**ASSIGNMENT 1**: **SOCIETY AND THE ENGINEER (SEMESTER 2, 2022/23)**

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**Question 3:**

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

In 2011, an earthquake of a magnitude of 9.0 occurred off the northeastern Japanese coast and triggered a tsunami (Ng 3Gong, 2022). This flooding led to great damage to the Fukushima nuclear accident. Recently, Japan intended to discharge the effluent from Fukushima into the sea in 2021. There are many harmful substances in Fukushima’s wastewater that would greatly impact the environment and the social perception of the company or country.

From the environmental aspect, the release of Fukushima’s wastewater would affect the normal marine environment (Guo et al.,2022). Since no purification method is able to completely eliminate all radioactive contaminants (BBC News, 2021), wastewater will still contain toxic radionuclides, such as tritium, cobalt 60, ruthenium 106 and strontium 90. If the element still exists in the wastewater and are released into the ocean, the global hydrological cycle will be negatively impacted. During the circulatory system, water is routinely moved throughout the Earth-atmosphere circulatory system (NWS, 2019). The basic idea behind the water cycle is the transportation of water from the earth to the atmosphere and back again. This process entails evaporation, transpiration, condensation, and precipitation. In addition, Fukushima’s wastewater will hasten the process of marine life mutation all over the planet.

Nevertheless, over time, the nuclear chemicals would build up in the marine food chain, where they may cause substantial harm to the living cells and perhaps threaten their ability to survive for thousands of years. Through the food chain, the associated pollution may re-enter the human population, posing a threat to human health (Greenpeace, 2021). One of the examples is tritium which cannot easily be removed from the wastewater. Once the chemicals were blighted, a quick-moving electron released by the disintegration of tritium has potential harm to the DNA. Additionally, some of the elements amplify the food chain due to the bioaccumulation factor. If the bioaccumulation factor in marine habitats of about 100 (Caesium), animals usually contain 100 times greater pollutants than the nearby water does (Jim, 2023). Thus, wastewater from the Fukushima accident affects the ecological safety of the environment and further deteriorates from the spread of the food chain.

Moreover, Fukushima’s wastewater leading a bad social perception of Japan and the Nuclear Power Company. The public believes that Tokyo Electric Power Company (TEPCO) was not reliable, as the company could not make any effective measures to control the ‘wastewater’ and the explosion of the Fukushima nuclear accident. Also, the Japanese government didn’t have any useful suggestions or policies to handle the ‘wastewater’, leading Japanese residents to worry about their living quality. Besides, the livelihood of the Fukushima fisherman would become largely damaged because of the environmental threat. Fukushima’s wastewater consists of toxic radioactive elements that could affect people’s normal operation and health (BBC News, 2021). If the release of wastewater is allowed, it could further decline the demand for aquatic products due to public fears of nuclear contamination and restriction from countries. The public has no confidence in the products and branding of ‘Fukushima’. Since most people refused to buy or eat the product coming from Fukushima, it would lower the global domestic product from Japan. Further, the Japanese economy become adversely affected because of limited international trade. Beyond that, neighboring countries may be impacted by the expansion of wastewater. Due to Fukushima’s wastewater, importing seafood and agricultural goods from Japan is not advised and provided restrictions by several nations, such as China, South Korea, and the USA (Bachey, 2021). Therefore, Fukushima’s wastewater would bring a negative image to the Japan and company, and it could lead to further problems for Japan, including loss of economy, and may trigger national medical problems in the future.

However, it was found that there are six alternatives to solve the problem of Fukushima’s wastewater, especially for the tritiated water. Fukushima’s wastewater can be purified by multi-nuclide removal equipment through Advanced Liquid Processing System (ALPS). Through the system, TEPCO has developed five possible methods to treat the impurities of Fukushima’s wastewater (IAEA, 2020). First, geosphere injection is a method that injects tritiated water deep inside the geosphere layers. After safety has been proven, tritiated water is pumped into 2500 meters deep geosphere layers through an underground conduit using a compressor and either without any pre-treatment or after dilution or isolation (METI, 2016). Second, controlled discharge into the sea is one of the options. Looking back to history, tritium water has been released into the sea by the other nuclear industry. After separating or diluted to the wastewater, tritiated water is discharged offshore with a controlled dilution factor. Then, another way is the vapor released. The benefit of vapor release is that certain radioactive substances after passing through the process of evaporation in ALPS would not be discharged (METI, 2020). Instead, it would become a dried residue. Purified vapor can be completely verified over the temperature. Next, the third option is hydrogen release. The simultaneous generation of hydrogen is a unique electrochemical purifying method for severely polluted industrial effluent (Fraunhofer, 2020). This process entailed electrolyzing the water to convert it into the form of hydrogen before discharging. Finally, the measures are called ‘underground burial’. Fukushima’s wastewater would have been combined with a solidifying agent made of cement and then buried underground in a concrete pit. For those five options, sightseeing is important to maintain a high-quality level of safety standards to extract ‘clean’ water and avoid any damage to the tanks or pipes. Nevertheless, there is another option which is to rise the amount of storage space. Since wastewater saving in the tanks can be a short-term effective way to alleviate the problem, the Japanese government can seek more areas for saving wastewater. According to the experiment report (METI, 2020), it showed successful and valid statistics to treat Fukushima’s wastewater through the above options.

In order to solve the problem of insufficient space to store Fukushima’s wastewater from TEPCO, the Japanese government allowed releasing the Fukushima wastewater. Since there are lots of negative impacts of wastewater release, it is suggested that several alternatives can reduce the problem of radioactive chemicals released into the ocean.

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