# *A River is Not a Radioactive Sewer*

Dr. Gordon Edwards, Media conference presentation,
New York State, August 23 2023,
Re: Plans to dump radioactive wastewater into the Hudson River

In 2017, I was invited to give a talk on the shores of the Hudson River. At that time, I began by saying "The age of nuclear power is winding down, but the age of nuclear waste is just beginning."

Well, here we are. Welcome to the brave new world of human-made radioactive waste. It is a toxic legacy that will last for a hundred thousand years and more, because no one knows how to turn off radioactivity. The only thing we can do is keep it out of the environment. Keep it out of the food we eat, the water we drink, and the air we breathe.

Chronic exposure to radioactivity is harmful to all living things even in small amounts, causing cancers and other diseases. It also damages the reproductive abilities of all species.

We are here today because Holtec wants to dump 1.3 million gallons of radioactively contaminated wastewater into the Hudson River. Many health professionals would be appalled at the prospect of dumping any cancer-causing pollutant directly into a river. The Hudson is the source of life-giving water for countless animals, fish, birds, plants, insects and, of course, humans.

Holtec says the wastewater has been "treated" to remove radioactivity. But Holtec has no technology to remove a single atom of the radioactive tritium contamination in the wastewater.

That tritium was created as a byproduct inside the Indian Point reactors, now being decommissioned. Holtec wants to just dump it directly into the river with no treatment whatsoever. Indeed, Holtec has no treatment to offer.

Last week, New York State passed a law prohibiting the dumping because it would further degrade the water quality of the Hudson River, which is already suffering from serious PCB contamination. Unlike PCBs, which are difficult to remove from drinking water, Holtec says tritium is impossible to remove. It goes right to the tap.

Halfway around the world, Japan is ready to dump 1.3 million metric tons of radioactive water into the Pacific Ocean. They plan to start tomorrow, August 24. The dumping is vehemently opposed by Japanese fishermen, and by the

governments of South Korea, China, and several Pacific Island nations, along with many independent scientists around the world.

The contaminated water in Japan is an aftermath of the triple meltdown at Fukushima Daiichi 12 years ago. Huge amounts of fresh water had to be used every day since the accident to cool the melted cores of the three crippled reactors. Flushing the molten fuel makes that water heavily contaminated, and it has been accumulating rapidly year after year. Japan now wants to dump it all into the Pacific Ocean, stretching the process out over a period of 30 years or more.

Like Holtec, the Japanese company TEPCO claims to be unable to remove tritium from the wastewater. So what is happening at Indian Point is part of a global pattern. Industry wants to rid itself of the responsibility of looking after at least some of the voluminous toxic waste that it has created, including tritiated water.

Let me explain the particular problem with tritium. Tritium is radioactive hydrogen. Hydrogen is a very important element. It is the most abundant element in the universe. It has the simplest possible atom, a single proton at the centre and a solitary electron in orbit around it. Some heavier hydrogen atoms have one or two additional neutrons in the nucleus as well.

Two hydrogen atoms are attached to every water molecule, and water covers 75 percent of the Earth's surface. More importantly, every living thing requires water. Each living cell is filled with at least two-thirds water by mass. Every organic molecule – all the carbohydrates, proteins, lipids, even the DNA molecules – are made up mainly of carbon and hydrogen atoms bonded together.

Tritium is created as an unwanted byproduct inside all nuclear power reactors. Since it is radioactive hydrogen, it behaves in exactly the same way as normal hydrogen. But tritium atoms are unstable, or radioactive. That means that every tritium atom will suddenly disintegrate without warning. Ordinary hydrogen atoms just don't do that.

By substituting for ordinary hydrogen, tritium forms radioactive water molecules, radioactive proteins, even radioactive DNA molecules. It soon becomes ubiquitous.

A radioactive disintegration is a kind of subatomic explosion. Each atomic disintegration emits a piece of subatomic shrapnel called atomic radiation, very harmful to nearby living cells because it breaks molecular bonds at random, including DNA molecules.

If cells with damaged DNA reproduce, they can develop into cancers or give rise to genetic illnesses in future offspring. A defective embryo may also develop in the womb of a pregnant female, as tritium crosses the placenta and enters the fetus.

In any population of creatures, chronic exposure to atomic radiation causes an increase of cancers of many kinds. Atomic radiation also damages reproductive cells – such as eggs and sperm. Consequently, genetic damage can be passed on as maladies to offspring and even transmitted to future generations. Radiation induced genetic damage occurs in every species that has been studied in the laboratory.

Evaporation of tritium-contaminated water (called "tritiated water") results in airborne radioactive water vapour. When it condenses, tritiated water comes back to Earth as radioactive dewdrops, or radioactive rain drops, or radioactive snow flakes. Breathing in radioactive water vapour is much more biologically damaging than drinking radioactive water or eating food containing "organically bound" tritium. So evaporation of tritiated water is no solution.

In Canada and other countries, large volumes of tritium-contaminated water are stored for years at a time in stainless steel drums, carefully sealed to prevent evaporation. The International Atomic Energy Agency believes that stainless steel drums can last for over 100 years before being replaced. (Not so with carbon steel drums!) In that time, over 99 percent of the tritium atoms will have disintegrated harmlessly inside those containers.

A more realistic life expectancy for steel drums is 20 years. But transferring tritiated water from an old drum to a new one periodically is easily done. Other containers can also be used, such as rubber bladders. One of the best containers that can be used is thick glass.

There is no reason why the Indian Point tritiated water could not be stored for a century or more rather than dumping it into the Hudson River. A river is not a radioactive waste facility, nor should it be treated as a radioactive sewer.

More broadly, we, as citizens of planet Earth, should resist the inevitable pressures from nuclear promoters and defenders to allow the unwise dispersal of human-made radioactive waste materials into the environment of living things or into articles of commerce.

For example, radioactively contaminated metal that is allowed to be melted down and blended with other scrap metal yields such things as radioactive zippers, radioactive safety pins, radioactive cutlery, et cetera. Carelessness and/or callousness regarding nuclear waste leads to an increasingly radioactive world.

Some final remarks about tritium are in order.

When a tritium atom disintegrates it gives off a beta particle with a very short range. It can only damage one or two cells at a time. It is completely harmless outside the body. It is also difficult to detect without laboratory analysis. It does not set off radiation alarms. These factors lead nuclear proponents and defenders to gravely underestimate the dangers of tritium.

Tritium can be very harmful as an internal emitter because of its unique properties as a highly mobile and bioactive element that freely enters into all living things. In general, atomic radiation that is "non-penetrating" is often the most harmful of all – such is the case with radon, plutonium, polonium and other alpha emitters. Tritium is not nearly as potent as these alpha-emitting radionuclides, but it's a whole lot more available – and quite insidious in its reach.

The nuclear establishment downplays or ignores or even denies the following:

1) the well-established fact that beta radiation from tritium is at least 2 or 3 times more biologically damaging in comparison with gamma radiation once it's inside the body, and may be up to 15 times more damaging than gamma;
2) the fact that if a larger population is exposed to the same small dose of atomic radiation, there will be a correspondingly larger number of radiation-induced cancers in proportion to the number of individuals exposed – so by dumping radioactive tritium into the Hudson River, we are endangering an inordinately large number of living organisms that don't need to be exposed;
3) the important and poorly understood role of organically-bound tritium (i.e. tritium as a constituent of organic molecules) in bio-accumulation and bio-magnification phenomena;
4) the fact that mammalian females typically store twice as much tritium in their body fat than similarly-sized males;
5) the deleterious effects of tritium on developing embryos;
6) the fact that tritium is routinely incorporated directly into DNA molecules, unlike any other radionuclide except carbon-14;
7) the fact that tritium, when released, remains in the environment for one or two centuries.