



Association pour la santé environnementale du Québec
Environmental Health Association of Québec

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Recognizing the Invisible

Everyday Exposures and Health Effects

Many studies performed in the USA, Canada, Germany, Sweden, Finland, Australia, Korea and Japan show that 9-16% of the population describe themselves as being more intolerant to chemicals than normal or attribute immediate reactions to chemical exposures. Up to 4% of the population reported having been [diagnosed with Multiple Chemical Sensitivity](#)¹ (MCS) by a doctor. MCS has clearly become a significant public health dilemma. In the USA, the prevalence of medically diagnosed [MCS has increased](#)² over 300% in the past decade and self-reported chemical sensitivity has increased over 200%. On the other hand, not everyone is sensitive to everyday chemical exposures that we all experience. These people describe themselves as [canaries in the coal mine](#).³ Are they right? And if so, what are they [warning everyone else](#)⁴ about? In order to answer these questions, we need to understand the subtle effects of pollution.

Everybody is [exposed regularly](#)⁵ to thousands of man-made chemicals in the air we breathe, the water and food we ingest, and the products we use in our homes and apply to our bodies. More than 140,000 chemicals have been [produced and used heavily](#)⁶ since the 1950s. In the USA, more than 84,000 chemical substances may be [in commercial use](#),⁷ and more than 4000 are considered [high production volume chemicals \(HPV\)](#),⁸ i.e., equal to or greater than one million pounds produced per year. The current presumption that

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chemicals are "[safe until proven dangerous](#)"⁹ stands in marked contrast to how pharmaceuticals and pesticide companies are handled. A high proportion of these chemicals and pesticides in commerce have [never been adequately tested](#)¹⁰ for safety or toxicity. Information on potential toxicity is publicly available for only about half of the HPV commercial chemicals that are in widest use, and [information on developmental or reproductive toxicity](#)¹¹ is available for fewer than 20% of these widely used chemicals.

But what the scientific data published to date is telling us is that the increasing prevalence of most chronic, non-infectious diseases is strongly linked to our exposures to pollution and the accumulation of chemicals in our bodies. The World Health Organization lists air pollution as one of the [top five major risk factors](#)¹² for developing non-communicable diseases, along with tobacco use, harmful use of alcohol, unhealthy diets and physical inactivity. [Living close to a major roadway](#)¹³ increases the risk for developing allergies, asthma, respiratory infections, cardiovascular disease, diabetes, fragmented sleep and decreased cognitive function. Adults are more likely to develop neurodegenerative disorders from exposure to pollution and children are more at risk for neurodevelopment disorders like [autism](#).¹⁴ Infertility and [adverse pregnancy](#)¹⁵ and [birth outcomes](#),¹⁶ such as low birth weight and preterm birth, are also linked to pollution exposures.

Exposure to pollutants occurs daily [during our entire lifetime](#)¹⁷ via various pathways, including inhalation of contaminated air and dust, ingestion of contaminated water and food, exposure to chemical or contaminated products on our skin, starting with exposures as a developing fetus from our mothers during pregnancy. The [most common route](#)¹⁸ of exposure is through inhalation.

[Air pollution](#)¹⁹ describes a collection of airborne pollutants that contribute to air quality. They typically exist as tiny microscopic or nanosized particulates and gases, such as oxides of nitrogen and sulfur, carbon monoxide and ozone. Air pollution also includes gaseous chemicals called volatile organic compounds (VOCs), which are precursors in the formation of ground-level ozone and [contribute to greenhouse gas emissions](#),²⁰ a significant factor in climate change.

Most of the long-term exposure studies observe the impact over years. While the building envelope of our homes and workplaces may reduce our exposures to outdoor air somewhat, we are still continuously exposed to outdoor air pollution [while in an indoor environment](#).²¹ Just because we spend more than [90% of our time indoors](#)²² does not



mean that we aren't better off. This is because indoor air pollution is in some ways worse. Total VOC concentrations are up to 10 times [worse indoors](#)²³ than in outdoor air, especially because of indoor sources, and even higher VOC concentrations are observed in new or renovated buildings. Common [indoor sources of VOCs](#)²⁴ include [household products, air fresheners](#),²⁵ fragrances and other [scented products and building materials](#).²⁶

We also have considerable, ubiquitous exposure to [semi-volatile organic compounds](#)²⁷ (SVOCs) in indoor environments, many of which are those high production volume chemicals used in plastics, detergents, synthetic musks, and furniture, building components and furnishings, including [flame retardants and stain repellents](#).²⁸ Being semi-volatile, they are commonly found in both gas and condensed phases. They are redistributed from their original source into the indoor air and then [stick to other interior surfaces](#)²⁹ including the tiny airborne particles, dust, and skin. Inhaled SVOCs on these particles are likely to penetrate deeper into the respiratory tract and then stick to and interact with the linings of our lung layers longer if they are [associated with the tiny nanosized particles](#)³⁰ as opposed to being in the gas phase.

Clearly, the burden of disease from air pollution is due to [the joint effects of indoor and outdoor sources](#).³¹ But it's not just our exposures that are important. We are all built with a system designed to detoxify and eliminate from our bodies the waste chemicals produced by our own metabolism. However, this system is now being burdened by the multiple new chemicals introduced by modern society. How well we can detoxify and eliminate them depends on our genetics and nutritional health. Some people are better than others, and those who are genetically poor detoxifiers to begin with are even more likely to [develop chronic medical conditions](#).³²

We all have synthetic chemicals stored in our bodies because we keep on ingesting them and/or because we can't break them down and eliminate them. We are also exposed to [pollutants that persist](#)³³ and don't break down in the environment even though they have been banned. They end up in the food chain and, as a result, [most of us are contaminated](#)³⁴ by these persistent pollutants because we can't break them down either. The body burden of all our exposures is being monitored, at least in part, by measuring the numerous chemicals found in humans, which includes heavy metals, pesticides, polyaromatic hydrocarbons, phthalates, flame retardants, parabens and the banned persistent organic pollutants, VOCs etc.. For example, the Canadian Health Measures Survey has measured over 250 of these chemicals [in approximately 30,000 Canadians](#).³⁵



since 2007. In the USA, biomonitoring data collected in the [American National Health and Nutrition Examination Survey](#)³⁶ (NHANES) has included 265 chemicals in total. And several hundred chemicals have been [identified in the cord blood](#)³⁷ of newborn babies.

The more pollutant exposures you have, and the more you accumulate them in your body, the higher the odds that you will develop one or more of [these conditions](#)³⁸ – high blood pressure, heart disease, diabetes, allergies, asthma, and neurodegenerative disorders, just to name a few. And there is a risk for [harmful, lifelong effects](#)³⁹ on unborn babies and children, such as neurodevelopmental disorders, like [autistic spectrum](#)⁴⁰ and [attention deficit/hyperactivity](#)⁴¹ disorders. Many environmental pollutants contribute to the [risk for cancer](#).⁴²

All these potential adverse effects on our health from the environment are due to the fact that our detoxification systems are less than perfect and, as a result, all our cells more or less endure subtle damages, which can affect how they function. It can damage our DNA, or affect gene function, energy production and how cells signal and communicate with each other and the outside world. The changes in the damaged cells is called oxidative stress and can be measured in research labs. It is present in chronic medical conditions and is made worse by chemical exposures. Oxidative stress can be [reduced by antioxidants](#),⁴³ which are plentiful in vegetables and fruits. This is one of the reasons why all healthy diets promote an increased intake of these foods.

Many cells, especially those in the nervous system, have [sensors on their surface](#)⁴⁴ that can [detect chemicals](#).⁴⁵ One of the things that can happen due to oxidative stress is that these sensors become hypersensitive and react strongly to very tiny levels of chemical exposures. When this happens to people, they react to low levels of chemical exposures, that they used to tolerate, and which are tolerated by others. This is [what happens to people with MCS](#),⁴⁶ the 40% of people with recurrent migraines who are [triggered by scents](#),⁴⁷ and many asthmatics.

The chemical contamination of a typical indoor environment, especially from substances which emanate from common scented products, such as perfumes, soaps, shampoos, cleaning products and fabric softeners, poses a [significant risk for triggering](#)⁴⁸ symptoms in people with chemical sensitivities.



As we have all experienced recently with COVID-19, life is hard when you have to stay home and avoid others, your income is reduced and you are unable to work or enjoy what society has to offer without risking getting sick, including shopping and seeking health care. This is how life is lived for the chemically sensitive; always trying to avoid chemical exposures, especially scented products used on a regular basis by others and tolerated by everyone else. And it's even more frustrating when no one else takes precautions to accommodate you, even though it is [your legal right](#),⁴⁹ and then belittles you for practicing avoidance and asking for support. Having MCS is life altering, can be stigmatizing, and have a devastating impact on people's health and quality of life.

Furthermore, chemically sensitive people are more likely to have [other chronic medical conditions](#),⁵⁰ such as myalgic encephalomyelitis/chronic fatigue syndrome (ME/CFS) and fibromyalgia, which decreases their quality of life and [ability to function](#)⁵¹ even more.

As stated in the final report of the [Ontario Task Force on Environmental Health](#):⁵²

Despite the large number of people affected, these conditions are under-recognized, under-researched, poorly understood, regularly misdiagnosed and poorly managed. Care providers lack the knowledge, resources and support they need, which means people with these chronic conditions struggle to get care, support and accommodation. More often than not, the care provided does not work for patients or their families.

Clearly, chemical pollution is not just about climate change and the health of our planet. The MCS canaries are giving us fair warning. It's time to start cleaning up our mess before it's too late.

¹http://health.gov.on.ca/en/common/ministry/publications/reports/environmental_health_2017/task_force_on_environmental_health_report.pdf

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³ <https://www.aseq-ehaq.ca/why-a-canary/?lang=en>

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⁵ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1497458/pdf/12477912.pdf>

⁶ <https://naviauxlab.ucsd.edu/wp-content/uploads/2016/09/Landrigan-Lancet-2017-Pollution.pdf>

⁷ <https://pubmed.ncbi.nlm.nih.gov/24830065/>

⁸ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2685828/>

⁹ <https://www.nytimes.com/2013/04/14/sunday-review/think-those-chemicals-have-been-tested.html>

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- ⁴⁹ https://www.chrc-ccdp.gc.ca/sites/default/files/policy_sensitivity_0.pdf



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