

Ontario nuclear's tritium problem

What is tritium?

Tritium is the radioactive isotope of hydrogen, produced on a continuous basis in nuclear reactors as a by-product of nuclear fission. Tritium is not dangerous externally, but it is dangerous when we inhale air near reactors or we absorb it through our skin, or when we eat food grown near reactors or drink water that has been contaminated with tritium.

This is because once tritium is inside us, it emits radiation: that is, it is an “internal emitter.” Tritium is a carcinogen (causes cancer), teratogen (causes deformations of the embryo during pregnancy) and mutagen (causes mutations to DNA). Even very low rates of tritium exposure can lead to cancer, leukemia, and birth defects.

Where does it come from?

Tritium is released by nuclear plants such as the Pickering Nuclear Power Station (NPS) mostly through routine daily leaks from the reactors themselves, and from the valves, seals, pumps and other components that transport radioactive water in the reactor. It is also released by non-routine spills, pipe breaks or other accidents at reactors. The Pickering Station has a long history of such incidents.

CANDU heavy water reactors, such as those used in Ontario, emit much more tritium than other reactor types – about 30 times more than the next most common reactor type (pressurized water reactors). The “heavy water” (deuterium) used in CANDU systems leads to much greater tritium production than in reactors that use regular (light) water or graphite to moderate the fission process and cool the reactor.

Tritium is discharged in two main forms. First and foremost, tritium is released as an invisible, odourless vapour called tritiated water vapour (HTO), which is practically indistinguishable from ordinary water vapour. The Pickering plant releases roughly 100 kilograms of tritiated water vapour every day. The second form is tritium gas (HT) which is very similar to hydrogen gas and is mainly released from the Tritium Recovery Facility at the Darlington Nuclear Station.

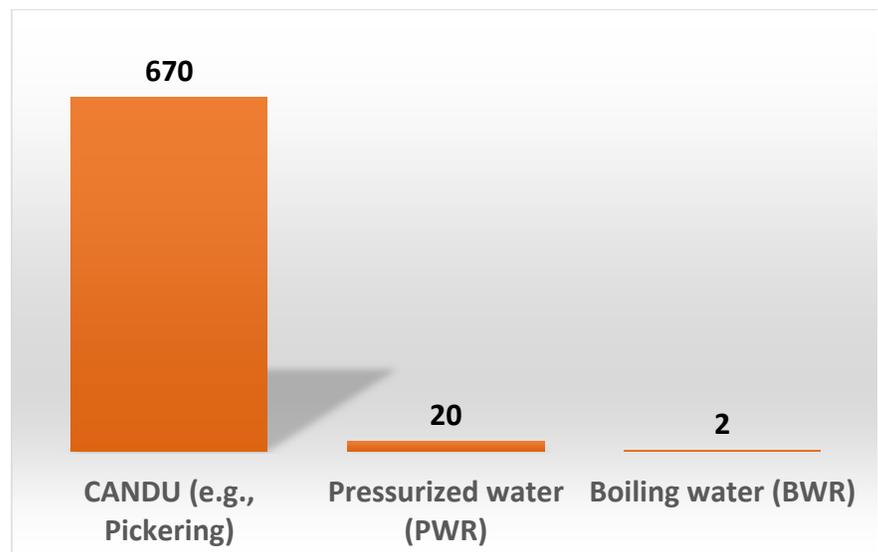
What are the risks?

Being so similar to ordinary water, tritiated water (and water vapour) mixes easily in the environment and is absorbed by everything from soils and plants to animals.

Tritium releases can spike when reactors are opened up for repairs or maintenance. They also rise as CANDU reactors age. But even during normal operations, tritium release levels are a concern.

CANDU reactors are Canada's largest source of tritium

Fig. 1. Annual Tritium Releases by Reactor Types (Terabecquerels per Gigawatt)



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The Canadian legal limit for tritium in water is 10 times higher than the U.S. limit

Unless otherwise noted, information is drawn from:

Dr. Ian Fairlie, *Tritium Hazard Report: Pollution and Radiation Risk from Canadian Nuclear Facilities*, prepared for Greenpeace, (June 2007).

Notes

1. Ontario Drinking Water Advisory Council, *Report and Advice on the Ontario Water Quality Standard for Tritium*, (May 2009), page 5.
 2. *Ibid*, p. 8
 3. Advisory Committee on Environmental Standards, *A Standard for Tritium: A recommendation to the Minister of the Environment and Energy*, (1994), page 8.
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Unfortunately, legal limits for tritium air concentrations are much higher in Canada than in Europe – as much as 500 times higher. And for water, the Canadian legal limit for tritium is 10 times higher than the U.S. limit. These limits seem to have more to do with accommodating the high tritium release levels from CANDU systems than with public health – they are based on calculations of “excess cancers” that are 35 to 350 times higher than what is used for calculating “safe” levels of dangerous chemicals in our drinking water.

In fact, in 2009, the Ontario Drinking Water Advisory Council explicitly stated that its recommended standards “would meet the requirements for an appropriate level of risk and public safety, **while remaining practicable and achievable by the nuclear power industry.**”¹ (emphasis added). It went on to note that “there could be significant cost implications to Ontario Hydro [now OPG], if the proposed Objective [recommended by experts in 1994] was adopted”.²

We are all exposed to very low background levels of tritium, which is formed naturally in the upper atmosphere and has been left behind by atomic bomb testing in the 1950s and 1960s. But levels near nuclear facilities are much higher. A 1994 study of tritium regulations prepared for the Ontario Government³ found that routine releases of tritium from Ontario’s CANDU nuclear generating stations are Canada’s largest source of tritium. Tritium levels in Lake Ontario are more than three times higher than the level in Lake Superior, the only Great Lake with no direct nuclear power plant discharges.

Tritium released to air is absorbed by all plants and animals, including fruit and vegetables sitting on supermarket shelves or grown in backyard gardens. Airborne tritium levels within 10 km of the Pickering Nuclear Station can be 50 to 1,500 times higher than background levels. This, in turn, results in elevated levels of tritium in vegetation and soils near the station. It has been estimated that tritium intakes among people living within 5-10 km of CANDU nuclear stations are 30 to 40 times greater than background intakes.

What are the health impacts?

It is recognized that exposure to radiation leads to cancer and birth defects. Considerable evidence from epidemiology studies around the world show raised childhood leukemia rates near nuclear plants. A major concern is that we are badly underestimating the actual radiation dosage being received by those exposed to tritium, especially to those living close to nuclear facilities. Meanwhile, Canada’s “safe” limits for tritium exposure are much more lenient than those in many other jurisdictions.

This is why radiation expert Dr Ian Fairlie recommends that pregnant women and children under four years old should not live within 10 km of tritium-emitting facilities. He has also recommended that anyone living within five km of such facilities should not consume food from their own gardens or grown in the area.

Dr Fairlie points out that some efforts to control tritium emissions, such as the tritium recovery facility at the Darlington Nuclear Station, are themselves sources of major tritium emissions.

For the Pickering Station, the simplest solution for reducing dangerous tritium emissions is to close the station when its licence expires in 2018 and immediately begin decommissioning the plant and cleaning up its surroundings.