**Q3: Analyze the impact of Fukushima’s wastewater to the environment, the social perception of the company/country. What are the alternatives?**

On 13th April 2021, the Japanese government has announced to release more than 1.37 million tons of nuclear wastewater generated from the destroyed Fukushima Daiichi Nuclear Power Plant (FNDPP) into the Pacific Ocean over a period of thirty years. Although the wastewater has been processed through the Multi-nuclide removal equipment (ALPS) and the Japanese government has promised its radiation level to be at lower standards than that of normal drinking water, it would still be an irresponsible behavior which could cause unpredictable effects to the marine ecological cycle and human lives.

图示

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Fig 1. Radionuclide transporting routes in the ecosystem [1]

Fig 1 shows the routes of the radionuclides’ transmission in the ecosystem, through which the pollution could spread into the atmosphere, biosphere, hydrosphere and pedosphere from the FDNPP area to even the entire northern hemisphere [1]. Through the wet/dry deposition or precipitation in the atmosphere, some radioactive substances could be attached onto the surfaces of the agricultural products such as vegetables, grains and some of the animal feed. Moreover, the cooling water generated from the molten damaged cores may also sink down into the ground water, thus bringing the pollutants into the sea gradually. With the paths of ocean current, it can be transmitted to the remote regions including the US and Canada through the breeding migration of various marine animals. Among those animals, as their trophic level increases, the ingestion of radioactive contaminants would also rise accordingly, which could be eventually eaten by humans, leading to high rates of chromosome aberration and physical deformity to both human and the wild animals. Additionally, for the radionuclides that could not be ingested by animals but attached onto the seafloor sediments, the degradation is also time-consuming, which is closely related to the half-life of the substances. This means that if the radionuclide with longer half-life is released into the ocean, the radioactivity would exist in the ecosystem chronically, leading to potential hazards in the following hundreds or even thousands of years, causing induced cancer or mutations to the creatures in the polluted environment.

Although the International Atomic Energy Agency has declared that the wastewater released reached a normal standard, and the Japanese government has also announced to be responsible for its decisions to determine the final discharge plan [2], it is still a depressing and irresponsible behavior that will have a huge impact on human life and health as well as the marine natural ecosystem, arousing intense discontents from the world community, especially for its neighboring countries. Russian has insisted that this would significantly damage its fishery industry since the adjacent sea areas are contaminated to varying degrees. The South Korean Foreign Ministry has publicly declared that Japan's discharge of radioactive water into the sea may break the international law, and demanded a response from the Japanese Foreign ministry [3]. Both India and North Korea have also brought up their worries, and the Chinese government has urged the Japanese authorities to pay more attention to the difficulties faced by the marine ecosystem instead of those immediate benefits.

The release of Fukushima’s wastewater also brought troubles to Japan’s fishing and export industry. After the nuclear accident in FDNPP in 2011, the US Food and Drug Administration (FDA) has adopted import alert No.99-33 to restrict the import amount of Japanese food, especially aquatic animals and products, to avoid its radiation contamination. In March 2021, the policy was updated and covers other Japanese foods such as meat products, vegetables and kiwifruit which cannot be sent into the United States as import commodities. This may generate negative effects to the Japanese economy since its food export is hard to trust and sell to other countries because of the radioactive pollution.

Apart from this, the nuclear wastewater discharged to the ocean could also affect the fishery industry of both local and its surrounding countries. Since the radionuclides may cause the mutation of marine lives, people are gradually losing their reliance to the seafood products, especially in the areas mentioned above. Fig 2 shows the top ten countries for fishery production in 2019 by percentages of marine area production, inland water production, and ocean production, and it is obvious that in most of the countries, the ocean production counts for more than 60% among those industries, which means that the ocean bears the majority of the fishery industry overall [4]. This could significantly affect the marine aquaculture and fishing industry, as well as further processed food industries. In addition, when Japanese nuclear waste is discharged into the ocean, it may serve as a terrible example for other nations with numerous nuclear power plants on how to handle nuclear wastewater, and other nations might release more nuclear wastewater into the ocean under the guise of financial constraints, leading to marine pollution on a global scale [5]. In this case, a crucial problem that needs to be resolved at this time is how to prevent the Japanese government and TEPCO from giving up on nuclear wastewater release.

图表, 折线图

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Fig 2. The top ten countries for fishery production in 2019 by percentages of marine area production, inland water production, and ocean production

The ALPS (Multi-nuclide removal equipment) Subcommittee has presented five possibilities for the treatment of nuclear wastewater: geosphere injection, discharge into the sea, vapor release, hydrogen release, and underground burial. Meanwhile, each project's expenses and viability were taken into account. The cost of dumping into the ocean would be roughly 3.4 billion yen, whereas the costs of the Vapor release program and the Underground burial program, respectively, would be tens of billions and hundreds of billions of yen [4]. Additionally, in 2016, some of the scientists have invented the first zero-power device for lead-based nuclear reactors, named as “Qiming”, which is applied to drastically minimize the quantity of nuclear waste accumulation [3]. Finally, the Japanese government selected the least expensive, least risky, and most practical technique of discharge into the sea.

References:

[1] Y. Lu, J. Yuan, D. Du, B. Sun, and X. Yi, Monitoring long-term ecological impacts from release of Fukushima radiation water into ocean, Geography and Sustainability,

Volume 2, Issue 2, 2021, Pages 95-98, ISSN 2666-6839, <https://doi.org/10.1016/j.geosus.2021.04.002>.

[2] L. Xu, X. Zhao, and J. Chen, Exploring the governance dilemma of nuclear wastewater in Fukushima: A tripartite evolutionary game model, Ocean & Coastal Management, Volume 225, 2022, 106220, ISSN 0964-5691, <https://doi.org/10.1016/j.ocecoaman.2022.106220>.

[3] X. Zhang, T. Qu, and Y. Wang, Optimal strategies for stakeholders of Fukushima nuclear waste water discharge in Japan, Marine Policy, Volume 135, 2022, 104881, ISSN 0308-597X, <https://doi.org/10.1016/j.marpol.2021.104881>.

[4] J. Guo, Y. Liu, X. Wu, and J. Chen, Assessment of the impact of fukushima nuclear wastewater discharge on the global economy based on GTAP, Ocean & Coastal Management, Volume 228, 2022, 106296, ISSN 0964-5691, <https://doi.org/10.1016/j.ocecoaman.2022.106296>.

[5] B. Yang, K. Yin, X. Li, and Z. Liu, Graph model under grey and unknown preferences for resolving conflicts on discharging Fukushima nuclear wastewater into the ocean, Journal of Cleaner Production, Volume 332, 2022, 130019, ISSN 0959-6526,

<https://doi.org/10.1016/j.jclepro.2021.130019>.