

FLUORIDE AND THE ENVIRONMENT: A Fact Sheet from the IAOMT Learn more at www.iaomt.org

“The constant increase in fluorine compounds emission to the environment leads to a strong F- accumulation in living organisms, and so the risk of the entire ecosystem suffering from fluoride pollution continues to increase.”—From a research study published in 2016¹

NATURAL SOURCES IN THE ENVIRONMENT

Fluorine commonly occurs as the minerals fluor spar (CaF_2), cryolite (Na_3AlF_6), and fluorapatite ($3\text{Ca}_3(\text{PO}_4)_2 \text{Ca}(\text{F},\text{Cl})_2$), and it is the 13th most abundant element on earth. Fluoride (F^-) is a chemical ion of fluorine that contains an extra electron, thereby giving it a negative charge. It naturally exists in minerals, as well as in soil, water, and air, and certain geographic areas have higher levels of natural fluoride than others.

ATMOSPHERIC POLLUTION FROM INDUSTRY EMISSIONS

Fluoride is also chemically synthesized for use in community water fluoridation, dental products, and other manufactured items, and industrial releases from these activities are contributing to increased levels of fluoride in the environment. This atmospheric pollution occurs in the form of gases and particulates, with the toxicity of the particulates being linked to their solubility.² Obviously, fluoride pollution can adversely impact wildlife, and these industrial atmospheric emissions are known for their ability to contaminate the soil, water, and vegetation in both the immediate vicinity and distant areas.³

Examples of Industries that Emit Fluoride Pollution

- *aluminum smelters*
- *blast furnace manufacturing*
- *cement and phosphate fertilizer units*
- *coal and fuel combustion*
- *enamel, pottery, glass, and brick works*
- *oil refineries*
- *plastic, pharmaceutical, tooth paste, chemical, and automobile industries*
- *steel and iron foundries*
- *welding, refrigeration, and rust removal activities*
- *zinc production*

Source: Swarup D, Dwivedi SK. Environmental pollution and effects of lead and fluoride on animal health. Indian Council of Agricultural Research Krishi Anusandhan Bhavan Pusa; New Delhi; 2002: Pages 72 and 74.

WATER AND SOIL POLLUTION

A report about environmental fluoride from the National Research Council of Canada noted that evidence from industrial waste waters showed “large quantities of fluoride are being discharged to waterways.”⁴ In fact, the same report mentioned data from a study on fluoride releases into Narragansett Bay, Rhode Island, that demonstrated over one-third of the fluoride emitted into the bay was due to water fluoridation in nearby communities.⁵

“Fluoride added to drinking water, ‘to improve dental health’, enters the fresh water eco-system, in various ways, at levels above 0.2 mg/L. This factor, if considered in ‘critical habitat’ decisions, should lead to the development of a strategy calling for a ban on fluoridation and rapid sunsetting of the practice of disposal of industrial fluoride waste into fresh water.”

Source: Foulkes RG, Anderson AC. Impact of artificial fluoridation on salmon species in the northwest USA and British Columbia, Canada. Fluoride. 1994 Oct 1;27(4):220.

Authors of research about fluoride’s effect on salmon found that the concentration of fluoride in surface run-off and sewer effluent exceeds 0.2mgF/L in artificially fluoridated communities, and they also found that, as a result, elevated levels of fluoride in the freshwater can continue for a distance.⁶ They explained that this fluoride is deposited into the sediment or carried out to the estuary, where it can remain for 1-2 million years⁷ and re-contaminate if dredging occurs. Furthermore, the researchers wrote that sewage sludge can contain fluoride, and when the sludge is used as fertilizer, the area is contaminated through the soil itself, as well as ground water and run-off from the soil particulates.

Soil pollution from fluoride also occurs in areas where industries emit fluoride pollution into the air and from the use of phosphate fertilizers.⁸ Animals eating food grown in the contaminated soil take on this additional burden of fluoride.⁹

HARM TO PLANTS

“Compared with other air pollutants, fluoride and its compounds may cause higher toxicity in plants.”

Yu MH, Tsunoda H, Tsunoda M. Environmental toxicology: biological and health effects of pollutants. CRC Press; 2011 Nov 16: Page 164.

The effect of fluoride on plants is dependent upon the species, climate, distance from the industrial source, and other conditions. This means vegetation responds to fluoride exposure in different ways. For example, over two dozen plant species can convert fluoride to lethal compounds such as fluoroacetate, which is extremely poisonous to animals.¹⁰

Exposure to fluoride accumulates in the foliage of plants and mainly occurs through the atmosphere or through root absorption of soil.¹¹ The result is structural and functional changes in cells,¹² and the impact of this fluoride exposure to the plant can result in genetic effects,¹³ margin necrosis (browning of leaf margins), reduction in photosynthesis,¹⁴ and decreased plant growth and yield.¹⁵ In addition to harming wildlife, this clearly implicates fluoride as a serious danger to crop yields and other agricultural activities.

HARM TO WILD ANIMALS

An animal's reaction to fluoride is dependent upon the distance from the source of industrial pollution, geographic levels of natural fluoride, species variability, the size of the animal, age, nutritional status, climate, and numerous other factors. Furthermore, animals are exposed to fluoride through air, water, soil, and food, and it is important to consider their overall fluoride exposure as a result of each of these sources.

Harmful effects of fluoride, including species vulnerability, have been reported in an array of animals. Field studies on mammals in the wild corroborate studies on livestock, both of which report dental and skeletal lesions, lameness, appetite impairment (anorexia), reproductive effects, and behavioral changes.¹⁶ Toxic exposures in birds have been associated with changes in egg quality and shell thickness, bone breaking strength, and lower reproductive success,¹⁷ such as the symptoms exhibited by screech owls exposed to sodium fluoride.¹⁸ Fluoride can be lethal to fish,¹⁹ and symptoms of acute fluoride toxicity in fish can include erratic movement and lethargy.²⁰ It can also adversely impact the migration and life expectancy of salmon.²¹ In amphibians, studies have demonstrated that fluoride causes deformation of the skeletal structure of tadpoles.²² While research is limited for reptiles, an incident involving fluoride pollution in Australia resulted in less vegetation in the area and caused the forest lizard species in the region to decline.²³ Invertebrates, too, are impacted by fluoride. For example, fluoride pollution has been linked to the die off and injury of bees.²⁴

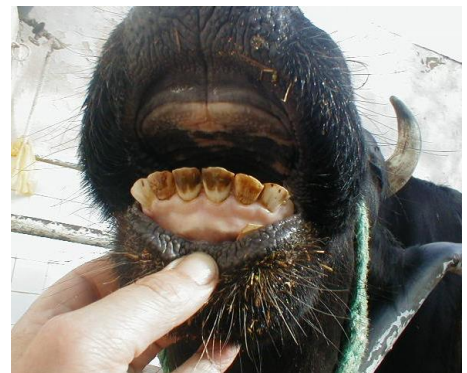
HARM TO DOMESTICATED ANIMALS

While there is documentation of fluoride toxicity in most livestock, cattle are recognized for being particularly susceptible.²⁵ The effects of fluoride on farm animals include dental fluorosis, susceptibility to environmental stresses, shortened life span, gastroenteritis, muscular weakness, pulmonary congestion, nausea, vomiting, diarrhea, chronic convulsions, necrosis of the mucosa of the digestive tract, anorexia, cramping, collapse, respiratory and cardiac failure, and death.²⁶

“Numerous incidences of fluorosis in animals have been accounted for industrial pollution with fluoride. It is stated that of all the pollutants which affect farm animals, fluoride has caused the most severe and wide spread damage (Aschabaker, 1973).”

Source: Swarup D, Dwivedi SK. Environmental pollution and effects of lead and fluoride on animal health. Indian Council of Agricultural Research Krishi Anusandhan Bhavan Pusa; New Delhi; 2002; Page 80.

Photos showing the effects of fluoride exposure on cattle



Photos showing the effects of fluoride exposure on horses



Horses exhibiting dental fluorosis and other crippling symptoms of fluoride toxicity have been studied in Colorado and Texas, and in both cases, when artificial water fluoridation was replaced with low fluoride well water, the surviving horses experienced drastic health improvements.^{27 28}

Domestic pets have also been subjects of reports raising concerns about fluoride exposure, especially through their water and food. The use of bone meal results in high levels of fluoride in dog food, and this has raised suspicions about dogs' high rates of osteosarcoma,²⁹ a bone cancer that has been associated with fluoride exposure. Fluoride has also been suggested as a potential factor for the high rates of hyperthyroidism in cats.³⁰

“The exposure of living organisms to above-normal concentrations of fluoride, which induces fluoride accumulation by the organism, may result in an alteration of the organism's biochemistry and morphology. Directly or indirectly, such changes may restrict the organism's ability to maintain its ecological position.”

--National Research Council of Canada, 1977³¹

**To learn more about fluoride from
The International Academy of Oral Medicine and Toxicology (IAOMT),
read our “Fluoride and Human Health Risks Fact Sheet” by [clicking here](#).**

You can also read our detailed “Position Statement Against Fluoride Use in Water, Dental Materials, and Other Products for Dental and Medical Practitioners, Dental and Medical Students, Consumers, and Policy Makers” by [clicking here](#), or by using the scan code below:



This fact sheet was last updated on 9/25/17.

PHOTO CREDITS:

All CATTLE photos are by L. Mahin and are public domain from Wikimedia Commons at https://commons.wikimedia.org/wiki/File:Fluor%C3%B4ze_egzostozes2-800h.jpg
https://commons.wikimedia.org/wiki/File:Fluor%C3%B4ze_dints.JPG
https://commons.wikimedia.org/wiki/File:Fluor%C3%B4ze_dints2.jpg

All HORSE photos are from the documentary *Poisoned Horses* and are courtesy of David Kennedy, DDS, MIAOMT.
See more at <https://youtu.be/QUsUujzNjEo>.

ENDNOTES

- ¹ Palczewska-Komsa M, Wilk A, Stogiera A, Chlubek D, Buczkowska-Radlinska J, Wiszniewska B. Animals in biomonitoring studies of environmental fluoride pollution. *Fluoride*. 2016 Jul 1;49(3):279.
- ² Rose D, Marier JR. Environmental Fluoride, 1977. National Research Council of Canada, Associate Committee on Scientific Criteria for Environmental Quality; 1977.
- ³ Cited as Radostits et al. 2000 (Radostits OM, Gay GC, Blood DC and Hinchcliff KW. 2000. Veterinary Medicine. 9th edn. London, W B Saunders) in Swarup D, Dwivedi SK. Environmental pollution and effects of lead and fluoride on animal health. Indian Council of Agricultural Research Krishi Anusandhan Bhavan Pusa; New Delhi; 2002: Page 74.
- ⁴ Rose D, Marier JR. Environmental Fluoride, 1977. National Research Council of Canada, Associate Committee on Scientific Criteria for Environmental Quality; 1977.
- ⁵ Cited as Groth 1975b (Groth, E. 1975b. Fluoride pollution. *Environment* 17: 29-38) in Rose D, Marier JR. Environmental Fluoride, 1977. National Research Council of Canada, Associate Committee on Scientific Criteria for Environmental Quality; 1977.
- ⁶ Foulkes RG, Anderson AC. Impact of artificial fluoridation on salmon species in the northwest USA and British Columbia, Canada. *Fluoride*. 1994 Oct 1;27(4):220-6.
- ⁷ Cited as (Carpenter R. Factors controlling the marine geochemistry of fluorine. *Geochemical et Cosmochimica Acta* 33 1153-1167 1969) in Foulkes RG, Anderson AC. Impact of artificial fluoridation on salmon species in the northwest USA and British Columbia, Canada. *Fluoride*. 1994 Oct 1;27(4):220-6.
- ⁸ Swarup D, Dwivedi SK. Environmental pollution and effects of lead and fluoride on animal health. Indian Council of Agricultural Research Krishi Anusandhan Bhavan Pusa; New Delhi; 2002: Page 73.
- ⁹ Yu MH, Tsunoda H, Tsunoda M. Environmental toxicology: biological and health effects of pollutants. CRC Press; 2011 Nov 16: Page 166.
- ¹⁰ Swarup D, Dwivedi SK. Environmental pollution and effects of lead and fluoride on animal health. Indian Council of Agricultural Research Krishi Anusandhan Bhavan Pusa; New Delhi; 2002: Page 73.
- ¹¹ Yu MH, Tsunoda H, Tsunoda M. Environmental toxicology: biological and health effects of pollutants. CRC Press; 2011 Nov 16: Page 164.
- ¹² Yu MH, Tsunoda H, Tsunoda M. Environmental toxicology: biological and health effects of pollutants. CRC Press; 2011 Nov 16: Page 164.
- ¹³ Pati PC, Bhunya SP. Genotoxic effect of an environmental pollutant, sodium fluoride, in mammalian in vivo test system. *Caryologia*. 1987 Jan 1;40(1-2):79-87.
- ¹⁴ Carlson CE, Dewey JE. Environmental Pollution by Fluorides in Flathead National Forest and Glacier National Park. U.S. Department of Agriculture, Forest Service; 1971. Page 3.
- ¹⁵ Yu MH, Tsunoda H, Tsunoda M. Environmental toxicology: biological and health effects of pollutants. CRC Press; 2011 Nov 16: Page 164.
- ¹⁶ Pascoe GA, Zodrow J, Greutert E. Evaluating risks to terrestrial wildlife from environmental fluoride. *Human and Ecological Risk Assessment: An International Journal*. 2014 Jul 4;20(4):951.
- ¹⁷ Pascoe GA, Zodrow J, Greutert E. Evaluating risks to terrestrial wildlife from environmental fluoride. *Human and Ecological Risk Assessment: An International Journal*. 2014 Jul 4;20(4):954.
- ¹⁸ Hoffman DJ, Pattee OH, Wiemeyer SN. Effects of fluoride on screech owl reproduction: teratological evaluation, growth, and blood chemistry in hatchlings. *Toxicology Letters*. 1985 Jul 1;26(1):19-24.
- ¹⁹ Palczewska-Komsa M, Wilk A, Stogiera A, Chlubek D, Buczkowska-Radlinska J, Wiszniewska B. Animals in biomonitoring studies of environmental fluoride pollution. *Fluoride*. 2016 Jul 1;49(3):281.
- ²⁰ World Health Organization. Environmental health criteria 227: fluorides. World Health Organization, Geneva. 2002. Section 1.8 Effects on other organisms in the laboratory and field. Available at <http://www.inchem.org/documents/ehc/ehc/ehc227.htm#1.8>. Accessed March 30, 2017.
- ²¹ Foulkes RG, Anderson AC. Impact of artificial fluoridation on salmon species in the northwest USA and British Columbia, Canada. *Fluoride*. 1994 Oct 1;27(4):220-6.
- ²² Cited as (Goh EH, Neff AW. Effects of fluoride on *Xenopus* embryo development. *Food Chem Toxicol* 2003;41(11):1501-8) in Palczewska-Komsa M, Wilk A, Stogiera A, Chlubek D, Buczkowska-Radlinska J, Wiszniewska B. Animals in biomonitoring studies of environmental fluoride pollution. *Fluoride*. 2016 Jul 1;49(3):279-92.
- ²³ Taylor JE, Fox BJ. Assessing the disturbance impact on vegetation and lizard communities of fluoride pollution interacting with fire and mining in eastern Australia. *Austral Ecology*. 2001 Aug 1;26(4):321-37.
- ²⁴ Carlson CE, Dewey JE. Environmental Pollution by Fluorides in Flathead National Forest and Glacier National Park. U.S. Department of Agriculture, Forest Service; (See numerous sections in the work, as well as page 3).
- ²⁵ Swarup D, Dwivedi SK. Environmental pollution and effects of lead and fluoride on animal health. Indian Council of Agricultural Research Krishi Anusandhan Bhavan Pusa; New Delhi; 2002: Page 77.
- ²⁶ Yu MH, Tsunoda H, Tsunoda M. Environmental toxicology: biological and health effects of pollutants. CRC Press; 2011 Nov 16: Page 167-9.
- ²⁷ Krook LP, Justus C. Fluoride poisoning of horses from artificially fluoridated drinking water. *Fluoride*. 2006 Mar;39(1):3-10.
- ²⁸ Macicek P, Krook LP. Fluorosis in horses drinking artificially fluoridated water. *Fluoride*. 2008 Jul 1;41(3):177-83.
- ²⁹ Environmental Working Group. Dog comparison shows high fluoride levels. Posted June 26, 2009. Online at <http://www.ewg.org/research/dog-food-comparison-shows-high-fluoride-levels>. Accessed March 30, 2017.
- ³⁰ Peterson M. Hyperthyroidism in cats: what's causing this epidemic of thyroid disease and can we prevent it?. *Journal of Feline Medicine and Surgery*. 2012 Nov;14(11):812.
- ³¹ Rose D, Marier JR. Environmental Fluoride, 1977. National Research Council of Canada, Associate Committee on Scientific Criteria for Environmental Quality; 1977.