

ENG3004 – Individual Assignment (Part A)

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An analysis on the social impacts and alternatives of dumping Fukushima's Wastewater to the Pacific Ocean

In March of 2011, a massive earthquake with a magnitude of about 9.0 struck an undersea area of the Pacific Ocean, about 70 kilometers from the largest island of Japan, Honshu. This earthquake triggered a large Tsunami with heights of up to 15 meters. As Fukushima's nuclear power plant is located by the shoreline of Japan, the tsunami damaged the power supply of the reactors which consequently disabled the cooling system of the three reactors [1]. Inside the reactors are fuel rods which emit heat to generate the energy required. While heat is emitted, water is used to control and cool these rods to an adequate temperature. The failure of the cooling system caused these rods to heat to an extreme temperature enough to melt the fuel rods [1]. As expected, there would be safety systems in place to prevent heating of the rod. Tokyo Electric Power Company (TEPCO), the company who is responsible for managing the plant, had three safety systems in place to prevent overheating of the reactors. However, the tsunami caused all these safety systems (some of which were power-related) to fail [1]. Even when the cooling systems have failed, various measures to pump water to cool the rods manually was conducted. Despite such, a series of chemical reactions (i.e., mixture of hydrogen and oxygen) occurred inside the cores which caused a catastrophic explosion. The explosion occurred in Fukushima's Reactor 1, 3, and 4 respectively.

So, the question now is, why are there so much treated water in Fukushima? About 150 tons of water is extracted due to continued flushing of water to cool the corroded reactors and groundwater leakage which was originally intended to cool the reactors continue to leak into the building due to the damages incurred from the explosion [2]. This ground water remains contaminated with various radioactive isotopes from the explosion. As such, TEPCO continues to decontaminate the extracted water through a sophisticated filtration system they call "Advanced Liquid Processing System" or ALPS [3]. This system is able to filter out isotopes with longer half-lives such as cobalt, strontium, and plutonium. However, a specific radio isotope called tritium, which emits low-energy beta particles, is unable to be filtered out

through this system as it is an isotope of hydrogen [3]. In other words, this isotope replaces hydrogen atoms found in water which makes it difficult to be filtered out with current filtration technology. Other dangerous isotopes such as ruthenium and cobalt, which would supposedly be filtered out by the ALPS technology, could still escape the filtration process [3].

To meet the regulatory requirements of Japan for drinking water, TEPCO is diluting this water to reduce the concentration of tritium by only 1/40 of permitted levels. More than 1,000 tanks of this water have been accumulated and stored around the Fukushima power plant area and allocated storage space for this is running low. TEPCO is therefore strongly considering releasing the filtered water to the Pacific Ocean. According to an article published by The Guardian, the Japanese government has concluded and approved to release the filtered water to the ocean despite the water remaining to be contaminated with tritium [4]. The government has insisted that the filtered water will not be harmful to neither human nor marine health as the water would be filtered out to contain low levels of tritium before being released to the sea. However, scientists believe that tritium may react differently in a marine setting although no study has proved this claim as a fact, to date.

As expected, a strong opposition to this move has been expressed by the Japanese public. Since April 2021, Japanese civil groups have expressed their strong objection towards the government and TEPCO's plan to release radioactive water to the ocean [5]. A representative from the Japanese anti-nuclear campaign group has also voiced out that dumping the nuclear contaminated water to the ocean would violate a 1996 protocol on preventing marine pollution [5]. Nevertheless, a major reason why society is against this action is due to the possible impacts of releasing radioactive water to the fishing and agriculture industry of the country. After the reactors exploded in 2011, Japanese fisherman have encountered a major setback in seafood catches up until today. Data from nippon.com shows that catches in 2010 were about 38,600 tons while catches in 2018 were only 5,900 tons, about 15% of the catches 8 years ago [6]. This statistic shows that the fishing industry in Fukushima has yet to recover despite the disaster occurring more than a decade ago. While public trust from seafood caught near Fukushima area has regained due to regular radiation testing for catches, Japanese fishermen continue to worry about how releasing radioactive water may affect the marine life near Fukushima.

Surrounding countries such as South Korea, Taiwan, and China have similarly expressed their reservations regarding the release of contaminated water to the Pacific Ocean. According to a publication by Reuters in 2021, the previous South Korean president Moon Jae-in has ordered officials to study the possibility of raising Japan's move to international court [7]. Fisheries organizations in Korea have also protested and pushing the government to ban seafood imports from Japan in fear of radioactive contamination. International concerns particularly with South Pacific countries continue to emerge due to history with nuclear testing carried out by the United States in the Marshall Islands causing public distrust. The effects of the test have caused severe radiation sickness among residents of the Marshall Islands as well as some Japanese fishermen [8]. The international distrust continues as a panel of scientists arranged by the Pacific Islands Forum (PIF) argues that the data from TEPCO's testing is biased. These scientists claim that the data was only tested from 9 out of 64 radioactive minerals while the remaining isotopes were not measured. Furthermore, the test was only carried out 30-liter sample before fully operating the ALPS [9]. Therefore, the lack of data transparency from TEPCO and the urgency of the Japanese government to release wastewater to the sea has continued to push international governments and parties to question the safety and impacts of this to the environment and society.

One of the reasons why both Japan and TEPCO is pushing to release the wastewater to the sea is due to the lack of space in the Fukushima plant area. However, environmental organizations in Japan claim that space remains available on land surrounding the nuclear plant area and that continued storage could offer more time to allow radioactive isotopes to decay and explore new technologies to filter out tritium [3]. Scientists from the PIF have also recommended to store the wastewater for a longer period of time to allow the radioactive isotopes to decay and adapt alternative (biological) methodologies to treat the contaminated water [9]. Another method recommended by PIF was to use the contaminated water in making concrete blocks which have minimal contact with humans. While these alternatives are viable in short periods of time, they fail to offer long-term viability due to space limitations and lack of scientific studies.

The Japanese government has officially announced that they will be releasing the wastewater from the Fukushima (Daiichi) Nuclear Plant in spring or summer 2023. The policy for this includes providing financial support to affected fisheries in the community and substantially decreasing the amounts of tritium found in the wastewater [10]. Both the Japanese government and TEPCO have considered a variety of options to release the wastewater but have ultimately

concluded to release it to the ocean following the filtration process using the ALPS. Although the Japan's decision has not gained the Japanese's public or social acceptance, the government has decided to stick with scientific data and ensure that international standards are not violated once the wastewater is released. Furthermore, the government has also promised to continuously monitor the various findings before, during, and after the release of wastewater to the sea.

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