



Xylenes

This fact sheet describes the Canadian Soil Quality Guidelines for xylenes to protect environmental and human health. It is part of the series *Guidelines at a Glance*, which summarizes information on toxic substances and other parameters for which there are Canadian Environmental Quality Guidelines.

The National Guidelines and Standards Office of Environment Canada coordinates the development of Canadian Environmental Quality Guidelines in cooperation with the Canadian Council of Ministers of the Environment (CCME).

Where do xylenes come from?

Xylenes, which occur in three forms, are compounds used in paints, lacquers, adhesives, inks, and cleaning materials. They are also used in the production of dyes, perfumes, plastics, pharmaceuticals, and pesticides. Xylenes exist naturally in petroleum, and therefore they are found in gasoline. In Ontario, total xylenes (all three together) are typically 6.9% of regular unleaded gasoline and 8.0% of premium unleaded gasoline. Sources of xylenes to the atmosphere include petroleum and coal refining, vehicle emissions, and evaporation from solvents and thinners. Xylenes are released to the soil and water from leaking underground petroleum storage tanks, landfill sites, spills during transportation, pesticide use, and discharges of industrial and municipal waste. Natural sources of xylenes are forest fires, volcanic eruptions, and volatile emissions from vegetation.

Xylenes are related to two other compounds, toluene and ethylbenzene, which are also found in gasoline. Together, the three compounds are often referred to as TEX.

What happens to xylenes released into the environment?

Xylenes can be very mobile when released into the environment. There are four main routes that xylenes take: (i) Xylenes easily evaporate from soil into the atmosphere, depending on factors such as temperature and humidity. (ii) Xylenes bind well to some soils, especially soils rich in organic matter. Clay minerals also bind xylenes. (iii) Xylenes are converted into carbon dioxide and water when soil microbes degrade them. Degradation occurs in both oxygen-rich and oxygen-poor conditions. (iv) Xylenes are moderately soluble in water, so rainwater leaching through the ground can carry toluene with it.

Xylenes have moderate attraction to fats so may accumulate in animals.

What effects can xylenes have on terrestrial forms of life?

Xylene toxicity has been examined in a limited number of studies of soil microbes, invertebrates, plants, and mammals. Some studies included only one of the xylenes, while others included a mixture of all three xylenes. Here, we refer to all xylenes as a group.

One study of soil microbes found that exposure to xylenes did not have a toxic effect. Another study found that soil microbes removed nitrogen compounds from the soil more slowly when exposed to xylenes. Earthworms were more likely to die when exposed to high levels of xylenes in the soil. Alfalfa, tomato, dwarf corn, squash, potato, and field bean crops were exposed to xylenes without being injured or having reduced yields. Lettuce and radish seeds exposed to toluene in the soil were less likely to emerge as seedlings, however. Xylenes in the soil reduced the growth of alfalfa shoots and of early northern wheatgrass roots. Xylenes have also been used as herbicides in carrot crops and to control submerged aquatic weeds.

Rabbits exposed to xylenes during pregnancy had offspring with lower birth weight. Pregnant rats exposed to xylenes were more likely to lose implanted embryos and have placentas of lower weight. In this study, rat fetuses also had delayed skeleton development. Other effects of xylenes on laboratory



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test animals include changes in behaviour, loss of body weight, and lower survival. Xylenes did not cause cancer in rats and mice. There are no studies of the effects of xylenes on livestock, wildlife, or birds.

What levels of xylenes are safe for humans and for plants and animals that live in or on Canadian soils?

The Canadian Soil Quality Guidelines (CSoQG) depend on the type of land and its use. The four land uses considered are agricultural, residential and parkland, commercial, and industrial. The guidelines also distinguish soil textures (coarse and fine) and soil depths (surface soil: ≤ 1.5 metres deep, and subsoil: > 1.5 metres deep). The guidelines are based on a number of toxicity studies that examined the effects of soil contact on laboratory animals and on plants and animals that live in or on our soils. In the case of agricultural land, the effects of soil and food ingestion are also considered.

The CSOQG to protect environmental and human health for all land uses and for both surface soils and subsoils is 11.0 milligrams of total xylenes per kilogram of coarse-textured soil and 2.4 milligrams of total xylenes per kilogram of fine-textured soil.

If the level of total xylenes measured in soil is less than the respective guideline, one would not expect to see adverse effects. In places where the CSOQG for xylenes is exceeded, adverse effects will not necessarily occur. Whether effects will occur depends on the amount by which the guideline level is exceeded and on the plants and animals that live there. Further investigation is needed at a particular site to determine whether or not there is a negative impact.

How do levels of xylenes in Canadian soils compare to the guidelines?

Very little information is available on the levels of xylenes in Canadian soils. Soil samples taken from undisturbed parklands in Ontario are considered to represent the background level of total xylenes. This level was 0.00092 milligrams of total xylenes per kilogram of soil, which is well within the guidelines for both coarse- and fine-textured surface soils and subsoils on all land types.

How can CSOQGs be used to make a difference?

In general, Canadian Soil Quality Guidelines can be used by Canadian federal, provincial, and territorial governments on a voluntary basis to set local guidelines and clean-up targets. CSOQGs are most commonly used in environmental assessments as benchmarks or yardsticks to which measured levels are compared. Anyone can use the guidelines to determine if the level of xylenes measured in a soil sample has the potential to cause adverse environmental effects.

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