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A TASTE OF CANADA

Comments and Analyses on Toxic Chemicals in Your Meals and Bioengineered Food made in Canada.

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Comments and Analyses on Toxic Chemicals in your Meals and Bio-engineered Food in Canada

A Report Prepared by Burkhard Mausberg and Paul Muldoon

on behalf of the Canadian Environmental Law Association

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Summary of Issues

Toxic Chemicals in Food

During the years 1994, 1995, and 1996, some 1.45 billion pounds of toxic chemicals were released from Canadian sources, of which 280 million pounds were carcinogens. These numbers come from a federal database. Many of these pollutants have been shown through scientific studies to cause serious health effects. Many are in our food which is the main pathway for Canadians to be exposed to toxic chemicals.

The implications of toxic substances in food are far from certain. It is difficult to establish a direct relationship between the consumption of food with contaminants and specific health effects. This difficulty arises because relatively little is known about the kinds and quantities of toxins in our food. Further, scientists are just scratching the surface in terms of understanding how toxins actually affect human health, and most recently, how it affects the endocrine system of our bodies. Rising breast cancer rates, lower sperm counts, and rising developmental effects in children have been attributed, at least in part, to exposure to toxic chemicals.

Despite the scientific uncertainty, given the weight-of-evidence as to the linkages between toxins in the environment and food, and their potential health effects, we do believe this is matter worthy of political priority and attention. There is no question that we need to reduce, and in some cases eliminate, many of the pollutants which are finding their way into our food supply. the strengthening of the Canadian Environmental Protection Act is one of the most obvious means to achieve reductions and eliminations.

Bio-engineered Foods

While bio-engineering has recently entered the public debate with the cloning of "Dolly," the sheep in Scotland, what has been overlooked is that bio-engineering has been here for some time and in every food group. If the trend continues, the fruits, vegetables, meat and milk products at the local grocer will never be the same.

Some 18 bio-engineered foods have been approved for human consumption in Canada, engineered for a range of traits, including herbicide resistance, pest resistance, delayed ripening, and anti-biotic resistance for such crops as canola, corn, potatoes, soybeans and tomatoes. Many more are on the way.

There are many concerns raised by bio-engineering in terms of human health and environmental protection: increased use of pesticides, potential disruption of ecosystems and allergic reactions.

Bio-engineered food does not have to be labelled as such in Canada. Canadian consumers are robbed of their right to know what they eat. Also, no tracking or monitoring of bio-engineered food is done in Canada. We simply do not know where and how much bio-engineered food is grown and what supermarkets or grocers sell them.

There have been repeated calls for the development of a comprehensive legal and policy regime governing the products of bio-engineering under the Canadian Environmental Protection Act. This comprehensive regime has yet to be developed by the federal government.

1. Introduction

The environmental and human health problems posed by toxic substances are not new to Canadians. Since the early sixties, there has been a growing realization that toxic chemical pollution affects ecosystems and humans. In recent years, there has been a resurgence of concern as a number of scientific studies have shown the effects of toxins to be more insidious than once understood.[1] Historically, the focus with toxic substances was whether a particular toxin would cause cancer. However, a range of broader effects are now being linked to toxic substances. These effects range from immune system suppression to behavioural problems. The catalogue of impacts arising from the use, generation and release of toxic substances is growing constantly.[2]

In this context, it is important to note that government data reveal that some 1.45 billion pounds (660 million kilograms) of toxic pollution was released into the Canadian environment between 1994 and 1996. Of that total, some 280 million pounds (127 million kilograms) were carcinogens. This includes such chemicals as arsenic, benzene and lead. On a provincial basis, the annual releases for toxins for the latest available year are:[3]

British Columbia	66.4 million pounds
Alberta	98.8 million pounds
Saskatchewan	3.5 million pounds
Manitoba	8.6 million pounds
Ontario	125.8 million pounds
Quebec	87.6 million pounds
New Brunswick	12.8 million pounds
Nova Scotia	6.1 million pounds
PEI	143,000 pounds
Newfoundland	341,000 pounds
Yukon	no reports filed
Northwest Terr.	8.4 million pounds

But how pervasive are toxic substances in our food, water and air? Should Canadians be concerned about the presence of toxic substances? At this stage, it is difficult to establish a *precise* link between the use and generation of toxic substances and specific human and environmental health impacts. However, there is sufficient evidence to be concerned. The International Joint Commission, an independent U.S. - Canadian advisory body, has examined these issues and posed three questions:[4]

"• What if, as current research suggests, the startling decrease in sperm count and the alarming increase in the incidence of male genital tract disorders are in fact caused in part as a result of <u>in utero</u> exposure to elevated levels of environmental estrogens?

• What if, as current research suggests, the epidemic in breast cancer is a result in part of the great numbers and quantities of estrogen-like compounds that have been and are being released into the environment?

- What if the documented declining learning performance and increasing incidence of problem behaviour in school children are not functions of the educational system? What if they are the result of exposure to developmental toxicants that have been and are being released into the children's and parents' environment, or to which they have been exposed in utero?"

Similarly, bio-engineered food raises a range of issues. While the technology has recently entered the public debate with the cloning of "Dolly," the sheep in Scotland, what has been overlooked is that bio-engineering has been active in Canada for some time. Some 18 bio-engineered foods have been approved for human consumption in Canada. They are engineered for a range of traits, including herbicide resistance, pest resistance, delayed ripening, and anti-biotic resistance, and include crops such as canola (for oil and margarine), corn, potatoes, tomatoes, and soybeans. If the trend continues, the fruits, vegetables, meat and milk products at the local grocer will never be the same.

There are many concerns raised by bio-engineering in terms of human health and environmental protection: increased use of pesticides, potential disruption of ecosystems, allergic reactions, and bacteria acquiring anti-biotic resistance genes and becoming resistant to important drugs.

1.1 Why We Did This Study

In late 1996, the Toxics Caucus and the Biotechnology Caucus of the Canadian Environmental Network commissioned research to review the most current data available on what toxic substances, and at what levels, are in Canadian food. The Caucuses of the Canadian Environmental Network include dozens of environmental, consumer, human health and labour groups from across Canada.

The purpose of this report is to articulate the results of that research initiative, and in particular, to provide current data on the level of toxic substances in food. Furthermore, the goal is to raise awareness of the problems of toxic substances and raise awareness of the issues related to the rapid development of bio-engineering. These are matters relevant to all Canadians.

The results indicate that dozens of different chemicals find their way onto the dining tables of Canadians. Many of them are pesticides and industrial by-products. And many of these substances persist in the environment and have the ability to accumulate in fish, wildlife and humans.

This report does not undertake a risk assessment to determine the relative risk of eating these foods, nor does it attempt to establish a cause-effect relationship between the levels of contaminants in the food and known or suspected impacts. Rather, it collects, for the first time in this fashion, recent information from a variety of sources and shows that toxin chemicals are present in Canadian food.

Raising the importance of bio-engineered food is equally important. Bio-engineered foods raise a host of questions which deserve public debate:

- what are the ethical issues of bio-engineering, especially as they relate to farm animals?
- are the bio-engineered applications worth the potential human health and environmental risks?
- why are we spreading anti-biotic resistance genes widely into the environment, when we are facing an ever increasing number of bacteria already resistant to anti-biotics?
- why are we not promoting sustainable agriculture, working with ecological rhythms, rather than against them?
- why are Canadians not allowed to know when they eat bio-engineered food?

Unless the federal government withholds future approvals, we can expect a growing presence of bio-engineered foods on our dinner table and lunch counters. By raising these issues now, a public policy debate can occur so Canadians can make a clear choice about what they will eat.

1.2 Outline of the Report

This report is divided into two parts, one dealing with toxic chemicals in Canadian food and the other pertaining to bio-engineered food. Although there are obvious similarities between the two issues, the two areas of concern also raise different matters.

Section 2 pertains to toxic chemicals in Canadian food, including an outline of how the information was gathered and from what sources, a summary of the findings, and a discussion on the implications of these findings.

Section 3 of this report deals with bio-engineered foods in Canada, including what we know (or do not know) about bio-engineered foods, and some of the concerns with bio-engineered food.

Section 4 outlines of a number of recommendations which attempt to address the concerns raised.

2. Toxic Chemicals in Your Food

During the 1990's, Canadians continue to be more health conscious. It is not surprising therefore, that we are attempting to eat wiser and more appropriately. But what exactly is in our food? This section attempts to address this question.

2.1 Sources and Methodology

Two main methodologies were used in gathering the information. First, federal officials in the Departments of Environment, Health and Agriculture and Agri-Food were contacted and requested to provide the most recent data with respect to contaminants in food. In particular, the information collected in market-basket analyses was of interest to this project. These studies take food from Canadian supermarkets across the country and analyse them for a few selected pollutants. The two market-basket surveys done by Health Canada in the 1980's and early 1990's were used in this report. It should be noted that, while some data was made available, government officials argued that data which had not been published in peer-reviewed journals could not be released to the Canadian public. Canadians will have to wait to obtain this data until government scientists publish the results in journals.

The second set of sources came from published government reports and scientific studies. Some 100 reports and scientific studies were collected. For example, much of the data came from government studies used in the assessment of toxic substances under the processes established under the Canadian Environmental Protection Act. These studies represent some of the best available information on toxins in food and were used to decide whether or not the government should take action on these substances. Indeed, based on their toxicity and exposure to Canadians, the government decided that for most of the substances assessed, action is required.

In sum, this report relies on published reports in collecting the information and did not actually undertake testing of toxins in food. While it would have been preferable to perform comprehensive food testing, the enormous costs associated with these measurements proved to be prohibitive. Nevertheless, the quality of the data presented here is, in our view, reliable given their sources in government reports and peer-reviewed scientific journals.

2.2 Summary of Findings

The detailed inventory of toxins in certain food is listed in Appendix 1. The contaminant, its use or source, and its quantity is provided for each food item, and when a range of data were available, the higher value is given to reflect the overall potential of chemicals to cause harm.

The variety of toxic chemicals in food is astounding: from paint strippers and pesticides to urinal deodorizers and wood preservatives. The range of data is equally important. While some pollutants may only be present in the parts per trillion range, others are present in the parts per million range. Some of the highlights are summarized in Table 1 (next page).

The nature of the Arctic food chain and the physical and chemical processes in the Arctic, make Inuit among the most highly exposed Canadians to toxic pollutants. Chemicals such as pesticides and PCBs build up in the fatty tissues of marine mammals, which are a major part of the traditional Inuit diet.

A number of studies of Inuit mothers and their children have shown PCB levels above Health Canada's "Level of Concern." There is of yet no direct evidence of effects of these chemicals on Inuit. The nutritional and cultural benefits of continuing to eat traditional food are still considered to outweigh the risks - especially given the alternative food sources in the Arctic. This makes the need to get at these contaminants at the source - before they are generated - all the more important.

Source: Inuit Tapirisat of Canada

Table 1: **Selected Highlights of Toxic Contamination in Food**

Food	Quantity of Selected Toxin	Use or Source	General Comment on Substance
water	47 ppb of benzene	industrial solvent & chemical	"..on the basis of available data, benzene is classified as carcinogenic to humans..."[5] Government of Canada, 1993
butter	84 ppb dichloromethane	paint stripper	"...dichloromethane as been classified as being 'probably carcinogenic to humans'..."[6] Government of Canada, 1993
milk	0.55 ppb 1,4-dichlorobenzene	urinal deodorizer	".. has been classified in Group III (possibly carcinogenic to humans)..."[7] Government of Canada, 1993
chicken	2.6 ppm bis(2-ethylhexyl) phthalate	plasticizer	"...may enter the environment in a quantity or concentration or under conditions that may constitute a danger in Canada to human health."[8] Government of Canada, 1994
beef	67 ppb pentachlorophenol	wood preservative	"...long-term exposure ...can cause damage to the liver, kidney, blood, and nervous system..."[9] U.S. Government, 1989
egg	7 ppb nickel	metal	"...each of the groups 'oxidic'..'sulphidic,.. and 'soluble'..nickel compounds has been classified as 'Carcinogenic to Humans'..."[10] Government of Canada, 1993
muktuk	468 ppb toxaphene	pesticide	"Pregnant animals exposed to low levels of toxaphene by mouth did not become ill although birth defects were observed in their fetuses."[11] U.S. Government, 1989

2.3 Implications - What Do These Findings Mean?

2.3.1 General Comments

From the summary of findings outlined above, it is apparent that many food items in Canada contain toxic contaminants at some level. However, the question is: do these levels actually effect Canadians' health? Is our food safe? The answers to these questions are often difficult to obtain. In most cases, we simply do not know. In other cases, the scientific basis is controversial. As with any difficult questions there will be many different responses.

2.3.2 The Information We Do Not Have

Two crucial pieces of information are often lacking:

- what and how much toxic chemical pollution is in our food; and
- what effects do these chemicals cause.

(i) Lack of Information of Toxins in Food

While the scientific knowledge base on toxic chemicals and their effects is increasing, many gaps still exist. The data is generally patchy even for substances acknowledged to be dangerous poisons. For example, just how much toxic chemical pollution is in food is often not known. Consider these statements in government reports:

> "Data on the occurrence of benzene in food are very limited." and "Few data are available on the concentrations of benzene in drinking water in Canada."[12]

> "Information on the concentration of tetrachloroethylene in foodstuffs in Canada is extremely limited."[13]

> "Few data are available on the levels of PAHs in drinking water, particularly for those compounds being considered principally with respect to human health..."[14]

> "Information on concentrations of 1,4-dichlorobenzene in Canadian food supplies is limited."[15]

> "No data on the levels of 3,3'-dichlorobenzidine in drinking water,...foodstuffs...within Canada were identified."[16]

Moreover, we do not have a comprehensive picture of <u>all</u> toxic chemicals in foods. That is, the information we do have is usually for single, or occasionally a few, chemicals in food. But what about the total amount of all possible toxins in food? Simply put, the full spectrum of toxic contamination in various food is unknown.

Nevertheless, some testing of food has been done and is summarized in Appendix 1.

(ii) Linking Toxic Substances in Food and Human Health

Information gaps also exist about the human health effects, even were we know at least something about the level of contamination in food. That is, when governments determine whether food is safe to eat, they generally look at the potential cancer rates each individual chemical can cause. So when a chemical is below the cancer-causing level it is considered safe. But what about other effects? Is the immune system affected? What about effects on the hormone system? What about intellectual impairments? What about cognitive and behavioural effects? These questions remain unanswered.

Moreover, we know little about the additive or synergistic effects of all the toxins in our food. That is, since the data suggest that a mix of toxins are in our food, we can expect additive and synergistic effects to occur, but little is known about this. There is certainly no valid scientific basis for assuming that the mixture of toxic chemicals in food is harmless.

2.3.3 Should We Be Concerned?

At this stage, it is difficult to establish firm links between the contaminants in food with specific health effects. The situation is far too complex for those direct relationships to be established. But even without absolute cause-effect relationships, should Canadians be concerned about the levels of contaminants in their food? While the science is often controversial and incomplete, the inescapable answer is <u>yes</u>.

> "In terms of human health, conclusions about the effects of exposure to toxic contaminants in the Great Lakes fall within the realm of inference. It appears that the dominant pathway of exposure is through food. The largest doses of a number of contaminants are to fetuses and infants through maternal transfer via the placenta and breast milk during periods of rapid development... The weight of present evidence suggests that human health probably is affected by exposure to the persistent chemicals found in the ecosystem."[17]

As noted, food is the main pathway for exposure to environmental toxins for Canadians. As a result, the only prudent course of action is to take a precautionary approach, and ensure that levels of contaminants decrease over time. There are a number of good arguments in support of the precautionary approach to contaminants in food. These may be stated as follows:

(i) The Understanding of the Types of Effects is Evolving

Historically, the focus on determining the effects of toxins was on their acute effects or the potential for them to cause cancer. However, in recent years, science has revealed how insidious some of the toxins are. They can cause very subtle, but important, effects in minute amounts.

Studies on a range of species have indicated population declines, reproductive impairment, hormonal disorders, developmental problems and other effects.[18] Such effects have been linked to the build-up of toxic substances in wildlife and their increasing body burden.

In 1992, a group of scientists developed a consensus with respect to toxic chemicals and their concerns. Now known as the Wingspread Statement, the scientists concluded:

> "A large number of man-made chemicals that have been released into the environment, as well as a few natural ones, have the potential to disrupt the endocrine systems of animals, including humans... Many wildlife populations are already affected by these compounds. The impacts include thyroid dysfunction in birds and fish; decreased hatching success in birds, fish and turtles; metabolic abnormalities in birds; de-masculinization and feminization of male fish, birds and mammals; de-feminization and masculinization of female fish and birds; and compromised immune systems in birds and mammals..."[19]

The statement also contains a dire warning about the impacts on human health. The scientists warned that:

> "Unless the current environmental load of synthetic hormone disruptors is abated and controlled, large scale dysfunction at the population level is possible."[20]

Another panel of experts convened by the Danish government concluded that male reproductive health and fertility has significantly diminished in the past 40 years, and that this decline can be associated, at least in part, with exposure to estrogenic environmental chemicals. For example, there has been approximately a 50 percent decrease in average sperm count and a several-fold increase in testicular cancer.[21]

(ii) Concentrations in Food are Approaching Trends Where Effects can be Expected

At this point, the prevailing point of view is that the concentration of pollutants in food are at levels too low to affect human health. For most pollutants, the evidence seems to support this position. However, some scientists are now questioning whether even present concentrations are acceptable. For some substances, it is being suggested that, although we are not at the point where concentrations are causing harm, we are approaching those concentrations.

One example of such a case is dioxin. Dioxin and dioxin-like compounds have long been identified as chemicals of concern. In the early 1990's, the United States Environmental Protection Agency undertook an extensive dioxin reassessment study.[22] Although it remains highly controversial, it does provide a scientifically sound analysis of the dangers posed by these substances. Similarly, the Government of Canada's Priority Substances List Assessment Report[23] for dioxin provides relevant information in regard to human health and environmental effects. The U.S. EPA dioxin reassessment found that:[24]

- dioxin is a probable human carcinogen;
- dioxin-altered development and reproductive function may be among the effects most sensitive to dioxin exposure, and dioxin may be toxic to the immune system at very low levels;
- some of the effects of dioxin have been observed in laboratory animals and humans at or near levels to which people in the general population are exposed, and that people in highly-exposed groups may already be experiencing subtle changes in biochemistry and physiology as a result; and
- high-exposure groups include nursing infants, who are both uniquely vulnerable for developmental toxicity and have some of the highest exposures to dioxin, 10 to 20 times higher than the estimated range of exposure for adults.

It also found that more than 95% of our dioxin exposure comes from the food we eat.[25] This caused one scientist to note that:

> "...Canada's dioxin guideline is not protecting the human population. Dioxin may not have a 'safe' dose, making it prudent to assume that it poses some health risk at any dose. The 'no effect level' upon which Health and Welfare Canada relies is unsound and outdated. The levels of dioxin and dioxin-like compounds found in the general human population are at or near the levels associated with adverse effects."[26]

There may be other examples where concentrations may be of concern. In Canada, for example, arsenic contamination may be of concern. Between 1985 and 1988, federal scientists surveyed food from six Canadian cities in a market-basket analysis.[27] Federal officials examined a range of food types, including dairy products, meat and fish, breads, and fruits and vegetables. The analysis focused on arsenic, and based on the test results, the scientists estimated the total arsenic intake on a daily basis (see Table 2).

Table 2: Daily Arsenic Intake (ug/person/day)[28]

Vancouver	33.2
Winnipeg	50.9
Toronto	37.5
Montreal	39.7
Halifax	35
Ottawa	36.5

The U.S. EPA has estimated that a lifelong ingestion of 50-100 micrograms/day of arsenic in an adult results in one extra skin cancer per 1000 people.[29] According to the federal government study, the person in Winnipeg eats, on average, 50.9 micrograms per day, which is within the range of skin cancer effects. Does that mean for every 1000 adults in Winnipeg, one more skin cancer has developed? Given the scientific data, this is certainly worth asking.

The question is especially relevant in light of Health Canada's provisional Tolerable Daily Intake (TDI) for inorganic arsenic. It is 2 ug/kg-bw/per day[30], meaning that the TDI for a person weighing 70 kilograms will be approximately 140 micrograms per day. But according to Health Canada data, a 20-39 year old male person in Winnipeg takes in 79 micrograms/day[31] of arsenic, more than half of the TDI. Does that mean they are close to levels at which the arsenic causes human health effects?

(iii) Evidence of Effects From Some Contaminants

Although it can be argued that there are a broader range of effects than once anticipated and the concentrations of some substances are nearing concern, there is still limited empirical evidence of harm. However, there is some evidence, especially from scientists studying the effects of toxins in the Great Lakes region.

Scientists have released numerous reports demonstrating impacts of some substances, and in particular, polychlorinated biphenyls (PCBs), on wildlife.[32] These studies are of particular interest since they do establish the cause-effect linkage between PCBs and actual impacts on various species of wildlife. These effects are varied, but certainly their range from population decline to immune suppression is of significant importance.[33]

The linking of these effects to humans, however, has always been difficult. Nevertheless, these links are gradually being established. One of the best known studies was conducted by scientists studying the children of women whose diet included fish from Lake Michigan, which continue to contain significant levels of PCB's. The first study, undertaken in the mid-1980s, demonstrated that the children suffered from subtle effects, such as lower body weights and suspected cognitive problems, Successive studies were undertaken examining the children at various ages with a battery of IQ and achievement tests. The latest 1996 study results showed that:

> "Prenatal exposure to polychlorinated biphenyls was associated with lower-scale and verbal IQ scores...The strongest effects related to memory and attention. The most highly exposed children were three times as likely to have low average IQ scores...and twice as likely to be at least two years behind in reading comprehension..."[34]

This study is perhaps one of the strongest to suggest the link between human health impacts from toxins in food. But how applicable is it to the average Canadian?

While a specific response cannot be given with any degree of certainty, one can argue that Canadians are not be free from worry over PCBs. Between 1992 and 1996, Health Canada surveyed food from six Canadian cities in a market-basket analysis.[35] Federal officials examined a range of food types, including dairy products, meat and fish, infant food and fast food. The analysis focused on polychlorinated biphenyls (PCBs) and the study found that fish and butter contained the highest total PCB concentrations. Based on the test results, the scientists estimated the total PCB intake from various food groups (see Table 3).

Table 3: Daily PCB intake (ng/kg/day)[36]

Vancouver	3.5
Winnipeg	4.46
Toronto	6.05
Montreal	5.44
Halifax	7.73
Ottawa	7.27

We simply do not know if these concentrations are sufficient to cause harm. However, a precautionary approach would certainly suggest that Canadians should attempt to ensure that such concentrations should decrease over time since it is known that, at certain levels, PCBs will have unacceptable impacts.

Can effects such as those described above occur as a result of Canadian mothers eating PCB through their foods and then passing it on to their children in utero or through breast milk?

3. Bio-engineered Foods

Genetic engineering has recently entered the public debate with the cloning of "Dolly," the sheep in Scotland. What has been missed in the debate is that genetic engineering has been in Canada for some time and in every food group. If the trend continues, the fruits, vegetables, meat and milk products at the local grocer will never be the same.

The moral questions raised by the emergence of bio-engineering and its products are enormous.

Just consider:

• Is it right to manipulate the blueprint of life of other species?
• Do we want, or need, genetically engineered food?
• Who owns genetic information? For what purpose?
• Is genetic engineering another form of human domination over nature?
• Is it right to use animals as "bioreactors" to produce drugs or chemicals?

These questions have never been answered or even partially addressed. But at the same time, the technology is racing forward and more bio-engineered foods are being developed and introduced into the marketplace.

3.1 Sources and Summary of Findings

The federal department of Agriculture and Agri-Food provided the information on bio-engineered foods. They publish a list of approved foods on a World Wide Web site. The bio-engineered foods, as approved by the federal government as of February 4, 1997, are listed in Appendix 2. Many more food products are being researched and expected to receive federal approval in the near future.

While the science with respect to the potential environmental and human health effects of bio-engineered products is limited, recent evidence confirms the validity of many of the concerns which have been theorized in the past. These findings include the following:

- that bio-engineered organisms and their genetic material can be expected to persist in the environment for a long time;[37]
- that the commercialization of bio-engineered plants will cause the engineered traits to be transferred to wild or weedy populations of these plants or their close relatives;[38]
- that the emergence of resistant pest populations in response to the commercialization of pesticidal plants is likely;[39] and
- that transgenic foods may produce allergic reactions.[40]

As the science evolves to predict and confirm such effects, what other impacts will we find? Is bio-engineering the desirable way for a safe and secure food supply in Canada?

3.2 What do we really know about bio-genetic products?

Consider the following quotes from a range of scientists and writers:

"Predicting the specific type, magnitude, or the probability of environmental effects associated with ... genetically engineered organisms will be extremely difficult, if not impossible, at the present time."[41]

"Unfortunately, when dealing with the potential risks to biological systems, the existing data base is meagre and the predictive ability of the ecological sciences is almost nil."[42]

"Insufficient data exist to forecast environmental problems and pest outbreaks resulting from the release of genetically engineered organisms. Based on the data presented, we expect some environmental problems to occur..."[43]

"There is no dispute that engineered organisms as a group will possess a higher degree of genetic novelty than .... naturally occurring organisms and that our environmental experience with such organisms is virtually nil."[44]

"Many answers dealing with genetically engineered micro-organisms are not available."[45]

These quotes show that scientists cannot predict environmental and human health risks satisfactorily. But scientific uncertainty is not new to the field of genetic engineering. From the early laboratory beginnings, molecular biologists were uncertain over the consequences of their activities.[46] They did not know what to expect from newly engineered organisms: if and how they would survive, if they would reproduce, how they would express their newly acquired traits, or how dangerous such organisms would be in a laboratory environment. This uncertainty is spreading from the lab to the fields, from the fields to the store shelves, and from the shelves to dining tables.

3.3 Food Production

The agricultural sector is by far the busiest area of bio-engineering activities in Canada, and indeed worldwide. Currently, research is being done to genetically alter both crop plants and farm animals, with the bulk of the research focusing on crop plants. As a result, the first products to reach Canadian supermarkets have been canola-based oils, potatoes, tomatoes, corn, and soybeans.

3.3.1 Crops

Bio-engineered crops have been developed and tested more than any other genetic engineering product, agricultural or otherwise. The number of releases has increased substantially since the first fourteen releases in 1988, to over 750 in 1994 and over 520 in 1995. It is no small wonder, therefore, that this area of genetic engineering has been quite controversial with environmentalists and some farmers.[47]

(i) Herbicide Resistance

Almost half of the research and development focuses on making crops resistant to herbicides. This enables the crop to survive the poison while the weeds around it die. But critics argue that herbicide-resistant crops do not move us towards environmentally responsible agriculture. The critics have a number of concerns:

- The use of herbicides in agriculture will continue high-input and energy-intensive agricultural practices. Such practices have caused a number of environmental and economic problems.
- The use of herbicide-resistant crops may increase the total amount of herbicides used.
- The intense use of herbicides will cause adaptive pressures which will lead to herbicide-tolerant weeds. For example, in the U.S. 55 species of weeds are now resistant to the triazine group of herbicide.[48]

It is clear that using genetic engineering to develop herbicide-resistant crops has little to do with sustainable agriculture. Quite the opposite, they are an obvious market niche for the world's eight largest pesticide companies, who have all initiated herbicide-resistant research programs.[49]

(ii) Resistance to Bt

Major research efforts and products are also geared towards pest-resistant crops. These crops contain genes which produce chemicals to kill insects feeding on the crop. Typically, such plants contain genes from a bacterium *Bacillus thuringiensis*, or Bt for short. The Bt has historically been used as a biological alternative to chemical pesticides, used sparingly and only when needed. However, environmentalists and organic farmers have opposed the approvals of Bt-engineered crops because they fear that widespread use of Bt crops will cause the target insects to develop resistance to the Bt toxin via evolutionary pressures. This will then render Bt useless as a non-chemical alternative.[50]

(iii) Anti-biotic Resistance

Each crop has also been engineered to be resistant to anti-biotics, that is, such crops contain genes which confer resistance to anti-biotics. The potential danger here is tremendous: what if disease-causing bacteria somehow incorporate the anti-biotic resistant gene into their genetic make-up? Since anti-biotic resistance is already becoming a significant problem in public health care, why take additional risks with the widespread use of crops containing anti-biotic resistance genes? Can disease-causing bacteria take-up the anti-biotic resistant gene? Some researchers believe so:

> “The adage that ‘you are what you eat’ has taken on a whole new meaning. Researchers in Germany claim that DNA fed to a mouse can survive digestion and invade cells throughout its body. Because food contains DNA, this may be a way for species to acquire genes...”[51]

Some governments are acting on the concern. For example, a British government advisory committee on novel foods had advised that bio-engineered foods with resistance to anti-biotics used in human and veterinarian applications should not be approved for human consumption. But such foods have been approved in Canada.

3.3.2 Animals

Genetic engineering of farm animals is used to increase their body weight, to increase milk production and to fight diseases. These activities are being achieved by the following methods:

- increasing their rate of reproduction, such as by splitting cattle embryos;
- developing vaccines to fight animal diseases, such as a vaccine to fight bovine (cow) virus diarrhoea;
- developing diagnostic tools to detect diseases, such as monoclonal antibody tests to diagnose for salmonellosis; and
- producing hormones to increase yields of meat or milk, such as bovine growth hormone (BGH) to increase milk production in cows.

The most controversial application so far has been the genetically engineered bovine growth hormone (BGH), although the federal Department of Health has yet to approve it.[52]

3.3.3 Bio-engineered Foods Approved in Canada

Appendix 2 contains a listing of the bio-engineered foods approved in Canada. Some 18 bio-engineered foods have been approved, engineered for a range of traits, including herbicide resistance, pest resistance, delayed ripening, and anti-biotic resistance. The crops include corn, canola, potatoes, tomatoes and soybeans.

Bio-engineered food does not have to be labelled as such. Canadian consumers are robbed of their right to know what they eat.

No tracking or monitoring of bio-engineered is done in Canada. We simply do not know where and how much bio-engineered food is grown in Canada and what supermarkets or grocers sell them.

3.4 What are the Environmental Risks?

The issue most often mentioned with biogenetic species is the potential for environmental damage. After all, the scenario of self-replicating pollution is cause for considerable concern.

The environmental risks depend on complex interactions between genes and cells inside the engineered organism, as well as interactions between the organism and its environment. In general, scientists have some reason to believe that biogenetic species may be less predictable than those developed by traditional techniques.[53]

The scientific literature is filled with what can happen to the environment when bio-genetic species are in the environment:

(i) The Creation Of New Pests.

The creation of new pests has long been a problem in the agricultural field. For example, numerous cases have been reported in which insects, through a single gene change, have developed resistance to insecticides.[54] Similarly, crops introduced from other parts of the world have become major food sources for what were once harmless insects but have since become agricultural "pests." For example, the Colorado potato beetle used to feed on wild rice but changed its diet following the introduction of the potato to North America. Its population size has since exploded, thus making it the "pest" it is today.[55]

Many such mishaps have occurred and similar ones are likely to be repeated with genetically engineered organisms. In fact, several agricultural scientists have concluded that:

> "This history suggests that the introduction of many types of foreign organisms in the environment could have a major negative impact on many of the 200,000 beneficial plant and animal species in the United States."[56]

(ii) An Increase In The Effects Of Existing Pests

The transfer of genetic information between a genetically engineered organism and a related species is of special concern for crop plants and micro-organisms. Crop plants are capable of transferring genes over relatively long distances to related plants, some of which may be "weeds."[57] Thus, traits which may be desirable in a crop plant, such as resistance to herbicides or drought, could be transferred to weeds and thus make the weeds even more difficult to control.

Just such a phenomenon could occur in Canada, where great emphasis is placed on the development of herbicide-resistant crops. Engineered canola could, for example, transfer its herbicide-resistance to wild rapeseed which could then become an unmanageable weed.

And again, the concern about the extensive use of Bt genes has raised questions about losing an effective non-chemical pest control product.

(iii) Causing Harm To Non-target Species

Bio-engineered organisms may cause damage to other species. The potential for environmental damage is especially high with the use of microorganisms because of their ability to affect many different species. For instance, viruses engineered to kill specific pests could also infect beneficial insects.

(iv) The Disruption Of Natural Systems

Releasing bio-engineered species into the environment could also disrupt natural systems or even whole ecosystems. Such disruptions could range from the replacement of a few native species to a complete change in the types of species which inhabit an area. Again, many examples of consequential introductions of non-engineered species have been documented in the agricultural field.

Aside from agricultural systems, other natural systems can also be affected. For instance, fish engineered to be larger or cold-tolerant can displace other fish species. Forests can also be severely affected. An example of the potential for disruption of forest communities occurs with the genetic alteration, for commercial purposes, of trees such as pines and poplars. Because these trees can pollinate over large areas, they have the capacity to spread themselves over a large area and thus greatly alter the natural balance within the surrounding area.[58]

(v) The Disruption Of Ecosystem Processes

The introduction of genetically engineered organisms may cause disruptions in ecosystem processes, such as nutrient cycles or weather patterns. Such effects are usually very difficult to predict for an engineered species because of the number of possible interactions between the engineered species, surrounding species and various elements in the surrounding environment. Nevertheless, several possibilities have been proposed. One such speculation is that bacteria which are resistant to frost may alter climatic patterns in the surrounding area.

4. Where We Go From Here?

Canadians should be concerned about the pervasiveness of toxic substances and the developments in bio-engineering. This concern, however, should be accompanied by actions to help address these concerns. Obviously, it is impossible to stop eating food. However, one option is to shop and eat wisely. For example, one should avoid eating foods with known unacceptable quantities of contaminants in them, such as fish that exceed the consumption guidelines outlined in some provinces.

Another avenue for participation is to assist in strengthening legislation governing toxic substances and the products of bio-engineering. There are a number of laws governing these issues. With respect to toxic substances, for example, the Pest Products Control Act, the Hazardous Products Control Act, the Food and Drugs Act, along with many provincial laws, could be strengthened. The following section focuses on one important law which has the potential to deal with many of the substances found in food.

4.1 CEPA and Bill C-74

The Canadian Environmental Protection Act (CEPA) was originally enacted in 1988. While one of its important components deals with toxic substances, CEPA also deals with pollution prevention, biotechnology, air quality, ocean dumping and coastal zone management, transboundary movement of waste, among other issues.

In 1995, the House of Commons Standing Committee on Environment and Sustainable conducted cross-country hearings to review the effectiveness of CEPA and released their recommendation in a report entitled, "It's About Our Health: Towards Pollution Prevention." The 141 recommendations in that report reflect the true concerns of Canadians and, if the recommendations had been accepted, would have significantly strengthened this law. The federal government's response was released in December of 1995. Some of the recommendations of the Committee's report reflect the influence of pro-industry federal departments and industry.

On December 10, 1996, Bill C-74, the new *Canadian Environmental Protection Act* was introduced into First Reading. It still awaits Second Reading, but how far it will go in the legislative process remains unclear in light of the impending election.

While Bill C-74 contains a few improvements, such as the provision that declares pollution prevention as a national goal for Canada, there are a number of important weaknesses of the bill. These are as follows:

Bill C-74 will Permit the Continued Generation and Use of the Worst Toxic Substances: There a number of serious concerns with Bill C-74 pertaining to the control of toxic substances. The most problematic provision in this part pertains to the definition of "virtual elimination." This definition is of enormous importance since it sets the long-term goal for the most dangerous substances. The term is defined as a release that is approaching the level of quantification and may result in harm to human health or the environment. The effect of using this definition is to actually allow industry to continue to use and generate the substances so long as releases are controlled to levels that are below detection and where no harm can be found to occur at those levels.

Further, when the goal of virtual elimination is defined as "no measurable release," legitimacy is given to continuing the use of pollution control techniques that attempt to reduce emissions at the end-of-the-pipe. Under the proposed definition, the thrust of the initiative will be to reduce emissions, not move toward process change or other measures that avoid the use or generation of toxic substances in the first place. As such, the proposed law will reinforce present practices that are expensive and inefficient.

Also, the bill creates a labyrinth of requirements for risk assessment and cost-benefit analysis before any action can be taken. There is no provision to "virtually eliminate" endocrine disruptors unless they are persistent and bioaccumulative. CEPA must include provisions to phase-out the use and generation of all inherently toxic substances, including endocrine disruptors.

Finally, environmentalists are not alone in their concern over this definition. Some international agencies, such as the International Joint Commission, disagree with the definitions such as those proposed in Bill C-74.[59]

Bill C-74 Will Weaken Existing CEPA Requirements for Biotechnology Products: Bill C-74 does deal with biotechnology products, such as genetically engineered plants, microorganisms and fish. However, its primary effect would be to permit Ministers other than the Environment Minister to exempt biotechnology products from CEPA's existing requirements to review their environmental and human health impacts prior to their introduction into Canada. For those products that are subject to a review, that review will not be as stringent or comprehensive as is the case. For example, the regulations under the Seeds Act require far less information to determine human health and environmental impacts than comparable regulations under the current CEPA. CEPA provisions should be strengthened, not weakened, with respect to all biotechnology products.

Bill C-74's Citizen Rights Provisions Will Be Ineffective: While the bill proposes a new right for Canadians to bring to court those who are violating the provisions of CEPA, the right to bring such an action is limited by so many qualifications that it is essentially without utility. The provisions are only operative after damage to the environment or human health has occurred. CEPA must include effective public participation rights, including the right to bring an action to *prevent* environmental or human health harm.

Bill C-74 Weakens the Federal Government's Ability to Protect the Environment: The bill effectively limits the ability of the federal government to protect the environment since it is made subservient to the "Harmonization Accord" proposed by the Canadian Council of the Ministers of the Environment. In practice, this accord will devolve significant federal roles and responsibilities to the provinces. CEPA should ensure that the federal government provide strong environmental leadership and act within its constitutional boundaries to protect the environment.

Bill C-74 and Pollution Prevention: It is always better to avoid the use and generation of pollutants than trying to treat them once created. Bill C-74 declares pollution prevention to be a national goal. However, despite this laudable declaration, the bill provides only for the discretion of the Minister of the Environment to require pollution prevention planning. In our view, pollution prevention planning should be made mandatory for at least all substances found to be toxic under the Act.

4.2 What Needs to be Done

There is need for governments to take decisive action to address toxic substances, and in particular, toxins in food. The federal government has yet to fulfil the Liberal Red book commitments to phase-out persistent toxic substances, and to establish meaningful and effective citizen rights. The citizens of Canada must insist that Bill C-74 be revised to address the above issues.

What kind of policy and legislative initiatives are needed? Here are our suggestions:

4.2.1 Frequency and Type of Testing - National Testing Regime

The Departments of Health Canada and Environment Canada should conduct more frequent and routine testing of our food. In fact, there should be a "national food testing inventory" that would have the most recent data on all contaminants in all major food products.

4.2.2 Data Availability of Food Testing - National Inventory of Food Contaminants

The "national food testing inventory" should be publicly available so that all Canadians have the choice of what food to eat. More importantly, the data bank would demonstrate exactly what contaminants we must deal with in a legislative context to ensure their levels do not increase. This data should be collected on a routine and predictable basis so that we can determine if the levels are rising or not.

4.2.3 Developing Standards to Protect Sensitive Populations

At present, standards are set based on assumptions that an average person is of a certain body weight. However, these assumptions seldom take into account sensitive populations, and in particular, children.

Children are not small adults. In relation to their body weight, they eat twice as much as an adult, ingesting more toxic chemicals per body weight, and because they are growing, they are more vulnerable. This is often not taken into account when governments set tolerances; generally they set them for adults. Some governments are planning to change this. The U.S. EPA Administrator, for example, said in October of 1996 that from now on EPA standards will be based on the risk of pollutants to children, the Canadian government has yet to set all its standards to protect children's health.

4.2.4 Improving the Canadian Environmental Protection Act

Canadians need better legislation to address toxins in food. Although there are many laws that could be improved, one of the laws that is most current is the proposed Canadian Environmental Protection Act, Bill C-74. The above sections outlined the weaknesses. Here are the highlights of what should be improved:

(i) Pollution Prevention: Bill C-74 must implement pollution prevention by mandating pollution prevention plans for all substances subject to the law.

(ii) Bans and Phase-outs: Bill C-74 must include provisions to phase-out the use and generation of the worst toxic substances, including endocrine disruptors.

(iii) Citizen Rights: Bill C-74 must include effective public participation rights, including the right to bring an action to prevent environmental or human health harm.

(iv) Pollution Prevention: Bill C-74 must implement pollution prevention by mandating pollution prevention plans for all substances subject to the law.

(v) Role of Federal Government: Bill C-74 must ensure that the federal government provide strong environmental leadership and act within its constitutional boundaries to protect the environment.

4.2.5 Bio-engineered Food

Several legislative improvements are required with respect to bio-engineered food to a number of federal statutes, including the Canadian Environmental Protection Act. These improvements include::

- All bio-engineered food must be labelled as such.
- Certain applications, such as herbicide resistance or Bt-resistance, should have their approvals reconsidered, and no new approvals should be given until a full environmental assessment and comprehensive environmental monitoring of these products has been undertaken.
- Given the growing gap between the development of bio-engineered products and our ability to assess their likely long-term effects resulting from them, a substantial portion of current federal bio-engineering funds should go to research on the ecological and health impacts of such products. These funds should not be tied to "partnership" requirements with the private sector. The goal should be to support high quality, independent research.
- Regulators should adopt a more precautionary approach to assessments. The limits of the current science on ecological impacts must be recognized. We must proceed with caution where we do not know full scientific details.
- The regulatory process should include consideration of alternative means to achieve a product's purpose which may present lower potential for harm to the environment and human health.
- Governments must provide for more open and transparent decision-making processes

regarding products of biotechnology including:

- notice and comment on major regulatory decisions, such as approvals of field tests and product approvals;
- improved access to information and;
- appeal procedures related to major regulatory decisions.

- The federal government should establish an independent advisory commission to develop an appropriate legal and institutional framework for the regulation of bio-engineered products in Canada, as recommended by the Standing Committee on Environment and Sustainable Development in their 1996 report on the regulation of biotechnology.[60]

4.2.6 Canada and the International Scene

Not only must Canada seek to improve its own domestic legislation, but it must take strong and aggressive stances to control global sources of toxic substances. Canada will have the opportunity to take such a role in a variety of fora, including the proposal for a global treaty for persistent organic pollutants under the auspices of the United Nations Environment Programme.

APPENDIX 1

Concentrations of Toxic Substances Found in Selected Food in Canada

DRINKING WATER

5.25 ppb tetrachloroethylene[61]	(dry cleaning solvent)
47 ppb of benzene[62]	(industrial solent and chemical)
0.139 ppb 1,2-dichloroethane[63]	(intermediate to make vinyl chloride)
1 ppb 1,4-dichlorobenzene[64]	(urinal deodorizer)
3.4 ppb 1,2-dichlorobenzene[65]	(metal degreaser and cleaner)
7.2 ppb bibutyl phthalate[66]	(plasticizer in polyvinvyl)
0.2 ppb trichloroethylene[67]	(cleaning and adhesives agent)
0.1 ppt 1,2,3-trichlorobenzene[68]	(solvents and industrical chemical)
0.250 ppb styrene[69]	(industrial chemical)
623 ppb fluoranthene[70]	(by-product from fossil fuels)
40 ppb benzo[k]fluoranthene[71]	(by-product from fossil fuels)
40 ppt benzo[b]fluoranthene[72]	(by-product from fossil fuels)
46 ppq octachlorodibenzodioxin[73]	(incineration by-product)
24.23 ppb trihalomethanes[74]	
6.7 ppt 1,2,3-trichlorobenzene[75]	(industrial chemical)
0.07 ppt hexchlorobenzene[76]	(industrial chemical)
21.45 ppt phenanthrene[77]	(by-product from fossil fuels)
5.45 ppb chloroform[78]	(general use chemical)
110 ppt toluene[79]	(industrial solent and chemical)

DAIRY

Butter

3.4 ppm bis(2-ethylhexyl) phthalate[80]	(industrial chemical; plasticizer)
6.837 ppb PCBs[81]	
1.5 ppm dibutyl phthalate[82]	(plasticizer in polyvinvyl)
800 ppt hexachlorobenzene[83]	(industrial chemical)
84 ppb dichloromethane[84]	(industrial chemical; paint stripper)
0.64 ppm butyl benzyl phthalate[85]	(plasticizer in PVC)
410 ppb trichloroethylene[86]	(cleaning and adhesives agent)

Milk

0.29 ppb hexachlorobenzene[87]	(industrial chemical)
0.1 ppm di-2-ethylhexyl phthalate[88]	(plasticizer in PVC)
0.038 ppt 2,3,7,8-tetrachlorodibenzo-p-dioxin[89]	
0.061ppt 2,3,7,8-tetrachlorodibenzo-p-dioxin[90]	
1.2 ppb 1,3,5-trichlorobenzene[91]	(solvents and industrical chemical)
1 ppt octachlorodibenzodioxin[92]	(incineration by-product)
2 ppb nickel[93]	
1.23 ppt 2,3,7,8-tetrachlorodibenzofuran[94]	

0.55 ppb 1,4-dichlorobenzene[95] (urinal deodorizer)
1 ppt 1,2,7,8-tetrachlorodibenzofuran[96] (incineration by-product)
2.9 ppt 1,2,7,8-tetrachlorodibenzofuran[97]
0.14 ppb 1,2,4-trichlorobenzene[98] (solvents and industrical chemical)
2.9 ppb arsenic[99]
0.304 ppb PCBs[100]
2.4 ppt dioxins and furans[101]

Cream
0.88 ppb of hexachlorobenzene[102] (industrial chemical)
657 ppt PCBs[103]
3.9 ppt 1,2,7,8-tetrachlorodibenzofuran[104]
0.11 ppt 2,3,7,8-tetrachlorodibenzo-p-dioxin[105]

Cheese
60 ppb lindane[106] (pesticide)
2.234 ppb PCBs[107]
20 ppb chlordane[108] (pesticide)
310 ppm di-2-ethylhexyl adipate[109] (plasticizer in PVC) many other cheeses
5.5 ppm di-2-ethylhexyl phthalate[110] (plasticizer in PVC) many other cheeses
45 ppb dichloromethane[111] (industrial chemical; paint stripper)
19 ppt dioxins and furans[112] (incineration by-products)

MEAT AND POULTRY

Chicken
2.6 ppm bis(2-ethylhexyl) phthalate[113] (industrial chemical)
4.2 ppm lindane[114] (pesticide)
30 ppb pentachlorophenol[115] (wood preservative)
2.6 ppm lead[116]
0.7 ppb PCBs[117]
2.3 ppm selenium[118]
1.2 ppm arsenic[119]
210 ppt octachlorodibenzodioxin[120] (incineration by-product)
14 ppm di-2-ethylhexyl adipate[121] (plasticizer in PVC)

Beef
0.7 ppb PCBs[122]
4.138 ppb PCBs[123]
0.45 ppm lindane[124] (pesticide)
67 ppb pentachlorophenol[125] (wood preservative)

2.1 ppm selenium[126]	
12 ppt dioxins and furans[127]	
2 ppm lead[128]	
6.2 ppm dibutyl phthalate[129]	(plasticizer in PVC)
822 ppb arsenic[130]	
3.2 ppm di-2-ethylhexyl phthalate[131]	(plasticizer in PVC)
12 ppt octachlorodibenzodioxin[132]	(incineration by-product)
2.5 ppm nickel[133]	
9.5 ppm di-2-ethylhexyl adipate[134]	(plasticizer in PVC)

Pork

220 ppb lindane[135]	(pesticide)
61.8 ppt dioxins and furans[136]	(incineration by-products)
0.8 ppm butyl benzyl phthalate[137]	(plasticizer in PVC) many other cheeses
630 ppb pentachlorophenol[138]	(wood preservative)
1.6 ppm lead[139]	
1 ppm selenium[140]	
3.7 ppm di-2-ethylhexyl phthalate[141]	(plasticizer in PVC)
1.6 ppm cadmium[142]	
1 ppb PCBs[143]	
2.362 ppb PCBs[144]	
600 ppb arsenic[145]	
1 ppm di-2-ethylhexyl adipate[146]	(plasticizer in PVC)
15 ppt octachlorodibenzodioxin[147]	(incineration by-product)

Turkey

840 ppb DDE[148]	(DDT pesticide derivative)
1.6 ppm selenium[149]	
539 ppb arsenic[150]	
840 ppb lead[151]	
1.5 ppm di-2-ethylhexyl adipate[152]	(plasticizer in PVC)

CEREALS & BREADS

Muffins

1.0 ppm bis (2-ethylhexyl) phthalate[153]	(industrial chemical; plasticizer)
24 ppb arsenic[154]	

Wheat and Bran Cereal

100 ppb chromium[155]

Ready-to-eat Cereal

95 ppb dichloromethane[156]	(industrial chemical; paint stripper)

FISH

Great Lakes Fish (unspecified)	
1.10 ppb of hexachlorobenzene[157]	(industrial chemical)
12.2 ppb of hexachlorobenzene[158]	(industrial chemical)
2 ppt 2,3,7,8-tetrachlorodibenzodioxin[159]	(incineration by-product)
5 ppb 1,2,4,5-tetrachlorobenzene[160]	(industrial chemical)
Crunchy Haddock	
3.42 ppt dioxins and furans[161]	(incineration by-products)
Perch	
2.69 ppt dioxins and furans[162]	(incineration by-products)
0.6 ppm di-2-ethylhexyl adipate[163]	(plasticizer in PVC)
Smoked Salmon	
220 ppm di-2-ethylhexyl adipate[164]	(plasticizer in PVC)
Marine fish (unspecified)	
4.830 ppm arsenic[165]	
8.832 ppb PCBs[166]	
Feshwater fish (unspecified)	
1.350 ppm arsenic[167]	
31.9 ppb PCBs[168]	
Shellfish (unspecified)	
4.200 ppm arsenic[169]	
0.9 ppb PCBs[170]	
4.558 ppb PCBs[171]	

FRUITS AND VEGETABLES

Apples	
310 ppb formetanate[172]	(pesticide)
8.5 ppb arsenic[173]	
4.0 ppm diphenylamine[174]	(pesticide)
0.06 ppm di-2-ethylhexyl phthalate[175]	(plasticizer in PVC)

2.6 ppm phosalone[176] (pesticide)
230 ppb endosulfan[177] (pesticide)
0.56 ppm dibutyl phthalate[178] (plasticizer in PVC)
210 ppb carbaryl[179] (pesticide)
250 ppb propargite[180] (pesticide)
46 ppt octachlorodibenzodioxin[181] (incineration by-product)

Leaf Lettuce
98 ppm dithiocarbamates[182] (pesticide)
2 ppm dimethoate[183] (pesticide)
5.4 ppb arsenic[184]
1.3 ppm parathion[185] (pesticide)
1.2 ppm methomyl[186] (pesticide)
1.2 ppm di-2-ethylhexyl adipate[187] (plasticizer in PVC)
4.2 ppm carbaryl[188] (pesticide)
1.3 ppm dichloran[189] (pesticide)

Corn (canned)
30 ppm zinc[190]
11 ppb arsenic[191]

Carrots (fresh)
210 ppb chloropropham[192] (pesticide)
440 ppb diazinon[193] (pesticide)
9.5 ppb arsenic[194]
9.5 ppm carbaryl[195] (pesticide)
181 ppb trifluralin[196] (pesticide)
6 ppb nickel[197]

Beans (canned)
4 ppm aluminum[198]
2 ppm chromium[199]
11 ppb arsenic[200]

Vegies/fruit (unspecified)
1.78 ppb benzo[b]fluoranthene[201] (by-product from fossil fuels)

WILDLIFE

Seal Blubber
119.5 ppb of hexachlorobenzene[202] (industrial chemical)

OTHER

Honey
600 ppb phenol[203]

Maple Syrup
1.2 ppm paraformaldehyde[204] (industrial chemical)

Eggs
45 ppb hexachlorobenzene[205] (industrial chemical)
0.8 ppb PCBs[206]
1.004 ppb PCBs[207]
44 ppt octachlorodibenzodioxin[208] (incineration by-product)
74 ppb 1,2,4 trichlorobenzene[209] (solvents and industrical chemical)
7 ppb nickel[210]
0.0018 ppm 1,2-dichlorobenzene[211] (metal degreaser and cleaner)
22 ppm di-2-ethylhexyl adipate[212] (plasticizer in PVC)
17 ppb arsenic[213]

FOODS WHICH ARE PART OF THE INUIT DIET

Ringed seal blubber

187 ppb chlorobenzenes[214]
383 ppb hexachlorocyclohexanes[215]
1 ppm chlordane[216]
673 ppb DDT[217]
2.1 ppm PCBs[218] (up to 3.4 ppm measured)
561 ppb toxaphene[219] (up to 1.5 ppm measured)
130 ppb Dieldrin[220]

Beluga blubber

1.2 ppm chlorobenzenes [221]
987 ppb hexachlorocyclohexanes [222]
4.2 ppm chlordane[223] (up to 6.4 ppm measured)
11.2 ppm DDT[224] (up to 21.7 ppm measured)
6.8 ppm PCBs[225] (up to 9 ppm measured)
15.4 ppm toxaphene (up to 28.9 ppm measured)[226]
1.6 ppm dieldrin[227]

Beluga muktuk

40.4 ppb chlorobenzenes [228]
24.9 ppb hexachlorocyclohexanes[229]
163 ppb chlordane[230]
272 ppb DDT[231]
317 ppb PCBs[232]
468 ppb toxaphene[233]
29 ppb dieldrin[234]

APPENDIX 2

Bio-engineered Foods Approved in Canada

February 4, 1997

Status of Plant with Novel Trait Approvals For:

Novel Food Use
Novel Feed Use
Environmental Release and
Variety Registration

Canola

Product	Trait	Proponent	Health Canada	Agriculture and Agri-Food Canada		
			Food Safety Approval	Animal Feed Approval	Environ-mental Approval	Variety Registration
1. Canola	1. Pollination Control Mechanism (MS1, RF1) & Glufosinate tolerant	Plant Genetic Systems	✓ (Sept '94)	✓ (May '95)	✓ (Apr '95)	✓ (May '95) 2 hybrids registered
2. Canola	Glyphosate tolerant (GT73)	Monsanto	✓ (Nov '94)	✓ (Mar '95)	✓ (Mar '95)	✓ (Apr '96) 2 lines with GT73 as a parent
3. Canola	Glufosinate ammonium tolerant (HCN92, HCN 10)	AgrEvo Canada	✓ (Feb '95)	✓ (Feb '95)	✓ (Mar '95)	✓ (92-Apr '95, 10-Jan '96)
4. Canola	Imidazolinone resistant (NS738, NS 1471, NS 1473)	Pioneer Hi-Bred Int'l	✓ (Apr '95)	✓ (Mar '95)	✓ (Apr '95)	✓ (NS 1471 reg'd Apr '95)

Product	Trait	Proponent	Health Canada	Agriculture and Agri-Food Canada		
			Food Safety Approval	Animal Feed Approval	Environ-mental Approval	Variety Registration
5. Canola	Pollination Control Mechanism (RF2) & Glufosinate tolerant	Plant Genetic Systems	✓ (Aug. '95)	✓ - Same review as #1 above	✓ - Same review as #1 above	No application received
6. Canola (Laurate rapeseed)	Higher quantities of laurate and myristate	Calgene	✓ (Apr. '96)	✓ (Feb '96)	✓ (Feb '96)	No application received
7. Canola	High oleic / Low linolenic acid	Pioneer Hi-Bred	✓ - Company requested (Aug. '96)	✓ - Not a product feed	✓ - Not novel to the environment	Under Review

Tomato

Product	Trait	Proponent	Health Canada	Agriculture and Agri-Food Canada		
			Food Safety Approval	Animal Feed Approval	Environ-mental Approval	Variety Registration
1. Tomato (Flavr Savr TM)	Delayed ripening	Calgene	✓ (Feb. '95)	Not fed to animals	✓[1] - Not grown in Canada (Jun '95)	Not required
2. Tomato	Delayed ripening	DNA Plant Technol-ogy	✓ (Nov. '95)	Not fed to animals	✓[1] - Not grown in Canada (Jun '96)	Not required

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This crop undergoes an review for product safety under the *Plant Protection Act* prior to importation

3. Tomato	Delayed ripening	Zeneca Seeds	✓ (Jun '96)	Not fed to animals	✓[1] - Not grown in Canada	Not required

Potato

Product	Trait	Proponent	Health Canada	Agriculture and Agri-Food Canada		
			Food Safety Approval	Animal Feed Approval	Environ-mental Approval	Variety Registration
1. Potato (New Leaf ™)	Colorado Potato Beetle resistant	Monsanto	✓ (Sep '95)	✓ (Dec '95)	✓ (Dec '95)	✓ (Feb '96)
2. Potato (Atlantic and Superior varieties)	Colorado Potato Beetle resistant	Monsanto	✓ (Nov. '96)	Under Review	Under Review	No application received

Corn

Product	Trait	Proponent	Health Canada	Agriculture and Agri-Food Canada		
			Food Safety Approval	Animal Feed Approval	Environ-mental Approval	Variety Registration
1. Corn	Imidazolinone resistant (3751IR, 3417IR)	Pioneer Hi-Bred Int'l	✓ (May '94)	✓ (Feb '96)	✓ (Feb '96)	✓ (Feb '96)
2. Corn	European Corn Borer Resistant (event 176)	CIBA Seeds / Mycogen	✓ (Dec '95)	✓ (Feb '96)	✓ (Feb. '96)	✓ 2 hybrids (Mar '96) 7 hybrids (Jan '97)

3. Corn	European Corn Borer resistant	Northrup King Co.	✓ (Aug '96)	✓ (Jun '96)	✓ (May '96)	✓ (Aug '96) 2 hybrids
4. Corn	Glufosinate tolerant	Dekalb Genetics Corporation	✓ (Dec '96)	✓ (Nov '96)	✓ (Oct '96)	No application received
5. Corn	Insect resistant	Pioneer Hi-Bred	✓ (Dec '96)	✓ (Nov'96)	✓ (Nov '96)	No application received

Soybeans

Product	Trait	Proponent	Health Canada	Agriculture and Agri-Food Canada		
			Food Safety Approval	Animal Feed Approval	Environ-mental Approval	Variety Registration
1. Soybeans	Glyphosate tolerant (GTS-40-3-2)	Monsanto	✓ (Apr '96)	✓ (Jun '95)	✓ (Nov 95)	No application received

Cotton Seed

Product	Trait	Proponent	Health Canada	Agriculture and Agri-Food Canada		
			Food Safety Approval	Animal Feed Approval	Environ-mental Approval	Variety Registration
1. Cotton-seed	Lepidopteran resistant	Monsanto	✓ (Apr '96)	✓ (May '96)	(May '96)	Not required
2. Cotton-seed	Bromoxynil resistant	Calgene	✓ (Aug '96)	Under Review	under review	Not required
3. Cotton-seed	Glyphosate tolerant	Monsanto	✓ (Dec '96)	Under Review	✓[2] - Not grown in Canada (Dec '96)	Not required

[2]This crop undergoes a review for product safety under the *Plant Protection Act* prior to

Status of AAFC Plant with Novel Trait Approvals for Plants Not Approved[2] As A Novel Food Above

Novel Feed Use
Environmental Release
Variety Registration

Canola

Product	Trait	Proponent	Agriculture and Agri-Food Canada		
			Animal Feed Approval	Environmental Approval	Variety Registration
1. Canola	Glusofinate ammonium tolerant (HCN28)	AgrEvo	✓ (Mar '95)	✓ (May '96)	No application received
2. Canola	Glyphosate tolerant (GT 200)	Monsanto	Not developed for commerciali-zation	✓ (Mar '96)	No application received
3. Canola	Glufosinate ammonium tolerant (MS3)	Plant Genetics Systems	✓ (Oct '96)	✓ (Oct '96)	No application received
4. Canola	Glufosinate ammonium tolerant (MS8)	Plant Genetics Systems	✓ (Oct '96)	✓ (Oct '96)	No application received
5. Canola (rapa)	Herbicide tolerant	Monsanto Canada	Under Review	Under Review	No application received
6. Canola	Canola	Rhone-Poulenc Canada	No feed application	Under Review	No application recieved

There may be a number of reasons why there has been no approval for novel food use including: (i) the company may not wish to use the crop as food; (ii) the application is still under review as a novel food; (iii) Health Canada has not received an application to review.

Flax

Product	Trait	Proponent	Agriculture and Agri-Food Canada		
			Animal Feed Approval	Environmental Approval	Variety Registration
1. Flax	Sulfonylurea tolerant	University of Saskat-chewan	✓ (May '96)	✓ (May '96)	✓ (May ' 96)

Corn

Product	Trait	Proponent	Agriculture and Agri-Food Canada		
			Animal Feed Approval	Environmental Approval	Variety Registration
1. Corn	Glufosinate ammonium tolerant (T14, T25)	AgrEvo	✓ (Jun '96)	✓ (May '96)	No application received
2. Corn	Sethoxydim tolerant	BASF	✓ (Apr '96)	✓ (May '96)	No application recieved
3. Corn	Imidazolinone tolerant	ICI / Zeneca Seeds	✓ (Apr '96)	✓ (Apr '96)	Under review
4. Corn	Glufosinate ammonium tolerant	Plant Genetics Systems	Under review	✓ (Oct '96)	No application recieved
5. Corn	Insect resistant & herbicide tolerant	Pioneer Hi-Bred	✓ (Nov '96)	✓ (Nov '96)	No application received
6. Corn	Insect resistance & glufosinate ammonium tolerance	Dekalb Genetics Corporation	Under Review	Under Review	No application recieved
7. Corn	Insect resistance (Mon 810)	Monsanto Canada	✓ (Jan '97)	✓ (Jan '97)	No application recieved
8. Corn	Insect resistance & herbicide tolerant (Mon 802)	Monsanto Canada	Under Review	Under Review	No application recieved
9. Corn	Glyphosate resistant (Mon 832)	Monsanto Canada	Under Review	Under Review	No application recieved

Notes

1. For example, see: Salem Alaton, "Effects of Pollutants Raise New Concerns" Globe and Mail, June 4, 1996; "Prostate cancer epidemic looms - Canadian men could see cases almost triple in the next 20 years, researchers say." November 27, 1995, Global and Mail; "Scientists alarmed over chemical use - Man-made substances dumbing-down society" The Spectator, May 31, 1996, p. B5.

2. For a Good Summary, see: T.E. Colborn, et al., Great Lakes, Great Legacy? (Washington: The Conservation Foundation/ The Institute for Research on Public Policy, 1990), Chapter 7.

3. Environment Canada, 1996. Summary Report 1994: National Pollutant Release Inventory, Supply and Services Canada, Ottawa.

4. IJC, 1995. Seventh Biennial Report Under the Great Lakes Water Quality Agreement of 1978, Ottawa & Washington, D.C., page 5.

9. Government of Canada, 1993. Priority Substances List Assessment Report: Benzene. Page 25.

6. Government of Canada, 1994. Priority Substances List Assessment Report: Dichloromethane. Page 29.

7. Government of Canada, 1993. Priority Substances List Assessment Report: 1,4-dichlorobenzene. Page 19.

8. Government of Canada, 1994. Priority Substances List Assessment Report: Dibutyl Phthalate. Page 29.

9. Agency for Toxic Substances and Disease Registry, 1989. What you need to know about toxic substances commonly found at Superfund hazardous waste sites, (U.S. Department of Health and Human Services: Atlanta, GA), page 2, pentachlorophenol pages.

10. Government of Canada, 1993. Priority Substances List Assessment Report: Nickel and its Compounds, page 52.

11. Agency for Toxic Substances and Disease Registry, 1989. What you need to know about toxic substances commonly found at Superfund hazardous waste sites, (U.S. Department of Health and Human Services: Atlanta, GA), page 4, toxaphene pages.

12. Government of Canada, 1993. Priority Substances List Assessment Report: Benzene. Page 8.

13. Government of Canada, 1993. Priority Substances List Assessment Report: tetrachloroethylene. Page 14.

14. Government of Canada, 1994. Priority Substances List Assessment Report: Polycyclic Aromatic Hydrocarbons. Page 18.

15. Government of Canada, 1993. Priority Substances List Assessment Report: 1,4-dichlorobenzene. Page 10.

16. Government of Canada, 1993. Priority Substances List Assessment Report: 3,3'-dichlorobenzidine. Page 4.

17. Theo Colborn, et. al., 1990. Great Lakes, Great Legacy? (Washington, D.C.: The Conservation Foundation and the Institute for Research on Public Policy), p. 183.

18. T.E. Colborn, et al. Great Lakes, Great Legacy? (Washington: The Conservation Foundation and The Institute for Research on Public Policy, 1990), Chapter 6.

19. Quoted in: National Wildlife Federation, 1994. Fertility on the Brink: The legacy of the chemical age, Washington, D.C., page 45.

20. Quoted in: National Wildlife Federation, 1994. Fertility on the Brink: The legacy of the chemical age, Washington, D.C., page 46.

21. IJC, 1995. 1993-95 Priorities and Progress under the Great Lakes Water Quality Agreement (Ottawa and Washington, D.C.)

22. U.S. Environmental Protection Agency (1994). *Health Assessment Document for 2,3,7,8-Tetrachlorodibenzo-p-dioxin and related compounds, Volumes I-III (Review draft).* Washington: U.S. EPA Office of Research and Development, EPA/600/BP-92-001.

23. Government of Canada, 1993. Priority Substances List Assessment Report: No. 1; Polychlorinated Bibenzodioxins and Polychlorinated Dibenzofurans. Environment Canada and Health and Welfare Canada, Ottawa.

24. U.S. Environmental Protection Agency (1994). *Health Assessment Document for 2,3,7,8-Tetrachlorodibenzo-p-dioxin and related compounds, Volumes I-III (Review draft).* Washington: U.S. EPA Office of Research and Development, EPA/600/BP-92-001.

25. L. Birnbaum, 1993. Re-evaluation of Dioxin, presentation at the 102nd Meeting of the Great Lakes Water Quality Board, Chicago, Ill, July 15, 1993.

26. T. Webster, 1994. "Dioxin and Human Health: A Public Health Assessment of Dioxin Exposure in Canada." Waste Not, No. 310, page 1. Author is with the Boston University School of Public Health.

27. Dabeka, McKenzie, Lacroix, Cleroux, Bowe, Graham, Conacher, and Verdier, 1993. "Survey of arsenic in total diet food composites and estimation of the dietary intake of arsenic by Canadian adults and children." Journal of AOAC International, Vol. 76, No. 1.

28. Dabeka, McKenzie, Lacroix, Cleroux, Bowe, Graham, Conacher, and Verdier, 1993. "Survey of arsenic in total diet food composites and estimation of the dietary intake of arsenic by Canadian adults and children." Journal of AOAC International, Vol. 76, No. 1, page 24.

29. Agency for Toxic Substances and Disease Registry, 1989. What you need to know about toxic substances commonly found at Superfund hazardous waste sites, (U.S. Department of Health and Human Services: Atlanta, GA), page 5, arsenic pages.

30. Jan van Ostam, Health Canada, pers. comm., April 1, 1997.

31. Dabeka, McKenzie, Lacroix, Cleroux, Bowe, Graham, Conacher, and Verdier, 1993. "Survey of arsenic in total diet food composites and estimation of the dietary intake of arsenic by Canadian adults and children." Journal of AOAC International, Vol. 76, No. 1, page 25.

32. See, for examples: M. Gilbertson, T. Kubiak, J. Ludwig and G. Fox, 1991. "Great Lakes Embryo Mortality, Edema, and Deformities Syndrome (GLEMEDS) in Colonial Fish-Eating Birds: Similarity to Chick-Edema Disease." Journal of Tox. and Env. Health, 33:445, pp. 507-510.

33. See: T.E. Colborn, et al. Great Lakes, Great Legacy? (Washington: The Conservation Foundation and the Institute for Research on Public Policy, 1990), Chapter 6.

34. J.L. Jacobson and S.W. Jacobson, 1996. "Intellectual Impairment in Children Exposed to Polychlorinated Biphenyls in Utero." New England Journal of Medicine, Vol. 335, No. 11, p. 783.

35. Newsome, Davies and Sun, 1997. "Residues of polychlorinated biphenyls in fatty foods of the Canadian diet." Submitted for publication in Food Additives and Contaminants, paper supplies by Health Canada.

36. Dabeka, McKenzie, Lacroix, Cleroux, Bowe, Graham, Conacher, and Verdier, 1993. "Survey of arsenic in total diet food composites and estimation of the dietary intake of arsenic by Canadian adults and children." Journal of AOAC International, Vol. 76, No. 1, page 24.

37. See, for example, Eric Triplett, "Overview of Risk Assessment Dimensions/R&D Activities for Recombinant Microorganisms" presented at "Risk Assessment at the Crossroads," Ottawa, June 23, 1996.

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42. J.J. Pasternak and B.R. Glick. "Assessing the Environmental Consequences of Genetically-Engineered Organisms", Alternatives, Vol. 14, No. 3, 1987, p. 39.

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49. R. Goldburg, J. Rissler, H. Shand, and C. Hassebrook, Biotechnology's Bitter Harvest: Herbicide-Tolerant Crops and the Threat to Sustainable Agriculture (Washington, D.C.: Biotechnology Working Group, 1990), p. 6.

50. Union of Concerned Scientists, The Gene Exchange, Vol. 6, No. 2&3, p. 1.

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52. Bovine growth hormone (BGH) controls several functions in cows, including that of milk production. Scientists can now produce BGH in large quantities through genetic engineering. BGH is then injected into cows and increases their milk production by about 15-20%. But this application of genetic engineering leads to many problems.

- One scientific study concluded that:
  - BGH altered the nutritional quality of milk (more fat, less protein);
  - synthetic BGH has up to a 3 percent difference in the molecular structure from the natural hormone; and
  - that this difference in BGH leads to stress effects in cows, making them for susceptible to infection, infertility and "burnout" (lactational failure).
- Other scientific studies have linked BGH to significant increases in mastitis (the inflammation of the cow's mammary glands), to reduced immune defences, and to decreased fertility.
- In order to withstand the illnesses resulting from BGH, the swollen cows must be treated with antibiotics, which will also enter the milk. This will needlessly expose us to antibiotics, potentially reducing their effectiveness when we need them for medical reasons.
- If dairy farmers in Canada were to use BGH, the country's milk production could increase by up to 20 percent. This would flood an already well-supplied market and almost certainly result in dairy farm closures.
- Several studies in both Canada and the U.S. have shown that consumers do not want farmers to use BGH. In a 1989 study, Canadians across the country expressed "considerable concern" over the use of BGH. Overall, many Canadians do not support the use of BGH. This became clear in the late 1980's. When BGH was used in experiments, the milk from the treated cows entered the milk-pool. Due to consumer pressure several provinces were compelled to ban BGH-derived milk from entering the milk-pool.

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54. D. Pimentel, M.S. Hunter, J.A. LaGro, R.A. Efroymson, J.C. Landers, F.T Mervis, C.A. McCarthy, and A.E. Boyd. "Benefits and Risks of Genetic Engineering in Agriculture", Bioscience, Vol. 39, No. 9, 1989, p. 607.

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57. C.A. Hoffman. "Ecological Risks of Genetic Engineering of Crop Plants", <u>Bioscience</u>, Vol. 40, No. 6, 1990, p. 434.

58. C.A. Hoffman. "Ecological Risks of Genetic Engineering of Crop Plants", <u>Bioscience</u>, Vol. 40, No. 6, 1990, p. 436.

59. The definition in Bill C-74 is in direct conflict with the International Joint Commission's interpretation of the term under the <u>Great Lakes Water Quality Agreement</u>. In particular, in its Eighth Biennial Report to the U.S. and Canadian government Commission stated:

"There are various interpretations of virtual elimination and zero discharge. Virtual elimination is not a technical measure but a broad policy goal. This goal will not be reached until all releases of persistent toxic chemicals due to human activity are stopped.

Zero discharge does not mean simply less than detectable. It does not mean the use of controls based on best available technology or best management practices that continue to allow some release of persistent toxic substances, even though these may be important steps in reaching the goal. Zero discharge means no discharge or nil input of persistent toxic substances resulting from human activity. It is a reasonable and achievable expectation for a virtual elimination strategy. The question is no longer whether there should virtual elimination and zero discharge, but when and how these goals can be achieved."

60. Standing Committee on Environment and Sustainable Development, 1996. <u>Biotechnology Regulation in Canada: A Matter of Public Confidence</u>, Ottawa, pp. 38/39.

61. Government of Canada, 1993. <u>Priority Substances List Assessment Report: tetrachloroethylene.</u> Page 13, reported as maximum level.

62. Government of Canada, 1993. <u>Priority Substances List Assessment Report: Benzene.</u> Page 8, reported as maximum level.

63. Government of Canada, 1994. <u>Priority Substances List Assessment Report: 1,2 dichloroethane.</u> Page 7, reported as maximum level.

64. Government of Canada, 1993. Priority Substances List Assessment Report: 1,4-dichlorobenzene. Page 8.

65. Government of Canada, 1993. Priority Substances List Assessment Report: 1,2-dichlorobenzene. Page 8, reported as maximum level.

66. Government of Canada, 1994. Priority Substances List Assessment Report: bibutyl phthalate. Page 9, reported as maximum level.

67. Government of Canada, 1993. Priority Substances List Assessment Report: trichloroethylene. Page 11, reported as maximum level.

68. Government of Canada, 1993. Priority Substances List Assessment Report: trichlorobenzenes. Page 9, reported as mean level.

69. Government of Canada, 1993. Priority Substances List Assessment Report: styrene. Page 9, reported as maximum level.

70. Government of Canada, 1994. Priority Substances List Assessment Report: Polycyclic Aromatic Hydrocarbons. Page 18, reported as maximum value.

71. Government of Canada, 1994. Priority Substances List Assessment Report: Polycyclic Aromatic Hydrocarbons. Page 18, reported as maximum value.

72. Government of Canada, 1994. Priority Substances List Assessment Report: Polycyclic Aromatic Hydrocarbons. Page 18, reported as maximum value.

73. Government of Canada, 1993. Priority Substances List Assessment Report: No. 1; Polychlorinated Bibenzodioxins and Polychlorinated Dibenzofurans, Table 6, page 14, reported as maximum value.

74. Department of Public Health, City of Toronto, 1990. The Quality of Drinking Water in Toronto; A Review of: Tap Water, Bottled Water and Water Treated by a Point-of-Use Device, page 6.

75. Department of Public Health, City of Toronto, 1990. The Quality of Drinking Water in Toronto; A Review of: Tap Water, Bottled Water and Water Treated by a Point-of-Use Device, page 6.

76. Department of Public Health, City of Toronto, 1990. The Quality of Drinking Water in Toronto; A Review of: Tap Water, Bottled Water and Water Treated by a Point-of-Use Device, page 54.

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Device, page 56.

78. Department of Public Health, City of Toronto, 1990. The Quality of Drinking Water in Toronto: A Review of: Tap Water, Bottled Water and Water Treated by a Point-of-Use Device, page 57.

79. Department of Public Health, City of Toronto, 1990. The Quality of Drinking Water in Toronto: A Review of: Tap Water, Bottled Water and Water Treated by a Point-of-Use Device, page 57.

80. Government of Canada, 1994. Priority Substances List Assessment Report: Dibutyl Phthalate. Page 9.

81. Newsome, Davies and Sun, 1997. "Residues of polychlorinated biphenyls in fatty foods of the Canadian diet." Submitted for publication in Food Additives and Contaminants, paper supplies by Health Canada. Maximum value.

82. Government of Canada, 1994. Priority Substances List Assessment Report: Bis(2-ethylhexyl) Phthalate. Page 11.

83. Personal communication from Dr. W.H. Newsome, A/Chief, Food Research Division, Health Canada, January 13, 1997.

84. Government of Canada, 1994. Priority Substances List Assessment Report: Dichloromethane. Page 11.

85. Page and Lacroix, 1995. "The occurrence of phthalate ester and di-2-ethylhexyl adipate plasticizers in Canadian packaging and food sampled in 1985-1989: as Survey." Food Additives and Contaminants, Vol. 12, No. 1, page 143.

86. Government of Canada, 1993. Priority Substances List Assessment Report: trichloroethylene. Page 12, reported as a cheese/butter composite.

87. Department of Environment and National Health and Welfare, 1993. Canadian Environmental Protection Act: Priority Substances List, Hexachlorobenzene Supporting Document, Table 14, reported in whole milk.

88. Page and Lacroix, 1995. "The occurrence of phthalate ester and di-2-ethylhexyl adipate plasticizers in Canadian packaging and food sampled in 1985-1989: as Survey." Food Additives and Contaminants, Vol. 12, No. 1, page 143; reported in whole milk.

89. Ryan, Shewchuk, Lau and Sun, 1992. "Polychlorinated Dibenzo-p-dioxins and Polychlorinated Dibenzofurans in Canadian Bleached Paperboard Milk Containers (1988-1989) and their Transfer to Milk." Journal of Agricultural and Food ChemistryVol. 40, No. 5, page 922. Values reported after three weeks in paperboard milk carton.

90. Ryan, Panopio, Lewis and Weber, 1991. "Polychlorinated Dibenzo-p-dioxins and Polychlorinated Dibenzofurans in Cows' Milk Packaged in Plastic-Coated Bleached Paperboard Containers." Journal of Agricultural and Food Chemistry, Vol. 39, No. 1, page 220. Maximum value reported in whole milk.

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92. Government of Canada, 1993. Priority Substances List Assessment Report: No. 1; Polychlorinated Bibenzodioxins and Polychlorinated Dibenzofurans, Table 6, reported as milk/diary.

93. Government of Canada, 1993. Priority Substances List Assessment Report: Nickel and its Compounds, page 22, reported as 2% milk.

94. Ryan, Shewchuk, Lau and Sun, 1992. "Polychlorinated Dibenzo-p-dioxins and Polychlorinated Dibenzofurans in Canadian Bleached Paperboard Milk Containers (1988-1989) and their Transfer to Milk." Journal of Agricultural and Food Chemistry, Vol. 40, No. 5, page 922. Values reported after three weeks in paperboard milk carton.

95. Government of Canada, 1993. Priority Substances List Assessment Report: 1,4-dichlorobenzene. Page 10, reported as 2% milk.

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98. Government of Canada, 1993. Priority Substances List Assessment Report: trichlorobenzenes. Page 11, reported as 2% milk.

99. Dabeka, McKenzie, Lacroix, Cleroux, Bowe, Graham, Conacher, and Verdier, 1993. "Survey of arsenic in total diet food composites and estimation of the dietary intake of arsenic by Canadian adults and children." Journal of AOAC International, Vol. 76, No. 1, page 15, reported in whole milk and 2% milk.

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103. Newsome, Davies and Sun, 1997. "Residues of polychlorinated biphenyls in fatty foods of the Canadian diet." Submitted for publication in Food Additives and Contaminants, paper supplies by Health Canada. Maximum value reported.

104. Ryan, Panopio, Lewis and Weber, 1991. "Polychlorinated Dibenzo-p-dioxins and Polychlorinated Dibenzofurans in Cows' Milk Packaged in Plastic-Coated Bleached Paperboard Containers." Journal of Agricultural and Food Chemistry, Vol. 39, No. 1, page 221. Maximum value reported.

105. Ryan, Panopio, Lewis and Weber, 1991. "Polychlorinated Dibenzo-p-dioxins and Polychlorinated Dibenzofurans in Cows' Milk Packaged in Plastic-Coated Bleached Paperboard Containers." Journal of Agricultural and Food Chemistry, Vol. 39, No. 1, page 221. Maximum value reported.

106. Agriculture and Agri-Food Canada, 1995. Report on Pesticide, Agricultural Chemical and Toxin Contamination in Agri-Food Commodities. Page 1.

107. Newsome, Davies and Sun, 1997. "Residues of polychlorinated biphenyls in fatty foods of the Canadian diet." Submitted for publication in Food Additives and Contaminants, paper supplies by Health Canada. Maximum value reported.

108. Agriculture and Agri-Food Canada, 1995. Report on Pesticide, Agricultural Chemical and Toxin Contamination in Agri-Food Commodities. Page 1.

109. Page and Lacroix, 1995. "The occurrence of phthalate ester and di-2-ethylhexyl adipate plasticizers in Canadian packaging and food sampled in 1985-1989: as Survey." Food Additives and Contaminants, Vol. 12, No. 1, page 138; reported in marble cheese.

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111. Government of Canada, 1994. Priority Substances List Assessment Report: Dichloromethane. Page 11.

112. Scheeter, Startin, Wright, Kelly, Papke, Lis, Ball and Olson. "Dioxins in U.S. Food and Estimated Daily Intake." Chemosphere, Vol. 29, Nos. 9-11, p. 2263, Table 1, reported in

blue cheese.

113. Government of Canada, 1994. Priority Substances List Assessment Report: Bis(2-ethylhexyl) Phthalate. Page 11.

114. Agriculture and Agri-Food Canada, 1996. Report on Pesticides, Veterinary Drugs, Agricultural Chemicals, Environmental Pollutants and other Selected Impurities in Agri-Food Commodities; Volume 1. Page 1.12. 1.

115. Agriculture and Agri-Food Canada, 1996. Report on Pesticides, Veterinary Drugs, Agricultural Chemicals, Environmental Pollutants and other Selected Impurities in Agri-Food Commodities; Volume 1. Page 1.13. 2 (reported in chicken liver).

116. Agriculture and Agri-Food Canada, 1996. Report on Pesticides, Veterinary Drugs, Agricultural Chemicals, Environmental Pollutants and other Selected Impurities in Agri-Food Commodities; Volume 1. Page 1.14. 3 (reported in chicken muscle).

117. Mes, Newsome, and Conacher, 1991. "Levels of specific polychlorinated biphenyl congeners in fatty foods from live Canadian cities between 1986 and 1988." Food Additives and Contaminants, Vol. 8, No. 3, page 354.

118. Agriculture and Agri-Food Canada, 1996. Report on Pesticides, Veterinary Drugs, Agricultural Chemicals, Environmental Pollutants and other Selected Impurities in Agri-Food Commodities; Volume 1. Page 1.14. 3 (reported in chicken muscle).

119. Agriculture and Agri-Food Canada, 1996. Report on Pesticides, Veterinary Drugs, Agricultural Chemicals, Environmental Pollutants and other Selected Impurities in Agri-Food Commodities; Volume 1. Page 1.14. 3 (reported in chicken muscle).

120. Government of Canada, 1993. Priority Substances List Assessment Report: No. 1; Polychlorinated Bibenzodioxins and Polychlorinated Dibenzofurans, Table 6, page 14, reported as poultry.

121. Page and Lacroix, 1995. "The occurrence of phthalate ester and di-2-ethylhexyl adipate plasticizers in Canadian packaging and food sampled in 1985-1989: as Survey." Food Additives and Contaminants, Vol. 12, No. 1, page 135; reported as maximum value.

122. Mes, Newsome, and Conacher, 1991. "Levels of specific polychlorinated biphenyl congeners in fatty foods from live Canadian cities between 1986 and 1988." Food Additives and Contaminants, Vol. 8, No. 3, page 354, reported as ground beef.

123. Newsome, Davies and Sun, 1997. "Residues of polychlorinated biphenyls in fatty foods of the Canadian diet." Submitted for publication in Food Additives and Contaminants, paper supplies by Health Canada. Maximum value, reported in ground beef.

124. Agriculture and Agri-Food Canada, 1996. Report on Pesticides, Veterinary Drugs, Agricultural Chemicals, Environmental Pollutants and other Selected Impurities in Agri-Food Commodities; Volume 1. Page 1.12. 1.

125. Agriculture and Agri-Food Canada, 1996. Report on Pesticides, Veterinary Drugs, Agricultural Chemicals, Environmental Pollutants and other Selected Impurities in Agri-Food Commodities; Volume 1. Page 1.13. 1 (reported in beef liver).

126. Agriculture and Agri-Food Canada, 1996. Report on Pesticides, Veterinary Drugs, Agricultural Chemicals, Environmental Pollutants and other Selected Impurities in Agri-Food Commodities; Volume 1. Page 1.14. 1 (reported in beef muscle).

127. Ryan, Panopio, Lewis, Weber, and Conacher, 1990. "PCDDs/PCDFs in 22 categories of food collected from six Canadian cities between 1985-1988." Page 500, reported in beef hamburger composites.

128. Agriculture and Agri-Food Canada, 1996. Report on Pesticides, Veterinary Drugs, Agricultural Chemicals, Environmental Pollutants and other Selected Impurities in Agri-Food Commodities; Volume 1. Page 1.14. 1 (reported in beef muscle).

129. Page and Lacroix, 1995. "The occurrence of phthalate ester and di-2-ethylhexyl adipate plasticizers in Canadian packaging and food sampled in 1985-1989: as Survey." Food Additives and Contaminants, Vol. 12, No. 1, page 140; reported in beef sausage.

130. Agriculture and Agri-Food Canada, 1996. Report on Pesticides, Veterinary Drugs, Agricultural Chemicals, Environmental Pollutants and other Selected Impurities in Agri-Food Commodities; Volume 1. Page 1.14. 1 (reported in beef muscle).

131. Page and Lacroix, 1995. "The occurrence of phthalate ester and di-2-ethylhexyl adipate plasticizers in Canadian packaging and food sampled in 1985-1989: as Survey." Food Additives and Contaminants, Vol. 12, No. 1, page 140; reported in salami.

132. Government of Canada, 1993. Priority Substances List Assessment Report: No. 1; Polychlorinated Bibenzodioxins and Polychlorinated Dibenzofurans, Table 6, reported in ground beef.

133. Government of Canada, 1993. Priority Substances List Assessment Report: Nickel and its Compounds, page 22, reported as cooked ground beef.

134. Page and Lacroix, 1995. "The occurrence of phthalate ester and di-2-ethylhexyl adipate plasticizers in Canadian packaging and food sampled in 1985-1989: as Survey." Food Additives and Contaminants, Vol. 12, No. 1, page 135; reported as maximum value in regular ground beef.

135. Agriculture and Agri-Food Canada, 1996. Report on Pesticides, Veterinary Drugs, Agricultural Chemicals, Environmental Pollutants and other Selected Impurities in Agri-Food Commodities; Volume 1. Page 1.12. 4.

136. Scheeter, Startin, Wright, Kelly, Papke, Lis, Ball and Olson. "Dioxins in U.S. Food and Estimated Daily Intake." Chemosphere, Vol. 29, Nos. 9-11, p. 2263, Table 1 (data is for pork chops).

137. Page and Lacroix, 1995. "The occurrence of phthalate ester and di-2-ethylhexyl adipate plasticizers in Canadian packaging and food sampled in 1985-1989: as Survey." Food Additives and Contaminants, Vol. 12, No. 1, page 140; reported in roast pork.

138. Agriculture and Agri-Food Canada, 1996. Report on Pesticides, Veterinary Drugs, Agricultural Chemicals, Environmental Pollutants and other Selected Impurities in Agri-Food Commodities; Volume 1. Page 1.13. 3 (reported in pork liver).

139. Agriculture and Agri-Food Canada, 1996. Report on Pesticides, Veterinary Drugs, Agricultural Chemicals, Environmental Pollutants and other Selected Impurities in Agri-Food Commodities; Volume 1. Page 1.14. 11 (reported in pork muscle).

140. Agriculture and Agri-Food Canada, 1996. Report on Pesticides, Veterinary Drugs, Agricultural Chemicals, Environmental Pollutants and other Selected Impurities in Agri-Food Commodities; Volume 1. Page 1.14. 11 (reported in pork muscle).

141. Page and Lacroix, 1995. "The occurrence of phthalate ester and di-2-ethylhexyl adipate plasticizers in Canadian packaging and food sampled in 1985-1989: as Survey." Food Additives and Contaminants, Vol. 12, No. 1, page 138; reported in cooked ham.

142. Agriculture and Agri-Food Canada, 1996. Report on Pesticides, Veterinary Drugs, Agricultural Chemicals, Environmental Pollutants and other Selected Impurities in Agri-Food Commodities; Volume 1. Page 1.14. 11 (reported in pork muscle).

143. Mes, Newsome, and Conacher, 1991. "Levels of specific polychlorinated biphenyl congeners in fatty foods from live Canadian cities between 1986 and 1988." Food Additives and Contaminants, Vol. 8, No. 3, page 354, reported as cured pork.

144. Newsome, Davies and Sun, 1997. "Residues of polychlorinated biphenyls in fatty foods of the Canadian diet." Submitted for publication in Food Additives and Contaminants, paper supplies by Health Canada. Maximum value reported.

145. Agriculture and Agri-Food Canada, 1996. Report on Pesticides, Veterinary Drugs, Agricultural Chemicals, Environmental Pollutants and other Selected Impurities in Agri-Food Commodities; Volume 1. Page 1.14. 11 (reported in pork muscle).

146. Page and Lacroix, 1995. "The occurrence of phthalate ester and di-2-ethylhexyl adipate plasticizers in Canadian packaging and food sampled in 1985-1989: as Survey." Food Additives and Contaminants, Vol. 12, No. 1, page 135; reported as maximum value in pork loin roast.

147. Government of Canada, 1993. Priority Substances List Assessment Report: No. 1; Polychlorinated Bibenzodioxins and Polychlorinated Dibenzofurans, Table 6, reported in cured pork.

148. Agriculture and Agri-Food Canada, 1996. Report on Pesticides, Veterinary Drugs, Agricultural Chemicals, Environmental Pollutants and other Selected Impurities in Agri-Food Commodities; Volume 1. Page 1.12. 5.

149. Agriculture and Agri-Food Canada, 1996. Report on Pesticides, Veterinary Drugs, Agricultural Chemicals, Environmental Pollutants and other Selected Impurities in Agri-Food Commodities; Volume 1. Page 1.14. 14 (reported in turkey muscle).

150. Agriculture and Agri-Food Canada, 1996. Report on Pesticides, Veterinary Drugs, Agricultural Chemicals, Environmental Pollutants and other Selected Impurities in Agri-Food Commodities; Volume 1. Page 1.14. 14 (reported in turkey muscle).

151. Agriculture and Agri-Food Canada, 1996. Report on Pesticides, Veterinary Drugs, Agricultural Chemicals, Environmental Pollutants and other Selected Impurities in Agri-Food Commodities; Volume 1. Page 1.14. 14 (reported in turkey muscle).

152. Page and Lacroix, 1995. "The occurrence of phthalate ester and di-2-ethylhexyl adipate plasticizers in Canadian packaging and food sampled in 1985-1989: as Survey." Food Additives and Contaminants, Vol. 12, No. 1, page 135; reported as maximum value in turkey breast.

153. Government of Canada, 1994. Priority Substances List Assessment Report: Bis(2-ethylhexyl) Phthalate. Page 11.

154. Dabeka, McKenzie, Lacroix, Cleroux, Bowe, Graham, Conacher, and Verdier, 1993. "Survey of arsenic in total diet food composites and estimation of the dietary intake of arsenic by Canadian adults and children." Journal of AOAC International, Vol. 76, No. 1, page 18, reported as maximum value in bran muffins.

155. Government of Canada, 1994. Priority Substances List Assessment Report: Chromium and its Compounds. Page 15.

156. Government of Canada, 1994. Priority Substances List Assessment Report: Dichloromethane. Page 11.

157. Department of Environment and National Health and Welfare, 1993. Canadian Environmental Protection Act: Priority Substances List, Hexachlorobenzene Supporting Document, Table 14.

158. Department of Environment and National Health and Welfare, 1993. Canadian Environmental Protection Act: Priority Substances List, Hexachlorobenzene Supporting Document, Table 15. Value is average from the following Lake Ontario species: Chinook Salmon, Coho Salmon, Rainbow trout, Brown trout, and Lake trout.

159. Government of Canada, 1993. Priority Substances List Assessment Report: No. 1; Polychlorinated Bibenzodioxins and Polychlorinated Dibenzofurans, Table 6, reported as smelt.

160. Government of Canada, 1994. Priority Substances List Assessment Report: 1,2,4,5 tetrachlorobenzene, page 12, reported as trout.

161. Scheeter, Startin, Wright, Kelly, Papke, Lis, Ball and Olson. "Dioxins in U.S. Food and Estimated Daily Intake." Chemosphere, Vol. 29, Nos. 9-11, p. 2263, Table 1.

162. Scheeter, Startin, Wright, Kelly, Papke, Lis, Ball and Olson. "Dioxins in U.S. Food and Estimated Daily Intake." Chemosphere, Vol. 29, Nos. 9-11, p. 2263, Table 1.

163. Page and Lacroix, 1995. "The occurrence of phthalate ester and di-2-ethylhexyl adipate plasticizers in Canadian packaging and food sampled in 1985-1989: as Survey." Food Additives and Contaminants, Vol. 12, No. 1, page 135; reported in ocean perch fillet.

164. Page and Lacroix, 1995. "The occurrence of phthalate ester and di-2-ethylhexyl adipate plasticizers in Canadian packaging and food sampled in 1985-1989: as Survey." Food Additives and Contaminants, Vol. 12, No. 1, page 135; reported as maximum value.

165. Dabeka, McKenzie, Lacroix, Cleroux, Bowe, Graham, Conacher, and Verdier, 1993. "Survey of arsenic in total diet food composites and estimation of the dietary intake of arsenic by Canadian adults and children." Journal of AOAC International, Vol. 76, No. 1, page 15, reported as cooked fish.

166. Newsome, Davies and Sun, 1997. "Residues of polychlorinated biphenyls in fatty foods of the Canadian diet." Submitted for publication in Food Additives and Contaminants, paper supplies by Health Canada. Maximum value reported.

167. Dabeka, McKenzie, Lacroix, Cleroux, Bowe, Graham, Conacher, and Verdier, 1993. "Survey of arsenic in total diet food composites and estimation of the dietary intake of arsenic by Canadian adults and children." Journal of AOAC International, Vol. 76, No. 1, page 15, reported as cooked fish.

168. Mes, Newsome, and Conacher, 1991. "Levels of specific polychlorinated biphenyl congeners in fatty foods from live Canadian cities between 1986 and 1988." Food Additives and Contaminants, Vol. 8, No. 3, page 354.

169. Dabeka, McKenzie, Lacroix, Cleroux, Bowe, Graham, Conacher, and Verdier, 1993. "Survey of arsenic in total diet food composites and estimation of the dietary intake of arsenic by Canadian adults and children." Journal of AOAC International, Vol. 76, No. 1, page 15.

170. Mes, Newsome, and Conacher, 1991. "Levels of specific polychlorinated biphenyl congeners in fatty foods from live Canadian cities between 1986 and 1988." Food Additives and Contaminants, Vol. 8, No. 3, page 354.

171. Newsome, Davies and Sun, 1997. "Residues of polychlorinated biphenyls in fatty foods of the Canadian diet." Submitted for publication in Food Additives and Contaminants, paper supplies by Health Canada. Maximum value reported.

172. Agriculture and Agri-Food Canada, 1996. Report on Pesticides, Veterinary Drugs, Agricultural Chemicals, Environmental Pollutants and other Selected Impurities in Agri-Food Commodities; Volume 2. Page 6.1. 1.

173. Dabeka, McKenzie, Lacroix, Cleroux, Bowe, Graham, Conacher, and Verdier, 1993. "Survey of arsenic in total diet food composites and estimation of the dietary intake of arsenic by Canadian adults and children." Journal of AOAC International, Vol. 76, No. 1, page 17, reported as maximum value in raw apples.

174. Agriculture and Agri-Food Canada, 1996. Report on Pesticides, Veterinary Drugs, Agricultural Chemicals, Environmental Pollutants and other Selected Impurities in Agri-Food Commodities; Volume 2. Page 6.2. 1.

175. Page and Lacroix, 1995. "The occurrence of phthalate ester and di-2-ethylhexyl adipate plasticizers in Canadian packaging and food sampled in 1985-1989: as Survey." Food Additives and Contaminants, Vol. 12, No. 1, page 141.

176. Agriculture and Agri-Food Canada, 1995. Report on Pesticide, Agricultural Chemical and Toxin Contamination in Agri-Food Commodities. Page 15.

177. Agriculture and Agri-Food Canada, 1996. Report on Pesticides, Veterinary Drugs, Agricultural Chemicals, Environmental Pollutants and other Selected Impurities in Agri-Food Commodities; Volume 2. Page 6.2. 1.

178. Page and Lacroix, 1995. "The occurrence of phthalate ester and di-2-ethylhexyl adipate plasticizers in Canadian packaging and food sampled in 1985-1989: as Survey." Food Additives and Contaminants, Vol. 12, No. 1, page 141.

179. Agriculture and Agri-Food Canada, 1996. Report on Pesticides, Veterinary Drugs, Agricultural Chemicals, Environmental Pollutants and other Selected Impurities in Agri-Food Commodities; Volume 2. Page 6.2. 1.

180. Agriculture and Agri-Food Canada, 1996. Report on Pesticides, Veterinary Drugs, Agricultural Chemicals, Environmental Pollutants and other Selected Impurities in Agri-Food Commodities; Volume 2. Page 6.2. 1.

181. Government of Canada, 1993. Priority Substances List Assessment Report: No. 1; Polychlorinated Bibenzodioxins and Polychlorinated Dibenzofurans, Table 6, reported with peaches and pear composite.

182. Agriculture and Agri-Food Canada, 1996. Report on Pesticides, Veterinary Drugs, Agricultural Chemicals, Environmental Pollutants and other Selected Impurities in Agri-Food Commodities; Volume 2. Page 6.1 2.

183. Agriculture and Agri-Food Canada, 1996. Report on Pesticides, Veterinary Drugs, Agricultural Chemicals, Environmental Pollutants and other Selected Impurities in Agri-Food Commodities; Volume 2. Page 6.2. 7.

184. Dabeka, McKenzie, Lacroix, Cleroux, Bowe, Graham, Conacher, and Verdier, 1993. "Survey of arsenic in total diet food composites and estimation of the dietary intake of arsenic by Canadian adults and children." Journal of AOAC International, Vol. 76, No. 1, page 16, reported as maximum value.

185. Agriculture and Agri-Food Canada, 1996. Report on Pesticides, Veterinary Drugs, Agricultural Chemicals, Environmental Pollutants and other Selected Impurities in Agri-Food Commodities; Volume 2. Page 6.2. 7.

186. Agriculture and Agri-Food Canada, 1996. Report on Pesticides, Veterinary Drugs, Agricultural Chemicals, Environmental Pollutants and other Selected Impurities in Agri-Food Commodities; Volume 2. Page 6.2. 7.

187. Page and Lacroix, 1995. "The occurrence of phthalate ester and di-2-ethylhexyl adipate plasticizers in Canadian packaging and food sampled in 1985-1989: as Survey." Food Additives and Contaminants, Vol. 12, No. 1, page 139.

188. Agriculture and Agri-Food Canada, 1995. Report on Pesticide, Agricultural Chemical and Toxin Contamination in Agri-Food Commodities. Page 18.

189. Agriculture and Agri-Food Canada, 1995. Report on Pesticide, Agricultural Chemical and Toxin Contamination in Agri-Food Commodities. Page 18.

190. Agriculture and Agri-Food Canada, 1996. Report on Pesticides, Veterinary Drugs, Agricultural Chemicals, Environmental Pollutants and other Selected Impurities in Agri-Food Commodities; Volume 2. Page 9.1. 7.

191. Dabeka, McKenzie, Lacroix, Cleroux, Bowe, Graham, Conacher, and Verdier, 1993. "Survey of arsenic in total diet food composites and estimation of the dietary intake of arsenic by Canadian adults and children." Journal of AOAC International, Vol. 76, No. 1, page 16, reported as maximum value.

192. Agriculture and Agri-Food Canada, 1996. Report on Pesticides, Veterinary Drugs, Agricultural Chemicals, Environmental Pollutants and other Selected Impurities in Agri-Food Commodities; Volume 2. Page 6.2. 4., reported as fresh carrots.

193. Agriculture and Agri-Food Canada, 1996. Report on Pesticides, Veterinary Drugs, Agricultural Chemicals, Environmental Pollutants and other Selected Impurities in Agri-Food Commodities; Volume 2. Page 6.2. 4., reported as fresh carrots.

194. Dabeka, McKenzie, Lacroix, Cleroux, Bowe, Graham, Conacher, and Verdier, 1993. "Survey of arsenic in total diet food composites and estimation of the dietary intake of arsenic by Canadian adults and children." Journal of AOAC International, Vol. 76, No. 1, page 17, reported as maximum value.

195. Agriculture and Agri-Food Canada, 1995. Report on Pesticide, Agricultural Chemical and Toxin Contamination in Agri-Food Commodities. Page 16.

196. Agriculture and Agri-Food Canada, 1995. Report on Pesticide, Agricultural Chemical and Toxin Contamination in Agri-Food Commodities. Page 16.

197. Government of Canada, 1993. Priority Substances List Assessment Report: Nickel and its Compounds, page 22, reported as cooked carrots.

198. Agriculture and Agri-Food Canada, 1996. Report on Pesticides, Veterinary Drugs, Agricultural Chemicals, Environmental Pollutants and other Selected Impurities in Agri-Food Commodities; Volume 2. Page 9.1. 4.

199. Agriculture and Agri-Food Canada, 1996. Report on Pesticides, Veterinary Drugs, Agricultural Chemicals, Environmental Pollutants and other Selected Impurities in Agri-Food Commodities; Volume 2. Page 9.1. 4.

200. Dabeka, McKenzie, Lacroix, Cleroux, Bowe, Graham, Conacher, and Verdier, 1993. "Survey of arsenic in total diet food composites and estimation of the dietary intake of arsenic by Canadian adults and children." Journal of AOAC International, Vol. 76, No. 1, page 17, reported as maximum value.

201. Government of Canada, 1994. Priority Substances List Assessment Report: Polycyclic Aromatic Hydrocarbons. Page 23.

202. Department of Environment and National Health and Welfare, 1993. Canadian Environmental Protection Act: Priority Substances List, Hexachlorobenzene Supporting Document, Table 16.

203. Agriculture and Agri-Food Canada, 1996. Report on Pesticides, Veterinary Drugs, Agricultural Chemicals, Environmental Pollutants and other Selected Impurities in Agri-Food Commodities; Volume 2. Page 8.1. 3.

204. Agriculture and Agri-Food Canada, 1996. Report on Pesticides, Veterinary Drugs, Agricultural Chemicals, Environmental Pollutants and other Selected Impurities in Agri-Food Commodities; Volume 2. Page 10.1.

205. Agriculture and Agri-Food Canada, 1995. Report on Pesticide, Agricultural Chemical and Toxin Contamination in Agri-Food Commodities. Page 13.

206. Mes, Newsome, and Conacher, 1991. "Levels of specific polychlorinated biphenyl congeners in fatty foods from five Canadian cities between 1986 and 1988." Food Additives and Contaminants, Vol. 8, No. 3, page 354.

207. Newsome, Davies and Sun, 1997. "Residues of polychlorinated biphenyls in fatty foods of the Canadian diet." Submitted for publication in Food Additives and Contaminants, paper supplies by Health Canada. Maximum value reported.

208. Government of Canada, 1993. Priority Substances List Assessment Report: No. 1; Polychlorinated Bibenzodioxins and Polychlorinated Dibenzofurans, Table 6.

209. Government of Canada, 1993. Priority Substances List Assessment Report: 1,2,4 trichlorobenzene. Page 11, reported as an egg/meat composite.

210. Government of Canada, 1993. Priority Substances List Assessment Report: Nickel and its Compounds. Page 22, reported as 2% milk.

211. Government of Canada, 1993. Priority Substances List Assessment Report: 1,2-dichlorobenzene. Page 9, reported in an egg/meat composite.

212. Page and Lacroix, 1995. "The occurrence of phthalate ester and di-2-ethylhexyl adipate plasticizers in Canadian packaging and food sampled in 1985-1989: as Survey." Food Additives and Contaminants, Vol. 12, No. 1, page 139; reported in egg salad sandwich.

213. Dabeka, McKenzie, Lacroix, Cleroux, Bowe, Graham, Conacher, and Verdier, 1993. "Survey of arsenic in total diet food composites and estimation of the dietary intake of arsenic by Canadian adults and children." Journal of AOAC International, Vol. 76, No. 1,

page 15.

214. Derek Muir, 1995. "Spatial and Temporal Trends of Organochlorines in Arctic Marine Mammals," in J.L. Murray et. al. [eds.], Environmental Study No. 73: Synopsis of Research Conducted Under 1994-95 Northern Contaminants Program, Department of Indian and Northern Affairs, Ottawa, Ontario, page 146, Table 1. Reported as mean value.

215. Derek Muir, 1995. "Spatial and Temporal Trends of Organochlorines in Arctic Marine Mammals," in J.L. Murray et. al. [eds.], Environmental Study No. 73: Synopsis of Research Conducted Under 1994-95 Northern Contaminants Program, Department of Indian and Northern Affairs, Ottawa, Ontario, page 146, Table 1. Reported as mean value.

216. Derek Muir, 1995. "Spatial and Temporal Trends of Organochlorines in Arctic Marine Mammals," in J.L. Murray et. al. [eds.], Environmental Study No. 73: Synopsis of Research Conducted Under 1994-95 Northern Contaminants Program, Department of Indian and Northern Affairs, Ottawa, Ontario, page 146, Table 1. Reported as mean value.

217. Derek Muir, 1995. "Spatial and Temporal Trends of Organochlorines in Arctic Marine Mammals," in J.L. Murray et. al. [eds.], Environmental Study No. 73: Synopsis of Research Conducted Under 1994-95 Northern Contaminants Program, Department of Indian and Northern Affairs, Ottawa, Ontario, page 146, Table 1. Reported as mean value.

218. Derek Muir, 1995. "Spatial and Temporal Trends of Organochlorines in Arctic Marine Mammals," in J.L. Murray et. al. [eds.], Environmental Study No. 73: Synopsis of Research Conducted Under 1994-95 Northern Contaminants Program, Department of Indian and Northern Affairs, Ottawa, Ontario, page 146, Table 1. Reported as mean value.

219. Derek Muir, 1995. "Spatial and Temporal Trends of Organochlorines in Arctic Marine Mammals," in J.L. Murray et. al. [eds.], Environmental Study No. 73: Synopsis of Research Conducted Under 1994-95 Northern Contaminants Program, Department of Indian and Northern Affairs, Ottawa, Ontario, page 146, Table 1. Reported as mean value.

220. Derek Muir, 1995. "Spatial and Temporal Trends of Organochlorines in Arctic Marine Mammals," in J.L. Murray et. al. [eds.], Environmental Study No. 73: Synopsis of Research Conducted Under 1994-95 Northern Contaminants Program, Department of Indian and Northern Affairs, Ottawa, Ontario, page 146, Table 1. Reported as mean value.

221. Derek Muir, 1995. "Spatial and Temporal Trends of Organochlorines in Arctic Marine Mammals," in J.L. Murray et. al. [eds.], Environmental Study No. 73: Synopsis of Research Conducted Under 1994-95 Northern Contaminants Program, Department of Indian and Northern Affairs, Ottawa, Ontario, page 146, Table 1. Reported as mean value.

222. Derek Muir, 1995. "Spatial and Temporal Trends of Organochlorines in Arctic Marine Mammals," in J.L. Murray et. al. [eds.], Environmental Study No. 73: Synopsis of Research Conducted Under 1994-95 Northern Contaminants Program, Department of Indian and Northern Affairs, Ottawa, Ontario, page 146, Table 1. Reported as mean value.

223. Derek Muir, 1995. "Spatial and Temporal Trends of Organochlorines in Arctic Marine Mammals," in J.L. Murray et. al. [eds.], Environmental Study No. 73: Synopsis of Research Conducted Under 1994-95 Northern Contaminants Program, Department of Indian and Northern Affairs, Ottawa, Ontario, page 146, Table 1. Reported as mean value.

224. Derek Muir, 1995. "Spatial and Temporal Trends of Organochlorines in Arctic Marine Mammals," in J.L. Murray et. al. [eds.], Environmental Study No. 73: Synopsis of Research Conducted Under 1994-95 Northern Contaminants Program, Department of Indian and Northern Affairs, Ottawa, Ontario, page 146, Table 1. Reported as mean value.

225. Derek Muir, 1995. "Spatial and Temporal Trends of Organochlorines in Arctic Marine Mammals," in J.L. Murray et. al. [eds.], Environmental Study No. 73: Synopsis of Research Conducted Under 1994-95 Northern Contaminants Program, Department of Indian and Northern Affairs, Ottawa, Ontario, page 146, Table 1. Reported as mean value.

226. Derek Muir, 1995. "Spatial and Temporal Trends of Organochlorines in Arctic Marine Mammals," in J.L. Murray et. al. [eds.], Environmental Study No. 73: Synopsis of Research Conducted Under 1994-95 Northern Contaminants Program, Department of Indian and Northern Affairs, Ottawa, Ontario, page 146, Table 1. Reported as mean value.

227. Derek Muir, 1995. "Spatial and Temporal Trends of Organochlorines in Arctic Marine Mammals," in J.L. Murray et. al. [eds.], Environmental Study No. 73: Synopsis of Research Conducted Under 1994-95 Northern Contaminants Program, Department of Indian and Northern Affairs, Ottawa, Ontario, page 146, Table 1. Reported as mean value.

228. Derek Muir, 1995. "Spatial and Temporal Trends of Organochlorines in Arctic Marine Mammals," in J.L. Murray et. al. [eds.], Environmental Study No. 73: Synopsis of

Research Conducted Under 1994-95 Northern Contaminants Program, Department of Indian and Northern Affairs, Ottawa, Ontario, page 146, Table 1. Reported as mean value.

229. Derek Muir, 1995. "Spatial and Temporal Trends of Organochlorines in Arctic Marine Mammals," in J.L. Murray et. al. [eds.], Environmental Study No. 73: Synopsis of Research Conducted Under 1994-95 Northern Contaminants Program, Department of Indian and Northern Affairs, Ottawa, Ontario, page 146, Table 1. Reported as mean value.

230. Derek Muir, 1995. "Spatial and Temporal Trends of Organochlorines in Arctic Marine Mammals," in J.L. Murray et. al. [eds.], Environmental Study No. 73: Synopsis of Research Conducted Under 1994-95 Northern Contaminants Program, Department of Indian and Northern Affairs, Ottawa, Ontario, page 146, Table 1. Reported as mean value.

231. Derek Muir, 1995. "Spatial and Temporal Trends of Organochlorines in Arctic Marine Mammals," in J.L. Murray et. al. [eds.], Environmental Study No. 73: Synopsis of Research Conducted Under 1994-95 Northern Contaminants Program, Department of Indian and Northern Affairs, Ottawa, Ontario, page 146, Table 1. Reported as mean value.

232. Derek Muir, 1995. "Spatial and Temporal Trends of Organochlorines in Arctic Marine Mammals," in J.L. Murray et. al. [eds.], Environmental Study No. 73: Synopsis of Research Conducted Under 1994-95 Northern Contaminants Program, Department of Indian and Northern Affairs, Ottawa, Ontario, page 146, Table 1. Reported as mean value.

233. Derek Muir, 1995. "Spatial and Temporal Trends of Organochlorines in Arctic Marine Mammals," in J.L. Murray et. al. [eds.], Environmental Study No. 73: Synopsis of Research Conducted Under 1994-95 Northern Contaminants Program, Department of Indian and Northern Affairs, Ottawa, Ontario, page 146, Table 1. Reported as mean value.

234. Derek Muir, 1995. "Spatial and Temporal Trends of Organochlorines in Arctic Marine Mammals," in J.L. Murray et. al. [eds.], Environmental Study No. 73: Synopsis of Research Conducted Under 1994-95 Northern Contaminants Program, Department of Indian and Northern Affairs, Ottawa, Ontario, page 146, Table 1. Reported as mean value.