ENG3004 ASSIGNMENT 1(a)

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**Background of the Fukushima Disaster**

On March 11 2011, an earthquake with magnitude of 9 occurred, which the epicentre was located 130 km east of Sendai. Fukushima nuclear power plant was damaged due to the earthquake and the tsunami triggered. The most noticeable damage was the Fukushima “Number One” Plant [1]. Because the “Number One” Plant was destroyed, the cooling system failed due to no power supply. This nuclear reactors were in overheating condition, and melts the fuel rods. The melted materials produced had reached the containment vessels on reactors no. 1 and 2 and led to explosion. It had brought chain effects to the 4 reactors. When the explosion occurred on reactor no.1 and 2, the pressurized hydrogen also accumulated on reactor no.3, and the temperature of the fuel rods in reactor no.4 were also heated. Intensive radiation leakage was occurred. Boric acid and seawater were used to alleviated the effect of damaged nuclear reactors.

**Government’s Plan for the Sewage**

Japan government decided to dump the sewage from the nuclear plant to the ocean. Before dumping the wastewater into the ocean, it was processed with Advanced Liquid Processing System (ALPS) [2]. The ALPS could filter the nucleic content in the sewage. Japan Government had approved the dumping of the radioactive sewage on 2021 [3]. It was mentioned that 1.25 million tons of wastewater will be released to the Pacific Ocean, and the processes would take 40 years to finish. In 2023 January, it is confirmed that the process will begin in next few months [4].

**Social Perceptions, Controversies and Environmental Issues**

Although the government had reassured that the sewage would be treated and released properly, and the marine effect would be minimized, it still brought a lot of controversies, including different aspects.

It was not simply water pollution caused by dumping sewage into the Pacific Ocean. Dumping radioactive sewage into the ocean would cause radiation pollution there, which is more severe than water pollution, as it could bring lethal hazard to the marine life. Dell'amore [5] asserted that once the sewage from the nuclear plant was dumped into the pacific ocean, serious damage to the aquamarine system will be done. That was because nucleic content in the sewage was life-threatening to the marine animals. The radiation could kill the animals directly, or causing gene mutation. The reproduction of the offspring of the marine animals will be highly affected due to altered genetics.

Also, the nucleic residue could sink into the seabed as sediments. Then the deepest level of the Pacific Ocean would have the highest radiation contamination level. In long term, the radioactive content and hence sediments would keep increasing if Japan insisted on dumping the radioactive sewage into the Pacific Ocean for 20 years. It would continuously bring harm to the marine life.

Moreover, radiation could be carried through the food chain, when a living organism took another one who had been affected with radiation, that predator would simply intake all the radiation from the organisms being eaten or taken. Eventually, the radiation would spread to other species in the marine quickly, leading to interruption of the normal food chain.

In a boarder perspective, dumping radioactive sewage had disrupted the marine ecosystem. The species that have taken the radioactive contents may create differences. Even if they are in the same ecosystem, the genetic change brought by radiation had interrupted the relationship of the species to the ecosystem. It was also noticed that radiation contamination also created resistance to the species population [6]. The modified population might make the marine ecosystem in the Pacific Ocean unbalanced, affecting the long-term marine ecology in Pacific Ocean.

The public had raised concerns to not only the environmental impacts caused, but also the socio-economic issues. To begin with, the fishermen feared that because of polluted ocean and the population of wild fish reduces, the profit of seafood trading would be greatly affected. A local fisherman responded to the government’s decision; their livelihood would be affected with the reduced marine life population due to radioactive pollution in the Pacific Ocean [4]. Fishing unions from other countries who also conduct aquaculture activities at the relevant region, opposed to Japan’s decision. Furthermore, Tilman Ruff, “Nobel Peace Prize Laureate and co-president of International Physicians for the Prevention of Nuclear War”, pointed out that the radioactive content was hazardous to the human body, especially for the women and the children [7]. Human exposed to radiation had a high risk of suffering from cancer. Children and females, especially, were more sensitive to the radiation, which meant that those 2 groups of people were easier to get cancer under high dose of radiation. Therefore, dumping the sewage could ring the alarm of social health and safety.

Not only the aquacultural stakeholders opposed Japan Government’s decision, even the governments of East Asia Countries expressed their discontents. For Example, Chinese government criticized that Japan government’s act was irresponsible that he did not communicate with the neighborhood countries before dumping the radioactive sewage and being inconsiderate to public health and safety [8]. Also, Korea had lifted the ban of seafood from Japan because the sewage could pollute the ocean and affect the marine life [4]. It implied that Japan’s decision of dumping sewage into Pacific Ocean had aroused much concern from different countries. Most of them had placed the environmental impact and food safety as their top concern because those were the 2 most crucial consequences of the method chosen by Japan.

The above had illustrated the threats to the environment and the social perceptions towards Japan’s decision of dumping radioactive sewage to the Pacific Ocean. There were alternatives besides dumping into the Pacific Ocean. However, Japan repeated that the sewage has been treated before dumping and reassures that the harm would be minimized, hence insisted on dumping into the Pacific Ocean instead of choosing other alternatives. To be honest, the harm of the sewage after treatment could be theoretically harmless. Brent Hunter, a professor from University of Illinois, pointed out that only tritium would be left inside the sewage after treatment, and it was harmless to the aqua life [9]. It is mentioned that most of the harmful radioactive contents are removed after treatment. The tritium content would be small with reference to the proportion of water, so the sewage could still be regarded as dilute, and it will not harm the marine environment. Zhou Yongmao, a nuclear engineering academician at the Chinese Academy of Engineering, objected that a very small amount of tritium in seawater was harmless [10]. He said the tritium oxide inside the seawater was the most dangerous radioactive chemical inside the sewage, which could be inhaled into the respiratory system, or entered through damaged skin or wounds.

**Alternatives Instead of Dumping Sewage to the Ocean**

Back to the alternatives apart from dumping into the ocean. The first alternative is to build more storage tanks to store the wastewater [10]. This is the simplest way to deal with the wastewater that exceeds the storage of the current tanks in the power plant. The problem is whether there are suitable locations to build the storage tanks, as there are many concerns like whether it will pose a great threat to the residents nearby in case of leakage.

The second alternative is to solidify the wastewater and place it underground. By hiding the solidified wastewater underground, the interactions between human and the radioactive components are greatly reduced. This can reduce the chance of absorbing the radioactive chemicals. However, hiding the radioactive sewage underground could cause land pollution, because the harmful radioactive chemicals may diffuse into the soil. If there are farmlands nearby, this solution will become “cons overweight pros” instead of “pros overweight cons”.

The third alternative is evaporation. This method means to let the wastewater evaporate into the air. This method could solve the problem of harming the marine life nearby and avoid polluting the Pacific Ocean. It should be known that it will be a continued process, which could be even longer than Japan’s plan (taking 20 years to finish dumping the wastewater into the ocean). Evaporation rate was subjected to humidity and wind. Higher humidity and weaker wind would reduce the evaporation rate, which made this alternative inefficient. The worst fact of this solution was the toxic chemicals could enter the water vapour in the air through diffusion. This increased the risk of inhaling the toxic air and other means of contact through the human body. As mentioned, human intaking excessive radiation was harmful. It could even lead to cancer.

**Conclusion**

To conclude, the method of dumping the sewage into the Pacific Ocean had risen concerns from different stakeholders. Many parties had expressed their discontent towards Japanese government’s decision, so it could be pictured that their overall perception was negative. Whether it was in environmental aspect or social aspect, dumping wastewater to the ocean brought cons more than pros. Japan insisted on dumping into the sea because it is “cost saving”. There are several alternatives. However, Chinese government said Japan did not consider other methods before deciding to dump the wastewater into the sea [11]. It was illustrated that Japan might want to solve the problem of accumulated radioactive wastewater as soon as possible.

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