mortality and hospitalization rates. *Listeria monocytogenes* was found to have a significant economic impact, in spite of very few total annual cases, mainly because it has a very high associated mortality rate, and significant incidence of chronic sequelae. The economic impact of VTEC was also more significant than the total case estimates might indicate, because of above average associated rates of hospitalization, mortality and chronic sequelae. Together, the four pathogens, *Campylobacter*, *Salmonella*, *Listeria monocytogenes* and VTEC, were found to account for approximately 94% of the health-related economic impact resulting from bacterial food-borne pathogens in the province of Ontario.

Uncertainty surrounding the estimates was quantified by applying probability distributions to the input variables, followed by Monte Carlo simulation in the @risk software package. A large source of uncertainty in total case estimates for most pathogens resulted from uncertainty regarding underreporting rates. For instance, the underreporting rate for both *Campylobacter* and *Salmonella* was estimated to range from 10X-31X, resulting in fairly wide ranges for the respective total case estimates. Uncertainty regarding total case estimates contributed, in turn, to significant uncertainty in the economic impact estimates for these pathogens. The availability of Ontario-specific information on underreporting rates for VTEC in the literature resulted in somewhat greater confidence in the total case and economic impact estimates for this pathogen.

The health-related economic impact estimate is useful as a comprehensive measure of the impact of individual pathogens, because it accounts for both the frequency and the severity of illnesses associated with a given pathogen. Ranking pathogens in this way, and accounting for uncertainty in the estimates, helps decision makers in government to evaluate resource allocation and risk management options in order maximize societal benefit.

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## Does One Mad Cow Equal One Dead Industry? BSE in Canada

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A single case of bovine spongiform encephalopathy (BSE) was discovered in a beef cow in Canada in May 2003. Canadian exports of beef products, live beef animals and other ruminant animal products ceased immediately as importing countries closed their borders to Canadian beef products. The Canadian Food Inspection Agency's (CFIA's) investigation into the cause of the BSE found no further cases of beef animals with BSE but also could not definitively determine the source of the BSE in the single infected cow. Trade in selected meat products resumed in September, 2003.

The Canadian beef industry, a large agricultural sector in Canada, is highly dependent on international trade and Canada was the third largest exporter of beef and cattle in the world in 2001. Approximately 50% of Canadian beef production is exported in the form of beef products or live animals. Over 70% of meat exports are to the United States with the remainder of exports to Mexico, Japan, South Korea and other countries. In 2001, 1.3 million beef animals were exported and there were over 300,000 tonnes in net beef product exports.

In 2001 the Canadian cattle industry introduced a compulsory cattle identification system to assist in tracing cattle in the event of a major food safety or herd health problem. The system assisted in tracing the offspring of the BSE infected animal but had not been in place for a sufficient period of time to assist in tracing back the history of the infected animal itself. For food safety or animal disease problems the ability to quickly trace back infected animals and to identify potentially affected herds is important both in reducing the potential private and public costs of a food safety problem and in limiting the economic damage to the rest of the industry. For the Canadian beef industry, an issue remaining to be examined includes whether the Canadian identification program should be expanded. In UK and other EU countries, a full cattle passport system is in place which tracks the animals throughout their lives.

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# Plant Biotechnology – Do the Benefits Outweigh the Risks?

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The use of biotechnology in agriculture has generated much controversy. On the one side environmental groups forecast food safety and environmental disaster with no benefits, on the other side advocates promote biotech as the solution to world hunger. Who can you believe? What does the evidence show to date?

Biotech crops were first commercialized in 1995. By 2002 more than half of total soybean acres globally were produced from biotechnology, with cotton and corn not far behind. Since 1995 over 5.5 million farmers around the world have adopted the technology. Clearly farmers must be realizing benefits in order to have made biotech crops the most rapidly adopted agricultural technology in history.

But do these benefits outweigh the risks? Are biotech crops safe to eat and what is their impact on the sustainability of agriculture? How is safety ensured from the farm gate to the dinner plate?

Canada’s federal government has guided the application of biotechnology for almost a quarter of a century, beginning in 1977 with guidelines for handling recombinant DNA molecules. In 1990 a regulatory framework was created in order to ensure protection of environment and human health. The Canadian safety system is a product-based approach which recognizes it is the safety of the product itself which is important, and not the process which was used to create it.

Food, feed and environmental safety are examined in Canada through government regulations that monitor plant biotechnology well before a crop is seeded. Health Canada is responsible for ensuring that food produced from biotech crops is safe for human consumption and does not create the potential for new allergens. The Canadian Food Inspection Agency determines whether these crops are safe for the environment and safe as animal feed. Since 1995 Health Canada and the Canadian Food Inspection Agency have approved the safety of more than 50 biotech crops.

Health Canada requires mandatory labelling if the food is significantly different in its nutritional or compositional attributes as well as if there are any potential allergenic components. Labels must be accurate, clearly worded and not misleading. When there are no safety or nutritional concerns, voluntary labelling is also permitted with the same requirement for accuracy and clarity.

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## Health Tradeoffs in Pesticide Regulation

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Carcinogenic risks posed by pesticide residues on food are a principle motivation for pesticide regulation in Canada and the United States. Some attention has been given in the regulatory process to the risks posed by those chemicals that may be used in place of a banned pesticide, but the risks that are raised by economic responses to the regulations have generally not been considered.

We developed a conceptual framework to compare the direct and indirect health effects of pesticide regulation. Regulators typically ban a pesticide if the risk of cancer after a lifetime over exposure exceeds some level of safety, such as one in 1,000,000. At the same time, removing a pesticide from producers' set of input choices forces a production change that will, generally, result in a price increase for the treated commodity. When consumers respond to the increased prices by reducing consumption of the affected fruits and vegetables (and perhaps shifting consumption to less nutritious foods), they will lose the health benefits associated with the change in consumption.

Recent medical literature allows for the calculation of dose-response functions describing the increase in specific health risks resulting from reduced consumption of fruits and vegetables, controlling for relevant behavioral, environmental, and genetic factors. Studies published in highly respected journals have explored the effects of fruit and vegetable intake on the risks of such common medical problems as coronary heart disease, ischemic stroke, and various types of cancer. Our study incorporates these medical findings in a series of simulations designed to calculate the magnitude of countervailing health risks that may result from pesticide regulation. The initial element in each simulation is the hypothetical ban of a pesticide or class of pesticides, with a resulting increase in the market price of fruits and vegetables. The change in the intake levels of a sample population of consumers is then calculated. Finally, the dietary changes in a sample of 20,000 individuals is related to the dose-response functions described above to yield the increased health risk and corresponding incidence in the population of several diseases.

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# What You Should Know About HACCP

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*People have the right to expect their food to be safe, of good quality and suitable for consumption* – this is one of the key founding principles behind the formation of the CODEX Alimentarius Commission, an international association created in the early 1960s as a joint effort of the Food and Agriculture Organization of the United Nations and the World Health Organization to actively promote harmonization of national food codes and standards.

CODEX is the single most recognizable international standard responsible for promoting HACCP as a means to enhance food safety. CODEX-based standards are the foundation for facilitating world trade of food currently valued at \$400 billion US annually.

CODEX Alimentarius implemented the Agreement on the Application of Sanitary & Phytosanitary Measures in 1995, (in part) to formally promote harmonization of international standards and guidelines to minimize or eliminate the risk of sanitary, phytosanitary and technical standards as becoming obstacles to international trade in food. In practice, however, the agreement has created issues for lesser developed nations.

HACCP has been leveraged by developed nations to provide a measure of protection from food imported from countries (often lesser developed) it considers a “threat” to the health and safety of their consumers, animal and plant populations.

What roles do Regulatory Agencies and Industry and Trade Association play in the international trade and politicization of food?

The presentation provides a “snapshot” of the regulatory systems governing the poultry industry of Guyana. The presentation compares the current food safety systems of Guyana against the food safety systems of developed nations like Canada. During July and August of 2002 Collis Consulting Inc., was contracted through a CIDA sponsored project to review the Poultry Codes & Standards of Guyana and benchmark feed mills, hatcheries and poultry processing plants of the largest poultry producers association of Guyana against CODEX standards for HACCP.

The presentation will highlight the key challenges facing Guyana and provide guidance to nations like Canada on how

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## HACCP Systems and the Management of Medication Residues in Feed Manufacturing: A Practitioner's Perspective

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Feed manufacturing is one of Canada's most regulated industries. In addition to the Feeds Act and Regulations that control and regulate the manufacturing and sale of feeds, there are six other Acts that affect feed production and distribution. In the mid-1990s, the Animal Nutrition Association of Canada (ANAC) in collaboration with the Canadian Food Inspection Agency (CFIA) launched a voluntary program called Hazard Analysis Critical Control Point (HACCP), which provides for an independently audited certification of feed mill manufacturing practices and controls. As of the end of September 2003, 141 feed mills in Canada or approximately 30% of all mills were HACCP certified. These mills account for approximately 60% of Canada's annual feed production.

The public, feed manufacturers and regulators are all rightly concerned about medication residues in feed and possible carryover into the human food chain. One of the primary goals of the rigorous controls exerted at critical points throughout the feed manufacturing process is to protect the safety and integrity of all medicated and non-medicated feeds. Without special attention to equipment cleanout, trace amounts of medication residue carryover from a medicated batch of feed into the following feed is a known fact of life in feed mills using a common line of processing equipment. The critical question becomes: how much residue is considered an "unsafe" level in the feed of a non-target animal species or an approved species, where no medication is requested?

Under the currently proposed Regulations Respecting the Making of Medicated Feeds published for comment by CFIA in February 2000, 'contamination' is defined as "a concentration of a medicating ingredient in human food in excess of the maximum residue limit (MRL) set out in Table III to Division 15 of Part B of the Food and Drug Regulations for that ingredient, or, the concentration of a medicating ingredient in animal food that is likely to cause exceedance of that MRL." Unfortunately, there are currently very few data available which attempt to correlate the presence of medication residue in feed with levels in animal tissues or products.

Without established correlations and where uncertainty exists, some would lean toward assigning "zero" or non-detectable medication carryover as the standard to prevent potential cross-contamination. Justification for this viewpoint could be derived from a discussion paper entitled, "A Canadian Perspective on the Precautionary

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Approach/Principle” (Regulatory Affairs & Orders in Council Secretariat of Canada’s Privy Council Office, 2001). Sound scientific evidence is noted as a fundamental prerequisite to applying the precautionary approach, yet the principles also state that “the absence of full scientific certainty shall not be used as a reason to postpone decisions where there is a risk of serious or irreversible harm”. Determining acceptable levels of safety where either the science, or the funding for developing the science lack, is a recognized challenge for the industry and those who regulate it.

This presentation reviews selected precautionary principles and interpretations of the proposed Regulations, in light of the practical realities of feed manufacturing. In addition, documented evidence of safe foods of animal origin in Canada produced under existing regulations is reviewed.

A brief overview of process flow in the feed mill is presented. Examples of medication residue management from the author’s HACCP certified, multi-species feed mill and from the industry are used to suggest that the current tendency towards ‘zero tolerance’ for medication residues goes beyond the intent of the safety goals embedded in the proposed Regulations. The apparent contradiction and cost ineffectiveness related to approving feed only if medication residues are non-detect, while acknowledging “safe” levels of residues (MRLs) in food products, is discussed. Equipment protocols and techniques currently in place that enhance safe feed production without necessarily achieving “zero” medication residues of lower risk in following feeds are outlined. Documentation of some related requirements and experience from other political jurisdictions is also cited.

Continuing improvements in existing good manufacturing practices as instigated by industry-led HACCP programs, combined with enforcement of existing legislation and enhanced public information programs, should serve to strengthen consumer confidence in the safety of animal products in the marketplace.

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## Ontario's HACCP Standard

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The Ontario Ministry of Agriculture and Food (OMAF) recognized the need to update its food safety system. As one component of this update, the ministry has undertaken the development of a HACCP standard for non-federally registered food processing facilities. For the most part, these facilities are small and medium sized enterprises (SMEs). Therefore the standard has been designed to be feasible and practical for this target audience. In addition, OMAF's HACCP standard has been developed to be applicable to all facilities, regardless of commodity.

Non-federally registered facilities are currently not eligible for HACCP recognition from the Canadian Food Inspection Agency (CFIA). In addition, the CFIA's approaches to HACCP, the Food Safety Enhancement Program (FSEP) and the Quality Management Program (QMP), were designed for specific target audiences. FSEP was initially designed for large meat and poultry processors exporting to the U.S.A, while QMP was designed specifically for the federal fish and seafood processing industry. As such, FSEP and QMP were not applicable to or feasible for OMAF's target audience, and a different HACCP standard was needed.

The HACCP standard that OMAF has developed is based on the *Codex Alimentarius General Principles of Food Hygiene* and includes all seven HACCP principles/12 HACCP steps. The standard includes prerequisite programs and HACCP plans. In addition, links are provided where additional regulatory requirements exist. This allows the standard to encompass universal food safety requirements applicable to all commodities, while ensuring that regulated commodities still meet the required regulations.

The HACCP standard was developed by the ministry and refined by consultation with a broad range of ministry staff. This included reviewing the wording of the standard to ensure consistency with legislation and regulations.

The next phase of the HACCP standard development process involves a proof of concept project, which began in June 2003. This project is being conducted in a medium sized provincially licensed poultry facility, using a HACCP consulting firm. The intent of the project is to implement the HACCP standard in the participating facility and to demonstrate its feasibility, practicality, and effectiveness. One component of this project will include capturing data on economic feasibility. The proof of concept project will also involve the development of a "how-to" manual, to provide processors with step-by-step instructions on how to develop and implement a facility-specific HACCP

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system based on the standard designed by OMAF. In addition, the project will demonstrate the compatibility of the HACCP standard with existing regulations.

Playing a role in the proof of concept project will be representatives from the Federal/Provincial/Territorial (FPT) HACCP recognition subcommittee, the Canadian Food Inspection Agency (CFIA), the Canadian General Standards Board (CGSB), Health Canada (HC), the Ontario Independent Meat Processors (OIMP), and OMAF.

While the proof of concept project is being conducted, the ministry will be conducting the necessary background work to ensure the availability of a HACCP recognition/certification framework for non-federally registered food processors. At this time, the preferred method of delivery is through the Standards Council of Canada (SCC) and its accredited bodies. One of the main benefits of this approach is that it is consistent with the development of a national approach.

It is anticipated that the proof of concept project will be completed in early 2004. In the spring of 2004, OMAF anticipates holding a public announcement/roll-out of the finalized HACCP standard, and the mechanism to obtain HACCP recognition/certification. This announcement will be held in a trade-show type of format and will be open to all interested stakeholders. It will provide an opportunity to learn about the HACCP standard, to ask questions, and to gather other necessary information from the trade-show exhibitors (e.g. sanitation companies, pest control companies, etc).

It is anticipated that future plans for Ontario's HACCP initiative will include pilot projects in a number of facilities representing different commodities and different processing capacities. As well, the ministry hopes to be able to facilitate HACCP adoption in the province through the provision of support mechanisms such as training programs, on-line resources, etc.

Through the development of a HACCP standard that is applicable to all non-federally registered food processors, and a recognition/certification framework that is delivered by a credible body in a consistent manner, OMAF intends to help ensure the safety of Ontario's food supply and maintain the competitiveness of this industry.

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## A Legal Analysis of Country of Origin Labelling Requirements

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Many have discussed the impact on producers of anticipated demands by consumers and regulators to establish mechanisms capable of tracing food back to the farm where it was produced. Labeling is a central issue in this discussion. Country of origin labeling (COOL) is of particular concern in Canada due to expected legislation in the United States. This presentation will provide an overview of existing and proposed international COOL labeling requirements and will identify issues of concern for the Canadian Food Industry.

The presentation will begin with an overview of the proposed and actual labeling requirements of each of Canada's agricultural trading partners. Attendees will gain a general understanding of the potential effect of each country's labeling requirements by comparing the scope of these laws with Canadian agricultural products exported to each country.

After the overview, the anticipated COOL requirements of the United States will be discussed in detail. This will allow for a more thorough evaluation of the impact of international labeling laws on the Canadian Food Industry. It will also provide an opportunity to highlight concerns including the legality of these requirements under the WTO agreements.

### **American COOL Regulations**

The 2002 American Farm Bill compels Congress to establish mandatory Country of Origin Labeling (COOL) regulations by 2004 for beef, pork, lamb, fish, peanuts, fruits, and vegetables.<sup>1</sup> To date, the final regulations have not been enacted nor has a final proposal been circulated by the United States Department of Agriculture for public comment. Consequently, there is much speculation about its potential impact on the Canadian Food Industry. The design of the system, however, will be a key determinant of its ultimate effect in Canada. By reviewing the guidelines set out in the Farm Bill, the motivation for its enactment, and the existing voluntary COOL regulations an insight can be gained into the systems being proposed. Following this analysis, a more accurate examination of the COOL regulations' impact in Canada can be achieved.

At the presentation, the different COOL systems being proposed in the United States will be outlined and their

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**Ontario's Surveillance of Chemical Contaminants in Foods**

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The Ontario Ministry of Agriculture and Food has a number of surveillance programs for chemical contaminants in foods ongoing in all commodity areas - meat, dairy and foods of plant origin. Surveillance for chemical food safety hazards is a part of each of the Ministry's program areas. Food product and chemical contaminants are chosen and prioritized based on scientific literature studies, results from surveillance programs, information from other jurisdictions such as CFIA in Canada and FSIS in the United States and requests from the Provincial Auditor General.

OMAF has recently begun baseline studies on contaminant levels in various foods; one for Ontario farmed trout has been completed and results are now being analyzed; one for chemicals in raw meats began in January 2003 and will be ongoing until March 2005; more baselines are being planned to provide information to assess risk. The data from these baseline studies, monitoring and surveillance programs are being used to determine risk rankings - through risk assessments when possible — to prioritize areas where risk mitigation steps are necessary.

Results from these testing programs that have been completed to date have indicated that there are very few problems overall, but the testing does allow us to focus on areas that are, or may become an issue.

Because of the expense of acquiring samples and chemical analysis, a much more efficient and effective use of our limited resources would be to know what chemical testing of food and food products was being done across Canada and also to have access to those results. Such a program would reduce duplication, allow collaboration and result in a coordinated approach to understanding levels of chemicals in foods in Canada. Ontario fully supports this initiative.

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## Surveillance of Selected Antimicrobial Residues in the 2000 Alberta Honey Crop

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Alberta honey producers routinely use oxytetracycline for the prevention and control of American and European foulbrood. Oxytetracycline is licensed for use in honeybees in Canada. There is no official withdrawal period for oxytetracycline, however there is a warning: "Do not medicate bees with this drug for at least four weeks prior to the main honey flow. Honey or syrup stored during medication periods in combs for surplus honey should be removed following final medication of the bee colony and must not be used for human food". Health Canada has recently announced an administrative Maximum Residue Limit (MRL) for oxytetracycline in honey at 0.4 ppm. No other antibiotics are currently licensed for use in honeybees in Canada.

The Alberta honey producer Co-op receives honey from major honey producers across Alberta. The Co-op accepts shipments only from producers of a minimum of 5,000 pounds of honey per season, which requires approximately 100 hives to achieve. There are approximately 200 honey producers in Alberta operating more than 100 hives per season. There are 180 Alberta members of the Co-op. The Co-op currently collects, for quality control analysis, a random sample of each shipment from each member. A portion of this quality control sample was screened for tetracycline and sulfonamide residues using the CHARM II test. Suspect positive samples were confirmed and quantified (>20 ppb tetracycline) by high pressure liquid chromatography (HPLC) analysis.

A total of 362 quality control samples representing 374 lots from 131 producers were collected in the 2000 honey season. Sulfonamide residues were not detected. Thirteen of the 362 samples (3.6%) were suspect positive using the CHARM screening test. Seven of these 13 suspect positive samples contained quantifiable levels of tetracyclines (>20 ppb) as determined by HPLC. All samples were below the 0.4 ppm administrative MRL for oxytetracycline. Six of the seven samples containing quantifiable levels of tetracyclines (>0.20 ppb) came from a single producer.

This study indicates that while antimicrobial residues were detected in the 2000 Alberta honey crop they were generally occurring at low levels not considered a concern for food safety. The fact that quantifiable levels of antibiotic residues were detected in samples from only 2 of 131 producers suggests that individual follow-up and education may be a practical method of reducing the prevalence of residues.

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**Use of Controlled Samples to Assess an Unknown Inhibitor in Rabbits**

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The purpose of the study was to test the hypothesis that a naturally occurring inhibitor in rabbits may trigger positive drug residue results. Rabbits were raised in a controlled environment for the duration of the study. While the inhibitor was not identified during this study, it was determined that inhibitors not originating from drug residues potentially caused positive antimicrobial test results.

The presence of unknown antimicrobial residues in rabbits has been detected through the Ontario Ministry of Agriculture and Food’s rigorous surveillance testing program. During the five-year period from 1997 to 2001 there were over 300,000 rabbits per year dressed at provincially licensed abattoirs. Throughout a 17-month period in 2000 and 2001, 55 rabbit surveillance tests were conducted. Analysis showed that over 10% of muscle tissues and 50% of kidney samples were positive for an unidentifiable antimicrobial drug residue.

Other jurisdictions have also had positive test results for antimicrobials in rabbits where the cause of contamination could not be determined. Analysis conducted by the Canadian Food Inspection Agency on rabbits slaughtered at federal plants, also showed instances of unknown antimicrobials using a screening test. During the 1998/1999-test period, one test revealed an unidentifiable inhibiting substance and one test the following year revealed the same result.

In the United States, rabbits are tested for drug residues as part of the Food Safety and Inspection Service National Residue Sampling Plan. During the years 1999 and 2000, 383 rabbits were tested for antibiotics. Almost 46% of these tests showed positive results, 14% of these were violative positives. It cannot be confirmed that the definite cause of the microbial inhibition shown during testing was derived from antimicrobial drugs.

In order to test the hypothesis, OMAF selected 375 clean rabbits to be used in the study. The rabbits were separated or isolated from the rest of the non-test herds to minimize risk of antimicrobial contamination from other rabbits. Conditions on the farms were such that all potential contact with livestock medicines and other sources of contamination were minimized. All feed and water used for the test rabbits was non-medicated.

At approximately twelve weeks of age, the rabbits were shipped to provincially-licensed abattoirs designated for the

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slaughter of the test rabbits. An inspector at the abattoir harvested kidneys from five rabbits in each litter to produce a composite sample. The samples were taken from five different animals within the same litter. One sample per litter was submitted. Composite diaphragm and skeletal muscle samples harvested from the abdominal strap muscles, neck and cheek meat weighing approximately 100 grams were also analyzed. These samples were taken from five rabbits within the same litter, and they corresponded with composite kidney samples taken from the same litter. One composite sample per litter was submitted.

A total of 75 kidney samples and 75 diaphragm-skeletal muscle samples were submitted for laboratory analysis. No positive diaphragm samples were found. However, of the 75 kidney submissions, 60 samples showed zones of inhibition and 31 of these were violative results. Immunoassays could not be used with the rabbit kidney tissues and therefore could not identify any of the violative samples to an antimicrobial class.

To further test the hypothesis, random kidney samples were heat treated at 82°C for two minutes and as a result, all zones of inhibition disappeared. Antibiotics will survive heat, natural inhibitors will degrade. Another set of random kidney samples were passed through a dialysis membrane, and as a result, all zones of inhibition disappeared. Natural inhibitors will not pass through the membrane but antibiotics may.

In addition, none of the feed samples tested were found to have residues present in excess of permitted amounts. The water samples tested showed negative results when screened for antimicrobial residues.

Although the antimicrobial drug residues found through testing could not be identified, it was proven that rabbits kept in a clean environment that were fed uncontaminated water and feed may produce positive results when tested for these specific residues. It is suspected that a natural inhibitor in rabbits is responsible for the positive drug residue results. Future rabbit sampling and testing projects are required to determine the identity of the natural inhibitor. This will aid in the development of an accurate analytical method which could account for natural inhibitors when testing rabbits.

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# Baseline Study of Ontario Unpasteurized Apple Cider

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In the fall of 2001, the Food Inspection Branch of the Ontario Ministry of Agriculture and Food conducted a Baseline Study of unpasteurized apple cider producers to determine the levels of microbiological contamination at various stages of the cider pressing operation and of chemical contaminants in the finished cider. This was done through a questionnaire on agricultural and manufacturing practices, and through the sampling of finished product, plant water, wash water and equipment swabs. Fifty producers were divided into three strata according to their production volume for the prior year. Low Volume (LV) <15,000 litres (26 producers), Medium Volume (MV) 15,000-75,000 litres (18 producers) and High Volume (HV) >15,000 litres (6 producers).

Answers to the questionnaire show that 66% of the operations allow animals to graze in their orchards, 44% use bruised or damaged apples and 18% use drops. As well, 26% do not disassemble and clean their equipment before each pressing day and 29% do not sanitize press cloths before each pressing day. With regard to labeling, 36% do not label their product as “unpasteurized”, 62% do not include a “lot number” and 50% do not include a “best before” date on their labels.

Apple cider (551), wash water (98) and plant water samples (125) were analyzed for total coliforms, generic *E. coli*, *E. coli* 0157:H7 and *Cryptosporidium parvum*. Equipment swabs (119) were analyzed for total coliforms (TCC), *E. coli* and *E. coli* 0157:H7. TCC were found in 37% of the apple cider samples, with HV, MV and LV pressers having similar prevalence values of TCC (38%, 41% and 33.7%, respectively). Prevalence for *E. coli* in the apple cider samples was 2.7%, while that of *Cryptosporidium parvum* was 2%. *E. coli* 0157:H7 was found in only one sample (MV stratum). No direct relationship was found between the use of drops or other practices and microbial results. This suggests that contamination with coliforms and *E. coli* may be a result of a combination of many factors.

Thirty-eight percent of the plant water samples tested positive for TCC and 3% for *E. coli*. Wash water samples showed detectable levels of TCC and *E. coli* in 78% and 21%, respectively. Prevalence of TCC in equipment swabs was 17% whereas *E. coli* was not detected.

Of 120 apple cider samples analyzed for more than 30 agricultural chemicals, 63 were positive for one or more of

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## Traceability: Across the Food Chain; Across the Country; Across the Globe

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Traceability is a tool that can facilitate safety, insurance, credibility, and product marketing. It is a tool with three essential components: an identifier; product information; and a linkage between the identifier and the information. This presentation will update you on how AAFC has been working with associations to toward national integrated and credible traceability systems: across the food chain; across the country; and across the globe.

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**A Canadian DNA Traceability Trial to Enhance the Identity Preservation and Control of Transgenic Livestock**

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In Canada the development and production of transgenic animals is increasing with advances in this technology. In particular, the transformation of livestock animals has become more prevalent and now includes cattle, sheep, goats and pigs. The biotechnology/pharming industry, regulatory agencies and the public alike all have a vested interest in ensuring that such transgenic livestock are properly monitored. However, in North America the unapproved release of novel animals into the public food/feed chain has already occurred on at least three occasions in recent years. Such erroneous releases threaten not only the public confidence in the emerging transgenic biotechnologies but can also damage trust in the regulatory authorities who oversee such novel genetic applications. The Canadian Food

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Inspection Agency (CFIA), a federal government agency in Canada, trialed a DNA traceability application on 300 conventional pigs. The aim of the study was to test the viability of the use of a modern biotechnology as a means tracing transgenic animals within a real time animal production system from gate to plate. More specifically the study allowed the participants, to (a) field test the on-farm sampling of animals with DNA sampling ear Biotags™; (b) to examine the use of specialised meat sampling devices in abattoir and supermarket level sampling and (c) to explore the ability to DNA trace meat from various supermarkets back through the production chain to the farm and animal of origin.

Results show that by employing the use of specialized DNA sampling Biotags™ and sampling at various critical points in the production and distribution chain, we demonstrated the successful tracking of target animals from field to fork. Retail samples from a number of supermarkets over several sampling dates were shown to be able to be traced back to specific individual animals thus adding an unprecedented enhanced level of risk mitigation and traceability. On-farm sampling and pig identification was carried out through the use of DNA sampling Biotags™, while specialised carcass sampling devices were used in the abattoir and supermarkets. Sampling was carried out with a 100% success rate.

The study positively linked meat products sampled along the supply chain with source carcasses. This was carried out with a view of testing the efficacy of traceability from farm to slaughter, slaughter to boning hall and slaughter to supermarket. Traceability levels were found to be 100% from farm to slaughter (n=300), 97.5% from slaughter to boning (n=40) and 88.8% from slaughter to supermarket (n=36). In addition the DNA analysis successfully isolated a deliberately spiked sample from the retail sample set.

The results show the value and suitability of such a DNA traceability based tool to enhance the CFIA's operational capacity to track and monitor transgenic animal stock that are considered high risk or that remain unapproved for food/feed use. The study also clearly demonstrates the potential for DNA TraceBack technology to trace meat cuts from the supermarket/retail level to the source animal. In doing so, it shows itself as a “next generation” traceability tool that can be added as an enhancement to already existing traditional livestock identification/identity preservation systems.

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**Effective Data Collection for Efficient and Accurate Traceability**

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The single case of BSE in Canada this year has brought to the forefront the importance of animal identification and the ability to conduct trace-back. In order to have effective trace-back, accurate recording of animal identification is necessary. Our aim is to demonstrate a flexible and working model of traceability that is delivered at the provincial level working within the context of the national mandate of the Canadian Cattle Identification Agency (CCIA).

In order to meet the objective of effective and accurate data collection, specific processes were implemented, such as utilizing bar code scanners for electronic data collection, transferring data in electronic format, and working collaboratively in order to ensure support from stakeholders involved.

Ontario has implemented a unique system to support the delivery of the cattle identification program across the province. Partnerships have been developed between both industry (Ontario Cattleman's Association - OCA, Ontario Independent Meat Processors - OIMP, and Beef Improvement Ontario - BIO) and government (Ontario Ministry of Agriculture and Food - OMAF and the Canadian Food Inspection Agency - CFIA). These partnerships were forged to develop an innovative approach to support cattle identification and trace-back within the framework and requirements of the national organization's (CCIA) mandate. The Ontario beef industry and government wanted to ensure that processes were in place to identify animals effectively and accurately, and therefore, trace cattle through the food continuum within the national program.

The Ontario model works because specific tasks and responsibilities have been assigned to the different partners. The levels in tracing an animal entering the food chain can be broken into the following categories: herd of origin, producer (multiple or single), abattoir, processing, retail and consumer. To date, systems implemented in Canada have focused on data retrieval up to the point of slaughter, before the animal enters the food chain.

A collaborative approach between plants, meat inspectors, and BIO has been devised to facilitate tag number collection. When cattle are processed in Ontario abattoirs (both provincial and federal), their national ID tags are removed. This is done for a given kill date, and provides the opportunity to link the carcass and tag number for trace-back. The tag numbers are recorded and delivered to provincial meat inspectors who complete an electronic

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spreadsheet file. BIO, in conjunction with OMAF's Meat Inspection Branch created this spreadsheet to capture information such as kill date, the total number of animals processed, the sequence of the kill, and the associated tag numbers. Inspectors submit the electronic files to BIO to be edited and compiled and then submitted to the CCIA national database for retirement. Retirement is an important part of trace-back in order to remove the tag number from the system, as well as to identify where the animal was slaughtered prior to entering the food chain.

A similar program has been established to collect tag numbers from animals collected by the deadstock depots. CCIA, OMAF, deadstock operators and BIO worked together to ensure that deadstock tags were retired from the national database. Tags are physically retrieved from deadstock operators and delivered to a central depot for scanning and subsequent delivery to BIO.

All technical aspects of the program from software development, hardware installation, to training and program delivery, have been delivered by BIO.

The communication plan has been a key element to the success of the national identification program in Ontario. Plant operators receive a monthly report that indicates the percent compliance with the ID program. The report allows packers to monitor their compliance rate with the ID program. In addition, this report can be used as proof of participation in the ID program. Periodically, meat inspectors and plant operators receive newsletters updating them on the ID program as it progresses.

It should be noted that the implementation of radio frequency identification is also another option that can increase efficiency and accuracy of tag data collection. The current system in Quebec utilizing electronic tags has some advantages over a visual tag. However, electronic tags require more costly infrastructure.

The Ontario model for animal identification and trace back is balanced in all aspects from communication, technology transfer and accountability. The model is flexible and can be adjusted to fit various scenarios.

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# The Canadian Identity Preserved Recognition System

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The Canadian Grain Commission (CGC) has developed a new certification service called the Canadian Identity Preserved Recognition System (CIPRS). The CIPRS will provide third party audits and certification of industry Identity Preserved (IP) programs designed to keep specialty grains, oilseeds or pulses separate from bulk commodities throughout the supply chain.

This is a voluntary program, designed to give the industry with another tool for providing their buyers an assurance that the shipment they receive will be of the quality they expect. The CIPRS requires that companies have effective quality management systems in place for the production, handling and transportation of specialty grain, oilseeds or pulses throughout the supply chain. These systems will ensure that there is full documentation and traceability from seed to export vessel, container or domestic end user.

Market research conducted during the early development stages of the CIPRS indicates that there are increasing demands for food safety assurance, especially in the high value niche markets that will be served by IP programs. The CGC, in partnership with industry, is therefore exploring the option of integrating food safety assurance with the CIPRS. This would allow for more efficient, lower cost, and less onerous certification requirements for the industry.

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## Strategy Towards a National Traceability System for the Swine Sector

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The Canadian Pork Council has been very proactive in better preparing the industry in facing upcoming challenges. In the course of the last decade, it has developed the Canadian Quality Assurance program (CQA®) whose aim is to demonstrate the food safety and quality of Canadian pork. It has also mandated the development of a national, voluntary, consensus-based environmental management system standard for hog operations, and is now exploring the development of auditable on-farm guidelines for animal care in the hog industry.

However, today, as farm animal movement increases and with potential risks from bio-terrorism, our industry must improve its preparedness in facing a foreign animal disease outbreak and a food safety crisis. It should also respond to increasing demand from consumers about the origin of their food.

The means chosen by the swine value-chain to respond to these needs is the development of a national traceability system, which will allow us to localize and provide information on all Canadian swine premises, and to trace forward and trace back all live animal movements on a real-time basis.

This decision meets the objectives of the Agricultural Policy Framework of the Government of Canada for which traceability receives great attention. Our strategy involves activities which will enable us, early on, to identify the farm of origin of the majority of the Canadian pigs, and later to improve our knowledge of swine premise localization and description, and finally to track live animal movements.

The national traceability system will serve the following goals:

1. To help minimize the impacts of a foreign animal disease outbreak or a food safety crisis by:
  - a) Identifying correctly the source of the disease or contamination, and to establish correctly the control area.
  - b) Reducing the response time.
  - c) Helping to zone Canada in addressing the guidelines of the *Organisation internationale des épizooties* (OIE, or World Animal Health Organization), and meeting our trading partners' expectations.

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**Toward Risk-Based Food Safety Policy: Rationale, Barriers and Solutions**

**Greg Paoli**

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Increasingly, governmental organizations are describing their food and agricultural policy as 'risk-based'. This presentation will review the rationale for this approach and the extent of its application in Canada and other countries. Not surprisingly, significant challenges accompany these new approaches. The main challenges in developing and integrating risk-based analysis into policy development will be described. Finally, pathways to overcoming these challenges and toward realizing the potential of risk-based policy will be offered.

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## Federal-Provincial-Territorial Framework Agreement on Agricultural and Agri-Food Policy for the 21st Century – Food Safety

### **Sally Rutherford**

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Our goal is to brand Canada as the world leader in food safety and quality, innovation and environmentally-responsible production. We focus on initiatives which are designed to protect human health by reducing exposure to food-borne hazards, increase consumer confidence and improve market access to maximize opportunities for industry.

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# Building Partnerships Through the Food Continuum

## Larry Copeland

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Food borne illness outbreaks in three important British Columbia agri-food industries (oysters, eggs and fresh produce) led to the formation of multi-stakeholder consultation committees for each sector.

Representatives from virtually every organization which had an interest in the commodity were invited to participate including; farmers/growers, marketing boards/agencies, industry associations, distributors, processors, retailers, and federal, provincial and local levels of government.

A key operating principle of the committees was not to become a fault-seeking exercise to identify any one responsible person or group. Rather the outbreaks of food borne illness were used as a rallying point to reinforce the necessity of working collaboratively to reduce food safety risks throughout the continuum. The committees thus identified areas of success/strength, and also gaps where additional food safety strategies were necessary to ensure the products remained safe throughout their passage from farm to fork.

Having all of the stakeholders at the table facilitated a systematic analysis, and produced solutions that would not likely have been otherwise attained in a secular, fragmented approach. Significant enhancements to food safety, and equally importantly to communications between stakeholders have been achieved through these committees.

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## Ontario's Food Safety Programs – Providing Province-Wide Protection By Effectively Managing Risks

### **Michael Cassidy**

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Ontario has an excellent reputation for food safety, and is continually reviewing its food safety programs to take advantage of new scientific knowledge and technology to minimize risks to public health and the economy.

Each step in the field-to-fork food chain has a role to play in maximizing food safety. Although all stakeholders are very active participants, food safety programs administered by the provincial ministries are central to successful food safety risk management.

The Ontario Ministry of Agriculture and Food (OMAF) administers and enforces a number of statutes established to minimize food safety risks and promote the orderly marketing of various commodities produced in Ontario. Standards may include the production, quality, composition, safety, grading, packaging, labelling, advertising and sale of a product, as well as facility and operating standards for the following: dairy farms, products and processing plants; abattoirs, the slaughter of animals and primary processing of meat; horticulture: including fruits, vegetables and honey; and eggs and livestock.

On-farm food safety programs are in the process of being developed. Ontario has comprehensive, well-established food inspection programs for meat, dairy products, fruits and vegetables, honey and maple products, as well as compliance and enforcement programs. The fish food safety program is being developed under a proposal to transfer responsibility for fish food safety from the Ministry of Natural Resources to OMAF. In support of these initiatives are the Food Safety Research and Technology program, and the educational components of each of the programs.

The Ontario Ministry of Health and Long-Term Care is responsible for the protection of public health and their role in food safety inspection is delegated to the 37 Municipal Public Health Units. Public health inspectors are responsible for inspecting approximately 80,000 food premises in the province. The key program responsibilities of the municipal public health units include food service and food retail establishments, and food processing plants that are not federally registered.

New technologies, scientific advances, changing diets, new food hazards and evolving trade requirements mean there is a constant need for renewal to minimize risks to both public health and the economy. This presentation will

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**Alberta Agriculture, Food and Rural Development – Food Safety**

***Sandra Honour***

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Food safety in Alberta falls under several jurisdictions. As with the rest of the provinces, the Canadian Food Inspection Agency (CFIA) has its federal role to play in regards to food safety. Food safety legislations and regulations fall under several acts in Alberta that are maintained by Alberta Health and Wellness (AHW) or by Alberta Agriculture, Food and Rural Development (AAFRD). Those items that fall under AHW are enforced by Regional Health Authorities (RHA's) in the province, which are non-governmental agencies charged with health care in the regions.

The Canadian Alberta Partners in Food Safety (CAPIFS) is a joint agreement between CFIA, AHW, AAFRD, and now includes Health Canada. There is an attempt to include RHA's in an official capacity as well. Several programs under CAPIFS will be discussed. Activities and programs regarding food safety in AAFRD are performed by the Food Safety Division. Its structure, mandate, priorities and partnerships with industry will be presented.

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# **Pest Control Products – The Role of Government and Industry in Ensuring Health and Environmental Protection**

## ***Peter MacLeod***

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Health and Environmental Protection is a key issue within our society. For Pest Control Products, there are many stakeholders involved in ensuring pest management needs are met while human health and the environment is not compromised. The manufacturer, the regulator and the user all have important roles to play. Recent changes in Government regulation of pest control products include a new federal Pest Control Products Act (PCPA) and sweeping restrictions on use in the urban environment by some provinces and municipalities. CropLife Canada and its member companies take health and environmental protection far beyond mere regulatory compliance. Industry's voluntary initiatives under the stewardshipfirst™ banner include areas such as certified warehousing, empty container and obsolete product collection.

This presentation will highlight the role of the government and CropLife Canada.

## **GOVERNMENT**

### **Federal**

After nearly 35 years the Pest Control Products Act was completely modernized in 2003. Although the PCPA received royal assent in late 2002, it is expected to come into force in spring 2004. Although the new Act codifies many of the policies and procedures currently in place at Health Canada, many aspects of the PCPA are new. Health and environmental protection will be strengthened by requiring additional safety factors for infants and children, assessing cumulative effects and aggregate exposure. The transparency of the regulatory system will be increased by allowing public access to detailed evaluation reports and test data. Other aspects include:

- Comprehensive adverse effect reporting;
- Mandatory product re-evaluation every 15 years;
- Public right to request a special review or a reconsideration of a registration decision;
- Expedite reduced risk product evaluation;

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- Product sales data reporting;
- Use of the precautionary principle; and
- enforcement/fine provisions.

### **Provincial/Municipal**

The issues surrounding the use of pest control products in urban environments prompted the province of Quebec and several municipalities to enact restrictions recently. The Quebec, Pesticide Management Code, prohibits the use of selected products on public then private land beginning in 2004. The city of Toronto also enacted a by-law that allows only the use of selected products unless an ‘infestation’ is present. While CropLife Canada welcomes additional science-based regulatory scrutiny, restricting the use of some products and allowing the use of others based on non-scientific criteria is poor public policy. As an alternative to duplicating Health Canada’s product evaluation program most provinces and municipalities have enhanced their efforts in other areas such as, public education, training, certification and licensing.

### **CropLife Canada**

The manufacturers and distributors of pest control products take health and environmental safety very seriously. The stewardshipfirst™ program of CropLife Canada revolves around a cradle- to- grave concept of product management. From discovery and research to obsolete product collection, every possible effort and precaution is made to provide pest control solutions to users in a responsible and sustainable manner. The cost of bringing a new pest control product to market has increased to over 300million dollars. New products must be designed and proven to surpass reduced risk criteria now and to meet future regulatory scrutiny to warrant this significant investment.

The stewardshipfirst™ program, although developed at CropLife Canada, is effective due to the many partnerships with users, governments and others, all working to the same goal, protecting the environment and human health while providing effective pest control technology.

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## Practical Aspects of BSE Testing in Abattoirs and Deadstock Receiving Plants Licensed by the Ontario Ministry of Agriculture and Food

### **Robert Vanderwoude**

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In Ontario, all cattle destined for sale must be inspected and receive both ante mortem and post mortem examination. The Ontario Ministry of Agriculture and Food (OMAF) maintains a staff of well-trained inspectors and employs full-time and appointed private veterinarians in its meat inspection system.

A state-of-the-art data and information system called the Food Safety Decision Support System (FSDSS) is used to track all OMAF inspection and sampling activities. This enables OMAF to record, analyse and take prompt action on food safety issues.

In 2001, OMAF senior management decided to increase the surveillance of Ontario's cattle population to ensure there was no BSE in Ontario. This activity was in addition to surveillance carried out by the Canadian Food Inspection Agency and significantly enhanced the national effort.

The OMAF plan called for upgrades to the laboratory system at the University of Guelph to allow for BSE testing and to begin this type of testing in target populations. The three populations were: mature cull cows going to provincially inspected abattoirs, specimens from mature cattle submitted to the pathology laboratory at the University of Guelph and specimens from mature cattle picked up by deadstock collectors.

Almost all cow slaughter in Ontario (mature cattle, older than 30 months) takes place in provincially inspected plants. OMAF also regulates deadstock collection and recycling and can field approximately 24 inspectors trained in deadstock inspection under the direction of a co-ordinator.

Approximately 11,000 cows were slaughtered in provincially inspected plants in 2002. Prior to the discovery of BSE in Canada on May 20, 2003, most cows in Ontario were exported to the United States for slaughter or slaughtered at a cull cow plant in Quebec.

All non-ambulatory cattle in Ontario must be examined by a veterinarian prior to transport and slaughter in provincially inspected plants. In the past 12 months, there were approximately 4,700 of these animals. Five provincial

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## Inventory and Risk Assessment of Free-Standing Meat Processors in Ontario

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During a review of the food safety system in Ontario, OMAF recognized the need to enhance the system by considering a transfer of regulatory responsibility for free-standing meat processors (FSMPs) to OMAF from the Ministry of Health and Long Term Care (MOHLTC). FSMPs are neither federally registered nor provincially licensed, but are inspected under the Food Premises Regulation of the Health Protection and Promotion Act. To facilitate a potential transfer, it was necessary to conduct an inventory and risk assessment of FSMPs in Ontario.

The work involved the Public Health Branch of MOHLTC, the municipal Public Health Units and the Food Inspection and Food Safety Policy Branches of OMAF. An Interagency Committee was struck to oversee inventory development and data collection, and to develop and make decisions about which firms met a risk-based definition of a FSMP, defined as a manufacturing facility located in Ontario that:

- a) Conducts any of the following processes: cutting, boning, breaking, comminution (e.g. grinding, flaking, etc.), fabrication, cooking and repackaging of meat products, and distributes some portion of its products through any wholesale or retail outlet not physically connected to the processing plant, or
- b) Conducts any of the following processes: by-product dressing for human consumption (e.g. offal processing or singeing of beef feet/skin), curing, smoking, fermenting or canning of meat products or vacuum packaging of high risk meat products, and
- c) Is not a federally registered establishment or a provincially licensed plant.

A database compiled from various sources contained 1686 firms. Phase I was a telephone survey to collect tombstone information about each facility, as well as business size, processing operations and a market profile. Following Phase I, 686 plants were eliminated from the database, as they had closed, were not in meat processing or were federally or provincially inspected. Data concerning the remaining 1000 plants were reviewed by the Interagency Committee. 227 plants were deemed to be meat retailers, while 773 plants went on to Phase II.

In Phase II, each plant was visited. Data gathered included information on control programs such as sanitation

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programs, employee training, pest control, water treatment, source and monitoring, Trichina control, process controls, temperature control, adequacy of facilities and equipment, packaging & labeling practices, drainage and waste disposal practices and shipping practices. Global Positioning System (GPS) coordinates were collected for emergency and disaster planning GIS databases.

During Phase II new plants were added, and several changed status. Ultimately, 681 plants were found to be FSMPs. More data is required on 49 plants and will be gathered by public health units.

The data underwent extensive analysis, and a risk profile was developed. Processing activities were divided into low, medium and high risk categories. Risk scores were developed by assigning values to each category and summing scores both by plant and by region.

Business size was analyzed based on number of employees. The majority (82.2%) of FSMPs has <10 employees, while only 7 (1%) have 50+ employees. It is important when considering business size to examine the percentage of the business that is meat processing. Meat processing is often only one of many business components.

Phase II examined risk control programs, such as sanitation and pest control. The standards used in responding to these questions were those currently used by the Meat Inspection Program. Many FSMPs do not meet current standards. For example, only 6.8% have a written sanitation or staff training program, and fewer than 5% have any type of process control. In contrast, 100% of provincially licensed abattoirs have a sanitation program or a corrective action plan to develop one.

Water treatment was a notable issue. The majority (82.2%) of FSMPs are in urban areas on municipal water systems, while licensed abattoirs, which are predominantly rural (79.9%), obtain water from wells. Of those with wells, only 37% of FSMPs have water treatment systems, compared to 93% of licensed abattoirs.

The data clearly indicate that there is a lack of food safety risk control programs in place in FSMPs and a need for improved food safety training.

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**Outbreak of *E. coli* O157:H7 Gastroenteritis Associated with Consumption of Unpasteurized Gouda Cheese, Edmonton, 2003**

***Lance Honish***

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Between October 2002 and February 2003, 13 lab-confirmed cases of *E. coli* O157:H7 gastroenteritis with like PFGE profile were reported in the Capital Health region (metro-Edmonton, Alberta). Cases ranged in age from 2 to 73 years; 5 cases were hospitalized and two cases (aged 2 and 4 years) developed hemolytic uremic syndrome (HUS) as a result of their infection. An investigation by Capital Health-Public Health Division revealed that 12 cases reported consumption of unpasteurized Gouda cheese produced at a local dairy farm, which was purchased mainly at farmers' markets, during their incubation period. During the investigation, 2 of 26 samples of cheese produced by the implicated manufacturer were positive for *E. coli* O157:H7 and PFGE profiles for cheese *E. coli* O157:H7 were identical to those of outbreak cases. To control the outbreak, a media release regarding the outbreak was issued by Capital Health, and implicated cheese was subsequently recalled by the Canadian Food Inspection Agency. The source of contamination was not confirmed; environmental samples from the cheese plant collected by Alberta Agriculture, Food and Rural Development, including dairy cow fecal samples, raw milk samples, well water samples and environmental swabs were negative for *E. coli* O157:H7. This outbreak demonstrates the ability of regulatory agencies to work collaboratively in addressing emergent food safety issues, and the need for review of current regulations *vis-à-vis* production of unpasteurized cheese in Canada.

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# Can Advertising and Media Health Coverage Mitigate the Consumer Effects of Food Safety Occurrences: The Case of Meat in Canada

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Food safety concerns around incidences of various animal diseases have dramatically increased in the past decade. Meat product contaminants such as *Listeria monocytogenes*, *Escherichia coli*, *Salmonella*, Bovine Spongiform Encephalopathy (BSE), dioxins, hormones and antibiotics are perceived to and do affect the health of consumers, potentially affecting meat consumption patterns. It is practically impossible to completely eradicate meat product contaminants from the supply chain; however the frequency and severity of outbreaks and resulting media coverage may have different effects in different countries. One unanswered question that arises is: Can information such as advertising ameliorate the impacts of food safety issues on demand for meat?

The last question relates to whether there are trade-off effects between different types of information sources because information about a given meat type can be positive or negative. For example, one of the potential benefits received from consuming beef is that it provides the most absorbable form of iron, called “heme” iron. On the other hand, this benefit may be balanced against the potential health cost imposed on good health if beef consumption causes increased exposure to *E. coli*. Beef is then demanded based on the trade-off between these characteristics.

In this study, the potential impacts of media coverage of health and food safety and advertising information on consumer’s demand for meat products in Canada are investigated. Canadian food safety indices are constructed separately for beef (coverage of BSE in U.K., France, Germany, Japan, Brazil, and coverage of *E. coli* in the U.S. and Canada) and chicken (coverage of *Salmonella* and *E. coli* in Canada and U.S.) allowing for the investigation of separate own- and cross-commodity impacts of food safety concerns. Evidence is found for the existence of cross-effects of beef food safety media coverage on pork and chicken. Beef food safety media coverage has spillover and substitute effects on pork and chicken consumption, respectively. Advertising of various types (generic, brand and restaurant) also affect meat consumption choices.

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**Canadian Consumers' Choices for GM Food: Risk Attitudes, Perceptions, and Responses to Information**

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This research arises from an economic research study which is part of the Prairie Genome GELS [Genomics, Ethics, Environment, Economics, Law and Society] project. It focuses on how consumers' risk perceptions and trade-offs for foods derived from modern agricultural biotechnology are influenced by information. In the course of the study, data on Canadian consumers' attitudes to a variety of agriculturally-related issues of food safety and environmental quality were collected, as were data for two experiments which probed consumers' stated choices for a selected food product (pre-packaged sliced bread). Conducted on a split sample-basis, one of these experiments investigated the impacts on respondents' choices of differing types of GM information. In this computer-assisted interactive survey, conducted in January 2003, some groups of people were offered bread product choices that included GM ingredients modified to increase the content of vitamins or to reduce pesticide use in agriculture. The statistical design enabled some respondents to access more information (through a mouse click); treatments included negative and positive information from specific and generic sources. The second experiment focused on consumers' stated choices in different labelling contexts; these include mandatory and voluntary labelling.

In the attitudinal component of the survey the 887 respondents gave importance ratings for numbers of food health risks; the Canada-wide responses are summarised (the order of importance, starting at the highest concern is: bacterial contamination; pesticide residuals; use of hormones; use of antibiotics; fat and cholesterol content; the use of GM in foods; mad cow disease; and food additives). Respondents' ratings of the relative importance of queried environmental consequences of agriculture are also summarised (in order of importance these are: water pollution from agricultural chemical run-offs; herbicide/pesticide resistance; agricultural waste disposal; soil erosion; GM effect on the environment; and GM effect on biodiversity). Ratings of sources of food information that are most trusted are presented (showing relatively low trust in industry, farm groups and government and high levels of trust in information from research institutions and consumer groups).

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## From Supermarket to Fork: Consumer Misconceptions to the Risk of *Salmonella heidelberg* Infection

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*Salmonella enterica* var. Heidelberg has recently become the second most common cause of human salmonella infections in Canada. Isolation of the organism from frozen chicken nuggets/strips during routine case follow-up prompted its study as a potential risk factor for infection. Suitable food preparation precautions may not be undertaken by consumers since par-frying of nuggets/strips gives them a cooked appearance when in fact most brands are raw. Laboratory confirmed cases identified between January 1st and April 1st, 2003 were studied. Controls were generated through forward digit dialling and individually matched by age category. Telephone interviews were conducted and limited sampling of unopened product conducted. The odds of infection were eleven times higher in individuals who had consumed frozen processed chicken nuggets/strips (95% CI 1.60 – 473.47). Frozen nuggets/strips were considered pre-cooked by one third of cases and controls. One quarter of respondents used the microwave, an ill-advised cooking method, to heat them. Consumer misconceptions contributed to the risk of infection. Clear labels identifying nuggets/strips as raw poultry are needed.

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**Ontario's Food Safety Decision Support System (FSDSS)**

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The Food Safety Decision Support System (FSDSS) is a 24/7 mission critical, comprehensive, electronic food safety information management system with complex business logic that supports the Food Inspection Branch (FIB) Dairy, Meat and Horticulture Programs and Operations. The business of food safety at the FIB is regulation-based and supported by a science-based decision-making system. The Provincial Auditor as well as the Standing Committee on Public Accounts has identified this computerized risk management system as critical to the successful delivery of the Ministry's food safety mandate.

On the business side the application is used as an inspection information management system that supports inspection functions, branch management and risk management. The FSDSS application consists of nine functional subsystems organized to carry out specific and related business functions: licensing; compliance; inspection operations; expert assistance; laboratory services; branch operations management and support; client statistics; appointed persons and risk management.

Maintenance objects within each subsystem allow business users to update maintenance tables without programming assistance. The FSDSS application utilizes Oracle replication to allow the synchronization of the main database with remote databases on approximately 170 laptops, which represent about 80% of the users. Remote users download data to their local database from the main database, work remotely, and then upload changes to the main database when the work is completed. Each snapshot site is synchronized with the central database server at least once per inspection shift through an upload that keeps the central database up to date. Downloads which update the snapshot sites take place less frequently, as downloads take significant amounts of time through the MPR dial system. The desktop environment differs from the notebook environment in that a local database is not installed on desktops. The complex replication environment is necessary because many of the client locations where inspection service is carried out do not possess facilities to allow web access for inspectors.

The FSDSS has a full-time manager, application support staff, including Help Desk staff with extended hours, a database administrator, a data scientist, a scientific support analyst and a maintenance contract.

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An example of the mission critical information the FSDSS tracks to aid with risk management is its system for handling client-licensing information, which is connected to a system to record facility audits and associated corrective action reports. Specific inspection tasks related to audit deficiencies and corrective actions are assigned by the system to provide continuous record updates. The FSDSS also tracks Ontario Ministry of Agriculture and Food (OMAF) laboratory sampling and testing activities. These activities are organized into projects. Projects are defined by the program area and scientific staff. Scientific support staff use this information to define the project within FSDSS. As inspection staff submit samples, physical samples are transported to the laboratory, and electronic information about the sample is entered in FSDSS. This information is communicated to the laboratory through an electronic interface, which also transmits results data back to the FIB. Communication through this interface takes place every fifteen minutes during the business day and less frequently throughout the remainder of the day.

The FIB is involved with the Food Safety Policy Branch and the IT cluster ministries in a broader initiative of the Ontario Food Safety System (OFSS). OMAF is in partnership with the Ministry of Health and Long Term Care (MOHLTC) and the Ministry of Natural Resources (MNR) and regularly consults with industry stakeholders and other food safety-related government departments at both the municipal (Health Units) and federal (Canadian Food Inspection Agency) levels.

The OFSS has an IT component that has finished a conceptual level enterprise architecture related to food safety that follows the Enterprise Architecture standards established by the Ontario Public Service (OPS). The architectural analysis revealed that approximately twelve public services were critical to Food Safety.

The goal this year will be to develop a working food-related inspection information system that could be used by all OFSS stakeholders and other OPS Ministries. In parallel the FSDSS will be strengthening its foundation. The database will be migrated to Oracle 8i, the replication technology improved, and some of the application subsystems will be enhanced for greater functionality. The FSDSS is intended to become the foundation of the broader OFSS or Ontario Food Safety System (OFSS).

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## Initiatives of the Canadian Partnership For Consumer Food Safety Education

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Industry, consumer and government organizations have been working separately for many years to improve consumer understanding of food borne illness and the measures that can be taken to decrease the risks of the illness. However, in December, 1997, communication between a number of industry, consumer and government organizations resulted in the formation of the Canadian Partnership for Consumer Food Safety Education, the goal of which is to develop and implement a comprehensive food safety education campaign aimed at consumers. Current membership totals over 20 industry, consumer, health and environmental organizations, and the federal and provincial government organizations concerned with food safety. In April, 1998 the Partnership incorporated itself as a non-profit organization committed to reducing food borne illness in Canada by increasing awareness of safe food handling practices through the coordination and delivery of food safety education programs focused on the consumer.

In 2003 the Canadian Partnership for Consumer Food Safety Education (the Partnership) participated in a strategic consultation process to develop a framework for a National Food Safety Communications Strategy. The purpose of this initiative is to identify common ground for organizations involved in food safety messaging. The strategy and its use will provide a common approach for further discussion, collaboration and voluntary harmonization of consumer food safety messages in Canada.

The objectives, goals, vision and principles focus on ensuring that consumers are receiving harmonized, science-based food safety messages. These messages will empower consumers to adopt food safety best practices, effectively reduce the incidence of food borne illness, and increase confidence in Canada's food system.

The vision and objectives of the national strategy align closely with those of the Partnership, which was formed to provide a process for coordinating food safety messages aimed at consumers. The Partnership has the opportunity, knowledge and the corporate history to continue the development of our initiatives.

Current Partnership projects underway include:

- A steaming hot university youth campaign with a brand new spokesperson for the FightBac! messages of Clean,

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## InfoBasket – A One Stop Shop for Agri-Food Information

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With increasing access and use of the Internet, portal technology has significant opportunity to support extension services in improving communication and awareness between producers and consumers in a broad range of agriculture and food issues. This presentation will look at the benefits in using a portal as an information delivery tool. InfoBasket is designed to assist industry and consumers with the challenges they face accessing credible, relevant and timely information. As well, examples related to food safety and quality will be discussed.

Historically, the BC Ministry of Agriculture, Food and Fisheries delivered much of its information to clients through one-on-one extension services. Today, changing client expectations and a refocusing of staff resources has led British Columbia's extension service to employ new tools and methods to meet client information needs.

The Ministry piloted a new approach for delivering information electronically via an information portal in 1999. (An information portal is a Web-based service that provides a one-stop point of access to key information resources). The pilot project received overwhelmingly positive support from clients and the new information portal, InfoBasket, was launched on March 30, 2001. This portal uses a client-focused approach to information organization (i.e., organizing information around client needs vs. organizing information around the Ministry's organizational hierarchy). Information presented in this way provides quick access and facilitates client self-service. The portal is structured into communities or business focus areas with each lead by a team of industry specialists. Information categories within the communities include; production and processing, business management and finance, marketing and trade, regulations and legislation, directories and contacts as well as statistics and market data.

Currently InfoBasket addresses the information needs of client groups including: Agroforestry, Apiculture, Beef, Bison, Field Vegetables, Forage, Game Birds, Goats, Grains, Oilseeds, Pulses and Forage Seeds, Micro Food Processors, Ratites (ostrich, emu), Sheep and Lambs, Specialty Crops, Tree Fruits, Organics, Ornamentals, and Waterfowl. Communities in development include Agritoursim, Berries, Freshwater Aquaculture, Oysters, Greenhouse Vegetables, and Horses. Other potential communities being considered are Youth Development/4H, Dairy, and Viticulture.

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**Baseline Risk Study of Chemical Contaminants in Raw Meats Processed in Ontario’s Provincially Licensed Plants**

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The Ministry of Agriculture and Food (OMAF) has taken the lead to improve Ontario's food safety system by designing and implementing a field-to-fork, science-based food safety system. As part of its ongoing development of a comprehensive science-based food safety system, OMAF recognized that consumers’ perception of chemical risk in meats and the global reporting of residue violations are public health realities which need to be addressed. As a result, it mandated the design and implementation of a series of baseline studies for the assessment of chemical risk in raw meat products produced in the provincially regulated abattoirs in Ontario.

Chemical baseline studies will provide relevant data describing the prevalence and levels of chemical contamination, if any, on raw meats processed in Ontario abattoirs. The information gathered will be used to assist the inspection program in targeting and prioritizing its resources to food commodities that present higher risk; support residue avoidance programs undertaken by the livestock industry, measure the impact of intervention programs (e.g. HACCP), and maintain overall consumer confidence.

In order to determine the proposed list of chemical contaminants and livestock species, OMAF considered a number of factors. These included: the likelihood of a chemical presence in meat, the extent to which the substance has been monitored in the past, the results of such monitoring, the persistence of a chemical in the environment, animals and crops and data from toxicological studies of human exposure. Where a lack of data existed, the recommended chemicals, animal tissues to be tested and livestock species were derived from scientific literature data in concert with advice obtained from veterinary practitioners in Ontario.

Testing for the chemicals included in the baseline studies has been staggered over three fiscal year periods. Priority for testing in the first phase was given to some of the veterinary drugs while the second and third phases will also include testing for some pesticides and environmental contaminants.

The chemical groups included in the studies are veterinary chemicals, pesticides, environmental organic contaminants and inorganic contaminants. Sampling is conducted randomly within a number of product classes

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including chickens, beef (steers, heifers, cows, and bulls), calves, market hogs, barbecue hogs, breeding hogs (sows and boars) and small ruminants (sheep, lambs and goats).

OMAF meat inspectors who are trained in the sampling methodology are carrying out sample collection and submission. Samples are collected from carcasses of animals that have been slaughtered in provincially licensed abattoirs. Samples are collected according to a random sampling plan that covers the entire geographic area of Ontario. Prior to the start of each phase of the study, hands-on training exercises and sampling methodology documentation are prepared for the samplers.

The Ontario Ministry of Agriculture and Food requires analytical methods comparable to those published in the AOAC Manual. OMAF requires contract laboratories to be accredited for residue testing, preferably, by the Standards Council of Canada for the testing of chemical residues in foods. The accreditation must cover the specific combination of analytes and matrices specified in the test. When possible, broad-spectrum screening tests – detecting a range of residues or contaminants – are used in preference to tests for specific residues for initial screening of samples. All of the positive samples are confirmed and quantified.

The first phase of the study was substantially completed in March 31, 2003. In phase I of the study, analyses were conducted using 1300 muscle samples, 300 thyroid gland samples and 120 fat samples. Over 13,000 results were obtained during the first phase of the study. The second phase of the study will start in summer of 2003, and will include a minimum of 2100 further samples.

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# Baseline Risk Study of Potential Chemical Contaminants in Ontario Farm-Raised Rainbow Trout

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A prerequisite for the development of boat-to-throat, science-based food fish safety programs for Ontario is to conduct baseline studies to determine the prevalence of microbiological, physical and chemical hazards. The data from these studies will be used to assess and manage the risks associated with particular fish products, and to develop programming, including regulatory and non-regulatory options.

In 2001, the Ontario aquaculture industry produced approximately 4500 tonnes of farmed fish with a farm-gate value in excess of \$16 million and an economic contribution of \$65 million. Currently rainbow trout accounts for over 90% of the production output from Ontario aquaculture, and represents more than two thirds of Canada's farmed trout production. In addition to trout, there is small-scale food fish culture in Ontario of perch, walleye, sturgeon, Arctic charr, and tilapia. Farm-raised fish may reach the Ontario consumer's plate through CFIA-registered processors, non-federally registered processors, farm-gate sales of fresh and smoked fish, farmers' markets and fee-fishing establishments.

Despite generally recognized health benefits of eating fish rich in omega-3 fatty acids, recent attention has focused on the safety of farm-raised fish as a food source. Chemical contaminants could be introduced into aquaculture-raised product through veterinary therapeutants, contaminated fish oil-rich diets, and the environment. As part of its ongoing review and development of a comprehensive food safety program, the Ontario Ministry of Agriculture and Food (OMAF) conducted a Phase I baseline study of chemical contaminants in farm-raised trout.

Samples of fresh, whole market-ready rainbow trout (*Oncorhynchus mykiss*) were collected between October and December 2002 from individual lots supplied by both land-based and cage producers in Ontario. A total of 171 samples from individual lots were collected (65 producers). Sampling plans were developed proportional to volume within stratum, with 58 samples collected from the large stratum (7 producers), 59 samples from the medium stratum (22 producers), and another 54 samples from the small stratum (36 producers).

Tissue samples were analyzed for 10 veterinary drugs, 5 metals, 56 organochlorine/organophosphate pesticides, and dioxins, furans, and dioxin-like polychlorinated biphenyl (PCB congeners), as per CFIA/US EPA guidelines. Veterinary

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drugs were analyzed on individual fish basis, other analyses on pooled sample of three lots of fish. Pooling was based on fish size, not by producer strata or location.

Residues of 62 analytes were not detectable in any samples. Analyses showed the presence of oxytetracycline (n = 127, 1 detectable residue: 0.062 mg/g), florfenicol (n = 127, 9 residues: range 0.1-0.3 ng/g), and sulfadimethoxine (n = 127, 3 residues: 0.056-0.096 mg/g). The presence in non-ready-to-market samples of chlortetracycline and sulfathiazole was unexpected. These are unapproved veterinary drugs for use in food fish, but may be legally used with veterinarian extra-label prescription, requiring careful observation of withdrawal times.

Analyses also showed the presence of mercury ( $n_{\text{pooled}} = 59$ , 18 residues: 0.01-0.07  $\mu\text{g/g}$ ), lead ( $n_{\text{pooled}} = 59$ , 1 residue: 0.1 mg/g), selenium ( $n_{\text{pooled}} = 59$ , 58 residues: 0.2-0.8 mg/g), and arsenic ( $n_{\text{pooled}} = 59$ , 58 residues, 0.27-1.55 mg/g). Mercury contamination was lower than expected and the low detected levels of selenium may counter negative health effects of mercury.

Dioxin (2,3,7,8-TCDD) was not detectable in any pooled sample (n = 63). Mean total PCB concentration was 0.024 mg/g (n = 63). Congener-specific analysis for dioxins, furans, and dioxin-like PCBs showed a total Toxic Equivalency Quotient (TEQ) ranging from 0.55-4.32 pg TEQ/g wet weight, with a median value of 1.44 pg TEQ/ g wet weight. Strong correlation was made between TEQ and fish size, independent of producer strata.

These results indicate levels of all chemicals tested in market-ready farmed trout are below current Health Canada Maximum Residue Limits (MRLs). This information will be used to develop appropriate science-based risk management programs for Ontario aquaculture to ensure public health and safety, while maintaining industry competitiveness.

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# Composting of Deadstock and Abattoir Inedible Material in Ontario

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Fear of prion diseases worldwide has forced feeding restrictions of ruminant meat and bone meal. Rendering companies have stopped accepting carcasses or offal of deer, elk, antelope, zoo animals, sheep, lamb heads, fallen animals, goats, companion animals and mink. Renderers now refuse animals that cannot be guaranteed free from sulfa drugs and carbadox. Serious concern exists over the collection and disposal of animal carcasses in Ontario.

A combination of these factors has led the deadstock collectors in Ontario into a crisis situation. Many deadstock collectors now charge producers for collection of their dead animals. As a result, farm animal mortalities are being disposed of illegally. The illegal disposal of deadstock will ultimately affect the health of the public, and create further crises. The current situation requires immediate resolution.

Composting provides farmers, deadstock collectors and abattoir operators a convenient and cost-effective disposal method of deadstock and inedible material. It can generate a usable end product from potentially hazardous waste into a soil building resource. Composting is a natural process where microorganisms decompose organic matters such as organs, soft tissue and bones in aerobic and anaerobic environments. Composting is safe when it is done properly. Results from previous research have shown that many serious pathogens would have difficulty surviving the composting process. Likewise, odour can be controlled and minimized.

The Ontario Ministry of Agriculture and Food (OMAF) provides support and assistance to anyone who is interested in composting. Fact sheets are available to farmers that are interested to compost deadstock on farm. Presentations made by technical staff from OMAF at public meetings also provide information on how to set-up on farm composting facilities. With assistance from OMAF, several abattoirs in Ontario have set-up composting facilities for composting abattoir inedible materials. Materials that are composted include sheep heads, inedible offal, blood, feathers and whole animals as well.

Under the current Dead Animal Disposal Act and regulations, farmers are allowed to compost deadstock on farm but not the deadstock collectors and receivers. The ministry has, however, proposed amendment to the existing regulation to allow deadstock collectors to compost deadstock at their facility. The proposed Dead Animal Disposal

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## Details of HACCP Standard for Non-Federally Registered Food Processors

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As part of the initiative underway by the Ontario Ministry of Agriculture and Food to develop a HACCP program and HACCP recognition/certification framework for non-federally registered food processing facilities, a new HACCP standard has been developed. This standard has been developed specifically for the non-federally registered food processing sector, especially small to medium sized enterprises (SMEs). The standard, unlike its federal counterparts, has been designed for all facilities regardless of commodity. Similar to the Food Safety Enhancement Program (FSEP) maintained by the Canadian Food Inspection Agency (CFIA), the HACCP approach outlined by the new standards include both prerequisite programs and HACCP plans.

The prerequisite program standards are divided into three broad groups, Control and Training Programs, Operational Controls, and Environmental Controls. Each category is further divided into subsections. Standards that fall into the 'Control and Training Program' group outline the written control programs (e.g. sanitation program, pest control program, preventative maintenance program, etc.) as well as outlining the required training programs to be delivered to employees (e.g. sanitation, critical control point, personal hygiene, etc.). The implementation of the written control programs outlined in this group are governed by the 'Operational Controls' group. These standards ensure that the programs devised in the first group are being followed as written and intended and are effective in maximizing food safety. Additionally, common good manufacturing practices surrounding personal hygiene and employee practices are also outlined within this group. The last group, 'Environmental Controls', outlines the basic requirements that the premises, facility, and equipment must meet to create a safe and suitable environment for food processing. This group includes standards that pertain to facility and equipment design and construction, water supply, ventilation, lighting, etc.

Each standard has 5 sections: the standard itself, Regulatory Action Points, associated risk(s), suggestions to meet the standard, and suggested monitoring procedures. The standard is straight forward and lays out the required food safety expectation in simple understandable language. In some regulated commodity areas, a facility may have requirements that are above and beyond the requirement of the prerequisite program standard. These requirements are referenced within the standard as 'Regulatory Action Points' (RAPs) and allow the regulated facilities to easily understand what is expected of them, with respect to a particular prerequisite program, for both HACCP and any

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regulated inspection programs. The 'associated risk' section provides the facility with the rationale as to why the standard is required to maximize food safety. When an operator understands the reasoning behind a prerequisite standard they are more apt to ensure the standard is properly met and implement effective control measures. The 'suggestions to meet the standard' section outlines common control measures and techniques used to meet the required standard. These are merely suggestions and are not the only way to meet the standard but are frequently the most effective way to meet the standard. The last section, 'suggested monitoring procedures', outlines common methods used to ensure that the standard is continually being met over a period of time. Again, these are merely suggestions to meet the standard, other methods may be used.

The standard for the HACCP plan itself includes all twelve steps and seven *Codex* HACCP principles and is very similar to the HACCP plan requirement set out in the FSEP program. Included in the HACCP plan are requirements for references to restricted ingredients as defined by the *Food and Drugs Act* as well as reference and control for all allergens. Additionally, a consumer packaging and labelling requirement is also included within the HACCP plan. The number of forms currently required in the FSEP model has been reduced in the new HACCP plan standard from ten to eight by combining duplicative forms.

Following a proof of concept project to demonstrate the feasibility and effectiveness of the new HACCP standard, a HACCP guidebook will be produced. This "how-to manual" will set-out some blanket requirements for the prerequisite program standards, including the need for well defined corrective actions and verification procedures. In summary, the new HACCP standards for non-federally registered food processors should provide a user-friendly and effective avenue for this group of food industry stakeholders to achieve a recognizable HACCP program.

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## Developing Ontario's Water Testing Program for Provincially Licensed Abattoirs

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Water quality has always been a priority of the Ontario Ministry of Agriculture and Food's (OMAF) Food Inspection Branch (FIB). Water is required in large quantities in food processing plants for various uses including cleaning and as an ingredient in many manufactured products. The use of non-potable water represents a public health hazard. OMAF has developed one of the most thorough water monitoring programs for its provincially licensed abattoirs. The program provides rapid action to address each incidence of adverse water quality to ensure food safety.

In 2002, a Water Safety Control Officer (WSCO) was contracted by the Ministry to assist in the further development of the water monitoring program. Duties of the WSCO include co-ordinating the testing program, co-ordinating the response to adverse water results, tracking results, documenting actions, reporting test results and training. The WSCO is part of a team comprised of meat inspectors, area managers, regional veterinarians, plant operators, and representatives from other ministries who all may be involved in an adverse water incident.

Meat inspectors sample water in each plant once or twice per month depending on the plant's water source, water treatment system, and water quality history. Microbiological testing is conducted by an accredited laboratory for coliforms, *E. coli*, and aerobic bacteria. An adverse result can be defined as a water sample having a total *E. coli* count greater than 0, and/or total coliform count greater than 0 and/or aerobic plate count (or heterotrophic plate count) greater than 500. This standard is the same as that recommended by Health Canada for drinking water.

OMAF recently developed and implemented a water policy that clearly outlines the monitoring frequency for plants and the actions and responsibilities required when there is an adverse water result. The water policy was distributed to all provincially licensed abattoirs in the fall of 2002 thus ensuring a fair and consistent response to adverse water.

Communication is a key component of the program. Arrangements have been made with the water testing laboratory to provide immediate notification of adverse results to the WSCO. The WSCO then contacts the area manager for the plant, the regional veterinarian and the Ministry of Health and Long Term Care (MOHLTC) public health unit if necessary. The plant operator is contacted by the area manager who advises the plant of the result and reviews with

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the operator what actions should be taken.

Approximately 80% of provincially licensed abattoirs are supplied with water from wells on their own property. The general practice for one of these plants having an adverse water result is to shock and flush their well and distribution system. It is important to determine if a well or treatment system problem exists and plant operators are encouraged to consult experts in this area for additional advice.

The MOHLTC public health unit for the regional area in which the plant is located is advised of any coliform (and *E. coli*) positive results. They work with the OMAF team and may take additional water samples and/or issue a Boil Water Advisory until the public is no longer at risk.

Slaughter operations are suspended in plants that have *E. coli* positive results or coliform positive retest results. Plant operations that use water may continue after negative re-test results are received with approval from the regional veterinarian. Meat and meat products are held when *E. coli* is detected in the water and further testing is conducted to determine if *E. coli* O157:H7 is present. Meat and meat products are released when negative results from these tests are received.

Education and action on adverse results have encouraged plants to install effective water treatment systems. Since the spring of 2002, the number of plants having effective water treatment systems has increased from 75% to 99%. The incidence of adverse water results is currently at 6 % with some seasonal variations. To provide an even greater level of protection for Ontario consumers continued government/industry efforts are required.

In the future, it is expected that the number of adverse water results in the province will decrease as plants continue to improve their water treatment systems and improve their system monitoring programs. OMAF's water monitoring program in provincially licensed abattoirs is making an important contribution to food safety in Ontario.

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## Enhancing Food Safety through Enforcement Activities

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The Enforcement Unit of the Ontario Ministry of Agriculture and Food (OMAF) consists of two distinct components, an investigative group and an advisory/enforcement group. Since April 2000 OMAF has had a cooperative Service Level Agreement with the Ontario Ministry of Natural Resources (MNR), which defines the investigative services MNR provides to OMAF. OMAF's advisory/enforcement group deals with complaints through advisory services, education and enforcement while MNR handles investigations. These investigations often result in charges and subsequent convictions.

The Ministry receives complaints from a variety of sources e.g. consumers, stakeholders and fellow staff members. These complaints are analyzed by the Unit to determine what action should be taken. If it is determined that an advisory and educational visit would solve the problem, one of the Ministry's Compliance Officers is sent. If stronger enforcement action is required, a request is made to the MNR for an investigation. Due to the large number of issues OMAF deals with, partnerships have been created with other Ministries, Agencies and other levels of government. On an ongoing basis, OMAF Enforcement and Compliance Officers train outside agencies such as Municipal Health Units, the Ontario Society for the Prevention of Cruelty to Animals and the Canadian Food Inspection Agency staff on how to detect uninspected product.

Enforcement of the *Meat Inspection Act (Ontario)*, with respect to preventing/controlling illegal slaughter and the sale of meat presents a particular challenge. Key partners for the Ministry in this area are the 37 municipal health units in Ontario. Each health unit is an independent entity. Therefore, to ensure that all units have consistent approach and understanding of illegal slaughter the OMAF Enforcement Unit developed a training program to assist public health inspectors to recognize the difference between inspected and un-inspected products.

For example, are there approved stamps on the meat, is the product properly packaged, does the owner have receipts, is the product clean, is signage accurate and complete? There are also many graphic pictures of what un-inspected product look like, the facilities that they are produced in and how they are marketed. OMAF has conducted 53 of these sessions to most of the units and other ministries and agencies. The partnering has resulted in numerous joint inspections, organized raids leading to loss of product and charges being laid. Our sister Ministry, the MNR, in

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# Enhancing Food Safety Through Research Initiatives

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During a review of the food safety system in Ontario, the Ontario Ministry of Agriculture and Food (OMAF) recognized the need to enhance the system by intensifying an investment in food safety research. A four year, four million dollar Food Safety Research Program (FSRP) was launched in February of 2001. The mandate of FSRP is to invest in research to assist in the implementation of a science-based food safety system. This funding initiative is supporting research to assess, manage and reduce the risks to public safety along the entire food chain. It is identifying emerging hazards and contaminants and developing/evaluating diagnostic methods for application in field and laboratory settings. It is also generating knowledge that will help government regulators, industry, and consumers develop strategies to prevent, control or eliminate food safety risk.

The program is open for competition among researchers from academia, industry, governmental agencies, private and regulatory labs, as well as partnerships of any of those. The researchers are eligible to apply for up to 250,000 dollars per project that has to be competed within two years. The Innovation and Risk Management Branch of OMAF manages the program by facilitating identification and development of specific research priorities, by issuing an annual call for proposals, by facilitating an expert review process and by managing research contracts.

Three competitive rounds have been completed and the fourth round is in a progress. To date the FSRP has allocated three million dollars to 25 successful projects at eight research institutions: Queen's University, the University of Guelph, the University of Manitoba, the University of Saskatchewan, Lakehead University, McMaster University, Agriculture and Agrifood Canada and Health Canada.

For example, FSRP is supporting a number of projects focused on the development and/or validation of diagnostic methods for rapid, accurate, reliable and less expensive detection of E. coli, Salmonella, Campylobacter, M. paratuberculosis, viruses and chemical residues in food and water samples. A focus of some projects is on very advanced technology, such as development of microarrays and microchip technology for multi-pathogen detection in the same sample, or fiber optic technology for E. coli detection. In some cases the projects are focussed on improvements and validation of existing technology to improve turn around time or sample throughput.

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From those projects focused on risk assessment, development of data for risk assessment and identification of emerging food safety hazards examples include the following:

- Risk assessment of prevalence and antimicrobial resistance of *Campylobacter* in chicken, veal and turkey products at retail level in Ontario.
- Surveillance of Ontario pig farms for diseases of public health importance – with emphasis again on antimicrobial resistance problems.
- The assessment of antimicrobial resistance in cull cows in Ontario dairy herds.
- Implementation of HACCAP-based food safety program implementation in food service sector.
- Transmission of pathogenic bacteria to horticulture crops via contaminated pesticide mixes.
- The investigation of routes for transfer of food and water-borne pathogens to produce - possible internalization of pathogens within produce edible tissue.
- The assessment of barriers to the effective implementation of HACCP in the Ontario food-processing sector.

The program is also supporting projects focused on risk control such as use of essential oils as an alternative to dietary antibiotics to control food-borne pathogens in livestock, the use of ozonation to decontaminate horticulture produce and the use of liquid feed in pork production – advantages and issues in terms of food safety.

OMAF is committed to ensuring the broad dissemination of research results. Information about the funded projects is available on the OMAF website and is highlighted in the Compendium of OMAF Funded Food Safety Research published by OMAF in 2002. The Compendium will be updated in November 2003. Also, the successful applicants are required to register their project with the Inventory of Canadian Agri-food Research (ICAR). Project results are shared with government and industry representatives. Successful applicants are encouraged to publish their results in the appropriate journals, as well as to commercialize the inventions where possible.

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# Inventory and Preliminary Risk Assessment of Non-Federally Registered Fish Processors in Ontario

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During a review of the food safety system in Ontario, the Ontario Ministry of Agriculture and Food (OMAF) recognized the need to improve Ontario's Food Safety System (OFSS). Fish processing in Ontario may be carried out by federally registered fish processors, or in facilities that are not federally registered. Non-federally registered fish processors (NFRFPs) are currently subject to provincial regulations under the *Fish Inspection Act (Ontario)*. While the Ontario Ministry of Natural Resources (MNR) currently has responsibility for the unlawful sale of decomposed, tainted, or unwholesome fish under the *Fish Inspection Act (Ontario)*, Ontario is considering a transfer of regulatory responsibility for non-federally registered fish processors from MNR to OMAF under the Food Safety and Quality Act, 2001. In light of this possible transfer, and to facilitate the development of appropriate food fish safety programs, an inventory of NFRFPs was undertaken in Ontario.

Successful implementation of this project required cooperation between the Public Health Branch of the Ministry of Health and Long-Term Care (MOHLTC), the Municipal Public Health Units (PHU), MNR, the Canadian Food Inspection Agency (CFIA), and the Food Inspection and Food Safety Policy Branches of OMAF. An Interagency Planning Committee was formed with representatives from each of these organizations to oversee development of an operational definition of a NFRFP, oversee development of a preliminary database, oversee development of a workplan and Request for Proposals for inventory data collection, select and oversee the work of a consulting firm to carry out the data collection and make decisions regarding the collected data to allow risk assessments to be conducted on those facilities meeting the operational definition.

The definition of a non-federally registered fish processor used in this survey is a manufacturing facility in Ontario that:

- a) Conducts any of the following processes: cleaning, scaling, icing, eviscerating, filleting, mincing, comminuting, reforming, extruding, shucking, de-shelling, breaching, cutting, freezing, repackaging and distributes some portion of its products through any wholesale or retail outlet not connected to the establishment, or:
- b) Conducts any of the following processes: cooking, smoking, salting, drying, pickling/marinating, canning, preparing ready to eat (sushi) products, or vacuum packaging of high risk products, and:

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c) Is not operating as a federally registered establishment with a CFIA Certificate of Registration.

A preliminary database consisting of 969 facilities was compiled from various sources. Validation of business data resulted in 145 businesses preliminarily meeting the operational definition of a NFRFP.

A consulting firm was selected through a competitive process to carry out a two-phased data collection. Phase I consisted of collection of business profile information to enable decision-making on which businesses match the operational definition based on survey data collected. Phase II consisted of an on-site survey of process control programs. A preliminary data analysis and risk assessment of businesses that match the operational definition was then conducted.

One hundred and forty-seven (147) processing plants are classified as NFRFPs. The majority of NFRFPs are small or very small enterprises that operate on a seasonal basis. Fish processed in NFRFPs come from a variety of sources, including aquaculture, commercial fisheries, and imports, and each source presents potential hazards over and above those introduced through processing activities. The majority of high-risk processing activity involves fish smoking. A variety of distribution methods are used to market fish products, but the vast majority is distributed widely through wholesale channels.

The data suggests that many NFRFPs could improve their food safety risk control programs at a relatively low cost to the NFRFP operator.

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# Microbiological Baseline Survey on Raw Beef Carcasses in Ontario Abattoirs

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The prevalence and levels of indicator and pathogenic bacteria on beef carcasses processed in Ontario's provincial abattoirs were evaluated in a microbial baseline study conducted between March 2000 and January 2001. The study was designed to account for variations due to establishment size, geographic location of plants and season. To minimize experimental error and ensure adequate representation, volume throughput data from the abattoirs was utilized as a design criteria for stratifying abattoirs into high, medium and low volume groups. Had a completely randomized design been used, 53% of the samples would have originated from less than 6% of the abattoirs.

Randomized sampling plans were developed on a weekly basis, providing for a sampling frequency based on probabilities proportional to volume within stratum. Carcass selection at the plant, using random number tables, was done by meat inspectors trained in aseptic sampling methodology. Carcass sampling was conducted 12-36 hours post-slaughter using sampling sponges with buffered peptone water as the diluent. Three sampling sites on the carcasses (rump, flank and brisket) were swabbed using a 100 cm<sup>2</sup> template. Information collected on the type of beef and dressing method included fed vs. culled beef, beef class (steer, heifer, cow or bull), dressing method (bed or rail), dehiding method (manual or mechanical) and shrouding practices. Samples were packed in chilled shipping containers, time and date stamped and shipped by courier to Laboratory Services Division, University of Guelph for analysis. A strict set of sample acceptance/rejection criteria was implemented. Only samples which were received by the laboratory within 24 hours of collection, complete with the three swabs, uncontaminated, non-leaking and whose temperature was between 0° and 8°C were accepted for microbial analysis.

Pooled swabs from 1459 carcasses were submitted for analysis of: aerobic colony count, total coliform count, *Escherichia coli* count, *Campylobacter* spp., *Listeria monocytogenes*, *Salmonella* spp. and VTEC. The analytical methods used for *E. coli* count, *Salmonella*, *Listeria monocytogenes*, and aerobic plate count were those accredited by the CFIA and described in the Health Canada, HPB Compendium of Analytical Methods, volume 3. The *C. jejuni/coli* analytical method and the verocell assay for *E. coli* 0157:H7 were modifications of those described in the former Agriculture and Agri-Food Canada laboratory procedure manual. Serotyping of *Campylobacter* and *Salmonella* isolates was provided by participating Health Canada Laboratories in Guelph and Winnipeg.

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Results were analyzed with SAS for associations with strata, geographical location, season and operational variables. The analysis of the aggregate results showed that contamination rates were 27.8%, 18.6%, 1.5%, 9.9%, 1.6% and 0.3% for total coliforms, *E. coli*, *Campylobacter*, *Listeria monocytogenes*, *Salmonella* and VTEC, respectively. Geographic location and season affected ( $P < .001$ ) total coliforms and *E. coli*; whereas total coliforms, *Campylobacter* and *Salmonella* were influenced ( $P < .05$ ) by strata. Means ( $\log_{10}$  cfu/cm<sup>2</sup>) for total coliform counts (1.44, 1.66, 2.03) and *E. coli* counts (1.22, 1.62, 2.06) varied significantly ( $P < .001$ ) among the three (Northeastern, Southcentral and Southwestern) regions of Ontario, respectively. Dressing method (bed vs. rail) influenced ( $P < .01$ ) the prevalent data of total coliforms (24.70% vs. 40.82%, respectively), *E. coli* (17.48% vs. 24.15%, respectively) and *Listeria monocytogenes* (8.43% vs. 14.63%, respectively). Hide removal system (manual vs. mechanical) also affected ( $P < .01$ ) the prevalence data of total coliforms (24.63% vs. 42.96%, respectively), *E. coli* (17.09% vs. 27.08%, respectively) and *Listeria monocytogenes* (8.85% vs. 13.72%, respectively). Results from shrouded and unshrouded carcasses were similar ( $P > .05$ ). Significantly more ( $P < .01$ ) samples collected from culled beef were positive for total coliforms, *E. coli* and *Salmonella* than from fed beef (36.51%, 24.87% and 4.23% vs. 26.72%, 17.92% and 1.29%, respectively). The within culled beef type analysis of the data has detected that a larger ( $P < .05$ ) percent of the samples positive for total coliforms, *E. coli*, *Salmonella* spp and *Campylobacter coli/jejuni* originated from cow carcasses. Similar analysis for the fed beef type shows that steer carcasses were more likely ( $P < .05$ ) to be found positive for total coliforms, *E. coli* and *Listeria*.

The microbial findings of the study will be used to establish microbial performance standards for beef processing in Ontario. Coupled with operational data the microbial results will be used to direct compliance and regulatory activities of the Food Inspection Branch towards the food processing activities of highest risk. The study findings will also be used as a statistical benchmark to assess future food safety intervention activities.

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# Microbiological Analysis of Raw Chicken Carcasses in Ontario Abattoirs

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The prevalence and levels of indicator and pathogenic bacteria on post-chill broiler and roaster chicken carcasses processed in Ontario's provincial abattoirs were evaluated in a study conducted between February 2001 and August 2002. Volume throughput data from the abattoirs was utilized to stratify abattoirs into large ( $\geq 100,000$  head/yr) and small ( $<100,000$  head/yr) volume groups.

Within Stratum, abattoirs were randomly selected weekly using probabilities proportional to slaughter volume. Using 400 mL buffered peptone water, randomly selected carcasses were shaken for 1 minute in sterile 3500 mL sampling bags. Information was collected concerning processing methods: scalding method; chilling method; dressing procedure (full, UDP, Hong Kong); evisceration method; temperature of chill tank; and chicken weight. Samples were packed in chilled shipping containers, time and date stamped, and shipped by courier to Laboratory Services Division, University of Guelph. Strict quality control criteria were observed for accepting/rejecting received samples. Misidentified, inadequate, frozen samples, warmer than 10°C or older than 24 hours were rejected.

Samples from 1480 post-chill carcasses were analyzed for: aerobic colony count (ACC), total coliform count (TCC), *Escherichia coli* count (ECC), *Listeria monocytogenes* (Lm), *Salmonella spp.* (S), *Campylobacter spp.* (C) and VTEC. Positive samples were quantified for S and C, and serotyped for S, C and VTEC. Serotyping of C and S was provided by Health Canada laboratories in Guelph and Winnipeg. Analytical methods for ECC, S, Lm, ACC, C and verocell assay for *E. coli* 0157:H7 were those described in the Health Canada, HPB Compendia of Analytical Methods and accredited by CFIA. S and C enumeration were performed using the Most Probable Number (MPN) procedures described by USDA.

Contamination rates were 99.86%, 98.99%, 29.95%, 31.55%, 63.85% and 0% for TCC, ECC, Lm, S, C and VTEC, respectively. The median log<sub>10</sub> cfu/ml for ACC, TCC and ECC were 3.95, 2.71 and 2.40, respectively; the median values for S and C were 0.64 and 0.63 log<sub>10</sub> MPN/mL, respectively. As an index of carcass contamination, 96.62% of the samples contained ACC (@ 35°C) of 10<sup>5</sup> or less cfu/mL. No significant association between Strata, season and geographical location and TCC prevalence data was detected (P>.05). ECC values were significantly lower in small volume plants (P<.05) and northeastern region (96% / 100% / 98% for Northeastern/Southcentral and Southwestern regions, respectively; P<.01). Data were analyzed under two seasonal groups, i.e., winter and spring formed a cold

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and wet group, summer and autumn formed a hot and dry category. ECC values were not associated with Season (99% vs 98% for cold/wet and hot/dry seasons, respectively;  $P > .05$ ). Significantly higher C (68% vs 60%;  $P < .05$ ) and S (33% vs. 30%;  $P < .01$ ) contamination rates were associated with hot/dry seasons. Carcasses from smaller volume plants had substantially less Lm and S than their large volume counterparts (14% vs. 47% and 20% vs. 45%, respectively ( $P < .001$ ), but higher C contamination (70% vs 58%, respectively;  $P < .001$ ). 50% of samples originated from automatically eviscerated carcasses, 90% were hard scalded, 83% had full or conventional dressing and 9% originated from carcasses that were both water and air chilled. No significant association was detected between TCC and scalding and evisceration methods ( $P > .05$ ). However, significantly higher ( $P < .001$ ) ECC values were associated with hard scalding and automatic evisceration procedures (99% vs 96% & 100% vs 98%, respectively). Similarly, hard scalding and automatic evisceration contributed to significantly higher Lm and S ( $P < .001$ ) contamination (31% vs 15% & 39% vs 14% for scalding & evisceration on Lm, respectively; 33% vs 16% & 43% vs 17% for scalding & evisceration on S, respectively). C was significantly lower in automatically eviscerated carcasses (63% vs 73%;  $P < .001$ ). Partially dressed carcasses contained significantly lower incidences of C (52% vs 66%;  $P < .001$ ). Significantly lower Lm and S were recovered from water and air chilled carcasses (18% vs 27%,  $P < .05$  & 18% vs 31%,  $P < .01$ ; respectively). A significant and positive correlation was detected between ECC ( $\log_{10}$  cfu/ml) and C ( $\log_{10}$  MPN/ml) values ( $r = .37$ ;  $P < .05$ ), indicating that *E. coli* (Biotype I) may serve as an indicator organism for C. Analysis of covariance identified that chilling temperature positively influenced ACC, TCC, ECC and C levels ( $P < .05$ ).

The microbial findings of the study will be used to establish microbial performance standards for chicken processing in Ontario. Coupled with operational data the microbial results will be used to direct compliance and regulatory activities of the Food Inspection Branch towards the highest risk processing activities. Findings will also be used as a statistical benchmark to assess future food safety intervention activities.

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# Microbiological Analysis of Raw Pork Carcasses in Ontario Abattoirs

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The prevalence and levels of indicator and pathogenic bacteria on hog carcasses processed in Ontario's provincial abattoirs were evaluated in a microbial baseline study conducted between December 1998 and January 2000. The study was designed to account for variations due to establishment size, geographic location of plants and seasonal impacts. To minimize experimental error and ensure adequate representation, volume throughput data from the abattoirs was utilized as design criteria for stratifying abattoirs into high, medium and low volume groups. Had a completely randomized design been used, 80% of the samples would have originated from only 8% of the plants.

Randomized sampling plans were developed on a weekly basis, providing for a sampling frequency that was based on probabilities proportional to volume within stratum. Carcass selection at the plant, using random number tables, was done by meat inspectors trained in aseptic sampling methodology. Carcass sampling was conducted 6-12 hours post-slaughter using sampling sponges with buffered peptone water as the diluent. Three sites on the carcasses were swabbed (belly, ham and jowl) using a 100 cm<sup>2</sup> template. Samples were packed in chilled shipping containers, time and date stamped and shipped by courier to Laboratory Services Division, University of Guelph for microbial analysis. A strict set of sample acceptance/rejection criteria was implemented. Only samples which were received by the laboratory within 24 hours of collection, complete with the three swabs, uncontaminated, non-leaking and whose temperature was between 0° and 8°C were accepted for microbial analysis.

Pooled sponge swabs of 1557 carcasses were submitted for microbiological analysis for: aerobic colony count, total coliform count, *Escherichia coli* count, *Listeria monocytogenes*, *Salmonella spp.*, *Campylobacter spp.* and verotoxigenic *E. coli* (VTEC). The analytical methods used for *E. coli* count, *Salmonella*, *Listeria monocytogenes*, and aerobic plate count were those accredited by the CFIA and described in the Health Canada, HPB Compendium of Analytical Methods, volume 3. The *C. jejuni/coli* analytical method and the verocell assay for *E. coli* 0157:H7 were modifications of those described in the former Agriculture and Agri-Food Canada laboratory procedure manual. Serotyping of *Campylobacter* and *Salmonella* isolates was provided by participating Health Canada Laboratories in Guelph and Winnipeg.

The microbial contamination data was statistically analyzed (SAS) for underlying associations with establishment

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size (Strata), geographical location, and season.

The contamination rates were 61.3%, 39.5%, 10.7%, 4.8%, 26.7% and 2.1% for total coliforms, *E. coli*, *Listeria monocytogenes*, *Salmonella*, *Campylobacter* and VTEC, respectively. Of the samples analyzed for the indicator organisms, 70% of them had aerobic colony counts (@ 35°C) of 10<sup>5</sup> or less colony forming units per cm<sup>2</sup>, whereas almost all of the samples with *E. coli* (Biotype I) contamination contained 10<sup>5</sup> or less colony forming units per cm<sup>2</sup>. The prevalence data of total coliforms (71.3%, 59.5%, 50.1%), *E. coli* (44.4%, 40.2%, 32.0%), *Listeria monocytogenes* (16.6%, 7.9%, 6.1%) and *Salmonella* (9.0%, 3.6%, 0.5%) were significantly different (P<.001) among the high, medium and low volume strata. Strata prevalences for *Campylobacter* (27.4%, 28.5%, 23.5%; P>.05) and VTEC (1.2%, 2.7%, 2.4%; P>.05) were similar. The prevalence data of *Campylobacter* (38.1%, 31.3%, 20.0%, 22.5%) and VTEC (3.3%, 3.5%, 2.0%, 0.6%) were significantly influenced (P<.001) by season (winter, spring, summer and autumn, respectively). Prevalence data of total coliforms, *E. coli*, *Listeria monocytogenes* and *Salmonella* have also indicated that microbial values peaked (P<.01) in the warmer months. Strata and geographic location had a significant impact on aerobic colony counts (P<.001). Means (log<sub>10</sub> cfu/cm<sup>2</sup>) for aerobic colony counts (4.69, 4.59, 4.21; P<.001), total coliform counts (1.64, 1.51, 1.44; P<.001) and *E. coli* counts (1.37, 1.33, 1.20; P<.05) were linearly different among the high, medium and low volume strata, respectively.

The microbial findings of the study will be used to establish microbial performance standards for pork processing in Ontario. Coupled with operational data the microbial results will be used to direct compliance and regulatory activities of the Food Inspection Branch towards the food processing activities of highest risk. The study findings will also be used as a statistical benchmark to assess future food safety intervention activities.

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# Renewing Ontario's Food Safety System

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In response to global food safety events in the late 1990's, Ontario embarked on a thorough review of its provincial food safety and inspection system. Led by the Ontario Ministry of Agriculture and Food (OMAF), since 2000 the Ontario government has been updating its system to:

- cover the entire food chain from “field to fork”,
- be based on a scientific assessment of the risks,
- harmonize legislation with national standards, and
- incorporate modern approaches and new technologies.

Other Ontario ministries involved in the review include the Ministry of Health and Long-Term Care and the Ministry of Natural Resources.

The process of updating Ontario's food safety system comprises many activities, including:

### **1. Information Gathering and Risk Assessment**

Baseline studies are being conducted to assess the risks in various foods including:

- pork, beef and poultry,
- cider, sprouts and minimally processed vegetables,
- sheep and goat milk, pasteurized fluid milk and fish.

Contaminants, which depending on the food may include pathogens and environmental or pharmaceutical residues, are being monitored. Part of the risk assessment includes identifying methods of managing the risks, which for some sectors may require an assessment of their current industry practices. In order to gather this information, inventories of current systems have been completed or are underway for:

- non-slaughter meat processing plants,
- dairy sheep and goat producers,
- fish processors,
- cider pressers, and

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- sprout producers and processors.

## 2. Developing Programs, Standards and Legislation to Manage the Risks

The review of the food safety system identified the need to continue to raise awareness and promote change in the agri-food industry. Since 1999, Ontario has supported several programs aimed at improving food safety in the agri-food sector, including:

- Healthy Futures for Ontario Agriculture has encouraged industry initiatives to meet market demands with regard to food safety and quality through partnerships along the food production continuum.
- The recently announced program for Food Safety Education and Training will provide greater access to training on food handling, good manufacturing practices and HACCP for small and medium food processors.
- Ontario's food safety research program has committed to date over \$3 million toward research and development in priority areas including test development and validation, risk assessment, risk management and control.
- OMAF continues to work both nationally and with the provincial agri-food industry on the development of On-Farm Food Safety and HACCP Programs.

A signature initiative in the update process was the development of the *Food Safety and Quality Act, 2001* (FSQA). This enabling legislation provides a firm basis for the regulatory framework that it will support, including powerful inspection and enforcement measures and penalties. It is based on the Model Provincial Act for Food Safety and Inspection that was developed nationally by the Canadian Food Inspection Implementation Group. Regulations for meat and poultry, and sheep and goat milk are now being developed under the FSQA based on the national standards developed for those areas. A regulation regarding dead animal disposal and additional regulations may be developed for higher risk foods.

The poster will illustrate how the various components fit together to form an updated and comprehensive Food Safety System for Ontario.

## NOTES

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