# BACKGROUND

## Food Safety Is Everyone's Business

The eating habits of Canadians have transformed during the past decade. As the health benefits of minimally processed fruits and vegetables have become more widely known and accepted, the variety and quantity consumed have increased dramatically. In addition to familiar, locally grown foods, consumers have access to foods from around the globe.

In response to busy lifestyles, many foods are now prepackaged in a minimally processed, ready-to-eat, value-added form. Regrettably, there has also been a corresponding rise in the number of foodborne illnesses linked to fruits and vegetables even as the overall incidence of foodborne illness appears to be decreasing.

All food producers and processors have an obligation to produce and sell food that is both safe and of high quality. Traditional production practices may no longer be adequate to meet society's increasing food safety and quality expectations. Consumer confidence in the safety and quality of Ontario-grown food and the long-term viability of Ontario's producers will be secure only if everyone in the industry is proactive on food safety and quality issues.

Throughout the food production, processing and distribution continuum, disease-causing, toxic or other harmful hazards may be introduced into the food supply. These hazards may be biological, chemical or physical. Ingestion of food containing any of these hazards may result in illness or injury.

## Types of Contamination

Bacteria, moulds, parasites and viruses are everywhere in the environment. Some of these microorganisms are beneficial to humans, and many are harmless. However, others, known as pathogens, have the potential to cause foodborne illnesses.

More than 250 known diseases are transmitted through food by biological hazards. In foods of plant origin, these hazards include the pathogenic bacteria *Salmonella* spp., *Escherichia coli* (*E. coli)* O157:H7, *Shigella* spp., *Listeria monocytogenes*, and many others that may result from food contact with soil, water, manure, sewage, animals, air and/or humans. Illness-causing parasites include *Cryposporidium*, *Cyclospora*, *Giardia*, *Entamoeba*, and others. Infected food handlers may introduce viruses such as Hepatitis A, noroviruses and rotaviruses into food. Moulds growing on

the ceilings of coolers and production areas can produce chemical mycotoxins, some of which are toxic enough to cause acute or chronic illness if consumed. To further complicate the issue, previously unknown pathogens continue to be discovered by scientists.

Some chemical contaminants occur naturally; some are a result of environmental contamination. Allergens and mycotoxins (e.g., aflatoxin, patulin) occur in nature. All can be hazardous to human health.

Chemical contaminants may also be added during agricultural production or during processing. Added chemicals may come from pesticides, fertilizers, lubricants, cleaners, sanitizers, pest control products and a multitude of other sources. Food additives or processing aids at levels over the prescribed limit are also chemical contaminants. **Ingestion of certain chemicals or combinations of chemicals can cause chronic illness or even death.**

Physical contaminants such as glass, metal and plastic fragments can injure those inadvertently consuming them. These contaminants can enter food during harvest, transport, storage or processing.

## Extent of Foodborne Illness —Canada

Estimating the extent of foodborne illness is an inexact science. Scientific methodology, statistical analysis, commodity groupings, and a host of other factors usually differ from study to study so an apples-to-apples comparison is often impossible. This should be kept in mind while reviewing any studies, including those that follow.

OMAFRA's Food Safety Science Unit (FSSU) estimates[1] that 41 per cent of foodborne illness in Ontario can be attributed to foods of plant origin. This exceeds every other food group including meat, fish, dairy and eggs. On average, FSSU estimates that foods of plant origin caused 90,200 illnesses annually from 1997 to 2001. The estimated annual health-related cost (health care, lost wages and other economic losses caused by illness) resulting from these foodborne illnesses was $143,591,577, second only to foodborne illness costs associated with meat.

During the same period, studies in the United States estimated produce-related illness outbreaks at 12 per cent of the total food-related outbreak total.

[1] with 90 per cent confidence

A report published in the June 2003 *Journal of Food Protection* offers insight into the relationship between intestinal illnesses in Ontario and food contamination. The report, titled *Enteric Illness in Ontario, Canada, from 1997 to 2001*, identifies foodborne contamination as the mode of transportation for 74.0 per cent (14,580) of the outbreaks caused by eight enteric pathogens. Foods of plant origin accounted for 31.6 per cent of the contaminated food investigated in this report.

The *Enteric Illness* report concluded that there appears to be a downward trend in the number of eight enteric diseases studied in the 1997 to 2001 period compared to the previous 1992 to 1996 five-year period. Despite an increase in population, the number of cases from 1997 to 2001 (44,451) was fewer than the number of cases reported from 1992 to 1996 (56,690). No reason for this decline is offered. In all foods, *Campylobacter* was the leading cause of illness in Ontario in both five-year periods, followed by *Salmonella*, VTEC (verotoxin *E. coli*), *Yersinia*, *Shigella*, Hepatitis A, *Listeria*, and *Clostridium botulinum*. There were 113 foodborne-illness-related deaths in Ontario between 1997 and 2001. The report cautions, "Although the incidence of these enteric diseases appears to be declining, the potential remains for occurrences of large outbreaks resulting from a pathogen having contaminated a widely distributed food product or a large water distribution system."

## Extent of Foodborne Illness —United States

Using statistics derived from the U.S. Centers for Disease Control, the Center for Science in the Public Interest (CSPI) linked 554 illness outbreaks involving 28,315 illnesses to produce between 1990 and 2003. Twenty-four per cent of these produce-related outbreaks were caused by salads, 18 per cent by produce dishes, 16 per cent by vegetables other than those listed below, 10 per cent by fruits other than those listed below, 8 per cent by lettuce, 5 per cent by sprouts, 5 per cent by potatoes, 5 per cent by melons, 3 per cent by mushrooms, 3 per cent by berries, and 3 per cent by home-canned vegetables. Produce accounted for more foodborne illness than seafood, poultry, beef or eggs.

The Foodborne Diseases Active Surveillance Network's report titled *Preliminary FoodNet Data on the Incidence of Infections with Pathogens Transmitted Commonly through Food—Selected Sites, United States, 2003* states, "For most pathogens, the 2003 incidence of infection was lower than the average annual incidence for 1996–1998" (p. 11). It goes on to note that "the changes in the incidence of these infections occurred in the context of control measures implemented by government agencies and the food industry, enhanced food safety education efforts, and increased attention by

consumer groups and the media" (p. 19). In other words, food safety programs, including changes in regulation, education and improved technology, are positively impacting food safety.

Reiterating concerns expressed in other reports, the *Preliminary FoodNet Data* report suggests that "efforts also should include steps to reduce contamination of fresh produce. The high incidence of several of these infections in infants and young children is of major concern."

Centers for Disease Control and Prevention (CDC) scientists in the United States warn against relaxing food safety efforts. The true number of foodborne illnesses is not known because of an undetermined amount of underreporting. (The CDC estimates that only one of every 37 foodborne illnesses is reported.). Mass production, widespread distribution and increased importation enable pathogens to spread more rapidly and broadly through the population than in times of local production and distribution. Scientists have been unable to determine the causes of a portion of foodborne illnesses possibly because they are caused by unknown pathogens.

**Reducing Risk**

No food product can ever be entirely risk free. The risk associated with consumption of any food depends on the quantity of contamination consumed, the strength (toxicity) of the contaminant involved and the susceptibility of the individual(s) consuming the contaminant (e.g., age, level of health, status of immune system).

Although the overall number of foodborne illnesses declined during the last five-year period, the number of foodborne illnesses in fruits and vegetables has increased. In large part, this increase is due to the greater level of consumption of whole and minimally processed fruits and vegetables, changes in consumer demographics, and more intensive production, processing and handling practices.

**Implementation Rationale**

Consumers and governments expect our food to be safe. Their expectations are not negotiable.

Traditionally, final product sampling has been used to identify suspect product. However, when pathogens are present, they are often randomly distributed at low levels, so they are extremely difficult to detect. This makes the cost of statistically valid sampling programs uneconomical. An example used by Dr. James Gorny of the International Fresh-cut Produce Association illustrates this point. According to Dr. Gorny, if pathogens are

present on 5 per cent of the final product, in order to have a 95 per cent probability of finding that contaminated 5 per cent, 60 per cent of the final product must be tested. This involves prohibitive costs, and the testing process is often painfully slow.

Because there are no known processing procedures that will completely eliminate contamination in minimally processed foods, and because final product-testing programs are slow, costly and ineffective, universally recognized prevention systems have been developed to minimize the risk of hazard introduction.

## Food Safety Programs

Food safety programs are preventive systems designed to detect potential hazards before they occur and to implement control measures to reduce or eliminate the likelihood of their occurrence. Food safety programs may be divided into three general areas.

The first of these proactive systems is the application of Good Agricultural Practices (GAPs) during growing, harvesting, on-farm transportation, packing and storage. Examples of programs for specific commodities may be accessed through the Canadian Horticultural Council (CHC). Excellent programs have also been developed by Cornell University, the University of California Davis (UC Davis) and the United States Food and Drug Administration (USFDA). GAPs may be developed as a stand-alone program. These programs for produce growers are currently voluntary.

At the processing level, Good Manufacturing Practices (GMPs) are the basic, universal conditions and procedures within the processing establishment that create conditions favourable for the production of safe food. GMP requirements are largely common-sense practices. They include all physical aspects of the production facility environment, as well as operational management of food handler hygiene, sanitation, chemical use, equipment maintenance, pest control, water safety, shipping, receiving, storage and recall procedures. None are process specific. As with GAPs, GMPs may be developed as a stand-alone program. These programs for foods of plant origin processors are currently voluntary. However, processors may choose to undergo a CGSB audit to become *GMP Advantage* certified.

Standard Operating Procedures (SOPs) and Sanitation Standard Operating Procedures (SSOPs) are an essential part of GMPs. SOPs are detailed documents that specifically define how procedures will be performed. SSOPs are the written procedures that describe step-by-step cleaning and

## Components of a Food Safety System

**Good Agricultural Practices**
(GAPs)

*Practices used in the growing, harvesting, sorting, packing, and storage operations to reduce contamination.*

**Good Manufacturing Practices**
(GMPs)

(also called Prerequisite Programs)

*Basic, universal conditions and procedures within the processing establishment that create conditions favourable for the production of safe food. They control general hazards.*

**Environmental Controls**
- Establishment Location and Construction
- Establishment Design
- Establishment Interior
- Equipment
- Water Supply

**Operational Controls**
- Personnel Practices
- Shipping, Receiving, Handling and Storage
- Sanitation
- Equipment Maintenance
- Pest Control
- Recall
- Water Ssafety

**Control Programs (written policies and procedures)**
- Personnel Practices
- Shipping, Receiving, Handling and Storage
- Sanitation
- Equipment Maintenance
- Pest Control
- Recall
- Water Safety

**Training**
- Personnel Practices
- Shipping, Receiving, Handling and Storage
- Sanitation
- Equipment Maintenance
- Pest Control
- Recall
- Water Safety

**HACCP**
**Hazard Analysis**
**Critical Control Points**

*A world-wide recognized, science- based, preventative system designed to detect potential hazards before they occur and to implement control measures to reduce or eliminate the likelihood of their occurrence.*

sanitation procedures required in a GMP sanitation program. Both include who, what, where, when and why. Each is tailored to individual operations as part of the operation's food safety plan.

HACCP is the final step in implementation of food safety practices in an operation. **HACCP is not a stand-alone program.** Only after a GMP program is in place can a Hazard Analysis Critical Control Points (HACCP) plan be prepared. During the development of a HACCP plan, potential biological, chemical and physical hazards are identified in the manufacturing process. Control and monitoring measures are implemented at these critical control points (CCPs) to ensure that the identified hazards are reduced, prevented or eliminated. Actions taken are recorded.

Worldwide acceptance and recognition of HACCP as a method for food safety assurance increased dramatically with publication of the *Guidelines for the Application of Hazard Analysis and Critical Control Points System* by the Food and Agriculture Organization (FAO)/World Health Organization (WHO) Codex Alimentarius Commission in 1993. Since then, as HACCP has gained worldwide acceptance, the Codex Alimentarius Commission has continued to refine the HACCP system and guidelines for its application.

## Food Safety Program Accreditation

Until recently, only federally registered food processors could gain HACCP accreditation through the Canadian Food Inspection Agency's Food Safety Enhancement Program (FSEP). However, the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) has designed a HACCP program for non-federally registered food processors called *HACCP Advantage*. It was introduced in 2003.

The voluntary *HACCP Advantage* program is designed to be feasible regardless of the size, commodity or volume of production of an operation. It complements food safety regulations but does not replace them.

As of March 1, 2006, food processors that wish to have their *HACCP Advantage* program certified by the Canadian General Standards Board (CGSB) have three options:

- *GMP Advantage*: CGSB certification that the requirements for environmental controls, control programs, operational controls and training have been met. For many foods of plant origin processors, this may be all that is required.

- *HACCP Advantage*: Certification includes requirements of the *GMP Advantage* program plus a HACCP plan, as outlined in the *HACCP Advantage* guidebook.

- *HACCP Advantage Plus*$^{+}$: To achieve certification, requirements of *GMP Advantage*, *HACCP Advantage*, four standards relating to traceability and eight standards relating to security must be achieved.

This *Minimally Processed Fruits and Vegetables Good Manufacturing Practices Guidebook* is consistent with the format of the *GMP Advantage* program manual. However, rather than cover all commodities, it is designed specifically to deal with challenges specific to fruit and vegetable operations. OMAFRA recommends that all fruit and vegetable operations implement the programs described in this manual, regardless of whether or not they plan to seek formal *GMP Advantage* certification.

## The Economics

The benefits of food safety programs are many. Some are tangible, money-in-your-pocket kinds of rewards, while others are less easily measured.

Implementation of effective food safety and quality control programs require critical examination of every aspect of facility environment and operations. This greater level of control generally leads to enhanced production efficiencies including higher production levels, increased yields resulting from less product waste, a reduced requirement for product rework, a more consistent product and increased shelf life. Less easily measured is the financial and emotional impact of fewer crises and freed management time. These tangible benefits are additional to increased protection from financial loss caused by unsafe product, increased credibility with buyers and the resulting potential for larger market share.

Obviously, certain costs are involved in the implementation of a food safety program. Some will be one-time costs (e.g., facility and/or equipment upgrades, developing and implementing programs) and some will be recurring (e.g., training, monitoring and record keeping). The number of products, the complexity of the processing procedures and the number of potential food safety hazards to be addressed also affect cost.

Ongoing economic studies suggest that long-term financial benefits of a GMP program generally outweigh the added costs. Therefore, an effective GMP program should be considered an investment in the business, not a cost of doing business.