Student Name: Lau Ka Ming

Student ID: 19050931D

**Q:** **Analyze the impact of Fukushima’s wastewater to the environment, the social perception of the company/country. What are the alternatives?**

Fukushima nuclear disaster took place on 3rd November 2011. The earthquake and subsequent tsunami destroyed the power plant facilities. The failure caused the breakdown of the protective system such as the cooler which led to the meltdown of the nuclear reactor. It resulted in the leakage of radioactive material. The leaked-out materials including I-131 polluted the soil nearby, air, and groundwater. Besides, seawater was used to cool down the reactor which also produced radioactive waste. The main pollutant such as I-131 and Cs-137 is harmful to human and is carcinogenic. The latter is even highly soluble in water so it can easily cause widespread pollution.

Tokyo Electric Power Company (TEPCO) as the plant's operator has been struggling with the ongoing cleanup and containment of the contaminated water that has accumulated at the site. However, there recently has been controversy surrounding TEPCO's plan to release the wastewater that has been treated to remove most of the radioactive materials into the ocean. The proposal has sparked concerns about the potential environmental and health impacts of such a release.

**Environmental Impact**

The natural hazard caused the failure of safeguard systems and the breakdown of the nuclear reactor. The nuclear fission was therefore out of control and the heat generated was enough to melt the control rod. A great amount of seawater was required to cool down the accident site. The cooling process lasted for a long period which led to water piling up at Fukushima and seeping into the soil and groundwater. The polluted environment was harmful to plant growth. For example, if the polluted soil which contained Cs-137 was absorbed by the root, it may make an impact on the reproduction of plants because Cs-137 will prevent them from absorbing Potassium [1]. Rather than soils, the polluted groundwater may spread the extent of the contamination. For example, radioactive materials may be discharged into the water resources nearby such as lakes, rivers, and even oceans. They could enter animals’ bodies directly by drinking these polluted water resources. The radiation emitted by the materials is harmful to cell organs and some of their half-life may even last for several decades so the wastewater could endanger the health of nearby animals and their offspring. Although TEPCO claimed that the treated water was safe and the release may have little impact on the environment, the treated water is expected to contain trace amounts of radioactive isotopes, including tritium, which can have a long half-life and can accumulate in organisms which will lead to Chronic radiation syndrome. The release of wastewater into the ocean could have negative environmental impacts, including the potential contamination of marine biodiversity and the ocean ecosystem so the concern about the potential impact on environment is understandable.

**Social perception**

As mentioned before, controversial measure has been taken by TEPCO. In March 2013, it was found that the wastewater leaked from the storage tank to the ocean because of tank deformation [2]. The amount of leakage reached above 300 tons with high radiation which may be hazardous to the health of nearby staff. The leakage incident created distrust in the company. It has had a significant impact on local communities such as the displacement of tens of thousands of people and the disruption of local economies. Besides, the cost of ongoing cleanup and containment efforts could be expensive which may be detrimental to the economic development of the community.

Public concern due to wastewater may affect the country’s perception. As the water resources polluted by wastewater may be used for agriculture, it also made an impact on the food market. There was research showing that the radiation of products such as fish and milk was detected to exceed the safe level [3]. From this case, the Japanese citizens may intensify the food safety concern and realize that their government was not able to control the spread of contaminated food products. Besides as mentioned before, wastewater discharging may affect the water quality nearby so several groups opposed the measures especially the fishery industry and environmental organizations. Research in 2021 mentioned that 55% of respondents disagreed to discharge wastewater into the ocean [4]. From this, it can be observed that the government’s policy was contrary to public opinion which may make a negative impact on the perception of the government.

In addition to the domestic concern, global opinion also made an impact on the perception of Japan. The IAEA mentioned that the discharging measure was feasible because the ALPS technology could purify the wastewater and filter the radioactive materials efficiently. However, its capability may be overestimated. Since it is not able to filter Tritium, the filtrate may still be radioactive and carcinogenic. Besides, once the small amount of residual radiation accumulates, it will also be harmful to the human body. Since the radiation of food was detected to exceed the safety level, several countries banned the import of food and agricultural by-products made in Fukushima and nearby. The policy could be seen as labeling which may make people associate Fukushima and its surrounding areas with radiation. As a result, the country may become vulnerable to external attack, discrimination, and even rumors which could lower competitiveness. Considering Japan’s discharging policy, it fueled resentment in several Asian countries especially Korea and China. The countries condemned that Japanese measure damaged marine ecology and violated international laws and rules. To this end, they took countermeasures such as strengthening water quality monitoring in domestic sea areas. Therefore, it could be observed that the discharge policy may establish a bad reputation in Japan.

**Alternatives**

Although discharging to the ocean has the advantage of low cost and low technology, it is not environmentally friendly. There are some alternatives to handling wastewater. For example, deep geological repository. The wastewater can be stored in a sealed tank and then placed in deep geology. This measure can provide a condition for the long-term isolation of radioactive waste from the environment. It also does not require high cost for maintenance. There are currently multiple storage places in Japan including Horonobe and Mizunami. However, this method could also have potential risks and uncertainties. Currently, it is necessary to prove that the repository is reliable over time and the possible spills will not be harmful to human health and environment in the future. It may require further study and analysis.

A long-term monitoring program may need to be taken. It is used to evaluate the potential impact of wastewater discharge on the environment and public health. It may include the ongoing monitoring and analysis of water quality in the surrounding areas. It will be benefit to provide more accurate and reliable data on the impacts of the treated water discharge, which can be used to take reference for future management decision. Last but not least, it is critical for the government making decision in a transparent and open manner so all stakeholders, including local communities, environmental groups, and the scientific community, can do suggestion and work together to find the most suitable, appropriate and sustainable measure.

**Reference**

1. D. K. Gupta and C. Walther , “Impact of cesium on plants and the environment,” SpringerLink, 2017. [Online]. Available: https://rd.springer.com/book/10.1007/978-3-319-41525-3. [Accessed: 13-Feb-2023].
2. P. J. Kiger, “Fukushima's radioactive water leak: What you should know,” Science, 03-May-2021. [Online]. Available: https://www.nationalgeographic.com/science/article/130807-fukushima-radioactive-water-leak. [Accessed: 13-Feb-2023].
3. H. Tabuchi, “Radiation-tainted beef spreads through Japan's markets,” *The New York Times*, 19-Jul-2011. [Online]. Available: https://www.nytimes.com/2011/07/19/world/asia/19beef.html. [Accessed: 13-Feb-2023].
4. yuki miyamoto, “福島原発の処理水、海洋へ放出「反対」55%　世論調査 via 朝日新聞,” *The Atomic Age*, 03-Jan-2021. [Online]. Available: https://lucian.uchicago.edu/blogs/atomicage/2021/01/03/%E7%A6%8F%E5%B3%B6%E5%8E%9F%E7%99%BA%E3%81%AE%E5%87%A6%E7%90%86%E6%B0%B4%E3%80%81%E6%B5%B7%E6%B4%8B%E3%81%B8%E6%94%BE%E5%87%BA%E3%80%8C%E5%8F%8D%E5%AF%BE%E3%80%8D55%E3%80%80%E4%B8%96%E8%AB%96%E8%AA%BF/. [Accessed: 13-Feb-2023].