

B

**Reducing the Risk of Breast Cancer:
Environmental factors in South Riverdale
Working report for meeting
March 7 2007**

This report is presented as follows

A. Introduction

- How many people are affected by breast cancer in South Riverdale?
- What are the risk factors besides environmental exposures?
- What types of experiments are done?
- Are children at increased risk?

B. What are the environmental factors of concern?

- Carcinogens
- Hormone disruptors
- Radiation

C. How are we exposed, and what do we know about exposures?

- Community exposure
- Personal/ household exposure
- Body burdens

D. Conclusions

Reducing the
risk of Breast
cancer FILE

A. Introduction

A.1 How much breast cancer is there in South Riverdale?

Each year, an estimated 7,200 Ontario women are diagnosed with Breast cancer in Ontario, and about 2,000 women die from the disease each year. It is the most common cancer among women. We know that 1 in 8 (or 12%) of women will get breast cancer in their lifetime; one in twenty will die from it. Canada as a whole has similar rates as Ontario, one of the highest rates of breast cancer in the world. The rate of breast cancer in Ontario has increased by 17% from 1971 to 1996, mostly for women over 50 years of age. Since then it has stayed the same. Fewer women are dying from breast cancer, because the treatments are better, and because more women are going for mammography, and therefore finding the disease earlier when it can be better treated. In the United States, Afro-American women get breast cancer more, and die more from it, than white women. 1,2. We don't know the breast cancer rates for women in South Riverdale, compared to all Ontario, but a Toronto Public Health study found that rates for all cancers combined were not elevated compared to the rest of Toronto. 3,4.

A.2 What are the risk factors for developing breast cancer?

The development of Breast Cancer is a very complicated process, with many factors involved in its development, and many of these factors not well understood.⁵

We do know that genetics play a part, but only in just over one quarter of cases is genetics the major factor involved.⁶

Other risk factors that we know about include:

1. Female Hormones (Estrogen)

A woman's own estrogen plays a role, and the more estrogen the greater the risk. So women who start periods early, or carry on periods late (have a late menopause) are at increased risk. Pregnancy protects women's breasts, so women who don't have children, or those who get pregnant late in life are also at increased risk. And women who take hormones AFTER menopause are at increased risk.

2. Diet

A diet high in fat is a risk factor, while a diet high in fibre, whole grains, fruit and vegetables might be protective. Fats like olive oil and fish oils are not "bad".

3. Exercise

Regular exercise seems to protect against breast cancer.

4. Obesity.

Overweight women, especially after menopause, have a higher risk; so one should maintain a healthy weight and prevent weight gain with age.

5. Alcohol

Drinking alcohol is a risk factor. How much is unclear, but it is advised to drink no more than one alcoholic drink per day. The more alcohol, the higher the risk.

6. Smoking and Second hand smoke

Smoking is a risk factor for the development of breast cancer, especially smoking early in life. Being exposed to second hand smoke is also a risk factor. ⁷

These “established” risk factors only partially explain why some people get breast cancer, about 25-50% (one quarter to one half) of cases. ⁸ There is a lot of uncertainty as to what the other causes or factors in the development of breast cancer are. Environmental factors are of concern.

A.3 What types of experiments do scientists and doctors do to gather evidence about breast cancer and the environment?

1. Laboratory experiments

Laboratory experiments are mostly done with animals, usually mice or rats. These animals are given chemicals in their feed, and then observed to see if they get cancer. Experiments can also be done on breast cancer cells. A chemical that is shown to cause cancer is called a carcinogen. Chemicals are also tested to see if they contribute to the cancer causing effect of these carcinogens. Among this group are hormone disruptors, which can alter the hormonal levels in the body encouraging the development of some cancers, including breast cancer. Both carcinogens and hormone disruptors can cause other cancers and health problems to humans, including children. If a substance causes harm, it is usually called a “toxic chemical”. 509 chemicals have been tested by US National toxicology Program (NTP). 42 chemicals were found to cause breast tumors (mammary gland tumors) in laboratory animals. ⁹

2. Epidemiology

Epidemiology involves counting people. For example, we can count the number of people getting breast cancer each year, called the “incidence.” We see that people who immigrate to Canada from countries where the incidence of cancer is much lower, say from Japan or most developing countries, over time in Canada they start to develop cancer at the same higher rate as Canadians. There is something in the environment in Canada, in the diet or lifestyle or chemicals, that causes cancer more than where they originally come from. ¹⁰

But the most common type of research done as epidemiology compares one group of people to another. For example, we can take people who smoke, or people who work on a farm with pesticides, and see if over time they develop cancer more frequently than people who don't smoke, or who are not exposed to

chemicals such as pesticides on a farm. Or we can compare a group of people who have breast cancer (say at princess Margaret Hospital in Toronto) and compare them to a group of people who don't have breast cancer, but are the same age and don't smoke etc, and see if in the past there is any difference in exposure to chemicals that might account for them having developed breast cancer. Occupational studies are studies done on workers in a particular industry or factory, where levels of chemicals are often higher than in the community. Since most workers traditionally have been men, and most breast cancer is in women (1% in men) this type of research has been less helpful than in cancers that are seen in both men and women.

As described above, studies in the laboratory with animals or cells show many chemicals that cause tumors in breast tissue or that mimic the activity of estrogen, and therefore might well contribute to the development of breast cancer. The epidemiology studies are less clear on this, most likely because the studies are so difficult to do. So the two bodies of evidence from different research methods often don't agree. What are we to do in this situation, especially when we suspect that there is widespread exposure to many of these chemicals? 11

A.4 Are children at increased risk?

Recent research in the US, at the Breast Cancer Research Centres, indicates that exposures early in life (from in the womb through childhood to puberty) might be very important in the development of breast cancer, in two ways:

- by leading to early breast development, or
- by affecting breast cells in young girls that are especially sensitive to changes.

This is especially true for hormone disrupting chemicals that were described previously. 12

Children are also at risk of being more exposed to environmental contaminants, for example to house dust, because they are on the floor or carpet more than adults

B. What are the environmental factors of concern?

According to the National Cancer Institute, more than 100,000 chemicals are in use today in the United States. Less than 10 percent of these chemicals have been tested for their effects on human health, meaning that 90% of the chemicals we are exposed to have not been tested for their impact on human health. This leads to much uncertainty and many gaps in what we know.

In this section, we will try to:

- list the chemicals of concern,
- describe where they are in use, and
- look at how we might be exposed to them.

We will discuss first carcinogens, and then hormone disruptors.

B.1 Carcinogens

Carcinogens are chemicals or other factors that damage the cells of the body, in this case breast cells, changing the cells so that they become cancerous and divide and grow out of control. Carcinogens are tested and classified by a number of research organizations, in particular, The International Agency for Cancer Research (IARC) and the National toxicology Program (NTP) in the US. 13,14.

There are a number of chemicals that are breast carcinogens:

- Benzene
- PAHs
- Tetrachlorethylene, or Perchlorethylene
- Heavy metals
- Pesticides
- Solvents

Benzene

Benzene is a compound used in many chemical processes, and is in gasoline and diesel exhaust. Benzene has been found to cause breast cancer in animals, but there is no reliable research about benzene causing breast cancer in humans. 15

A similar substance, 1,3 Butadiene, is also related to breast cancer in lab animals, but studies on people have not been done. 16

Uses

It is used in the manufacture of plastics, pesticides, drugs and detergents. It is also a component of gasoline and diesel.

Exposure

Traffic exhaust in the air we breathe is probably the major source of exposure in

South Riverdale. Canada has regulated the amount of Benzene allowed in gasoline, and so levels have dropped in the air of most Canadian cities since the 1980s. (*Graph*) However, a report by Toronto Public Health found that benzene is present in outdoor air at levels that are ten times higher than the levels that are considered safe. Most of this was from automobile exhaust. 17.

PAHs (Combustion by-products)

Polycyclic Aromatic Hydrocarbons (PAHs) are a group of about 200 different chemicals that are formed by combustion or burning. We know that PAHs cause a number of other cancers, but the science is less clear about breast cancer. PAHs cause breast cancer in animals. We don't know if exposure to PAHs from the air is enough to cause breast cancer in humans, because the mixtures of PAHs in the air seem to be less powerful than PAHs studied in animal experiments, or in workers (coke ovens). But exposure to PAHs at a young age might be more dangerous to the developing breast. 18

Uses

PAHs are not intentionally used. Instead, they are chemicals given off by burning. So they are found in tobacco smoke (smoking and second hand smoke), in auto exhaust and as an air pollutant from industry, and in food that is barbequed, grilled and smoked. They are also frequently found as contaminants in petrolatum, or petroleum jelly, which is sold as Vaseline, and in many lipsticks, baby lotions and oils. 19

Exposures

Exhaust from traffic is probably the most important source of PAHs in South Riverdale. A report by Toronto Public Health found that PAHs (and benzene) are present in outdoor air at levels that are ten times higher than the levels that are considered safe. Most of this was from automobile exhaust. 17. The other sources are from foods, and importantly we think from personal care products such as lipstick, lotions and baby oils.

Tetrachlorethylene

Tetrachlorethylene is a chemical widely used for dry cleaning, textile processing and metal degreasing. It is also known as perchlorethylene, PCE or Perc. It is a known carcinogen, causing a number of cancers in laboratory animals and exposed workers. The question of whether it causes breast cancer is uncertain. Animal studies are negative, but some human epidemiologic studies do support this. 20

Uses

It is widely used for dry cleaning and metal degreasing.

Exposure

We can be exposed from breathing air, and from water contaminated with PCE. It gets into the air by evaporation from dry cleaning or other industrial operations.

Dry cleaning operations are often small companies that are mixed in with residential apartments or homes. Some consumer products contain PCE, such as water repellents, spot removers, adhesives, and wood cleaners.

Heavy metals

Cadmium

Cadmium is a natural substance found in the soil and rocks. It has been shown to be a probable carcinogen, and does cause breast cancer cells to grow in the laboratory. It is also an hormone disruptor. It is not known whether cadmium is a breast carcinogen in humans, although one study indicates this. ²¹ There is some research indicating that other metals, such as copper, lead and arsenic might act as hormone disruptors stimulating breast cancer cells in the laboratory, but there is no other evidence about links to breast cancer.

Uses

Cadmium does not corrode easily and has many uses, including batteries, pigments, metal coatings, and plastics. Cadmium enters the air from mining and coal burning.

Exposure

Cadmium is long lasting in the environment and in the body. We are exposed from tobacco smoke, from air (working in battery industry) or Toronto's air, and some from foods (shellfish, kidney, and liver). In the Ashbridges Bay Treatment Plant Study, cadmium levels in the air over South Riverdale were estimated to be above the recommended safe level when the incinerator was in operation, before 2002. ²²

Ethylene Oxide

Ethylene oxide is a known human carcinogen, and on the NTP list as a breast carcinogen in animals. ²³

Uses

Ethylene oxide is a gas used in many production processes, including textiles, detergents, adhesives, pharmaceuticals and polyurethane foam. It is also used to sterilize equipment in hospitals, and as a sterilant in the production of cosmetics.

Exposure

Exposure might be from release from industry into the air, or from working with ethylene oxide (in hospital sterilizing or industry). There is concern that it can also be absorbed because it is an impurity in many personal care products. ²⁴

Pesticides

Pesticides will be dealt with under hormone disruptors in the next section. They can cause cancer directly as carcinogens, but the most important effect in terms of breast cancer is by changing the way hormones work in the body (hormone disruption).

Solvents

A number of chemicals that are solvents have been associated with breast cancer in both laboratory and occupational studies. The chemicals include formaldehyde, methylene chloride and styrene. Formaldehyde is one of the "Top Ten carcinogens of concern" in Toronto, as listed by Toronto Public Health. 17

Uses

These chemicals are used in many manufacturing processes and in building materials.

Exposure

Exposures occur mostly in workers in metal products, printing, textiles, wood and furniture making, chemical production and clothing. Besides workers, the concern is mostly from indoor air exposure, where solvents especially formaldehyde can be released from building materials such as plywood, as well as from furniture, permanent press fabrics, draperies, carpets and mattresses. 17

B.2 Hormone disruptors

Hormone disruptors are chemicals that affect the body by interfering with hormones, for example female hormones, estrogen and progesterone, which determine pubertal development, the menstrual cycle, and menopause. Thyroid hormones can also be interfered with. Because breast development is dependent on female hormones, interference with these hormones and how they control puberty and breast development, can lead to the promotion of breast cancer cells. 25, 12.

This is a new area of science. It has lead to a number of new understandings.

1. *Exposure to very low doses* of chemicals can interfere with these hormonal processes
2. *Timing of exposure is crucial.* It appears that exposure in early life, while the first breast cells are developing, can cause powerful effects later in life. So the fetus in the mother's womb during pregnancy, the infant and young girls before puberty are most sensitive to these effects. There is also research indicating that some chemicals might bring on early breast development in younger girls, and that this early pubertal development has a role in development of breast cancer. 12
3. *Combinations of substances.* Experiments in the laboratory usually test one substance at a time. However, in our daily lives, we are not exposed to one chemical or substance at a time, but to a "chemical soup". Researchers are concerned that exposure to small amounts of a number of substances, all with similar hormone disrupting effects, will add up to effects powerful enough to cause disease, and cancer.

4. *Uncertainty.* Because this is new science, the research is in the early stages of development, and there is a lot of uncertainty. The more we learn, the more we realize that there are large gaps in our understanding.

5. *The Precautionary principle.* What do you do when the research tells you that there might be a risk for breast cancer from exposure to a certain chemical or group of chemicals, but we are not sure, and it will take more research over many years to be sure? Do you wait for certainty, or do you act to protect people now? 26

We will list a number of hormone disrupting chemicals.

- Alkylphenols (Nonylphenols)
- Bisphenol A
- PBDEs
- Phthalates
- Organochlorine pesticides

Alkylphenols (nonyl-phenols)

There are a number of these phenol chemicals (alkylphenol polyethoxylates). They are widely used to kill germs in household cleaners, in laundry detergents, latex paints, in textile and leather treatments, and in some pesticide formulations. Some are used in sunscreens.

Exposure

We might be exposed to alkylphenols by using these products in our homes. Like other substances in this group, these can be found in household dust, and it is likely that we are exposed by breathing in this dust, or by it getting into our food. 27,28.

Bisphenol A

Bisphenol A (BPA) is used in the manufacture of polycarbonate plastics that are used to line food cans and to make drink containers. The clear plastic water bottles often have BPA, which can leak out into the water, especially if reused several times. It is also used as a dental sealant.

Exposure

We are exposed to BPA as a fetus in the mother's womb before birth, because it crosses from the mother into the baby through the placenta. We are also exposed through food and water. BPA is found in household dust, and we likely are exposed by breathing in this dust, or by it getting into our food. 28

PBDEs

These chemicals are used as flame-retardants, and are put into many of the products in our homes to make them safer. They are found in plastics used in electronics such as computers and TVs, carpets, foam furniture, mattresses and

paints. Flame retardants prevent products from burning, and are therefore very important to our health, but because of their toxicity, they have been banned in Europe, and other less toxic substances substituted as flame retardants.

Exposure

The chemicals are added to the plastics and other substances, but they do not bind well, and so can come off as small particles, forming dust or getting into the water and food supply from waste dumps. 28

Phthalates

Phthalates are used in many common products, mostly to make plastic or PVC products flexible and soft, in clear food wraps (e.g. Saran wrap does have, but Glad cling wrap does not have phthalates), vinyl flooring and adhesives, and in soft plastic children's toys and even teething rings. Phthalates are also used in many cosmetics and personal care products, such as shampoos, perfumes, soap, deodorants, lotions, nail polish and hair sprays. They are usually not listed as ingredients on bottles or containers. Some companies are now making Phthalate free products. 27,29. They have been shown to increase the growth of human breast cancer cells in the laboratory, and there is concern that they might be involved in early puberty and breast development.

Exposure

Phthalates can be absorbed through the skin, so that any cosmetic or beauty product like shampoo or lotion applied to the skin or scalp can be absorbed. We can also be exposed if they are in food, e.g. from food wrap, especially if the food is heated in a microwave. And children might absorb some if they suck or chew on plastic toys that contain phthalates. Like the other substances, they are present in household dust, and this might be a way for their absorption into the body.

Pesticides

There is concern about the effects of some pesticides on breast cancer, especially a group of pesticides and insecticides called organochlorines: DDT/DDE, hexachlorobenzene (HCB), hexachlorocyclohexane (lindane), heptachlor epoxide (a breakdown product of the insecticide heptachlor which is now banned)), dieldrin and triazine herbicides (including atrazine). 30. Included in this group, although not pesticides, are PCBs, chemicals that were widely used in industry, but have now been banned. Some of these products, such as DDT, PCB and heptachlor, are banned in North America, but they persist for a long time, and so are still in the environment and our bodies.

Studies of pesticide and breast cancer, like many other studies in the causes of cancer, are difficult because it is understood that the exposure to chemicals can occur many years before cancer develops; and at the point that the cancer develops it is difficult to measure whether a person was exposed to pesticides many years before. These pesticides might work as direct carcinogens, but many

of them also have properties of hormone disruption, which may promote the development of cancer.

Studies of people working on farms who would likely be more exposed to pesticides show mixed results. However some studies show increased breast cancer, especially in women who spent time close to where pesticides were applied. A recently released study in Windsor, Ontario showed that women with breast cancer were more likely to have worked on a farm, and were at highest risk if after being on a farm, they then worked in the automotive industry. 31,32.

Exposure

Pesticides are used in farming, but are also commonly used in home gardening and lawn care, and indoors for control of pests, such as spraying for termites or cockroaches, or to treat head lice (lindane).

Farmers and others using pesticides in their jobs are exposed. We might be exposed from air if pesticides are sprayed near us; from pesticides left on the foods we eat, pesticide residues on fruit and vegetables, or PCBs in farmed salmon; and we know that dust in homes has pesticides in it, probably brought in from the outside by air drift, on our shoes or on the dog, and that we can absorb the chemicals from the dust in the house by breathing, by it getting into our food, or through the skin. 33,34.

B.3 Radiation

We know that ionizing radiation causes many cancers, and the research is clear that it also causes breast cancer. Research comes from Hiroshima survivors, and people treated with radiation for medical conditions, such as other cancers. The risk is higher in women exposed at a younger age, when the breast is immature, especially at the time of onset of menstruation and in pregnancy.

Radiation is not a major cause of breast cancer. Less than 1% of breast cancer is thought to be due to radiation.

There have been many studies looking at radiation like that from electrical equipment, electric blankets, cell phones, etc. There are some reports of increased cancer risk from this in workers with high levels of exposure, although even this is unclear. There is no evidence of a link to exposures at the levels experienced in our daily lives and homes.

Uses

Radiation is natural and manmade. There is a low level of natural radiation from the earth. We have used radiation for X-Rays and other medical investigations and treatments, for nuclear power and weapons. Non-ionizing radiation, such as microwaves, has not been associated with breast cancer.

Exposure

Exposure might be in people who have needed radiation for medical treatments, such as cancer, and from workers in medical professions and nuclear facilities.

Routine X-Rays and mammography, even if repeated, are not thought to give a dose that would be of concern for breast cancer.^{35,36}

C. How are we exposed, and what do we know about our exposures?

One of the most important questions to answer when trying to find out the risk for breast cancer from exposure to an environmental toxin is: How much am I exposed to? But this question of exposure is also one of the most difficult issues to sort out.

We would like to know:

How much chemical is in

- the air we breathe, in the house, school or workplace, or outside air
- the food we eat
- the water we drink or bathe in
- our house environment, especially housedust and the things we buy
- the soaps, shampoos, and cosmetics we put on our bodies?

And how much of the chemical that is in these areas (we call media) *gets into our bodies* by

- Breathing
- Eating or drinking or
- Coming into contact with our skins.

But in fact we know very little about our exposures to environmental toxins and carcinogens.

This section will help you to understand what we do know. There are three sections:

1. Community exposure
2. Personal/ household exposure
3. Body burdens

C1. Community exposure

By community exposure we mean what are our exposures to chemicals from the common air we all breathe, or the water we drink, or the food we eat etc in South Riverdale, and where do the chemicals come from? We do not know of any breast carcinogens or endocrine disruptors of significance in Toronto's water. Food issues will be dealt with more in household exposures, but residue pesticides on food are regulated by the Pest Management Regulatory Agency (PMRA) of Health Canada and monitored by the Canadian Food Inspection Agency (CFIA). 36a,36b. The main focus here will be chemicals in the air.

There are some reports that list this information.

1.1 NPRI

1.2 Ashbridges Bay Treatment Plant Study (ABTP)

1.3 The Ten Carcinogens report by Toronto Public Health

1.4 CRTK

1.5 Toronto Public Health

1.6 US studies

1.1 The National pollution Release Inventory (NPRI) 37

The National pollution Release Inventory (NPRI) is a Canadian database available on the web, of releases of key pollutants by industry. However, the NPRI was not of much use to our investigations. The NPRI focuses primarily on large point sources, companies that have 10 or more employees, and those that emit more than 10 tonnes of a toxic substance on the list.

So this misses emission from cars and trucks (mobile sources), and from small and medium-sized commercial and industrial and institutional sources, such as drycleaners, body shops, and hospitals. For example, NPRI shows only 3 facilities in Toronto releasing 7.84 tonnes of Perchloroethylene (PCE). But other data from the Federal Commission for Environment and Sustainable development suggests that there are probably at least 500 tonnes of PCE released annually into Toronto's air and water.

NPRI information is made more user friendly in a website called Pollution Watch, where you can find information by postal code. 38

A search for M4M 3P3, the South Riverdale CHC postal code, shows the following results for the year 2004.

RANK	NPRI_ID	FACILITY NAME	COMPANY NAME	TOTAL AMOUNT
1	2298	TORONTO	REPUBLIC POWDERED METALS	58998
2	2240	Ashbridges Bay Treatment Plant	CITY OF TORONTO	3979.23
3	3658	Don Valley Plant	Korex Don Valley ULC	2068
4	5793	Stanley Plant	STANLEY MANUFACTURING COMPANY INC.	1602
5	5884	North Toronto Treatment Plant	CITY OF TORONTO	170.42
6	500	LEASIDE	COLGATE PALMOLIVE Canada Inc.	160
7	642	Toronto Plant	The Canada Metal Company Ltd.	105.56
8	5823	Plant and Distribution Centre	APCO INDUSTRIES Co. Ltd.	59
9	3433	ISP (CANADA) INC. (PRE2002 LEASIDE)	ISP (CANADA)	28
10	4542	Waterman	SCHNEIDER CANADA	27

1.2 Ashbridges Bay Treatment Plant study 3

The study:

Since Ashbridge's Bay Treatment Plant is the second biggest emitter on the NPRI list, it is useful to look at it in more detail. Toronto Public Health did a study in 2005, looking at the air emissions from the Ashbridges Bay Treatment Plant and their impact on the local community, and examining whether residents of South Riverdale and The Beaches had different rates of illness or death compared to other neighbourhoods in the City of Toronto.

Health findings:

- Found cancer rates were no different than comparison communities.
- Overall death rates were higher in South Riverdale and the Beaches, as compared to their comparison neighbourhoods.
- South Riverdale had higher rates of death from heart and breathing problems than its comparison communities.
- These differences likely reflect a blend of environmental exposure and socio-economic differences between the study communities and their comparisons, although this study cannot determine the actual causes.

Environmental findings:

- Focused on 17 of the chemicals of most concern that may have been emitted by the Ashbridges Bay, including breast carcinogens like benzene, cadmium and arsenic, using computer models to analyze their emissions.
- Found that with the closing of the incinerators (2003) and the installation of odour control measures by 2010, the impact of the Ashbridges Bay emissions on local air quality is reduced.
- The 15 chemicals that were found in the Ashbridges Bay emissions met Ontario air quality standards in both communities.
- Most of these 15 chemicals also met health criteria. All will meet the health-based criteria by 2010.

1.3 The Ten carcinogen report 17

The study:

Toronto Public Health conducted a study in 2002 to find out what we know about the potential for exposure to the most important carcinogens in the workplace and from environmental exposures in Toronto. The ten carcinogens were chosen because of their potential to cause cancer and because they are frequently found in the workplace and in the environment in Toronto. Relevant to breast cancer are benzene, 1,3-butadiene, cadmium, dioxins, polycyclic aromatic hydrocarbons (PAHs), and tetrachloroethylene (Perc).

Findings:

- Nine of the ten carcinogens are present in Toronto's outdoor air at levels that approach or exceed the level considered for "tolerable"; that is, a risk of one excess cancer per million people exposed daily over a lifetime.
- Two of the carcinogens – **benzene and PAHs** – are present in outdoor air at

levels ten times higher than the benchmark.

- Five of the ten carcinogens (**benzene**, formaldehyde, 1,3-butadiene, trichloroethylene and **PAHs**) can be found in indoor air at levels approaching or exceeding tolerable levels;
- Another study by Prof Miriam Diamond at University of Toronto showed that air levels for many substances emitted in the city are about 10 times greater at downtown than suburban and rural locations (e.g., PCBs, PAHs, PBDEs).³⁹

1.4 Community Right To Know study 40

The study:

In 2004, the Toronto Cancer Prevention Coalition assessed how easy it was to access information on chemicals, especially substances associated with cancer, for residents and workers in the South Riverdale and Beaches neighbourhoods of Toronto.

Findings:

- It was difficult for residents to find information on toxic chemicals that are present in their neighbourhood.
- The information is scattered, incomplete and difficult to access and understand.
- “Higher concern” industries included businesses involved in manufacturing, dry cleaning, auto servicing (auto body shops, service stations and repair shops) publishing and printing, film and photo development, incineration and landscaping.
- There were 115 such businesses in South Riverdale.
- Attempts to access information on these businesses showed:
 - On the NPRI and PollutionWatch websites, they could access pollutant release information for only 11 of the 115 businesses (10 %).
 - On the provincial Ministry of the Environment’s Environmental Registry, they found information for only 2 of 30 auto body and dry cleaning businesses regarding environmental approvals (Certificates of Approval, or other environmental instruments). A further search by staff, using a Freedom of Information request, found information for 10 of the 30 businesses.

The group defined Community Right-To-Know as: “the community’s right to access a broad range of information related to environmental and human health and safety. It includes a community’s right to access information on releases to the environment, a consumer’s right to know about harmful ingredients in products and a worker’s right-to-know about the health effects of chemicals in the workplace.”

1.5 Future work.

Toronto Public Health is at present working on a project to better define the carcinogens in Toronto’s air, and what risk they pose to residents.

1.6 MATES Study: 41

A comprehensive assessment of "air toxics", which are air pollutants that are cancer causing, was conducted in the Los Angeles area in 2000. (MATES Study). The study found that mobile sources i.e. cars, trucks, trains and aircraft, especially from diesel engines, were the most important contributor to air toxic pollution, more so than industrial sources; that the pollution was evenly distributed through the area; and that levels were lower than previously measured. The overall risk was 1,400 per million people, meaning that it is estimated that 1,400 people per million will develop cancer as a result of air pollution.

C2. Personal/ Household exposure

In this section, we ask the question: How much do we know about exposures that occur to individuals and families, where they work, and in their homes. There is a difference here, because we have some control over these exposures, whereas if the outdoor air is polluted, we can't do anything about that.

There are 3 sections discussed:

2.1 Workplace exposures

2.2 Home exposures

2.3 Consumer products

2.1 Workplace exposures

This was discussed in the Community right to Know Study described above. There is generally a lack of public information on occupational exposures in Ontario work places. The Ontario Ministry of Labour used to collect exposure information on selected chemical agents for Ontario workplaces, but this data has not been collected for several years. By law, workers should be able to access information about any toxic substances that they might be exposed to in the workplace, through the Workers Hazardous Materials Information System (WHIMIS) and Material safety data Sheets (MSDS) in the workplace. Some workplace issues have been discussed, such as farmers, automotive workers, workers in the textile and clothing industry, dry cleaning, pharmaceuticals, hairdressing and beauticians, jobs associated with radiation exposure, and possibly night shift workers.

2.2 Home exposures

We know very little about exposures inside the home. This is very difficult to study, as each home is different. We'll discuss two topics

- How do toxic chemicals can get into the home?
- What studies have been done about household exposures?

How do toxic chemicals get into the home?

- A chemical comes into the home from outside e.g. pesticides come in on our shoes or the dog, or air pollution comes in the windows.

- Chemicals are given off from new building materials or household products e.g. "off gassing" from new carpets, flame retardants from computers or TVs
- A chemical is used or applied intentionally in the house e.g. spraying for cockroaches or other bugs, paint, make up, perfumes, lotions.
- Unintentional release of chemicals in the home e.g. a chemical is spilled, or it is not stored properly.

What studies have been done about household exposures?

Studies have been done examining

- Indoor air
- Dust in homes

Indoor air studies

A number of studies have looked at various toxic air pollutants in homes. A recent study in New York and Los Angeles that had teenagers wearing personal monitors for 48 hours found that levels of many chemicals were higher indoors than outdoors, and were higher than levels considered safe. This was for all carcinogens, not specifically for breast carcinogens. Similar findings were made in a study of indoor air and dust in the US, and in a study of indoor air in Ottawa 42,43,44.

Indoor Dust studies

There was no information on this until recent (2003) studies by Rudell with the Silent Spring Institute examined the dust in 128 homes, and found that the dust contains levels of many of the carcinogens and hormone disruptors that we have mentioned in this report, including phthalates, pesticides, alkylphenols and PBDEs, brought into our homes in ordinary consumer products.

These chemicals can get into the body by breathing, or in our food. Children who spend a lot of time on the floor are likely to absorb more of these chemicals from the dust. 45,46,47.

2.3 Consumer products

On your shelves, in your bathroom, basement, storage area, kitchen and the rest of your house are many chemical products that we use to clean, to wipe, to paint, to shave, shampoo, and use as cosmetics, lotions, air fresheners, pesticides and that are in our furniture, mattresses, TVs and computers. We are unaware as to which compounds are safe and which might be harmful. Many of the products are complex mixtures of chemicals. Many of the substances listed as endocrine disruptors might be in products we buy, including alkylphenols, bisphenol A, the flame retardants (PBDEs), phthalates and pesticides. The products that they are in have been described in the section on endocrine disruptors. A few groups of products can be singled out.

1. Pesticides
2. Food and water

3. Cleaning products
4. Cosmetics and Personal care products
5. Plastics.
6. Flame Retardants. PBDEs.

1. Pesticides.

Pesticides are used on lawns and gardens, but we include here also chemicals used to eradicate cockroaches, termites, bed bugs and other infestations and flea treatments for pets. Lindane is used as a treatment for head lice.

2. Food and Water

We make choices when we buy our food. We know that healthy eating, especially lots of fruits and vegetables, is important in breast cancer prevention. Food itself may contain some pesticides as discussed above (see 36a, 36b), and there is concern about contaminants in farmed salmon. But here we also refer to the phthalates in food wraps, and the Bisphenol A that might be in linings of cans and water bottles.

3. Cleaning Products

Concern here is about endocrine disruptors such as nonylphenols described above that are in some laundry detergents and bathroom cleaners, and which are not listed or very difficult to figure out. See the resource list below for help with this. 27,48,50,51.

4. Cosmetics and Personal Care Products

A number of endocrine disruptors have been found in cosmetics and personal care products. This is described previously, under the section on phthalates, and PAHs. Once again these ingredients are often not listed, or difficult to understand. 27,48,49,50,51.

5. Plastics

Phthalates are used to soften many plastic products, and in some food wraps. This is especially important in products that come into contact with food and water, and that children put in their mouths.

6. Flame Retardants. PBDEs.

As discussed above, PBDEs are used in many products as flame retardants, in furniture, mattresses, TVs and computers. They are not tightly bound in these products, and can leach out over time into the household environment, especially into dust.

7. Other products.

Other products that we use around the house might contribute to our total carcinogen load. For example, methylene chloride may be contained in paint strippers.

A number of very useful and reliable guides have been developed to help the consumer to identify safe versus unsafe products.

1. The Cancer Smart Consumer Guide. 27

<http://leas.ca/CancerSmart-Consumer-Guide.htm>

2. Guide to less toxic products. Environmental Health Association of Nova Scotia. 48

<http://www.lesstoxicguide.ca/index.asp?>

3. Environmental Working Group: Skin Deep. News about the safety of popular health and beauty brands. 49

<http://www.ewg.org/reports/skindeep2/advanced.php>

4. Household products database, National Institutes of Health. 50

<http://hpd.nlm.nih.gov/index.htm>

5. Safer products project. Alternatives for a healthy home. 51

<http://www.safer-products.org/page.php>

C3. Body levels

Another way of researching what we are exposed to is by measuring how much chemical, or carcinogen, is in people's bodies. This is called biomonitoring. There is not very much information about this in Canada, although Health Canada has recently announced that it will begin a program of extensive biomonitoring soon. There has been some limited measurement of chemicals in mother's milk, and a Toronto environmental group, Environmental Defence, has tested a small number of people. (Toxic Nation Study)

Toxic Nation Study 52

The study

There were two studies, the first of 11 people tested for 88 substances, a follow up of 5 families tested for 68 substances.

Findings

11 people: 60 of 88 chemicals tested for were detected. Of the 60 chemicals detected 41 are suspected cancer-causing substances.

5 families: 46 of 68 chemicals tested for were detected. Of the 46 chemicals detected 38 are cancer-causing substances. Both included many of the substances mentioned in our report, including PBDEs, pesticides, PCBs and heavy metals.

D. Conclusion

About one in eight women in South Riverdale will get breast cancer in their lifetime, a number similar to women elsewhere in Toronto. We know about many risk factors for developing breast cancer.

This report looked at the environmental exposures that might contribute to the development of breast cancer. It examines chemicals in the environment that cause cancer directly, and it examines the emerging science and concerns about hormone disruptors and breast cancer. It further explores how women might be exposed to these substances of concern, in the community, in their workplaces and in their homes.

We hope that this report helps you to better understand and the environmental risks for breast cancer, or taking action in terms of recommending further research, education, and advocacy for individuals and consumers or in terms of advocating for changes in the way chemicals are regulated.

References and Resources

1. Breast Cancer in Ontario 1971-1996 October 2000 Anna M Chiarelli Beth Theis Eric Holowaty Veronika Moravan E Diane Nishri Surveillance Unit and The Ontario Breast Screening Program Division of Preventive Oncology Cancer Care Ontario
Preface/Highlights/Background
2. Cancer Care Ontario. Cancer Fact: Breast cancer: rate of new cases and deaths in Ontario, July 2003.
http://www.cancercare.on.ca/index_ontarioCancerFacts.htm
3. Toronto Public Health. Ashbridges Bay Treatment Plant study
http://www.toronto.ca/health/hp/he/pdf/abtp_board_of_health.pdf
4. Mortality, Cancer Incidence and Hospitalization Among Residents of the Neighbourhoods of South Riverdale, The Beaches, and Comparison Communities
Murray M. Finkelstein for Toronto Public Health April 2005
http://www.toronto.ca/health/hp/he/abtp_emissions.htm
5. Understanding Breast Cancer Risk and Risk Factors Associated With Diet and Lifestyle <http://envirocancer.cornell.edu/factsheet/diet/fs49.BCRisk.cfm>
- 6 Lichtenstein, N. Engl. J. Med., vol. 343, pp. 78-85, 2000
7. EHP March 2007. <http://www.ehponline.org/members/2007/115-3/focus.html>
8. Madigan et al., JNCI vol. 87, pp. 1681-1685, 1987; Rockhill et al., Am. J. Epidemiol., vol. 147, pp. 826-833, 1998).
9. <http://ntp-server.niehs.nih.gov/htdocs/Sites/MAMM.HTML>
10. Understanding Breast Cancer Rates
<http://envirocancer.cornell.edu/FactSheet/Rates/fs3.rates.cfm>
11. Green Brody J, Rudel R. Environmental pollutants and Breast cancer. Environmental Health Perspectives. 2003. 111(8)
<http://www.ehponline.org/docs/2003/6310/abstract.html>
- 12 Fenton S. Endocrine-Disrupting Compounds and Mammary Gland Development: Early Exposure and Later Life Consequences. Endocrinology 2006;147(6) s18-s24)
- 13 IARC International Agency for Research on cancer <http://www.iarc.fr/>
- 14 NTP. National Toxicology Program. Report on carcinogens
<http://ntp.niehs.nih.gov/index.cfm?objectid=72016262-BDB7-CEBA-FA60E922B18C2540>
- 15 Benzene <http://ntp.niehs.nih.gov/index.cfm?objectid=0707525C-0F07-05BF-A16CAC7B0ECC97B5>
- 16 (Abstract for TR-288 - 1,3-Butadiene)
<http://ntp.niehs.nih.gov/index.cfm?objectid=0709EBD3-05D3-ADFC-33BD031C26E4A48B>
17. Ten Key Carcinogens in Toronto Workplaces and Environment: Assessing the Potential for Exposure.
http://www.toronto.ca/health/pdf/cr_summaryreport.pdf
- 18 Polycyclic aromatic hydrocarbons
<http://envirocancer.cornell.edu/Factsheet/general/fs41.pah.cfm>
- 19 (EWG Skin deep <http://www.ewg.org/reports/skindeep2/impurities.php>)

- 20 Tetrachlorethylene <http://ntp.niehs.nih.gov/index.cfm?objectid=E87D1CE3-BDB5-82F8-FF89E156508651F8>
- 21 McElroy JA, Shafer MM, Trentham-Dietz A, Hampton JM, Newcomb PA. Cadmium exposure and breast cancer risk. *Journal of the National Cancer Institute*. 2006;98(12):869-73.
22. Toronto Pubic Health.2005. Air Emissions from the Ashbridges Bay Treatment Plant Emission Study
http://www.toronto.ca/health/hp/he/pdf/abtp_emissions_executive_summary.pdf
23. Ehtylene oxide <http://www.epa.gov/ttn/atw/hlthef/ethylene.html>
http://www.scorecard.org/chemicalprofiles/summary.tcl?edf_substance_id=75-21-8
- 24 (EWG <http://www.ewg.org/reports/skindeep2/impurities.php>
- 25 Endocrine disruptors <http://envirocancer.cornell.edu/factsheet/cendocrine.cfm>
- 26 Green Brody J, Tickner J, Rudel R. Community-initiated breast cancer and environment studies and the precautionary principle. *Environmental Health perspectives*, August, 2005 <http://www.ehponline.org/members/2001/109p871-876kriebel/kriebel-full.html>
- 27 The CancerSmart Consumer Guide. LEAS; <http://leas.ca/CancerSmart-Consumer-Guide.htm>
28. Rudel R, Brody J, Spengler J. Identification of Selected Hormonally Active Agents and Animal Mammary Carcinogens in Commercial and Residential Air and Dust Samples *Journal of the Air & Waste Management Association*. 2001. 51 (4) 499-513.
<http://library.silentspring.org/publications/pdfs/JAWMAabstract.pdf>
- 29 EWG. Poisoned cosmetics. Not too pretty. <http://www.nottoopretty.org/>
30. Chemicals fact sheet.
<http://envirocancer.cornell.edu/factsheet/cchemicals.cfm>
- 31 Ontario Colege of family Physicians: Pesticide report.
<http://www.ocfp.on.ca/English/OCFP/Communications/CurrentIssues/Pesticides/default.asp?s=1>
- 32 Brophy J, Keith M et al. Occupation and Breast Cancer A Canadian Case–Control Study. 2006. *Ann. N.Y. Acad. Sci.* 1076: 765–777
- 33 Rudel Household Exposure Study. *Env SC and Tech* 2003;
<http://www.silentspring.org/newweb/research/household.html>;
34. Sick of Dust Report <http://www.safer-products.org/downloads/Dust%20Executive%20Summary.pdf>
35. Cornell Fact Sheet. Ionizing Radiation and Breast Cancer Risk <http://envirocancer.cornell.edu/factsheet/physical/fs52.radiation.cfm>
36. Ronckers C, Erdman C, Land C. Radiation and breast cancer: A review of current evidence. *Breast Cancer research*. 2005. <http://breast-cancer-research.com/content/7/1/21>
- 36a PMRA Maximum Residue Limits for Pesticides. <http://www.pmara-arla.gc.ca/english/legis/maxres-e.html>
- 36b. Canadian Food Inspection Agency. Chemical residue reports.
<http://www.inspection.gc.ca/english/fssa/microchem/resid/reside.shtml>

37. The National pollution Release Inventory (NPRI)
http://www.ec.gc.ca/pdb/npri/npri_home_e.cfm
38. Pollution Watch. <http://www.pollutionwatch.org/>
39. Butt C, Diamond M. Spatial Distribution of Polybrominated Diphenyl Ethers in Southern Ontario As Measured in Indoor and Outdoor Window Organic Films. *Environ. Sci. Technol.*, 38 (3), 724 -731, 2004
40. Community Right to Know. Toronto Cancer Prevention Coalition case study on public access to information on toxic substances in the South Riverdale/Beaches community
http://www.toronto.ca/health/hpbe/pdf/boh_case_study_riverdale.pdf
41. MATES study. <http://www.aqmd.gov/matesiidf/es.pdf>
42. Sax S et al. A Cancer Risk Assessment of Inner-City Teenagers Living in New York City and Los Angeles. 2006;114,10.
<http://www.ehponline.org/members/2006/8507/8507.html>;
43. Silent Spring Institute.
<http://www.silentspring.org/newweb/research/household.html>;
44. Selected Volatile Organic Compounds in Residential Air in the City of Ottawa, Canada
<http://pubs.acs.org/cgi-bin/abstract.cgi/esthaq/2005/39/i11/abs/es050173u.html>)
45. Silent Spring Institute.
<http://www.silentspring.org/newweb/research/household.html>
46. Safer products project: Sick of dust project
<http://www.safer-products.org/downloads/Dust%20Executive%20Summary.pdf>
47. BCERF: Household exposure to chemicals
<http://envirocancer.cornell.edu/learning/household/exposures.cfm/>)
48. Guide to less toxic products. Environmental Health Association of Nova Scotia.
<http://www.lessstoxicguide.ca/index.asp?>
49. Environmental Working Group: Skin Deep. News about the safety of popular health and beauty brands.
<http://www.ewg.org/reports/skindeep2/advanced.php>
50. Household products database, National Institutes of Health.
<http://hpd.nlm.nih.gov/index.htm>
51. Safer products project. Alternatives for a healthy home.
<http://www.safer-products.org/page.php>
52. Environmental Defence. Toxic Nation Study
<http://www.environmentaldefence.ca/toxicnation/pollutionInYou/toxicNationReport.htm>

