8

Food Quality

FOOD QUALITY

While poor nutrition probably remains the most important food-related health issue for Canadians (with nutrition-related chronic diseases remaining prevalent in Canada), many people may also be worried about food quality. Common concerns include the quality of sport-caught fish, the use of pesticides and chemicals during food production and handling, the use of drugs such as antibiotics and hormones to treat livestock, and the use of food additives and preservatives.

8.1 Exposure to Contaminants from Food

Exposure to contaminants through food is affected by many factors: food availability, method of preparation, amount and type eaten, age, occupation, gender, health status, culture, religion, socio-economic factors, geography and the nature of the contaminant. Canadian dietary surveys indicate that, in general, exposures are below guideline limits and the intake of some contaminants such as DDT and dieldrin has decreased significantly.

Estimating Exposure from Food

To estimate how much of a contaminant is eaten with food requires a knowledge of eating habits of the group or population being studied, and knowledge of the concentration of the contaminant in different kinds of food. Eating habits, i.e., the amount of each different kind of food eaten in the community and by individuals may differ from the national average. For example, in some communities, far more fish is eaten than the average for Canada.

Food generally accounts for about 80 to 95 percent of our daily intake of most persistent toxic contaminants, air contributes about 10 to 15 percent, while drinking water contributes very little.
(Parfett et al. 1994; Feely 1994)

Sources of Food Contamination

Food supplies of Canadians are considered to be among the safest in the world, with food related concerns generally ranked in the following order:

- **Microbial contamination** — microbial contamination heads the list because it can be introduced in so many ways, e.g., during processing and packaging, by incorrect handling or storage, and through improper preparation of foods in restaurants or homes;
- **Environmental contamination** — chemical contaminants can enter the food supply through uptake from the water or soil and by air deposition on leaves and fruit. Some contaminants bioaccumulate in such a way that the concentration of a potentially harmful substance can increase to harmful levels when it reaches the top of the food chain;
- **Naturally occurring contaminants** — naturally occurring contaminants include natural carcinogens found in foods, plants and herbs as well as seafood toxins and parasites;

- **Pesticide residues and chemicals in meat and milk products** — residues of chemicals used in food production and handling are found on produce. Hormones and antibiotics are used to increase meat and dairy production.
- **Food additives and preservatives** — chemicals and other substances are added to food to preserve freshness, improve aesthetic quality and to enhance flavour and colour.

8.2 Microbial Contamination

Bacteria in Raw Food

Every year, some 10 000 cases of food poisoning are reported in Canada — a number which is steadily rising. Health authorities believe that for every reported case there could be 100 unreported cases. Some bacteria are pathogens (disease-causing agents) and are found in raw foods such as meats and poultry, eggs and unpasteurized milk.

The three types commonly found in raw foods and associated with food poisoning are:

- ***Salmonella*** — identified several decades ago (there are 2000 different varieties known);
- ***Campylobacter*** — identified within the past 20 years (there are more than 100 known varieties); and
- ***Escherichia coli*** — identified as a disease-causing bacterium that may be present in undercooked and raw meat and poultry and in raw milk and eggs. Of all the bacteria found in raw food, *E. coli* has the greatest potential to cause serious disease in humans. It can lead to bloody or watery diarrhea and may cause kidney damage in children and the elderly.

Not everyone who consumes bacteria-contaminated food will develop food poisoning. Cases of food poisoning are most common during the festive seasons (Thanksgiving, Christmas, New Years) when poultry is a popular food and during the barbecue season (July and August).

The most common symptoms of food poisoning include stomach cramps, nausea, vomiting and diarrhea (any of which can be mistaken for indigestion or stomach flu), and fever. Severe cases may require hospitalization. For infants, the chronically ill or the very old, food poisoning can result in death.

Because contaminated raw foods often look, smell and taste normal and because bacteria can spread between raw foods and prepared foods, it is important to remember that the proper handling and cooking of foods can significantly reduce the risk of disease in humans.

The only certain way to eliminate bacterial contamination of raw foods is to irradiate them, a practice that is not currently followed in Canada. However, bacteria in foods can be significantly reduced, even eliminated, if you follow safe handling and cooking practices.

Since bacteria thrive and multiply at room temperature (indeed, many can grow at temperatures between 4°C and 60°C), it is important to keep raw foods cold until they are to be cooked. Raw poultry and meat should be refrigerated or

frozen immediately after purchase. Frozen poultry should be thawed in the refrigerator or in cold water.

Wash your hands well before and after handling raw meat or poultry. Avoid cross-contamination by keeping your utensils and kitchen surfaces clean including the cutting board). Bacteria are difficult to remove — a quick wipe of surfaces may only move bacteria around. To kill them, you must remove all food residues, wash surfaces with hot soapy water and disinfect with household bleach (30 to 45 ml of household bleach in one litre of water).

Thorough cooking of poultry, meat and eggs will kill all the bacteria in the food. Poultry that is pink from undercooking should not be eaten. Use a meat thermometer to determine whether poultry is completely cooked. If this is not possible, some indications that the poultry is well cooked are when the whole leg of the bird moves easily and the meat is fork-tender. It is prudent to cook stuffing separately. The same applies to ground-up meats such as hamburger. Eggs, especially those with cracked shells, should not be eaten raw or partially cooked (still runny).

Proper handling of food after cooking is also important. Cooked meat, poultry and stuffing should be eaten immediately or stored in the refrigerator or freezer. A good rule of thumb is to "keep hot foods hot and cold foods cold."

(See also *Contaminant Profiles*.)

Q. What is barbecue syndrome?

A. Barbecue syndrome is the common name for a type of food poisoning caused by verotoxigenic *E. coli* or VTEC, a coliform bacterium. The VTEC bacteria live in the intestines of cattle, other meat animals (such as pigs and sheep) and possibly poultry. The syndrome is sometimes called "hamburger disease," (ground beef may contain higher numbers of the bacteria than other foods because the grinding process helps to spread the bacteria through the meat). However, people have become ill after eating other kinds of undercooked meat and poultry, and after drinking unpasteurized milk or unchlorinated water.

Some people who are infected with VTEC do not get sick at all; some feel like they have a bad case of the flu, others experience severe or even life threatening symptoms. VTEC is the number one cause of kidney failure in children. Children, the elderly and other people whose immune systems are not fully functional are at greatest risk of developing more serious illness.

Studies have shown that VTEC and its toxin are easily destroyed at temperatures achieved when food is fully cooked. Proper handling and cooking of food can practically eliminate this disease:

- Meat should be refrigerated or frozen as soon as possible after being purchased. It should always be thawed in the refrigerator, not at room temperature. Meat should not be removed from the refrigerator until just prior to cooking.
- Prepare thin hamburger patties to allow the hamburger to cook thoroughly so that the meat is brown and the juices are clear rather than pink. You can eat most roasts and steaks a little rare, as long as they are well-cooked on the outside. However, rolled roasts must be cooked like ground meat, so that no pink remains. Poultry also must be cooked until there is no pink left near the bone. Cooked foods must not come

into contact with uncooked foods, or with plates and utensils which have been in contact with uncooked foods.

- Eat cooked foods while still hot. Foods left to cool at room temperature permit the growth of a number of disease-causing micro-organisms. Likewise, leftover food should be refrigerated immediately.
- Wash dishes, cutting boards and counters with hot, soapy water and bleach after handling meat to prevent bacteria spreading to other foods. Wash your hands both before and after handling foods.
- Make sure foods that should be cooked are served to you well cooked and hot. If they are not, ask for them to be cooked longer whether you are eating out in a restaurant or elsewhere.
- Avoid drinking raw or unpasteurized milk.

Source: Health and Welfare Canada. *Issues — Barbecue Syndrome*. February 22, 1993. (See also Chapter 3. "Contaminants," and Chapter 4. "Exposure")

THE MAJORITY OF HUMAN EXPOSURE TO MANY PERSISTENT TOXIC CHLORINE-BASED CHEMICALS, SUCH AS PCBS, IS THROUGH FOOD, PARTICULARLY WILD GAME AND SPORT-CAUGHT FISH.

8.3 Environmental Contamination

Fish and Wildlife Consumption

Biota in lakes and rivers can take in and accumulate persistent chemicals, including polychlorinated biphenyls, some pesticides (e.g., DDT, dieldrin, hexachlorobenzene, mirex), and dioxins. Fish and wildlife, such as ducks, geese, crayfish, turtles and moose, accumulate these chemicals in their fatty tissues, muscle and organs after eating contaminated plant life, fish or sediments. Fish, crayfish and some insect larvae also absorb them directly from the water through their gills.

In some lakes (especially inland lakes) and rivers in Ontario, and areas of the Great Lakes, fish can be contaminated with methyl mercury. Instead of being stored in fat, methyl mercury attaches to proteins in fish flesh, accumulates in the liver and builds up over time. Kidney and liver of terrestrial wildlife, (e.g., moose, caribou and bear) and marine mammals, (e.g., seals and whales) can contain high levels of cadmium. Lead can accumulate in fish flesh in lead-polluted waters.

Which Fish?

Contamination varies by locale, species and origin. Many bodies of water that are polluted still have large populations of edible fish. However, contamination levels in certain fish can be a million times higher than levels found in the water they live in. As described earlier, the process of biomagnification increases the levels of contamination up the food chain, and as a result top predator species such as lake trout, walleye and salmon tend to become most highly contaminated.

Organochlorines build up in organs and fat over time, meaning older, larger fish are usually the most highly contaminated. Shorter lived species like perch are generally less contaminated than longer lived species such as salmon. Bottom-dwelling species that feed in contaminated sediments, such as brown bullhead, white sucker or carp, are also likely to accumulate more contaminants.

Fish Advisories and Resources

In Ontario, the Ministry of Environment and Energy publishes a biennial update of the *Guide to Eating Ontario Sport Fish*, which contains advice on species types, recommended consumption levels, and location of sport fish species by water body. The Ontario Ministry of Environment and Energy does yearly testing on thousands of fish from many locations throughout Ontario. The advice in the guide is prepared by comparing test results and by taking into account any guidelines, tolerances and tolerable daily intakes set by Health Canada for a number of contaminants in commercial fish. These guidelines are under constant review and revision as new scientific data become available. The consumption advice in this guide is stricter for children and women of child bearing age.

Samples of fish caught and sold **commercially** are routinely monitored by the Department of Fisheries and Oceans before they are offered for sale.

Who Is At Risk?

Some people eating large amounts of freshwater fish and/or wildlife may be at higher risk of adverse health effects either because of:

- **High exposure**: Some people are likely to eat more fish than the general population. Groups such as Southeast Asian Canadians and Aboriginal peoples who may traditionally rely on freshwater fish as a dietary staple, sport anglers, and others who subsist on fish out of financial necessity, may all have higher exposure; people who regularly consume large amounts of such wild foods as waterfowl eggs, turtles and turtle eggs, muskrat, otter, moose or deer may also be at higher risk.
- **Greater susceptibility**: Developing fetuses of mothers who eat contaminated fish may be susceptible to developmental effects due to high exposure, (e.g., to PCBs or methyl mercury) before and after birth. Infants are susceptible to contaminants that reach them via the mother's milk through breast feeding. Older people, children under 15 and people with diseases that weaken the immune system may also be at greater risk.

Barriers to information are the primary reason why many people at higher risk do not change their fishing and fish-eating habits. Some people are unable to read and understand fish advisories. These anglers may include: first generation Canadians who are eating contaminated fish and who face language and cultural barriers; anyone with a low literacy level; and anyone fishing without a licence who may never see the *Guide to Eating Ontario Sport Fish* or hear about advisories.

Exposure

Persistent toxic chemicals such as organochlorine pesticides or PCBs are stored in body fat and tend to be eliminated very slowly. Therefore over time they will concentrate in our bodies. Almost all Canadians today have small amounts of DDT and PCBs in their blood and fatty tissues. A woman with high levels of stored PCBs, can transfer PCBs directly to her fetus while pregnant, and then

later her infant can receive additional PCBs through her breast milk. Almost all women have measurable amounts of PCBs in their breast milk. People who eat a lot of fish and wildlife with high PCB levels have higher concentrations of the chemical in their bodies than the general population.

With time, the body can eliminate many contaminants, provided that exposure is stopped. This time period can vary from several months (e.g., for mercury) to many years (e.g., for persistent chlorinated contaminants such as DDT). Harmful levels of contaminants may be found in the body only if the person eats large amounts of contaminated fish and/or wildlife frequently.

Q. Can contaminants in fish affect childhood learning and behaviour?

A. Animal studies and a longitudinal epidemiological study suggest that persistent chlorinated pollutants can affect the developing fetus. Babies born to mothers who ate very large amounts of highly contaminated fish from Lake Michigan had smaller birth weights, smaller head circumferences and shorter attention spans than babies born to those not eating fish. As they have grown older these children have continued to do more poorly in a range of skill and development tests. While other factors could account for some of these results, the studies suggest that high level exposure to persistent chlorinated pollutants can cause developmental deficits in animals and humans.

Q. Who is at risk?

A. High risk groups may be groups of people least informed and supported in protecting themselves from exposure to toxic chemicals. For example, certain ethnic minorities, especially first generation immigrants, may not be able to read the fish advisories written in English or French or may come from a culture where it is extremely difficult to change fish cooking customs. Added to this, a low income may result in the need to feed the family frequently on caught fish. Fish licences may seem too costly or people may not have heard about them.

Health Effects

There are many nutritional benefits of eating fish. Fish is an excellent source of protein, low in fat. Fish is an important dietary staple in certain communities and for certain individuals.

In laboratory animal and wildlife studies, organochlorine pesticides and PCBs have been linked to many health effects, including ill effects on the immune system, fertility, pregnancy, birth and the development of offspring. A limited number of studies have indicated that organochlorines are linked to reproductive, developmental and immune system effects in humans as well. There is some evidence that *in utero* exposure to high PCB levels can cause maturational delay in the fetus and developmental delay in primates.

Mercury is known to affect the human nervous system. Unborn babies, children, and pregnant women may be more sensitive to mercury.

(See *Contaminant Profiles* for information on cadmium, dieldrin, dioxins, hexachlorobenzene (HCB), lead, mirex, PCBs and toxaphene.)

Reducing Exposure: Considerations for Anglers and Wildlife Eaters

1. Dispel myths

Some anglers feel they will be able to tell if a fish is contaminated, and will decide whether to eat a fish based on appearance of the fish or of the water in which the fish was caught, depending on smell, taste, or whether there are dead fish in the area. It is important to note that it is usually impossible to see, feel or smell low levels of toxic chemicals in fish. For example, PCBs, mirex, dioxins and mercury are all odourless and tasteless at the concentrations usually found in water and fish.

2. Use **A Guide To Eating Ontario Sport Fish**

The guide is available from many fishing licence outlets, fishing and hunting stores, beer stores, or any Ministry of Natural Resources or Ontario Ministry of Environment and Energy office.

- Remember the consumption advice in the guide is stricter for children under 15 and women of childbearing age (pregnant women, women intending to become pregnant or breast-feeding mothers). These groups should only eat fish from the "unrestricted" category.
- Size and type of fish are important. Choose fish that are:
  - shorter/(younger);
  - shorter-lived;
  - non-fatty (to reduce organochlorines only); and
  - prey species.

3. Intake of specific organochlorine chemicals can be minimized by the proper cleaning, trimming, and skinning of Great Lakes fish

To reduce organochlorine contaminants, trim and discard:

- the skin;
- the fat along the backbone;
- the fat along the lateral line; and
- any belly fat from the fish.

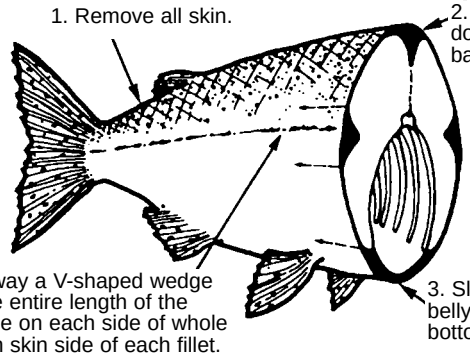
Use cooking methods that reduce fat content:

- broil fish on a rack;
- discard fatty juices;
- avoid making fish chowders where the fat is kept in the soup; and
- discard organs.

Note: Preparation and cooking methods will not affect the levels of methyl mercury.

Figure 8.1

CLEANING GREAT LAKES FISH



Some Great Lakes fish are contaminated with low levels of toxic chemicals. You can minimize your intake of these chemicals by properly cleaning, trimming, and skinning your fish. Follow the four steps.

Cooking does not destroy chemicals but the heat from cooking melts the fat in the fish, removing some chemicals. Do not use fish drippings in anything meant to be eaten. Discard fish drippings in the garbage.

Source: University of Wisconsin Sea Grant Institute, 1800 University Ave., Madison, WI, 53705.

4. Communicating risk to the community

The health professional plays an important role in providing information to the community about exposure to contaminants in fish and wildlife.

The message in most areas of the Great Lakes basin is that fish is nutritious and can be eaten under most conditions. While fish may be an important source of nutrition for some people, advice should be offered to women of childbearing age, pregnant women and nursing mothers or parents with young children, to select and prepare their catch carefully. It is important not to dissuade people from eating freshwater fish.

Note: Consumption of certain marine fish and canned fish can contribute contaminants to the diet as well. For example, the Canadian guidelines/tolerances for chemical contaminants in fish do recommend that swordfish and shark consumption not exceed one meal/week (based on mercury contamination).

Health professionals may incorporate safer fish and wildlife eating information into their regular health education programming. Programs on nutrition, cooking classes, pre- and post-natal programs, and infant health programs are all natural settings in which to deliver such information. Health professionals can give credibility to the health messages provided by the fish advisories. Local fish consumption advisories can be posted in the appropriate languages at beaches, boat access points or ramps, community halls, in community newspapers and in doctor's offices, health clinics etc.

Health professionals may also need to identify individuals and groups consuming large amounts of fish and wildlife, who may be at higher risk in the community. They can assess their patients' potential health risks by questioning and evaluating their patients' food consumption patterns. An understanding of the importance of fish and wildlife in the diet is of the utmost importance. In some communities, fish and wildlife consumption provides a large part of the nutritional requirements. This may be true for Aboriginal communities, for certain immigrant communities and for others. There are cultural and economic considerations related to fishing and hunting to take into account as well.

FISH ADVISORIES

HEALTH PROFESSIONALS SHOULD BE AWARE OF LOCAL FISH ADVISORIES AND BE ABLE TO OFFER ASSISTANCE TO THOSE IN THE COMMUNITY WHO MAY NOT BE ABLE TO EASILY ACCESS OR UNDERSTAND THE *GUIDE TO EATING ONTARIO SPORT FISH*. THE INFORMATION IN THE GUIDE NEEDS TO BE PROVIDED IN MANY DIFFERENT WAYS THAT WILL BE UNDERSTOOD AND RELEVANT TO A VARIETY OF GROUPS AND INDIVIDUALS IN THE LOCAL COMMUNITY. HEALTH PROFESSIONALS CAN PLAY A KEY ROLE IN PROVIDING SUCH INFORMATION.

Human Breast Milk and Organochlorine Contaminants

Exposure

Exposure of infants to organochlorine contaminants such as DDT, PCBs, and dioxins and many of their degradation products, metabolites or by-products may begin *in utero*, since these substances cross the placenta. Breast milk, like all human tissues and fluids, contains a mixture of these fat-soluble substances. Therefore, exposure continues during nursing as these chemicals are transferred from mother to child via breast milk. According to Health Canada (1994), about 80 percent of Canadian mothers breast feed their babies, and nearly one third do so for more than three months. The daily volume of breast milk consumed by infants over the first six months of life has been estimated at about 750 mL.

Health Canada monitors organochlorine pesticides in the breast milk of Canadian women (Newsome et al. 1995; Mes 1994). PCBs, DDE (a by-product of DDT), hexachlorobenzene (HCB), and *trans*-nonachlor were present in all

samples (Newsome et al. 1995). Compared with earlier surveys in Canada, concentrations of most contaminant residues continue to decline and are lower than those reported recently in European countries. Concentrations of PCBs, DDT and metabolites, HCB, and *trans*-nonachlor were slightly higher in the milk of Canadian women who ate more than 100 grams of fish weekly. Table 8.1 lists breast-milk concentrations of dioxins and furans (expressed as toxic equivalents of 2,3,7,8-TCDD) for Canadian women (Ryan et al. 1993), some organochlorine residues reported for Ontario women (Newsome et al. 1995), and the daily contaminant intake estimated for nursing infants.

Table 8.1

Concentrations of Organochlorine Contaminants in Canadian Breast Milk and Daily Intakes by Nursing Infants

Residue	Concentration (ng/g whole milk)	Nursing Infant's Daily Intake* (ng/kg body weight/day)
Dioxins/Furans (TEQ)	0.00057	0.06
p,p'-DDE	5.09	545
p,p'-DDT	0.60	64
Dieldrin	0.37	40
HCB	0.40	43
Mirex	0.07	8
PCB (total)	6.94	744
trans-Nonachlor	0.57	61

* Daily intakes were estimated assuming nursing infants consume 750 mL of breast milk per day (equivalent to 750 g), and have an average body weight of 7 kg over the six-month nursing period.

Health Effects

Very little is known about the effects of exposure of infants to current organochlorine contaminant levels during the breast feeding period. Studies in the United States (Rogan 1996) and in the Netherlands (Huisman et al. 1995; Koopman-Esseboom et al. 1996) have reported that newborns and infants highly exposed both pre- and post-natally to dioxins and dioxin-like PCBs and DDE showed signs of adverse neurobehavioural and muscular effects. Some of these effects are comparable to those seen in experimentally exposed laboratory animals. In newborn infants, these adverse effects were generally expressed as decreased breast-feeding duration, weaker reflexes, weaker muscle tone, and some reduction in cognitive and intellectual abilities and more labile temperaments. These effects were largely attributed to **prenatal** exposure. Generally, the adverse effects did not persist beyond 18 months to two years of age, and in none of the studies were the most severely affected children considered clinically abnormal. However, in the most highly prenatally exposed children in one study, slight intellectual impairments as measured in school performance scores persisted to the age of 11 years (Jacobson and Jacobson 1996).

During the breast-feeding period (which varies for each child), an infant may receive a large proportion of the exposure to persistent organochlorines that he might receive in his entire lifetime. This is because human breast milk may contain much higher levels of these contaminants than adult foods that meet proscribed regulatory limits. Despite this, public health authorities as well as maternal-child health practitioners, support breast feeding over bottle feeding unless there is a very strong reason to the contrary. This strong support for breast feeding rests on studies of child development following *in utero*

exposure, and evidence of the beneficial effects of breast feeding on the mother and the child: maternal-child relationships, improved infant nutrition, conferral of immunity, protection against allergy, and possibly maternal protection against breast cancer.

WITH FULL REGARD FOR THE UNCERTAINTY OVER THE TOXIC EFFECTS OF CURRENT ORGANOCHLORINE LEVELS IN HUMAN MILK, THE KNOWN BENEFITS OF BREAST FEEDING ARE EXTENSIVE AND SERVE AS A STRONG RATIONALE FOR ADVISING MOTHERS TO CONTINUE BREAST FEEDING THEIR BABIES.

Reducing Exposure: Considerations for Breast Feeding

Provincial guidelines recommend that women of childbearing age, including breast feeding mothers, should not eat fish categorized as restricted in the *Guide to Eating Ontario Sport Fish* (Ministry of Environment and Energy 1997). Unless this guide allows unrestricted consumption of a particular species in that locale, these women could instead eat commercially-available fish that are subject to surveillance testing for PCBs and other substances.

In addition, pregnant and nursing women should avoid crash diets to lose weight. Starving will increase the normal fat mobilization that occurs during lactation, resulting in additional mobilization and transfer of stored PCBs and other fat-soluble contaminants into breast milk.

Testing Breast Milk for PCBs

Breast milk should never be tested for PCB content unless there is good reason to suspect that there has been extremely unusual exposure for the mother. In such a situation, the mother might be advised against breast feeding. The test results are usually not available for six weeks. Therefore the decision to breast feed a particular child cannot be made on the basis of the results of one test, which will not be available until long after the decision has to be made.

It should be noted that for the purpose of bio-monitoring programs and epidemiology studies, breast milk is tested for various organochlorines.

8.4 Naturally Occurring Contaminants

There are many potential contaminants in food, including polycyclic aromatic hydrocarbons, (PAHs), (from broiling and smoking); aromatic amines (from broiling and frying); nitrosamines, mycotoxins (from moulds); antioxidants in prepared foods; and alkaloids in plants and herbs. Plants also produce their own defence systems, natural pesticides that prevent their being eaten. These natural pesticides may reach levels that are toxic to humans.

Q. What are aflatoxins?

A. Mycotoxins (mycos is Greek for mould) are undesirable chemical compounds produced by some species of mould. Mycotoxins are persistent substances and may remain in a product even after the moulds that produced them are killed. Mycotoxin-contaminated food can cause mycotoxicosis. Of all mycotoxins, aflatoxins are the most studied and regulated. Certain crops grown in warm, humid climates are susceptible to mould contamination that can result in the production of aflatoxins.

These crops include corn, tree nuts and peanuts. Aflatoxins are rarely found in Canadian field crops because of our climate.

Because of the popularity of peanuts and peanut butter, the presence of aflatoxins in these vulnerable foods is of particular concern. Imported peanuts and those grown in Canada are regularly monitored for aflatoxin contamination. Peanuts of acceptable quality are roasted. This has been shown to destroy approximately half of any aflatoxin in the nuts. After roasting, the nuts are sorted to remove damaged or discoloured kernels, which are likely to contain most of any aflatoxin residues present. Peanut processors also analyse samples of finished peanut butter for aflatoxin residues to ensure that they do not exceed the standard set out in the *Food and Drugs Act* and Regulations.

Peanuts consumed in Canada are primarily imported from other countries, mainly the United States. Peanuts and peanut butter are checked for aflatoxin contamination at many points during the manufacturing and marketing process. In the United States, the Department of Agriculture analyses every lot of raw peanuts to ensure that peanuts sold for human consumption do not contain excessive amounts of aflatoxins. Each lot of peanuts imported into Canada from the United States is accompanied by a certificate of analysis.

Safety tips for the consumer:

- Throw away all food contaminated with mould. This is a good rule to follow to avoid mycotoxin intake in general.
- Do not eat shrivelled, discoloured, mouldy or damaged nuts of any variety.
- Do not allow peanut butter or other foods susceptible to mould growth to stand uncovered for long periods of time. Store in a cool dry place to avoid mould contamination.

The act of cooking food provides safety against bacterial or parasitic infection, but may introduce several potential carcinogens. The PAHs from charbroiling, smoking or barbecuing food include benzo[a]pyrene, a known animal carcinogen. The major route of exposure to benzo[a]pyrene in humans is through food. (See PAHs in *Contaminant Profiles.*)

Nitrosamines may be formed in foods preserved by the addition of nitrites or nitrates. Although this preservation method protects against outbreaks of botulism in cured meats, some nitrosamines have been shown to be carcinogenic in laboratory animals. The *Food and Drugs Act* and Regulations stipulate maximum permitted levels of nitrate and nitrite addition to minimize the potential for nitrosamine formation.

It should also be noted that many plants and fruits produce compounds that are considered anticarcinogens, such as anti-oxidants and fibre. These include phenethyl isothiocyanate (PEITC) in cauliflower and broccoli; ellagic acid (EA) found in fruits, vegetables and nuts; and vitamin C in vegetables and fruits.

Seafood Toxins

Shellfish can become toxic when they ingest certain types of marine algae that produce a variety of neurotoxins. Shellfish such as oysters and mussels are filter-feeders; they strain and eat particulate matter, including bacteria, from the water. Paralytic shellfish poison (PSP) and the more recently discovered domoic acid toxin occur in molluscs (mussels, clams and oysters). Not all toxins are destroyed by heat from cooking, so both raw and cooked shellfish can be dangerous. Shellfish sold commercially are regularly tested for the presence of seafood toxins.

Persons with pre-existing diseases such as liver disease, diabetes mellitus, and immune compromising diseases are at higher risk of contracting infections from seafood toxins.

(See also *Contaminant Profiles*.)

DOMOIC ACID WAS IDENTIFIED WHEN OVER A HUNDRED CANADIANS WERE POISONED AFTER EATING MUSSELS FROM PRINCE EDWARD ISLAND IN 1987. THIS HAPPENED AS A RESULT OF AN INTENSE BLOOM OF *NITZSCHIA*, AN ALGAE CONTAINING DOMOIC ACID, IN WATERS OFF EASTERN PRINCE EDWARD ISLAND. THE ALGAE WERE INGESTED BY THE MUSSELS, AND DOMOIC ACID ACCUMULATED IN THE MUSSELS' TISSUE. WHILE DOMOIC ACID IS NOT HARMFUL TO MUSSELS, IT IS TOXIC TO HUMANS IN LARGE ENOUGH AMOUNTS. SINCE THE OUTBREAK IN 1987, SHELLFISH IN THE ATLANTIC HAVE BEEN REGULARLY TESTED FOR DOMOIC ACID.

Parasites

Parasites are organisms, such as tapeworms, that may infect people who eat raw or undercooked foods. In Canadian fish the most common worm parasites are the cod worm, the herring worm and the fish tapeworm. Common domestic animal parasites are the beef and pork tapeworm and the pork trichinosis nematodes. Parasites infect fish and animals, and improper cooking allows the living parasite to enter the human digestive system.

The Canadian Food Inspection Agency (CFIA) monitors fish for cod worm, herring worm and fish tapeworm. Fish tapeworms are common in freshwater fish and while hazardous to humans, infections are rare. Commercially available meat is monitored by CFIA. Parasites are rarely found in supermarket products.

Parasites can cause a range of symptoms from stomach cramps to ulcers and muscle pain. Parasites are killed by thorough cooking or by freezing.

Giardiasis is a protozoan infection of the intestine caused by Giardia cysts present in human or animal excrement. Localized outbreaks may occur from ingestion of water contaminated by animals or less commonly, through food contaminated by infected food handlers (e.g. in day-care centres). (See Giardia in *Chapter 3. "Contaminants"* and in *Contaminant Profiles*.)

8.5 Pesticide Residues

People are exposed to persistent organochlorine pesticides primarily by eating fatty foods containing small amounts of these compounds. Since the ban of many organochlorine pesticides in the mid-1970s, their levels in crops have been decreasing and are expected to continue to fall. Residue levels in the Canadian food supply are among the lowest in the world.

The Pest Management Regulatory Agency (PMRA) of Health Canada reviews and registers products under the authority of the *Pest Control Products Act*. Before making a registration decision regarding a new pest control product, the PMRA conducts the appropriate assessment of the risks and value of the product specific to its proposed use. The value assessment may consider whether the use of

the product contributes to pest management and whether the application rates are the lowest possible to control the target pest. The risk assessment considers the inherent toxicity, persistence and bioaccumulative nature of the product, while addressing such key concerns as the degree to which humans and the target and non-target environment may be exposed, and the possible health and environmental hazards associated with the product. Pest control products will be registered if the data requirements for assessing value and safety have been adequately addressed; the evaluation indicates that the product has merit and value; and the human health and environmental risks associated with its proposed use are acceptable.

The PMRA determines the amount of a pesticide residue, if any, that is allowed on a food commodity without posing an unacceptable health risk to consumers. Many factors are considered in these assessments including identification of the type and amount of pesticide residues remaining on crops at harvest time (or in animals at time of use for food) and food consumption patterns, as well as the toxicity of the pesticide.

Manufacturers are required to submit detailed toxicity studies that may involve five to ten years of research in order to develop sufficient information to demonstrate the value and safety of a new product. From the manufacturer's studies and other available data, the PMRA determines the dose per unit of body weight producing no observable adverse effect in animals. From here, an acceptable daily intake (ADI), (also referred to as tolerable daily intake or TDI) is obtained for that particular pesticide. The ADI is the amount of the pesticide considered to be safe for human consumption each day for an entire lifetime. In general, these ADIs are in close agreement with the ADIs recommended by the World Health Organization.

Provincially, the departments of agriculture advise farmers regarding application and spraying programs, and the departments of health or environment regulate or assist in the control, distribution and handling of pesticides.

Residue Limits

Approximately 250 to 300 pesticide chemicals are registered in Canada for use in production or handling of various foods. Maximum residue limits have been established for about 100 of these. The remaining chemicals include those too toxic for any of their residues to be allowed to remain on foods, those not likely to leave any residue because of their chemical nature or the way they are applied, and those exempt from the requirement to set residue limits because of their low toxicity.

Setting Maximum Residue Limits

Maximum residue limits for pesticides on food are established by determining the amounts likely to remain in food at point of sale, (e.g., harvest of crops, slaughter of animals) after pesticides are used in accordance with registered uses. Maximum residue limits are also established for pesticides not registered in Canada that may be found as residue on imported food.

Enforcement of Regulations

The Canadian Food Inspection Agency is responsible for investigating possible violations of accepted residue levels. This program includes monitoring, inspection, education and involves the analysis for pesticide residues of some 2000 samples of imported and domestic foods each year.

When excessive residues are found in food, a thorough investigation is conducted to determine their source and extent. When the information indicates a violation of the Food and Drugs Act and Regulations, appropriate action is initiated and may involve removal of foods from the food outlets, seizure of food stocks, rejection of imports, or prosecution.

Research

In federal laboratories, research is conducted to find more sensitive methods of analysis and to learn more about residues and their long-term effects. The "total diet" concept has also been used over the last 10 years to estimate the pesticide residue intake of urban Canadians from food prepared for eating in the usual manner. In this study, foods are purchased in grocery stores and brought into the laboratory where scientists prepare them by washing, trimming, and cooking (if the food is not consumed raw) in the same manner as they would be in a home or a restaurant. They are then analysed for pesticide residues and the average daily intakes calculated. These studies have indicated that the residues detected are within the WHO proposed acceptable daily intakes.

(For a more detailed discussion of pesticides see Chapter 3. "Contaminants" and specific pesticides in *Contaminant Profile*s: aldrin and dieldrin, DDT and related compounds, hexachlorobenzene, mirex, toxaphene.)

IMPORTED FOODS
APPROXIMATELY 50 PERCENT OF THE FOOD SAMPLES TAKEN FOR PESTICIDE ANALYSIS ARE IMPORTED FOODS. SUCH FOODS ARE OFTEN TREATED NOT ONLY DURING GROWING, BUT ALSO DURING STORAGE AND SHIPMENT. AN EXAMPLE IS CITRUS FRUIT, WHICH MUST BE PROTECTED FROM ROTS AND MOULDS WITH FUNGICIDES; OTHERWISE, TRANSPORTATION OF THESE FOOD PRODUCTS WOULD BE NEARLY IMPOSSIBLE. SUCH PESTICIDES ARE OFTEN LISTED ON THE LABELS OF THE FOOD CONTAINERS BY THE EXPORTING COUNTRY. ONLY THOSE PESTICIDES EVALUATED BY THE PMRA AND CONSIDERED ACCEPTABLE ARE PERMITTED ON FOODS IMPORTED INTO CANADA.

8.6 Food Additives

Most consumers do not obtain food from its original source. It is usually shipped, stored, packaged and handled before sale. Canadian consumers have become accustomed to food that looks fresh or that is of a certain colour, size and shape. People also expect that food should be affordable and easily available. Lettuce is not grown in Canada in January, it has to be imported. Produce grown in Canada is often stored for months for winter consumption. Canada is a multicultural country and the amount and variety of non-native food types available for consumption has increased accordingly. Societal changes also mean the use of more processed foods and ready-to-eat meals.

Food additives include both natural and artificial compounds that are added to a particular food for a specific reason. According to the Canadian *Food and Drugs Act* and Regulations, any chemical substance added to food during processing or storage, which could, either by itself or through its by-products, affect the characteristics of a food or become part of it, is considered a food additive. An additive may perform a variety of functions: to enhance keeping quality and stability for transport and storage; to maintain product consistency and attractiveness; to improve or maintain nutritional value; to maintain palatability; to provide leavening or control acidity and/or alkalinity; and to impart desired colour. This definition **excludes** food ingredients (e.g., salt and sugar), vitamins, minerals, amino acids, spices, seasonings, flavourings, flavour enhancers (e.g., MSG), packaging materials, veterinary drugs and agricultural chemicals. These latter substances fall under categories covered separately in the Canadian *Food and Drugs Act* and Regulations.

Exposure to food additives will depend on diet.

Some Common Food Additives

Emulsifiers, Stabilizers and Thickeners

To maintain product consistency, agents such as emulsifiers give products texture and prevent them from separating. Albumin, a natural product found in egg whites, is a common emulsifier. Stabilizers and thickeners give smooth uniform textures. Anticaking agents help substances such as salt flow smoothly. Carrageenan, derived from seaweed is used to make salad dressings thick. Another common thickening agent is xanthan gum (also called locust bean gum). These additives are used in foods such as baked goods, cake mixes, chocolate and ice cream.

Preservatives

Preservatives retard product spoilage caused by moulds, air, bacteria, fungi or yeast. Some food must be stored or displayed for extended periods of time, increasing the chances of bacterial or other contamination. The antioxidants, butylated hydroxyanisole (BHA) and butylated hydroxytoluene (BHT) are two of the most common synthetic preservatives used. They can be found in many products, including cheeses, potato chips and cake mixes. There has been some debate in the scientific literature about the roles of BHA/BHT in promoting of cancer in the rat forestomach. Humans do not have a forestomach and hence this effect is not relevant to humans.

Nitrite and nitrate salts, (such as "salt peter," potassium nitrate), are chemicals used for food preservation and are commonly found in processed meats. Nitrites produce the characteristic colour and appearance of cured meat products. They also have the advantage of combatting the growth of botulinum spores. *C. botulinum* bacteria produce a deadly toxin that causes botulism, a potentially fatal form of food poisoning. (For more information on *C. botulinum*, see *Contaminant Profiles*.) Upon cooking, the nitrites can react with naturally occurring amines to form nitrosamines some of which have been shown to be carcinogenic in rats. The formation of these nitrosamines has been minimized through advances in food processing technology, such as the use of vitamin C, and food additive legislation to reduce permitted nitrite levels in foods. The moderate consumption of cured products, including fried bacon, as part of a well balanced diet is not considered to pose a significant hazard to the health of the consumer.

Leavening Agents

Leavening agents and compounds that control acidity and/or alkalinity are used in baked goods and prepared mixes. They act to produce the light, fluffy texture associated with baked goods. The most common is baking soda, but amylase (a chemical naturally occurring in saliva) is used to assist dough to rise in prepared mixes.

FOOD LABELLING

FOOD LABELLING HELPS THE CONSUMER KNOW WHAT FOOD ADDITIVES ARE BEING USED. MOST PREPACKAGED FOODS MUST CARRY ON THE LABEL A LIST OF INGREDIENTS, INCLUDING FOOD ADDITIVES, IN DESCENDING ORDER OF PROPORTION. FRESH PRODUCTS, WHICH ARE NOT PREPACKAGED OR PREPARED, ARE LEAST LIKELY TO CONTAIN ADDITIVES. ADDITIVES ARE NOT PERMITTED IN SOME PREPACKAGED FOODS SUCH AS FRESH EGGS, MILK AND MEAT. MOST PLAIN CANNED OR FROZEN FRUITS AND VEGETABLES ARE FREE OF ADDITIVES. LABELLING PROVISIONS ARE ADMINISTERED BY THE CANADIAN FOOD INSPECTION AGENCY.

Flavour Enhancers

To enhance flavour, many spices and natural and synthetic compounds are used. To make "sugarless" food taste sweet, hydrogenated starch hydrolysate is used as a sweetener and malic acid made from apples or cherries boosts the flavour of instant drinks. Synthetic flavour enhancers are substances such as maltol, ethyl maltol, inosinates, guanylates and MSG. Most consumers are familiar with beverage sweeteners. A number of accusations about the safety of aspartame have been made over the years, but no reproducible scientific evidence can be found to support these claims. Aspartame is considered safe for use by humans.

Colour Additives

Many foods make use of colour additives. Colour additives are used in foods to impart colour, offset colour loss due to storage or processing of foods, and to correct natural variations in food colour. Natural colour additives can include pigments from vegetables (beta carotene), minerals (titanium dioxide) or animals (shellac). A common colouring agent is caramel, derived by heating sugar and other carbohydrates under strictly controlled conditions for use in sauces, gravies and soft drinks. Examples of synthetic colouring agents are amaranth, carotene and tartrazine. At present there are no requirements for the labelling of the specific food colours in foods in Canada, beyond the mandatory statement of "colour" in the list of ingredients on the food product.

Producers are not allowed to colour fresh and frozen meat, poultry and fish, and most fresh, frozen and canned fruits and vegetables.

Sulphite

Sulphite compounds include sodium sulphite and sodium and potassium bisulphites, which may be added to food such as baked goods or condiments to act as a preservative. They are used to sanitize and inhibit the growth of undesirable micro-organisms during the making of wine and beer. They were once used to maintain the fresh look of vegetables and fruits.

A small segment of the population has been found to develop allergic reactions, including hives, nausea and even fatal shock after consuming sulphite. While it is estimated that such attacks may be precipitated in 5 to 10 percent of asthmatics after consuming food containing sulphite, people other than asthmatics can also have adverse reactions to sulphite.

In Canada and the United States, the use of sulphite on fresh fruits and vegetables intended to be sold or served raw to consumers, (e.g., in salad bars) is banned. Sulphite is used in packaged goods and processed foods such as soups, jams, dried fruit, frozen pies and pastries but must be listed on the product label. Regulations prohibit the use of sulphite in any foods, recognized by Health Canada as being a source of thiamine (Vitamin B1), because sulphur dioxide is known to destroy thiamine.

Food Additive Regulations

The Health Protection Branch of Health Canada is responsible for controlling food additives. All additives permitted in food in Canada, (in both Canadian-produced and imported foods) are listed in 15 tables in the Canadian *Food and Drugs Act* and Regulations. Requests for additions or changes to these tables must be accompanied by a detailed submission to Health Canada including the following information:

- physical and chemical properties of the product;
- justification for use;
- amounts to be used;
- detailed results of controlled animal studies made to establish the safety of the additive under the conditions of use recommended. (Extensive testing is done to determine acute, short-term and long-term or chronic, including carcinogenic effects of food additives);
- data to indicate residues that may remain in the food;
- proposed maximum limit for residues of the food additive in the finished food;
- specimens of proposed labelling; and
- a sample of the food additive in the form in which it is proposed to be used, a sample of the active ingredients and, on request, a sample of the food containing the additive.

This information is then evaluated by Health Protection Branch scientists. The additive must not only meet the safety criteria, but must also serve a useful purpose, without disguising a faulty manufacturing process or deceiving consumers about the quality of the food. Because of the high costs involved in meeting these stringent rules, generally only one or two additives are added to the tables in any one year. However, extensions of existing food additives for new uses are more frequent.

Maximum amounts of additives permitted for use will depend on the toxicology of the additive, the smallest amount needed to achieve the desired result, and the kind of food to which it is being added. Maximum levels are not always stipulated in the *Food and Drugs Act* and Regulations. Often the level mentioned in the *Food and Drugs Act* and Regulations is stipulated as "Good Manufacturing Practice." A manufacturer's use of an additive will often be based on the technical food-processing needs.

Additives listed under the *Food and Drugs Act* and Regulations are continually monitored. They can be withdrawn from the list if any new evidence indicates that their safety is questionable. This evidence may come from Health Protection Branch laboratories (as in the case of saccharin which was then restricted) or it may come from clinical observations or new research done elsewhere in Canada or internationally.

Inspectors from the Canadian Food Inspection Agency monitor the use of additives through unannounced inspections of food manufacturing plants. Random samples are collected, (from imports as well) and tested to ensure that products conform to existing regulations.

Antibiotics and Growth Hormones in Food

The use of antibiotics and growth hormones for domestic animals is controversial. These substances are thought to be potentially "bioactive," that is, residual amounts may continue to be active in food when it reaches the consumer. It is estimated that nearly half the antibiotics produced in the United States are fed to farm animals to prevent disease and promote growth. Most are broad spectrum antibiotics. Antibiotics can be transmitted to people through ingestion of dairy products. It is thought that cooking would render most growth hormones inactive.

A human health concern is the transmission of antibiotics through milk, dairy products and meat to individuals who may be allergic to particular drugs. Such practices may also contribute to the ongoing problem of bacterial resistance to medications.

Antibiotics used in Canada for livestock are labelled to indicate the time that must pass between the administration of drugs and their slaughter or milking, to ensure the chemicals leave the animals' systems or that residual levels are below guidelines. The use of growth enhancing hormones in cattle to enhance milk production is under active scrutiny.

VITAMINS AND MINERALS IN FOOD

SOME FOODS LOSE NUTRITIONAL VALUE AFTER THEY ARE HARVESTED OR THROUGH PROCESSING. VITAMINS AND MINERALS ARE ADDED TO MANY COMMON FOODS SUCH AS MILK, FLOUR AND CEREAL TO MAKE UP FOR THOSE LOST IN PROCESSING OR LACKING IN A PERSON'S DIET. COMMON EXAMPLES ARE THE ADDITION OF IODINE TO SALT AND THE RANGE OF VITAMINS ADDED TO MANY BREAKFAST CEREALS. VITAMINS AND MINERALS ADDED TO FOODS ARE SUBJECT TO THE VITAMIN, MINERALS AND AMINO ACID REGULATIONS OF PART D OF THE *FOOD AND DRUGS ACT* AND REGULATIONS.

8.7 Cookware Safety

Some materials used to make common cookware can potentially enter food.

Aluminum Cookware

Canadians normally take in about 10 milligrams of aluminum daily, mostly from food: cookware contributes about one or two milligrams of the total. Aluminum has been implicated as a risk for Alzheimer's disease. However the source and nature of the aluminum that may produce the risk is not known. Not enough is known about all of the factors which affect Alzheimer's disease to be able to make a definitive statement about aluminium in food, pots or drinking water.

During cooking, aluminum dissolves most readily from worn or pitted pots and pans. The longer the food is cooked or stored in aluminum vessels, the greater the amount dissolved in food. Leafy vegetables and acidic foods (such as tomatoes and citrus products) aid in the release of aluminum most readily.

(See *Contaminant Profiles* for an overview of aluminum, see also Chapter 6. "Water Quality.")

Q. Is aluminum a health hazard in food?

A. Aluminum occurs naturally in many foods, but usually only in low concentrations. Certain aluminum compounds used as food additives may contribute additional aluminum to such foods as dairy products (milk, processed cheese and yoghurt), grains and grain products, desserts and beverages. However, the amounts of such additives are strictly

controlled. Aluminum-containing cookware, utensils and wrappings can also increase the presence of aluminum in foods, but studies to date have shown that contamination from this source is generally negligible.

It is estimated that teenagers and adults consume between 9 and 14 mg/day of aluminum in food. Children ingest an estimated 2 to 6 mg/day. While food represents a significantly greater source of aluminum than water, only a very small percentage of aluminum from either source is actually absorbed by the body.

Health Canada recently completed a survey of aluminum levels in infant formulae available in Canada. Although these are higher than levels in human or cow's milk, the aluminum intake of infants who consume these products is still significantly lower than the Food and Agricultural Organization/World Health Organization recommended tolerable intake, which is applicable to all age groups. Consumption of aluminum at this level is not considered to pose a health hazard based on currently available information.

Bovine Somatotrophin (BST)

BST is a synthetic growth hormone that is used to increase milk production in dairy cows. It has been made available for sale and use in the United States. Health Canada is currently evaluating **BST** to determine its safety both for humans (exposed to **BST** though drinking the milk) and for the cattle to which it is administered.

Copper Cookware

Copper and brass cookware sold in Canada are coated with another metal. This prevents the copper from coming into contact with the food. Small amounts of the coating can be dissolved by food, particularly acidic food cooked or stored for long periods of time in the cookware. Nickel is one of the metals used in coating.

Coated copper cookware can lose its protective coating if scoured. Badly scratched or uncoated copper cookware should not be used to cook or store food.

Stainless Steel and Iron Cookware

The most common metals present in stainless steel or iron cookware are iron, nickel and chromium.

Iron is essential in producing red blood cells. Large amounts can be poisonous but most North Americans are more likely to lack iron than to have too much. For a very small number of people in the population, excess iron ingestion can be dangerous. Generally, these conditions are inherited (e.g., haemochromatosis, thalassaemia) and individuals are generally aware of their particular need to restrict iron intake. However, for the vast majority, iron as derived from iron cooking pots is even desirable.

Small doses of chromium, like iron, are beneficial, but can be harmful in larger amounts. The safe intake range is about 50 to 200 micrograms per day and most Canadians take in amounts in this range. One meal prepared with stainless steel equipment gives about 45 micrograms of chromium, not enough to cause concern.

Ceramic, Enamel and Glass Cookware

Material used in the manufacture of ceramic, enamel and glass cookware may contain some pigments and lead. In Canada, the likelihood of any potentially harmful material entering food is controlled through manufacturing techniques. The sale, advertising and importation of glazed ceramicware used for food have been regulated in Canada since 1971. Ceramicware is permitted to release only very small amounts of lead and cadmium. Lead is used in glazes and cadmium is used in pigment production for pottery. Glazed ceramicware from abroad and personally imported by Canadians may not meet the Canadian permitted levels of lead and cadmium. Some other countries do not have the same strict regulation on glazes. A potentially important source of lead is from the storage of alcoholic beverages in lead glass decanters.

(See *Contaminant Profiles* for an overview of lead and cadmium.)

Plastics and Non-stick Coatings

Using plastic containers and wrap for anything other than their original purpose may result in exposure to toxic substances. Food may absorb some of the plasticiser (a material that helps make the wrap flexible). This is most likely to occur at high temperatures (such as microwaving), and with fatty or oily foods like cheese or meat. It is best not to use plasticware or plastic wrap in the microwave unless it is specifically labelled as microwave safe by the manufacturer. If items are reused for storage, like dairy product containers, let the food cool before storing it in them, then refrigerate immediately.

Avoid visibly damaged or stained plastics or containers with an unpleasant odour. Do not heat or store food in plastic containers that were not intended for food.

Non-stick coatings are chemically inert, so even if some of the coating were ingested, it would pass through the body harmlessly. The only time nonstick coatings are likely to pose any risk is if they are heated to temperatures greater than 350 degrees centigrade or 650 degrees Fahrenheit. This might happen if an empty pan was left on a hot burner. In this case, the coatings can give off irritating or poisonous fumes.

Lead in Food

Prior to 1985 canned food was an important source of lead exposure. Today, almost all cans made in North America for food or drinks are lead-free. In Canada this was a result of a voluntary program (OMOEE 1994). Canada has no regulation regarding lead soldered cans.

In the United States, the Food and Drug Administration prohibited the use of lead solder in manufacturing cans for packaging foods as of December 1995 (Department of Health and Human Services 1995). This regulation also requires that warning labels be placed on food cans that contain lead solder.

Because cans imported from other countries may still contain lead, Health Canada continues to examine cans in the marketplace and to track down the source of those few cans containing lead and acts to correct the situation. Lead cans are of most concern when the foods they contain are acidic, such as tomatoes, citrus juices, and pickled foods.

Cans made without lead have a smooth, flat side seam with a blue or black line. Lead soldered seams are wider, thicker, and feel bumpy — they may also have dents or solder smears. Cans without seams do not contain lead.

Lead can also be a concern in the making of baby formula if water containing lead is used. (See Chapter 6. "Water Quality" for more information on reducing exposure to lead in tap water.)

In general, children should be encouraged to eat foods rich in iron (such a dark green leafy vegetables) and calcium (such as milk, cheese and yogurt). This will allow less lead to be absorbed by the body.

(For more information on lead, see *Contaminant Profiles*.)