

# Canadian Water Quality Guideline

## Inorganic Fluorides

This fact sheet describes the Canadian water quality guideline for inorganic fluorides to protect freshwater life. It is part of the series *Guidelines at a Glance*, which summarizes information for the Canadian public 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 inorganic fluorides come from?

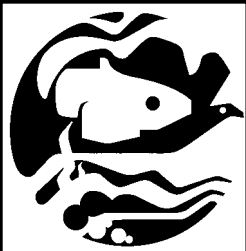
The Earth's crust contains about one tenth of a percent of fluorine, making fluorine its thirteenth most common element. Fluorine is widely found in minerals and sedimentary rocks formed by compaction of particles in lakes and oceans. The main fluorine-containing minerals are calcium fluoride, fluoroapatite and cryolite. All compounds that contain fluorine are called fluorides; inorganic fluorides are a subset, referring to those that do not contain carbon. Inorganic fluorides are released slowly from rocks and minerals as they erode under normal weather conditions. Other natural sources for inorganic fluorides are active volcanoes and marine aerosols. Human activities such as mining, phosphate fertilizer production, and aluminium smelting cause unnaturally high levels of inorganic fluorides to be released into air, onto land, or into water.

### What happens to inorganic fluorides released into the environment?

When released to air, gaseous inorganic fluorides may combine with water vapour and fall back to Earth in rain while particulate inorganic fluorides attach to fine particles in the atmosphere which eventually settle to the Earth's surface. Most of the naturally occurring inorganic fluorides on land are tightly bound to the soil. When the level of inorganic fluorides exceed that which the soil can retain, inorganic fluorides may be taken up by plants or leached into groundwater. Inorganic fluorides may also be released to water directly (e.g., municipal wastewater discharges). Once in water, inorganic fluorides can be taken up by aquatic plants. Fish and other aquatic animals can also take up inorganic fluoride from water and food and accumulate it in their bones or exoskeletons. Although inorganic fluorides may move around in the environment, and even change form depending on, for example, water chemistry, fluorine itself can not be degraded. Over time, anthropogenic releases of inorganic fluorides may, therefore, cause levels to rise above natural background.

### What effects can inorganic fluorides have on our fish and other forms of aquatic life?

Inorganic fluorides affect basic physiological and biochemical processes of fish, plants and other aquatic organisms. By doing so, inorganic fluorides can slow growth and development, cause abnormal behaviour, and lead to death. The degree to which these effects occur depends in part on the concentration and form of inorganic fluoride, period of exposure, water chemistry, and species and age of aquatic species. Some species that seem particularly sensitive include rainbow trout, fingernail clams, water fleas, and certain green algae.





### **What levels of inorganic fluorides are safe for plants and animals that live in Canadian waters?**

The Canadian Water Quality Guideline (CWQG) to protect freshwater life is 0.12 milligrams of inorganic fluoride per litre of water. The guideline is based on a number of scientific studies that examined the impacts inorganic fluorides have on the plants and animals that live in our lakes and rivers. If the level of inorganic fluorides measured in a lake or river is less than the guideline, one would not expect to see adverse health effects in even the most sensitive species. In places where the CWQG for inorganic fluorides is exceeded, an adverse effect on the environment may not necessarily occur. Rather, there is an increased chance of an effect depending on how high above the guideline the levels are, on which kinds of plants and animals live there, and on other characteristics of the water (e.g., how hard the water is). Further investigation at a particular site would be needed to actually determine whether or not there is a negative impact.

### **How do levels of inorganic fluorides in Canadian lakes and rivers compare to the guidelines?**

On average, the level of inorganic fluorides in fresh waters across Canada is 0.05 milligrams of inorganic fluoride per litre of water, or about half of the guideline value. Levels vary from lake to lake and depend, in part, on the presence of minerals containing inorganic fluorides in the immediate and surrounding area, water hardness and pH, and presence of bentonite clays and humic acid.

### **How can CWQGs be used to make a difference?**

In general, Canadian Water Quality Guidelines can be used by Canadian federal, provincial and territorial governments on a voluntary basis to set local guidelines, discharge limits for industry, and remediation (clean-up) targets. CWQGs are most commonly used in environmental assessments as benchmarks or yardsticks to which measured levels are compared. In the case of inorganic fluorides, the guideline could be used by municipalities or industry to ensure that the local levels remain safe for aquatic life. The guideline is of particular relevance to waters that receive direct inputs of inorganic fluorides, for example, from municipalities that fluoridate their water supplies, from aluminium or fertilizer industries, or from areas of heavy fertilizer use. The guideline can be used by anybody to help evaluate if the inorganic fluoride level measured in a sample of water has the potential to cause adverse environmental effects.

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