Scientific evidence supports safe discharge of Fukushima wastewater into the Pacific Ocean

October 6 2023

Credit: CC0 Public Domain

Following the second release of treated radioactive wastewater from the Fukushima nuclear plant (5 October), a team of international researchers have addressed concerns and misinformation.

Beginning in August and continuing for the next 30 years, treated water contaminated by the 2011 meltdown of the plant is being slowly released into the Pacific Ocean.

Several nations and international groups have raised concerns over the potential risks of this new discharge.

A new review, titled "The risks of radioactive waste water release" published in Science, has provided comprehensive scientific insights into the planned release and its potential impacts on marine life and humans.

Experts from the University of Portsmouth in England, Curtin University in Australia, and Australian National University, assessed any potential effects based on the scientific evidence from past releases of radioactivity and radiation dose calculations from independent researchers and the International Atomic Energy Agency (IAEA).

Comparisons with nuclear facilities globally reveal that the planned tritium discharge from Fukushima is substantially lower than discharges from many other nuclear facilities, such as the La Hague reprocessing plant in France.

The team has concluded that the anticipated radiation doses to marine life and seafood consumers will be negligible, falling well below safety thresholds.

The treated wastewater is being diluted before it is discharged to ensure that tritium levels are far below regulatory limits. Levels of other radionuclides in the release are also being carefully monitored to ensure compliance with standards set by regulatory bodies.

Professor Jim Smith, from the University of Portsmouth, said, "The release follows stringent regulations and safety measures.

"The plan—as long as it is carried out correctly—is supported by strong scientific evidence on the risks of radioactivity discharges to marine systems."

The primary radioactive contaminant in the wastewater is tritium, present in the form of tritiated water (HTO). While tritium, like other radioactive substances, can induce DNA damage in organisms, its low radiotoxicity significantly reduces potential harm.

Tritium's chemical similarity to ordinary water prevents significant increase in concentration of the substance, also known as biomagnification, as its uptake and distribution are controlled by the much larger volume of non-radioactive water.

"Our long term studies have found that much more contaminated aquatic ecosystems near Chernobyl show remarkable resilience to radiation—fish and aquatic insect populations are thriving," explained Professor Smith.

Honorary Associate Professor Tony Irwin from the Australian National University added, "Tritiated water releases happen all over the world at significantly higher levels than the Fukushima release and have been happening for many decades.

"The Kori Power Station in South Korea discharges about twice as much tritiated water to the sea compared to the Fukushima release. The La Hague facility in northern France discharges 450 times as much as the Fukushima release to the English Channel and no significant radiation doses occur."

Associate Professor Nigel Marks, from Curtin University, added, "There are understandable concerns from the Fukushima community and the public, given the historical context of the disaster, but these fears are not based on scientific evidence. The real focus should be on pressing environmental challenges like climate change, overfishing, and plastic pollution.

"The scientific consensus, backed by evidence, is that the release of Fukushima wastewater poses no significant threat."

Q&A with Professor Jim Smith

What investigations have been carried out to assess the potential impact of the Fukushima Wastewater release?

A report by the IAEA concluded that radiation doses to people and the environment will be extremely low.

This has been supported by the TEPCO risk assessment which I think is also credible. It is also supported by an independent study by Dutch, Ukrainian and Japanese scientists. I believe that these conclusions are sound and make sense, based on my understanding—from over 30 years of experience—of radioactivity in aquatic ecosystems.

How is the wastewater being released?

TEPCO assure us that the water which is being discharged through the pipeline will be analyzed by state of the art radioanalytical methods in the same way as is done for nuclear power plant releases all over the world, including in South Korea and China.

The water being released, after checking, will be diluted 100 times to ensure that tritiated water levels are about 40 times less than the discharge limit and that the sum of other radionuclides will be more than 100 times less than the relevant limits. The discharge limits are very cautious. The TEPCO analysis method has been checked by the IAEA and other independent laboratories.

How will the discharge process be monitored over 30 years?

We can have a lot of confidence that the discharge process is being carried out correctly as the IAEA assure us that they will be on site checking this. If there were significantly higher radioactivity in the discharge than TEPCO has promised, this would be detectable in the sea. I do not believe that the Japanese government could "hide" higher releases than they promise.

Why do you think there is such a backlash against this plan?

I think that there has been a very effective campaign against this release by anti-nuclear lobbying groups and also by some people and countries who are against the plan for political reasons. I also understand that this release will have an impact on the reputation of Japan's fisheries which will affect them economically. This is not helped by scientifically misleading claims about the risks.

What other options do countries have to dispose of radioactive wastewater?

Suggestions have been made that using the wastewater to make concrete is a better option than discharge to the ocean. This is an interesting idea, but very speculative at present. No risk assessments have been made for this and this option needs to account for potential evaporation of tritium from the concrete.

Previous experience has shown that evaporation of tritium leads to significantly higher radiation doses than discharge to water. I do not

think this is a realistic option at this time.

More information: Jim Smith et al, The risks of radioactive wastewater release, *Science* (2023). DOI: 10.1126/science.adi5446. www.science.org/doi/10.1126/science.adi5446

Provided by University of Portsmouth