

# Japan's discharge of radioactive water from Fukushima is avoidable, risky and potentially illegal, say experts

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The Japanese government intends to discharge all 1.34 million tons of wastewater from the Fukushima Daiichi Nuclear Power Station, an operation that [began on 24 August 2023](#). Presumably, it also plans to

discharge the wastewater that will continue to accumulate over the coming decades.

This decision is not only harmful to human and environmental health but is also in [direct violation](#) of international law.

The original [announcement](#), made in 2021, came 10 years after a 9.0 earthquake and tsunami struck Japan's east coast, damaging the cooling mechanisms at the Fukushima Daiichi Nuclear Power Station (FDNPS) and causing three nuclear reactors to meltdown.

The destruction of the FDNPS released an [estimated 520 Peta Becquerels \(520 x 10<sup>15</sup> nuclear decays per second\) of various radionuclides \(radioactive elements\)](#) into the atmosphere, including cesium, carbon-14, iodine-129, and tritium. However, this figure excludes [noble gases](#) such as xenon-133, of which the Fukushima release was the [largest](#) since atmospheric nuclear bomb tests.

## **An incomplete clean-up**

Following the incident, the Japanese government worked with the UN's International Atomic Energy Agency (IAEA) and the Tokyo Electric Power Company (TEPCO) on a plan to decommission the plant, efforts which continue to this day.

The first step of this process was to ensure the reactors remained stable. As such, [ocean water](#) was pumped into the reactors as a replacement for the now-defunct cooling mechanisms. Though necessary, this process, along with extensive groundwater leakage, has produced over one million tons of irradiated wastewater, which continues to accumulate daily.

This wastewater is being decontaminated using an [advanced liquid](#)

[processing system \(ALPS\)](#), a filtration process intended to remove 62 radionuclides from water using a series of chemical reactions. However, this system's consistent effectiveness, even with repeated treatment, has not yet been demonstrated, and ALPS is [incapable of eliminating tritium and carbon-14](#).

[As of July](#) 2023, the ALPS-treated wastewater was being stored on-site in 1,046 storage tanks that are nearing [capacity](#), hence the claimed need for ocean discharge.

The [Japanese government plans](#) to incrementally discharge the treated wastewater into the Pacific Ocean over the next 30 to 40 years. Though [presented with other disposal options](#), such as long-term storage in purpose-built, seismically-safe tanks and solidifying the water in a leakproof form such as mortar or concrete, the [task force](#) declined to explore these avenues due to complexity and cost.

Even after initial cleaning, [70%](#) of the stored wastewater contains levels of radionuclides above [regulatory standards](#), in some cases up to [20,000 times higher](#). And it's not just tritium (more on this substance below) in this water, there are other, more toxic, substances, such as cesium-137, strontium-90 and cobalt-60.

However, the [IAEA](#) found that Japan's plans "are consistent with IAEA Safety Standards" and that the levels of tritium, carbon-14, and other potential radioactive contaminants will be within international standards when discharged, without TEPCO having demonstrated its water cleaning can [consistently achieve this](#).

Dilution of the wastewater as planned to meet regulatory limits will not alter the total amount of materials released, which is the key factor.

TEPCO estimates the annual radiation dose to people from the

discharged water would be [lower than that of a dental X-ray or a round-trip flight from New York City to Tokyo](#).

However, TEPCO's [checkered history](#) gives little [grounds for confidence](#) in its assurances.

## **Not enough evidence of safety**

Despite reassurance from the IAEA, the [scientific community](#) remains divided on the decision, citing growing evidence of how tritium may impact human and environmental [health](#).

Moreover, environmental scientists have argued that the amount considered to be an environmentally safe level of radiation is more [political than scientific](#). National standards invariably lag behind the science, and regulatory limits for tritium in water vary from as much as 7,000 Bq/L (Becquerels per liter) in Canada to 15 Bq/L in California.

[Tritium](#) is a naturally occurring, radioactive form of hydrogen also produced by nuclear reactors and explosions. It is the largest radioactive byproduct of nuclear power plants. It reacts with oxygen to create tritiated water, which is why ALPS is unable to filter it. Tritium exposure has been largely considered to be [harmless](#) in low concentrations and, when ingested, tritiated water is processed in the body identically to water.

There is strong evidence, however, that tritium, particularly organically-bound forms, may have lasting [health effects](#) similar to other forms of radiation exposure, such as [decreased lifespan](#), [developmental delays and cognitive deficits](#), [immunodeficiency](#), [infertility and birth defects](#), and [cancer and DNA mutations](#) among humans, land animals and aquatic vertebrates and invertebrates who experienced high or prolonged exposure.

The International Commission on Radiological Protection considers tritium's beta radiation overall to be [twice as biologically damaging as X-rays](#), and organically-bound tritium three times as damaging as tritium incorporated into water.

Though the task force has committed to monitoring tritium exposure in aquatic animals, [TEPCO](#) noted that "fish tritium measurement is very difficult and there are only a few analysis agencies that are capable of performing this measurement," and that reports from these agencies are often conflicting, making this an insufficient risk mitigation strategy.

## **Illegal under international law**

Japan joined both the 1972 London Convention to prevent marine pollution by waste dumping, and also the 1996 Protocol which specifically [prohibits the marine dumping of radioactive waste](#). In 1996, [Japan ratified](#) the United Nations Convention on the Law of the Sea ([UNCLOS](#)), an international agreement that established a framework for maritime activities.

By [ratifying UNCLOS](#), Japan committed itself to "protect and preserve the marine environment" and abstain from polluting waterways from "land-based sources."

Additionally, in 1992 Japan committed to the [Rio Declaration](#), a collection of goals created by the UN targeting sustainable development and [environmental protection](#) that heavily emphasizes the precautionary principle. Article 15 states: "where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."

Though there is still debate within the scientific community surrounding

the effects of tritium and what constitutes an acceptable level of radiation exposure, two truths remain. One, Japan has committed itself to environmental protection, and two, the contaminated wastewater is a land-based source of pollution.

Furthermore, the very existence of the debate on [tritium](#)'s safety and the knowledge that the discharged water will contain other, more harmful radioactive pollutants, requires Japan to employ the precautionary principle just as they agreed to in 1992.

The Japanese government moving forward with the discharge plan, disregarding its commitments to the global community and international efforts for environmental protection sets a precedent for how the global community responds to modern nuclear crises.

Approving this plan means approving a compromise on human and [environmental health](#), inflicting a transboundary and transgenerational problem on peoples around the Pacific with no offsetting benefit or say in the decision, and a failure to engage state and non-state actors with stakes in the nuclear industry to question what's acceptable.

As such, the Japanese government must follow through on its commitments to the international community and critically consider alternatives for wastewater disposal. The discharge is planned to go on for 30-40 years and radioactive wastewater will continue to accumulate.

Even though it has already started, it can still be stopped and a better alternative implemented.

Provided by University of Melbourne

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