

PRIVATE PARTS

by Zoe Cormier

Wednesday, November 30, 2005

Part one of a four-part series on health and the environment

Two years ago, people from the Aamjiwnaang First Nation near Sarnia noticed something strange—they had three girls' softball teams but only one boys' team. The people of this Chippewa community on the St Clair River had suspected for some time that they had fewer male births, but this hit it home.

Ada Lockridge, an environmental activist from Aamjiwnaang, noticed the lack of boys herself; she and her two sisters had eight daughters and one son between them. She pored over her band's birth registry and tracked the changes over time. In 1984 the birth rates were relatively balanced. But in 1993, slightly more girls were born than boys, and by 2002 the birth rate for girls had jumped to twice that of boys.

The story made it into both the local papers and The Globe and Mail. The Aamjiwnaang reservation is surrounded by petrochemical plants that bought the land from them in the 1960s. There was speculation that chemicals from the surrounding factories had caused the men (because sperm, not eggs, determine the sex of a baby) to father more daughters.

Many different kinds of chemicals, known as endocrine disruptors (popularly called 'gender benders') can act as hormones and distort the body's chemical balance. A variety of endocrine disruptors are released by chemical processing, including many created by petrochemical refining. In the case of Aamjiwnaang, scientists and industry representatives argued that the difference could simply be a statistical fluke, as only 850 or so people lived on the reservation.

Constanze A. Mackenzie, a professional in wildlife toxicology, analysed the data. She found that the decline in male births—which occurred gradually—was statistically significant. Her findings were published (with Ada Lockridge and Margaret Keith as co-authors) in the October 2005 issue of *Environmental Health Perspectives* (EHP), the scientific peer-reviewed journal of the US Department of Health and Human Services' National Institute of Environmental Health Sciences.

Other parts of the world have also seen the same trend, such as Seveso, Italy, after a 1976 explosion at a herbicide factory that released a cloud of dioxins (toxic chemical by-products that mimic estrogen).

But the Aamjiwnaang reservation had not experienced any single large catastrophe. "If a community can be affected by environmental contaminants [such] that their reproduction is affected to such a significant degree, this could mean that low-level exposures could also have an effect on populations," says Mackenzie.

Currently, there are other health problems that plague the reservation. Women often suffer from multiple miscarriages, "as many as six in a row," says Lockridge. Asthma is practically the norm in young people, and it is extremely common for children to have chronic ear infections, an affliction that plagues many of Canada's First Nation's communities. "I realized my one-year-old daughter had an ear infection when she started slamming her head against the wall," says Lockridge. "She had to have tubes inserted into her ears for a year."

Lockridge is certain of what is to blame: "We never knew that these problems could have been because of the factories, nobody told us. We thought it just ran in the family. But after I started finding out about all of this, all the chemicals they release and what they can do to you, I was crying all the time. Now I'm just angry," she said.

Most people in Canada, like the residents of Aamjiwnaang, are not exposed to large amounts of one single chemical; rather, we are all exposed to small amounts of hundreds (even thousands) of different chemicals every day. Many of these are detrimental to our lungs, often toxic or carcinogenic, and some can mimic hormones.

And many of these chemicals are becoming more abundant in our surroundings. In some respects, industrial pollution in Canada hasn't been getting better—it's been getting worse.

We Canadians often consider ourselves world leaders in a green economy. Our forests have grown over the past few years. Compared to levels in the 1970s, our air contains much less sulphur dioxide and lead. Our lakes and rivers contain far less of certain pollutants than those in other countries.

Although we have made considerable progress since the 1950s, pollution in Canada has actually risen during the past few years, while we've been busy congratulating ourselves. PollutionWatch, a collaborative effort of Environmental Defence Canada and the Canadian Environmental Law Association, found that total releases and transfers of core pollutants from core facilities in Canada increased by about 12 per cent from 1995 to 2003, based on information from the federal government's National Pollutant Release Inventory (NPRI), a database of industrial chemical releases.

The Commission for Environmental Cooperation (CEC), relying on the same NPRI and Total Release Inventory (TRI) databases, found that while Canadian total releases and transfers increased by seven percent from 1998 to 2002, the US totals decreased by eight per cent over the same time period. To be fair, Federal Environment Minister Dion pointed out that part of the discrepancy might reflect that the US economy has had a relative downturn while Canadian sectors have been booming, particularly oil and gas facilities, which are not counted in the US by the TRI. However, this is a bit of a red herring, as oil and gas facilities are not part of the CEC analysis. For manufacturing facilities that reported in both 1995 and 2002, Canada is still a far cry behind the US; while Canada decreased air releases by 10 per cent, the US decreased them by 39 per cent. "George Bush's America is doing a better job at preventing pollution than our own Canadian government," commented Rick Smith, executive director for Environmental Defence Canada.

No one can deny that when it comes to placing pressures on the environment, Canada is one of the worst offenders. A David Suzuki report released in October, 2005, found that among the 30 OECD countries, Canada pulled up the rear, ranking 28th overall. Other reports by David Boyd (28th of 30) and the WWF Living Planet Report 2004 (25th of 30) place Canada in similarly humiliating spots. Turkey, for instance, an OECD member reviewed in the Suzuki report, ranked better than Canada. That's not to say that the state of Turkey's environment is better than Canada's—it just means that for a variety of reasons (below-market prices for energy and water, long distances, and a harsh climate), Canadians make big ecological footprints, and we're not starting to tread any lighter.

"What an incredible embarrassment for Canada, that in the span of a decade we have gone from being an environmental leader to an environmental delinquent," commented Smith. "The irony is that we've never had more information about the impact of pollution on human health, and yet there has never been less willingness on the part of the federal government to do anything about it."

Nowhere in Canada does pollution prevention seem like more of a myth than in Ontario. A CEC assessment of all the states and provinces in the US and Canada (based on 2002 data) ranked Ontario as the second-worst polluter in North America—outdone only by Ohio.

Ontario creates more pollution than Texas.

Few places in Ontario have a bigger pollution issue than Sarnia, an industrial town that sits in the Great Lakes region (home to 45 per cent of toxic air pollution reported in Canada in 2002).

Just a few hours west of Toronto, across the St Clair River from Michigan, Sarnia is home to the largest concentration of petrochemical factories in Canada. Shell, Dow, Imperial Oil, Nova, Royal Polymer, Suncor—the biggest names have factories there. And just outside of Sarnia sit the Lambton Generating Station (one of the coal-fired stations Ontario Premier Dalton McGuinty has promised to close) and the Clean Harbors Lambton Facility garbage incinerator—the largest releaser of carcinogens and hormone mimics in Canada in 2001 and 2002. The incinerator is also a thriving recipient of waste transfers from many of Canada's more brand-conscious industrial players.

Sarnia is considerably less polluted in some respects than it was decades ago because of more efficient refining technology and large-scale efforts to clean up the river. But Lambton County still suffers from some problems that seem incontrovertibly linked to pollution. Currently, only a third of all babies born on the Aamjiwnaang reservation are boys. Male snapping turtles and white perch with abnormal genitals have been found in the St Clair River. A 2004 study in Environmental Research points out that Sarnia's rate of cerebral palsy is 4.8 times the provincial average.

Chemical spills are commonplace in the area. "The provincial government a few months ago did a sweep of industries in Sarnia and found almost 100 per cent non-compliance with the law [regarding spills]," says Smith. According to Lake Ontario Waterkeeper, there have been more than 800 spills from both the American and Canadian facilities into the St Clair River over the past 20 years. On February 1st, 2004 there was an accidental release of 150,000 litres of ketones into the river (toxic industrial solvents that blur vision and cause dizziness) by Imperial Oil. There was also a spill of vinyl chloride (a carcinogen) by Royal Polymer during the 2003 blackout. The ketone spill forced the Walpole First Nation down the river to close their water intake for drinking water for several days. "It was quite traumatic," said David White, director of the first nations heritage centre at Walpole.

And you can still see plumes of strange gas in the air every now and then. In July, Ada Lockridge saw an orange cloud from the Suncor plant float over her home. She called both the Ministry of Environment and Suncor about it, but Suncor told her they were testing the air and did not want to warn the people of the reservation to stay indoors until they knew if the cloud posed a threat. "So I asked them: What, would you rather just wait and have a bunch of dead Indians on your hands?"

Aamjiwnaang's situation is not unique. It is easy to get the impression that we live in a fairly clean country. But even in the remotest corners of Canada, people still come into contact with many of the pollutants that the residents of Aamjiwnaang are subjected to. Trace amounts of corrosive gases, heavy metals and carcinogens from industrial releases are found everywhere. These chemicals often do not biodegrade, so they persist in our environment and scientific studies have documented traces of hundreds of synthetic chemicals in the blood and urine of human beings.

The Environmental Working Group (a US-based non-profit environmental research organization) released a disturbing study in July, 2005, after examining the umbilical cord blood of ten American babies (the gateway for oxygen and nutrients for the foetus). They found a total of 287 toxic chemicals: 180 that cause cancer, 217 that are toxic to the brain and nervous system, and 208 that cause birth defects. Each baby was exposed to an average of 200 chemicals through its umbilical cord. Every mother in the developed world today will unwittingly and unwillingly pass on a legacy to her children: the residue from two hundred years of industrial pollution.

Before any of these babies had a chance to take even one breath, they were contaminated by hundreds of dangerous chemicals: heavy metals, flame retardants, pesticides, wood varnishes, and perfluorinated chemicals such as those found in Teflon—just to name a few.

Pollutants are particularly dangerous to unborn babies because they are incredibly vulnerable. Embryos do not have proper detoxification systems to deal with foreign chemicals, and the barriers that keep toxic chemicals in the blood from reaching the brain are not fully developed. Moreover, all of a person's organs are constructed during foetal life—any damage to the developing body can have permanent consequences.

And if it isn't bad enough that children are exposed to chemicals that can cause brain damage and cancer before they are even born, some scientists and environmentalists are now extremely concerned about a previously-unknown threat from synthetic chemicals: their ability to mimic hormones. Lab studies have shown that exposure to even small amounts of hormone mimics in the womb can throw the entire system out of balance, and lead to cancers, brain damage, and reproductive abnormalities.

In the same ten umbilical cords the EWG scientists found 210 different chemicals that can mimic hormones.

Hormones are powerful, natural chemicals our bodies use to relay messages from one organ to another. From cradle to grave they regulate our growth and appetite, affect feelings and emotions, and direct the creation of eggs and sperm and, therefore, new life. We could never exist without hormones.

But hormones can be dangerous—they are powerful chemical messengers that work together in a complicated network. Too much (or too little) of any one hormone can make the whole system go awry.

Estrogen (the 'female' hormone) can even cause cancer.

Estrogen normally makes cells grow and divide, but if the body's estrogen level is raised too high, it can create a tumour by causing cell division to spin out of control. For this reason, the International Agency for Research on Cancer now defines hormone replacement therapy as a known human carcinogen – it raises the body's estrogen level just a bit too high and can lead to endometrial cancers.

This isn't the first time, however, that synthetic hormones have caused cancer. In the 1950s and 60s, doctors were puzzled by a sudden rise of some rare cancers (vaginal and uterine) in teenaged girls. Careful screening of the victims revealed that their cancer had been spawned in the womb by a synthetic estrogen called diethylstilbestrol (DES) that their mothers took because it was thought to prevent early miscarriage (it didn't).

But while we can choose to avoid being exposed to some kinds of estrogen—in pills, red meat, or soy—everyone is exposed to estrogen mimics every single day of our lives, with or without our consent.

Scientists have not screened many chemicals yet for the ability to mimic hormones, but already Environment Canada defines the following as known endocrine disruptors: dioxins (toxic gases from waste incinerators); polychlorinated biphenyls (PCBs, banned flame retardants that persist in the environment); many banned pesticides such as DDT; several pesticides that are still in use, such as atrazine; tributyltin (an antifoulant used to clean the hulls of ships); alkylphenols (a group of soap detergents); phthalates (chemicals used to soften plastic); phytoestrogens (natural plant estrogens in soy and paper pulp); and hormones excreted by women into the sewers. In addition, Polybrominated diethyl ethers (PBDEs, widely used flame-retardants), polyaromatic hydrocarbons (PAHs, released by fossil fuel burning), and several metals (cadmium, lead and mercury) are also considered by some scientists to be endocrine disruptors.

TIPS FOR THE FEDS

The CEPA review, underway this year, is an opportunity to bring the regulation of toxic chemicals in Canada up to international standards.

Establish timelines for the virtual elimination of toxic chemicals.

- Achieve virtual elimination of all releases of carcinogens to the air and water by 2008.
- Establish timelines to virtually eliminate respiratory toxins, endocrine disruptors, and reproductive and neurological toxins from use, release, generation, disposal or recycling.
- As a matter of priority, ban brominated flame retardants, perfluorinated chemicals and their precursors, and phthalates.

Make industry accountable for its chemicals.

- Shift the burden of proof onto industry to prove the safety of its chemicals before introduction or continued use in the market.
- Mandate industry to adopt a safe substitution policy to replace toxic substances with safer or non-toxic substances.

Regulate toxic chemicals in consumer products.

- Expand CEPA to regulate toxic chemicals that may be released during the use or disposal of consumer products.

These are probably only a handful of what might become a long list of potential hormone mimics. We do not even have a clear idea of what makes a chemical capable of mimicking estrogen, so we have no way of knowing just how many of the 23,000 chemicals used in Canada are estrogenic.

But we do know that hormone mimics are widespread. Thousands of academic and federal studies have shown that hormone mimics have already caused serious harm to wildlife and resulted in instances of malformed genitalia, brain damage, immune depression, and cancer.

One of the most common ailments is 'feminisation' of males. 'Gender benders' in the bodies of male animals can cause their hormonal balance to swing away from male to female, producing more estrogen and less testosterone—often, male babies will later display female characteristics as a result.

In the 1980s, alligators began to disappear from Lake Apopka in Florida. The few males that were left had testosterone levels three times lower than alligator males elsewhere in Florida, and their testicles and penises were small and malformed. With inadequate equipment, they simply could not mate with the females, and their population crashed. A 1994 analysis in EHP of frozen alligator eggs from Apopka found high levels of the banned pesticide DDT.

Florida panthers are also suffering from a biochemical imbalance—male panthers in southwest Florida have virtually the same level of estrogen in their bodies as females. This is considered to be partially responsible for high instances of common thyroid problems, heart defects, abnormal sperm, and undescended testicles in the cats.

Large numbers of hermaphroditic cricket frogs from the north eastern US and south western Ontario (particularly during the 1950s, when production of many pollutants peaked) led the authors of a 2005 EHP study to pinpoint pesticides and PCBs as responsible for the disappearance of the frogs. Frogs can also be easily feminized by atrazine, the most commonly used pesticide in the US.

In Canada, effluent from paper pulp mills has feminized fish; dioxins have been blamed for the appearance of female egg protein in herring gull testicles around the Great Lakes; and turtles with abnormally small penises have been found in the St Clair near Sarnia.

Intersexual fish (having both male and female characteristics) are also commonly found in the intensely polluted Great Lakes. Fish populations are sparse, and a number of scientists have pointed out that the decline and then rebound of some fish species occurred in parallel to the rise and fall of PCBs and other toxic pollutants in the water.

Endocrine disruptors can also damage the immune system, often by damaging T cells. Epidemic diseases in dolphins have been linked to PCBs and DDT. A 2002 Environment Canada study found more than 80 different pollutants in Norwegian polar bears and especially high levels of PCBs, which are presumed to have caused swollen thyroids in the bears.

Diseases in wildlife have caused many to worry that we also might be affected by endocrine disruptors. A number of startling trends in North America and Europe—falling sperm counts, rising cancers, malformed penises and early puberty—suggest that synthetic gender benders may be to blame, as people in less industrialized areas of the world tend to experience fewer of these problems. In the past ten years, scientists have produced hundreds of studies to support their suspicion: that estrogen mimics are everywhere, and we are suffering from estrogen overload.

A 2000 EHP paper, surveying data from 101 studies, calculated that sperm counts in Europe and North America fell by about 40 per cent between 1938 and 1991.

Cancers are increasing in the sex organs (which are strongly affected by hormones). The Canadian Cancer Society Statistics 2005 found that the “Age-Standardized Incidence Rates” for prostate cancer increased by

95 per cent and breast cancer by 25 per cent in Canada between 1976 and 2005; after lung cancer, prostate and breast cancers are currently the most frequently diagnosed kinds of cancers.

Reproductive abnormalities in boys are becoming more common as well, such as undescended testicles, and urethras that come out at the side rather than the tip—a study in the 1997 issue of *Pediatrics* estimated that the incidence of misshapen urethras doubled in the US between 1973 and 1993 from one in every 250 boys to one in 125.

And girls are starting puberty younger. An April, 1997 study in *Pediatrics* that examined 17,000 girls between the ages of three and twelve found that at the age of three, three per cent of African-American girls and one per cent of Caucasian girls had signs of pubic hair and/or breasts. By the age of eight the numbers climb to 48 per cent and 14 per cent, respectively.

Although many scientists and industry representatives are sceptical that synthetic chemicals could be responsible for all these problems, a substantial body of evidence suggests that they might be. Many studies have found that the same chemicals that have plagued wildlife could be causing similar ailments in humans: cancers, immune system damage, feminization, and birth defects.

A 2003 EHP study found that women with high levels of PCBs in their blood are more likely to have sons who develop testicular cancer. A 2005 report in EHP found that low-dose exposure to PCBs and other flame-retardants can impair the thyroids of pregnant women and could lead to postpartum depression.

A paper in *The Lancet* in 2000 found that fathers who were younger than 19 years of age at the time of the herbicide plant explosion in Seveso, Italy in 1976, sired significantly more girls (62 per cent) than boys (38 per cent).

A 2002 Dutch study in EHP found that young boys and girls exposed to above-average levels of dioxins in the womb (estimated from the blood in their own frozen umbilical cords) exhibit “more feminised play behaviour.”

Research in EHP in 2003 attributed low sperm counts in men living in rural Missouri to the high concentrations of the pesticides alachlor, dianinon and atrazine in their urine. Another 2003 EHP study suggested that chlorophenoxy herbicides could cause birth defects, as areas of the US that grow high amounts of wheat (like much of Canada) have more than a twofold increased rate of combined circulatory and respiratory malformations.

Many scientists are now convinced that humans and animals are both at risk from the same hormonal activities of molecules in our environment: banned flame retardants (such as PCBs), toxic waste products (like dioxins), and many pesticides. But the threat doesn't end there—scientists have discovered a number of hormone mimics inside our homes: in computers, mattresses, carpets, curtains, wooden furniture, CDs, shampoos, nail polish, and even dental fillings.

Phthalates, chemicals that are used to make plastics soft and pliable, are particularly worrisome because they escape very easily from consumer products, including shampoos, vinyl flooring, pharmaceuticals, and nail polish. About 3.5 million metric tonnes of phthalates are made every year, and a 2004 analysis in EHP, using data from the Centers for Disease Control and Prevention in Atlanta (CDC), says they appear in the urine of 75 per cent of Americans.

Many studies published in the last few years have linked phthalates to a frightening diversity of human health problems. An Italian study from EHP in 2003 found that 88 per cent of Italian babies are exposed to phthalates in the womb, and that high amounts of them can shorten pregnancy by one week. A report in the 2003 EHP suggested that women with high levels of these chemicals in their blood are more likely to have sons who go on to develop testicular cancer. A 2000 study in EHP found that Puerto Rican girls who start puberty earlier than their peers have higher levels of phthalates in their blood. And a 2003 study in Epidemiology demonstrated that men with high levels of phthalates in their blood have reduced sperm quality.

To add strong evidence to the case against phthalates, a number of biochemical studies have uncovered some of the molecular secrets behind how phthalates actually work. Most recently, a paper in the 2005 edition of EHP examined how phthalates might affect penis size. The researchers found that newborn baby boys with the highest levels of phthalates in their blood had smaller penises and often had incompletely descended testicles.

“This followed exactly the predictions of the animal studies,” said Dr. Frederick vom Saal, a professor of endocrinology at the University of Missouri. “This doesn't sit out there as some unexplainable association. This is rooted in animal findings that are understood at the molecular level.” Adding insult to injury, that same study found that one quarter of American women carry enough phthalates in their blood to give their unborn sons a smaller-than-average penis.

Gender benders may be reaching us from a variety of consumer products—such as PBDEs (a class of fire retardants used in Canada to prevent fires in furniture), electronics, fabrics, and foam mattresses. PBDEs

were introduced when PCBs were banned in the 1970s but over the past five years, research in mice has shown that they, too, are toxic.

More than 40 studies in Neurotoxicology, Toxicology and Applied Pharmacology, and Toxicological Sciences have shown that exposing mice in the womb to PBDEs can cause physical abnormalities, brain damage, and can impair learning and memory. Many of these studies have identified the actual genes and molecules that the PBDEs interfere with, giving their research a great deal more credibility in the eyes of sceptics.

Canada and most US states have not moved to ban PBDEs (unlike the EU). Nonetheless, electronics giants Sony, Toshiba, Intel, Philips, Apple, IBM, Panasonic, Motorola, Hewlett-Packard, Ericsson, and furniture multinational Ikea are all starting to phase out PBDEs from all their products.

Few synthetics have come under more scrutiny than bisphenol A (BPA), a chemical that is used to make polycarbonates (clear plastics) and epoxy resins (smooth plastic coatings). One of the most widely used chemicals in the world, 6.4 billion pounds of BPA are produced every year for use in a huge number of every day products, including the lining of tin cans, plastic baby bottles, CDs, sports equipment, and white dental sealants.

“BPA is a powerful estrogen mimic – you can see effects as low as the part per trillion level, an absolutely phenomenal potency,” says vom Saal. Because BPA can leach out of tin can linings into food and beverages, a CDC analysis published in EHP in 2005 found BPA in 95 per cent of American urine samples—usually at the part per billion level.

But the fact that BPA can mimic estrogen should come as no surprise: British chemist Charles Edward Dodds discovered this in 1936, and thought that it be used as a hormone drug. Dodds later went on to synthesize the synthetic estrogen DES (which was subsequently banned for the uterine cancers it induced) and gathered a nomination for the Nobel Prize in 1947.

“In mice, DES and BPA cause the same effects,” said vom Saal, such as inducing breast cancers in the mothers and vaginal cancers in the offspring. “It’s just a matter of connecting the dots. How could anybody say the fundamental assumption is that no human harm should be expected?”

More than a hundred studies in lab animals have documented harmful effects from BPA exposure in the womb, including many studies in EHP, and a report published in the Proceedings from the National Academy of Sciences (widely considered one of the world’s most prestigious scientific journals) in 2005 linked the compound to prostate cancer and malformed urethras. Other studies in mice have shown BPA to

cause brain damage, immune suppression, early puberty in females, and have uncovered possible links to diabetes, obesity, and attention deficit and hyperactivity disorder (ADHD).

The plastics industry maintains that BPA poses no risk, and they point to published research that has deemed the molecule safe. These studies are, however, often funded by the plastics manufacturers themselves, such as a 2004 review from the Harvard Centre for Risk Analysis that was financed by the American Plastics Council. That review declared BPA to be harmless in lab animals at doses people are typically exposed to. According to Steve Hentges, executive director of the polycarbonate business unit of the American Plastics Council, BPA is a very weak estrogen mimic, humans are exposed to extremely low levels, and the small amounts of BPA that do get into our bodies are purged within a day.

However, “our work shows that [BPA] gets into the blood and is able to cross the placenta and reach the foetus,” says Dr. Ana Soto, who researches endocrine disruptors at Tufts University.

In EHP in 2005, vom Saal compared studies on BPA that were funded by industry, all 11 of which found no harm from BPA, to studies funded by government, of which 94 out of 104 reported ill effects from the chemical. He points out that the chances of 100 per cent of industry studies being negative and over 90 per cent of government studies being positive, is about one in two billion. “In other words, somebody’s not telling the truth,” he said.

Some governments have moved to limit the use of gender benders in plastics. In addition to limiting PBDEs, the EU has also banned phthalates from baby toys, and the California State Legislature has proposed to do the same. But most federal departments are not moving to control the use of BPA any time soon—which may have something to do with the fact that BPA is a chemical with one of the highest volumes of production in the world.

“There is a strong push by certain elements in the US that makes it extremely difficult to challenge any chemical in commerce. Two perfect examples are Vioxx and the recent Teflon controversy,” said vom Saal. “[The BPA debate] is not much different from what happened for years with cigarettes and with lead in gasoline—corporations said there was no harm, independent science said there was.”

Although government and industry may be slow to address the threat of hormone mimics, endocrine disruptors are listed as pollutants in the NPRI, and industrial facilities are required to report how much of these chemicals they release. The largest producer in Canada of endocrine disruptors in 2001 and 2002 was

the Clean Harbors Lambton Facility waste incinerator, located just a half-hour drive from Ada's house in Aamjiwnaang.

In 2003 the largest releaser of endocrine disruptors in Canada was the Stalex Canada Inc. waste incinerator in Blainville, Quebec. Petrochemical facilities comprised most of the rest of the top ten in 2003. Duke Energy Gas had two facilities rank in the top ten for 2003: the Pine River Gas Plant (2) and the Fort Nelson Gas Plant (5), both in B.C. Six of the top ten facilities were located in Alberta, including two Shell Canada Limited facilities: the Burnt Timber Complex (3) and the Waterton Complex (6).

Shell spokesperson Laurieanne Lynne noted that although carbon disulphide, one of the NPRI-classified endocrine disruptors released by their Alberta plants, "is believed by some to cause reproductive and developmental harm in large doses, we have very effective incineration so even though there is a certain amount of carbon disulphide, it is very well dispersed, and concentrations at ground level are too small to be a danger to humans."

According to Lynne, Shell is in the process of installing new sulphur recovery technology at the Jumping Pound Complex, and in 2003 they installed a new sulphur plant catalyst at the Burnt Timber Complex that brought a 30 per cent reduction in carbon disulphide emissions. The Burnt Timber complex's overall releases of endocrine disruptors also declined from 831,191 kg in 2002 to 548,022 kg in 2003, according to PollutionWatch.

"We believe we're going to see better performance in the next report that comes out," said Lynne.

So how to explain the missing boys in Aamjiwnaang? Dioxins from the nearby waste incinerator? Fumes from the petrochemical plants?

While Sarnia may be lined with smokestacks, its levels of air pollution are below federal guidelines. So how about all of the above? What happens if you are exposed to small amounts of PCBs, dioxins, BPA, phthalates, pesticides, and other chemicals, all of which raise estrogen and lower testosterone? Many scientists think it is likely that many of our hormonal ailments are due not to any one endocrine disruptor, but rather our cumulative exposure to many estrogen mimics all the time.

There are over 23,000 chemicals on the Domestic Substances List (DSL) in Canada that have not yet been assessed to determine their potential impact on the environment and human health. The Canadian Environmental Protection Act, 1999 requires that the Ministers of the Environment and Health categorize these substances by September 2006. This means identifying which chemicals pose the biggest threat to

Canadians (i.e., chemicals that are particularly toxic and do not break down easily). But when this is complete, we still won't really know if we are exposed to safe levels of endocrine disruptors, because Health Canada is screening chemicals and basing guidelines on how the chemicals affect lab animals one at a time, not in conjunction.

The main problem with reviewing such a vast number of chemicals in a meaningful way is that Canada just doesn't have the capacity to do the job. A CEPA Review document points out that this massive challenge of reviewing 23,000 chemicals is compounded by the lack of qualified scientists and required resources from government and industry. To put things in perspective, the Federal body responsible for ramping up health research capacity, the Canadian Institute for Health Research, only managed to muster up \$1.13 million of funding for toxicology research in 2001-2002, according to the Toronto-based Centre for Global Research and Education on Environment and Health.

The Canadian government is simply not doing as much as it could to protect us—even our neighbours to the south appear to be doing more at times to tackle this issue. The Canadian government has said nothing on any regulations for phthalates or PBDEs. The EU has already banned both, while Michigan, Maine, New York, Hawaii, California, Washington and Massachusetts, have all proposed (or already passed) bills to control PBDEs. And while the CDC regularly monitors the blood of Americans for a large number of toxic chemicals, no comparable program exists at Health Canada.

As usual, the European Union is out in front. In 2006, the EU will adopt a new approach to pollution prevention, called REACH (Registration, Evaluation, and Authorization of Chemicals). REACH, if passed in its current form, will greatly improve the safety of chemicals allowed on the market and will ensure the phase-out of all inherently hazardous chemicals.

In the US, the proposed Child, Worker, and Consumer-Safe Chemicals Act has the potential to follow the European lead. When these frameworks become law, citizens of the EU and the US will be granted a higher level of protection for their health and safety than Canadians.

On a bright note, there is strong scope to piggyback on the progress being made in other jurisdictions. CEPA requires that the Federal government keep abreast of what other OECD jurisdictions are doing regarding banning or restricting substances for environmental or human health reasons. So if the EU or a US state bans a substance, Canada has a requirement to review the substance and take appropriate action as well.

We don't know exactly how or why the Aamjiwnaang boys are disappearing or why turtle penises are shrinking. But the fact is that it's happening. And along with a host of other environmentally-induced human ailments, one thing is clear: We have poisoned our ecosystem and now it is poisoning us.

The EU and the US are doing something to improve the situation. What is Canada waiting for? CK

Zoe Cormier is a Toronto-based writer with a regular science column in Corporate Knights.

This article appeared on the CK14 issue of corporate knights: 2005 Air Issue