An Estimate of the Reputational Damage to Fukushima's Fishery Industry Following the Release of ALPS Treated Water

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Abstract

Ever since the catastrophic events of the 2011 Tohoku earthquake, Fukushima's name has been tarnished by the subsequent TEPCO nuclear reactor meltdown. To this day, industries in Fukushima suffer from this reputational damage. After the Japanese government decided the decommission of the Fukushima Daiichi Nuclear Power Plant, the government also announced the release of its contaminated water in the ocean. This contaminated water goes through the Advanced Liquid Processing System – a multi-nuclide removal system which removes most radioactive materials except tritium – and becomes ALPS-treated water. Considering the impact the nuclear disaster left on Fukushima's industries, we extrapolate that a similar problem will occur when the ALPS-treated water is released in 2023.

We aim to argue that there is a high likelihood any damages from this release will be solely reputational and estimate its severity. Since the release of the ALPS-treated water is a controversial topic, to do this, we will not only utilise the scientific data provided by TEPCO and the Japanese government, but also interview those supporting the fishery industry and the economy of Fukushima. We hope that our research could serve as a basis for the prevention of such damage from happening when the water is released.

Keywords

ALPS-treated water, reputational damage, nuclear power plant accident, Great East Japan Earthquake, Fukushima

1 Introduction

On March 11, 2011, a magnitude 9.0 earthquake, one currently known as the Great Wast Japan earthquake, struck the eastern region of Japan, wreaking havoc on public infrastructure and causing many casualties. Since then, both the citizens in the surrounding regions and the Japanese government have worked together in moving forward from both the earthquake and the nuclear power plant accident that followed it.

One particular issue that the region still faces is reputational damage. This is a type of damage where the general public avoids products from a certain region or manufacturer after an incident despite there being no fact-based reasons to do so, leading to financial damage to said region or manufacturer. Fukushima, a prefecture in Japan, is a particular victim of this, as they had the Fukushima Daiichi Nuclear Power Plant disaster. This was an accident where, due to the earthquake cutting off the power supply, a meltdown occurred in the nuclear power plant. This caused radiation to leak into the air and ocean, as well as for the water that was used to cool down the reactors when they were operating and when the meltdown occurred to become contaminated. The effects were disastrous for the surrounding regions, with industries such as agriculture and fishery having to halt operations for months before they could confirm the safety of their products. Even when they were able to do so, many were still reluctant to buy from the region. This still continues today even more than a decade after the accident.

Recently, the Japanese government announced that they were going to release some of the water that had been contaminated into the ocean. Of course, they weren't going to release it as it was; they would put it through a system called the Advanced Liquid Processing System, a system that filters out most of the contaminants from the water, making it safe for release. The water passed through this system is often referred to as the ALPS treated water, and it caused widespread controversy. Many, especially in the local fishery industry, were concerned that the release would lead to further reputational damage.

In our group, we also found it concerning that the regions might be facing further reputational damage. Therefore, we wanted to see if there was a way we could combat it and make sure that the Fukushima fishery industry won't face false accusations of their products being unsafe.

This paper will do mainly two things. First, through examining past cases of reputational damage, we will find which ways of combating have proven effective in the past. Next, we will look into what reputational damage will happen due to the release of the ALPS treated water and propose ways to prevent it or reduce its impact on the fishery industry in Fukushima.

2 Purpose of the research

The reputational damage regarding the Fukushima nuclear power plant 10 years ago is classified as "unexpected" [1]. On the other hand, the ALPS-treated water is a different case. In spring 2021, the Japanese government made an active decision to release the water into the Pacific Ocean [2]. This paper will both explore the reputational damage that is expected to occur from the release of ALPS-treated water and compare it to past unforeseen cases. In the end, we want to identify the unique characteristics of an expected nuclear incident, and how that affects reputational damage of a region.

3 Methods of research

We divided our research into two parts. In the first part, we will state the reasonings to the thesis that the soon-to-be-released ALPS-treated water is almost guaranteed to be safe. Through this, we want to show that any damage to the Fukushima fishery industry after the release will be almost completely reputational. In the second part, we will demonstrate both the extent of the predicted reputational damage and the effectiveness of our proposal to help prevent it. We will show this through interviews with experts and by analysing the results of an independent survey.

4 Origins of "reputational damage"

The term, "reputational damage", was first used in official government papers in the early 1970s; to be more specific, it was coined in 1974 when the Mutsu Radiation Accident occurred [3]. In September 1974, the nuclear power ship Mutsu had a deadly accident. The ship, which was also the first nuclear-powered ship, leaked radiation into the pacific ocean during its experimental voyage.

4.1 The Mutsu Accident

Even during the construction of the ship, there were small protests in the area concerning the ship. The reactor was completed in late August, 1972, and the nuclear fuel was loaded on September 4 [3]. The ship's test run, with the reactor operating at low output, was soon announced by officials. Local fishermen and residents, much to the surprise of the officials, objected to this experiment and the test run was postponed. Following several negotiations, the government, Japan Nuclear Ship Development Agency, and the local community agreed to test the ship far out in the sea. The ship left its port on August 26, 1974, but was still faced with protests during its departure [3].

At around 17:00 on September 1, the alert detected an increase in radiation when its personnel pushed the reactor up to 1.4% of maximum capacity. The incident was reported in the media as "Nuclear powered ship Mutsu leaked radioactivity" [3]. Concerned about the negative image the ship would bring to the region, the locals of Ōminato, Aomori, where the ship was built, refused to let the ship return. Mutsu was forced to drift in the ocean for months before Sasebo city allowed the ship to anchor there [4]. On October 14, the Japanese government, the local government of Aomori, the town of Mutsu and the Aomori Prefectural Fishery Cooperation reached a compromise and signed an agreement on Mutsu's entrance into its home harbour. The ship returned to the port of Ohminato on October 15 [3].

Despite the controversy over the ship, the experiments continued until 1992 [5]. However, after having its nuclear reactor replaced with a diesel engine and being rebranded as the RV Mirai, the ship is still in operation today and is one of the largest oceanographic research vessels in the world.

Other than this accident, there are numerous other cases where widespread reputational damage has actively harmed the economic activity of a region. Another example is the Fukushima nuclear accident.

4.2 Government Efforts on the Mutsu Accident

In the case of this accident, there was already concern on the effects the ship would have on Aomori's fishery industry and that harmful rumors would likely arise after the experiments with the ships start. This was because, although the infamous accident in itself was a sudden occurrence, the local fishermen were concerned about the effects that a nuclear powered ship in itself would have on the region's reputation. The fishermen did not trust the government's claims that the experiment would be completely safe, either. That is why the Japanese government provided around 300 million yen (approximately $2 million in modern currency) before the ship itself started sailing to counteract the potential reputational damage [4].

In response to the incident, the government issued several investigations to figure out what had happened. In the end, the accident was deemed to have not affected the safety of the fishery, but the damage had already been done; prices for Aomori-produced fishery, including scallops, which were a so-called "10 billion yen industry" at the time, dropped significantly after the accident [4]. After that, Aomori prefecture refused to have the ship dock in their prefecture anymore, and Sasebo city, a city in Nagasaki, volunteered instead despite facing widespread opposition from its citizens, mainly the fishermen [6]. "In order to counteract the effects of the change in reputation", the Japanese government gave approximately 2 billion yen (approximately $15 million in modern currency) to Nagasaki prefecture for compensation [4]. The Japanese government also paid Aomori prefecture an additional 1.7 billion yen in addition to the previous 300 million yen for the same reasons [4].

One of the biggest controversies surrounding this accident was whether such damages should have been covered under the Act on Compensation for Nuclear Damage. In article 2 (2) of said act, it defines the sort of damage that the government should compensate for as being "Damage caused by the action of the process of atomic fission of nuclear fuel material or by the action of radiation or toxic effects of nuclear fuel material, etc."[7]. Many argued at the time that the reputational damage caused by nuclear accidents such as the Mutsu accident should be covered under this act. However, the government refused to do so, citing that, while the accident may have caused economic damage to the region, the fish themselves weren't actually contaminated by radiation. This set a precedent for the way these accidents were treated, and those cases that don't fit under the "nuclear damage" that the government set yet still suffer from economic damages stemming from their worsened reputations are now considered to be "reputational damage" [4].

4.3 Mechanism of the reputational damage

According to a 2003 paper by Naoya Sekiya, an associate professor at the Interfaculty Initiative in Information Studies department in the University of Tokyo, the mechanism of modern reputational damage is as follows [4]:

After an event concerning radiation or a nuclear accident occurs…

1. Concerned that consumers would avoid buying the products from the affected regions, retailers and distributors pull such items from circulation. This leads to the first wave of economic damages, such as a decline in prices or transaction refusals.
2. Seeing the economic damages and people's reactions to negative rumours, scientists, government officials, CEOS of industries, politicians, and such people start thinking about the situation more severely. It is here that the "reputational damage" becomes official.
3. There is broadcasting of the issue in mainstream media. As a result, reputational damage spreads.
4. People see the media broadcasts and start avoiding products from the affected regions. The concern of retailers and distributors' concern about consumer's reaction turns into reality and reputational damage brings tangible harm.

Thus, it is necessary to stop the initial circulation of false information within the retailers and distributors to prevent reputational damage. In the event of such accidents, spreading accurate information is also important so that the economy is not hit as hard as it has been in previous cases.
An example of this happening is the JCO criticality accident. This accident happened when, while they were processing the radioactive fuel set to be used in nuclear reactors over at the JCO Tokai Operation center located in Tokai village, the Uranium they used in the process reached a criticality. This lasted for around 20 hours, leading to the deaths of 2 workers, the severe illness of 1 worker, and the radiation poisoning of 667 others from the surrounding regions.
In its case, it happened according to the following:

1. Even from the day after the accident when it wasn't widely known that there was an accident, products from Tokai village, the place of the accident, such as dried sweet potatoes, were denied retail in Tokyo [4]. This continued for several months even after the products' safety was confirmed.
2. The experts, whose opinions on the matter were valued highly, said that they couldn't be completely sure on the matter. In these sort of situations, the experts at the time thought that "it was the reasonable choice to be cautious"[4]. Their voices were amplified and made it so that the JCO accident seemed unsafe.
3. The mainstream media began to report on the issue, giving reports that gave the impression that the accident was much more severe than it actually was. [4]
4. The general public began to avoid the products from the region even when they started to be sold as they were under the impression that the accident was a severe one where large amounts of radiation leaked from the operation center. In a survey conducted after the accident, 77% of those surveyed thought that the accident involved a "massive radiation leak" [4].

5 The Great East Japan Earthquake

The 2011 Great East Japan Earthquake occurred on March 11, 2011 at 14:46 JST. It was a magnitude of 9.0, the largest ever recorded in Japan. Nearly 20,000 people lost their lives, 2,600 still reported as missing, and over 6,000 people injured. Over 470,000 people were evacuated from their homes [8]. The earthquake and tsunami caused substantial and severe structural damage to communities throughout northeastern Japan (Tohoku Region), including significant damage to roads, railways, and airports as well as the loss of electricity, gas, and water in several residences. As of June 2011, the direct financial damage was estimated to be around 16.9 trillion yen (US$154 billion), with damages to buildings totaling 10.4 trillion yen, lifeline utilities costing 1.3 trillion yen, social infrastructure costing 2.2 trillion yen, and other areas costing 3.0 trillion yen [8].
Additionally, the tsunami activated the nuclear disaster at the Fukushima Daiichi Nuclear Power Plant. The government established evacuation zones to protect communities in the vicinity of the power plant, which led to almost 110,000 people leaving their homes [8].
On April 17th 2011, the "Roadmap toward Restoration from the Accident at Fukushima Daiichi Nuclear Power Station" (hereinafter referred to as the "Roadmap") was established in order to systematically promote the restoration from the accident. The basic concept of the Roadmap is "to establish stable cooling of the nuclear reactors and spent fuel pools and control the release of radioactive materials so that evacuees can return to their homes and the public can live in peace" [9]. Step 1 (radiation levels should be steadily decreasing) and Step 2 (release of radioactive materials should be under control and radiation levels should be significantly reduced) were set as targets for the period of three to six months after the completion of Step 1. Subsequently, on July 19, the Nuclear Emergency Response Headquarters confirmed the completion of Step 1 and the transition to Step 2, since the radiation levels indicated by monitoring posts, etc. were decreasing and the amount of radioactive materials released had decreased sufficiently compared to the initial accident level. In addition, at the Nuclear Emergency Response Headquarters on December 16, it was confirmed that Step 2 had been completed because the reactor had reached a cold shutdown state and the radiation dose at the site boundary remained sufficiently low even in the event of an unforeseen situation.

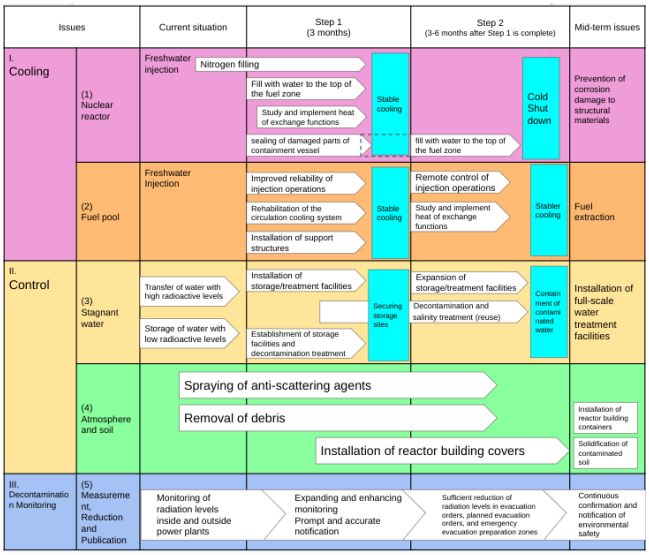

Figure 1:Roadmap toward Restoration from the Accident at Fukushima Daiichi Nuclear Power Station

5.1 What happened on the day of the Great East Japan Earthquake?

The tsunami waves of the Great East Japan Earthquake damaged the Fukushima Daiichi Nuclear Power Plant, which led to the release of radiation into the air and ocean.
Below is the chronological order in which the ALPS-treated water was created [10]:

1. Due to the earthquake, power is cut down from the national electricity grid (backup diesel generators start up- continue circulating cooler water in the nuclear reactors)
2. A 14-metre tsunami floods the entire Fukushima facility, and diesel generators are shut down
3. Temperatures rise within nuclear reactors
4. Water levels in the nuclear reactors fall so low that the top of the nuclear rods are fully exposed to air
5. A molten slag heap of highly radioactive metal pools at the bottom of the reactor vessel
6. Workers pumped fresh seawater into the reactors to cool the rods, which created contaminated water
7. Radioactive materials other than tritium have been removed to below regulatory standards using ALPS (Advanced Liquid Processing System) to create ALPS-treated water
8. Water is purified enough to meet regulatory standards for environmental releases

5.2 Overview of the reputational damage in Fukushima

If we apply the mechanism for reputational damage to the Fukushima nuclear disaster, it would go along these lines:

1. Although the levels of radiation were tested to meet the safety standards, many distributors pulled products from Fukushima because they feared that consumers would avoid them and their commercial value would plummet [11]. This led to a significant drop in their wholesale prices, with one example being the beef industry in the region. For one farmer, even after they were able to test that their products were safe, the beef was only sold at a third of their pre-disaster value and only 2 or 3 of the original 30 distributors continued to do business with them [12].
2. After they started to start selling their products again, local governments started to act. For example, the city of Fukushima decided to test all of the products to show the public that their products were safe [13].
3. The media had widespread coverage on the disaster and its subsequent effects on the local industries, putting emphasis on the destruction that occurred because of the earthquake and the danger of radiation in some of the areas. This led to more widespread concern for the safety of the products.
4. Many started actively avoiding the products from Fukushima, with 19.4% of consumers stating they do so in a survey by the Japanese Consumer Affairs Agency in 2013 [14].

Regarding the reputational damage Fuksuhima faced, the government has made various efforts to dispel rumors. In Fukushima Prefecture, various departments within the prefectural government in charge of primary industry, tourism, Orihara, education, and other areas are working to dispel rumors in their respective fields [15]. In 2017, the government announced the "Strategy for Dispelling Rumors and Strengthening Risk Communication" policy to disseminate information across ministries and agencies. and has also promoted projects to communicate information across government ministries and agencies. This includes spreading correct information through objective information transmission, using many types of media, and concise expression [16].
In an effort to promote the safety of Fukushima Prefecture's agricultural, forestry, and fishery products, which have been verified through inspections, throughout Japan and around the world, Fukushima Prefecture is working to restore and expand sales channels for its agricultural, forestry, and fishery products [17].
One of these efforts is the holding of fairs and other events and the strengthening of face-to-face sales. The governor of Fukushima Prefecture has been promoting the safety of agricultural, forestry, and fishery products produced in Fukushima Prefecture, mainly in the Tokyo metropolitan area. The Fukushima Prefecture-sponsored "Fukushima Grand Exchange Festa" has grown into a major event, with approximately 100 organizations from the prefecture exhibiting.
Furthermore, Fukushima Prefecture is implementing various measures under the slogan "Fukushima Pride" to promote the high quality of Fukushima Prefecture's products throughout the country. In 2017, the prefecture launched the "Fukushima

Pride Experience Campaign," a campaign that allows people to buy seasonal products from Fukushima online, in collaboration with Amazon, Rakuten Ichiba, Yahoo! Shopping, and other e-commerce sites. As of March 22, 2018, total sales for the same year exceeded 1.5 billion yen.

In order to objectively prove safety and gain consumer trust, Fukushima Prefecture is also focusing on obtaining certification at production sites. The first of these is the spread of initiatives to ensure food safety, known as Good Agricultural Practices (GAP), and the acquisition of GAP certification, which certifies that these initiatives are in place. Fukushima Prefecture has established "FGAP (Fukushima Prefecture GAP)" as the prefecture's own officially certified GAP in compliance with the guidelines of the Ministry of Agriculture, Forestry and Fisheries. In addition to the mandatory items stipulated by the government, the FGAP is characterized by the inclusion of an item for measures against radioactive substances. The GAP covers a wide range of products, including rice, wheat, soybeans, buckwheat, vegetables, fruit trees, and mushrooms.

5.3 The aftermath of the Great East Japan Earthquake: from the perspective of the Fukushima Fishery Association

The earthquake left the entire country in shock. Buildings were destroyed, transportation systems were in shambles, and countless were hurt or missing. Thanks to the subsequent nuclear disaster in Fukushima, the prefecture was under harsh restrictions. In this paper, we look more specifically at the restrictions and their effects on the fishing industry.

During the 2011 Great East Japan Earthquake, the fishing ports in the area were not only warned against going to but were unable to sell any of their products for “one year and three months”. During this time, there were restrictions on up to 44 different species of fish. The business resumed in June 2012, after fifteen months of inactivity.

Even during this break, the Fukushima Fishery Association said that “everyone's tables and supermarkets were still stocked with seafood”. According to them, “even if fish were unavailable from Fukushima Prefecture, fish from other prefectures would still be on the shelves”. Before the earthquake, Fukushima was able to produce approximately 200 kinds of fish. However, none of these were unique to Fukushima and could be caught in other prefectures. For example, if you went to the market looking for olive flounders, there would be some from Ibaraki, Fukushima, Hokkaido, and so on. Thus, when Fukushima’s fishing industry finished their hiatus, it was extremely difficult for them to convince stores to sell their products.

Currently, Fukushima’s *nori* (dried seaweed) is only sold within the region. Yet, they had strong businesses with other prefectures before the disaster and would sell *nori* for them to sell along with the products from other prefectures. When they went to the prefecture in 2017 and informed them that they had resumed sales. They were turned down and asked, “Why do you need to mix Fukushima's seaweed with ours?” After the nuclear disaster in Fukushima, the industry’s product mass has only returned to about 20% of the pre-disaster level. Although the Fishery Association does not attribute this entirely to reputational damage, they have stated that “many people still believe that the produce from Fukushima is dangerous and thus refrain from buying it”. Still, they made it clear that this was not the fault of the consumers. Unless they receive accurate information on and understand how the water’s radiation, the ALPS-treated water issue, and the Fukushima disaster, it is very hard for them to trust Fukushima’s fisheries. The association has already presented data, such as inspection results, to show that their products are safe. Whether the consumers choose to believe that data or not is solely up to them.

5.4 The aftermath of the Great East Japan Earthquake: from the perspective of antenna shops

Antenna shops, which is a term coined in Japan, are shops operated by either regional governments or corporations that only sell products from a certain region. They play a crucial role in the revitalization of rural areas in Japan, with many prefectures advertising their area’s specialty products in them. We interviewed the vice store manager of an antenna shop that exclusively sells products from Fukushima. He told us about the reputational damage that happened due to the 2011 Great East Japan, what Fukushima prefecture and this shop are doing to reduce this damage, and the estimated effects of the release of the ALPS treated water.

Fukushima’s antenna shop has held events to promote the safety of fish from Fukushima, such as a fishery fair, where they invited chefs to cook using fish from the region. This event was a success and prompted the shop to start regularly selling fishery products. However, when talking about the sustainability of such events, he said that “it would be difficult for such events to take root if they are held only once and that is the end of the project.”

When we asked whether they planned similar events for the future, he said that there weren’t any that they had planned already, citing their “limited ability to attract customers”. He said that, rather, “if we held it at a famous department store in Tokyo or at a big shopping mall, for example, we would be able to attract many more customers than we can at our place, so it has the advantage of appealing to many more people.” Therefore, while these events are effective when held on their own, the government should perhaps consider periodic ones held at larger scales in order to attract more people and counteract their remaining negative reputation.

He said that the store has not felt any reputational damage from the earthquake as they opened after it happened. However, they did mention that “if this store had opened before the earthquake, there would be damage if you

compare before and after the earthquake". He also made clear that, while not ideal, the release of the ALPS-treated water would probably lead to people shying away from Fukushima-made products, especially the fishery industry. Here, he said that "it should be the position of the national and prefectural governments to provide a thorough explanation of this."

6 ALPS-treated water

In April 2021, Japan announced the basic policy for handling the treated water (mostly referred to in this paper as the ALPS-treated water) that is stored in the Fukushima Daiichi Nuclear Power Station [18]. The government is set to discharge the water into the seas surrounding the Fukushima area, in accordance with domestic regulations. In an effort to implement their plans with safety and transparency, the Japanese authorities sought assistance from the International Atomic Energy Agency (IAEA) to monitor and review actions related to the ALPS-treated water [18].

6.1 Properties of ALPS-treated water

ALPS-treated water is water that went through the Advanced Liquid Processing System, a system that treats the contaminated water. The contaminated water is purified in two steps. First, strontium and cesium are removed from the water. Then, it goes through the purification system called ALPS (Advanced Liquid Processing System), removing most of the radionuclides with tritium being the exception [19]. All radionuclides aside from tritium are purified to the level of global standards. However, most of the water in the tank has not caught up to the stage of ALPS and remains water without after the first step.

6.2 Definition of Tritium

ALPS treated water contains a radioactive substance called "tritium" that cannot be removed by purification equipment [20].
Tritium is a radioactive isotope of hydrogen that, unlike normal hydrogen, has two neutrons, one electron, and one proton in its atomic nucleus. Regular hydrogen consists of one electron and one proton. These two extra neutrons make the tritium unstable and cause it to emit beta radiation, a type of ionising radiation. Its radioactive half-life is 12.3 years [19].

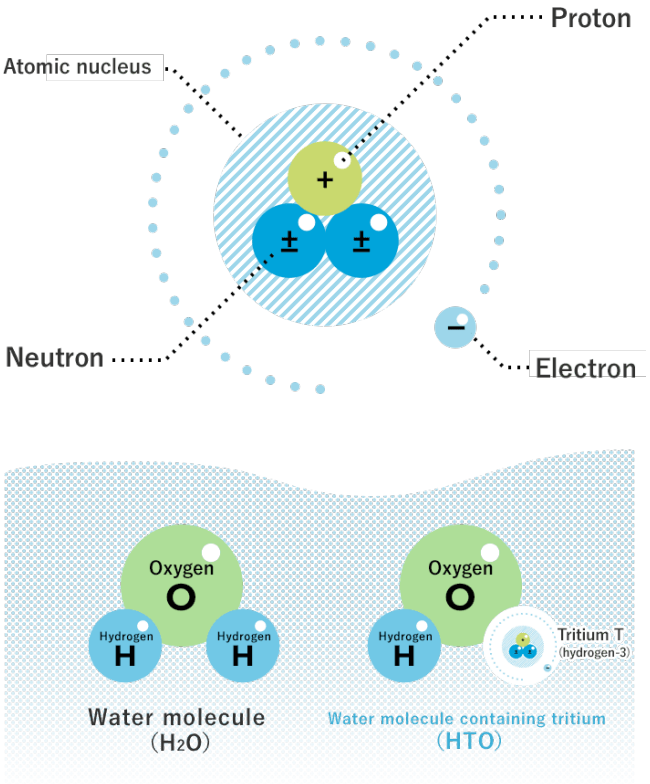

Figure 2: Composition of Tritium

Ionising radiation is defined as the following by the Australian Radiation Protection and Nuclear Safety Agency:

> Radiation that produces ionisation in matter. Examples are alpha particles, gamma rays, x-rays and neutrons. When these radiations pass through the tissues of the body, they have sufficient energy to damage DNA [21].

Beta radiation holds the least energy out of the three ionising radiations– alpha, beta, and gamma radiation. Beta radiation is emitted when one of the neutrons loses an electron, turning it into a proton. The emitted electron is the beta radiation. During this process, the tritium decays into helium-3 [22].

6.3 Why is the discharge of the ALPS treated water needed?

The water used to cool fueling debris is purified to a certain extent and contained in the tank at Fukushima Daiichi Nuclear Power Station (FDNPS). The current storage tanks are calculated to reach full capacity after the summer of 2022. Since all tanks must be removed once the decommissioning is over, the discharging cannot be postponed [19].

Status of water in tanks at FDNPS (As of October, 2021)	
Tank storage volume	1.28 million ㎥
Tank capacity (end of 2020)	1.37million ㎥
Increase of treated water	50,000 to 60,000 ㎥/year
Amount of Tritium	About 780TBq (15g)

Figure 3:Status of water in tanks at FDNPS

6.4 Why was Discharge into the sea selected as the method of disposal?

There were two options regarding the ALPS treated water: "vapour release" and "discharge into the sea". The latter was decided considering the monitoring methods and facilities available to help discharge the water. Finally, its decision was approved by the IAEA as "based on a sound scientific and technical basis of analysis" [23, 24].

6.5 Is ALPS-treated water harmful?

In making our decision, we decided to compare the amount of tritium in the ALPS treated water to the global standards established by the World Health Organisation (WHO) and IAEA.

According to the Japanese national standard set by the IAEA, the maximum concentrations allowed for 8.51 x 109 Bq/t of tritium. The concentration of the ALPS-treated water is 1,500Bq/L. This is a mere 2.5% of the regulatory standard (60,000Bq/L) and 14% of the WHO drinking water guideline level (10,000 Bq/L) [25].

Based on the statistics, it is safe to conclude that the water released into the ocean via this plan will have no major effect, if any, on the quality of water and its surrounding ecosystem.

7 Government efforts regarding harm reduction

In the aftermath of the 2011 Great East earthquake, the fisheries of Fukushima suffered greatly and as of 2020, the amount of fish sold from coastal and offshore trawl fisheries were only 17% of what it was before the disaster [26]. Subsequently, people within the fisheries industries have expressed concerns about additional reputational damage.

To counter the expected reputational damage to Fukushima and its industries, the government is set to issue several subsidies and implement measures to cushion the worst of the blow. This includes extending the assistance for Project to Support the Reconstruction of the Fishing Industry. This project is one where, based on a recovery plan for the fishery industry formulated in the region, the program provides support for necessary expenses such as operation or production costs and material costs to fishery cooperatives, etc. that contribute to the establishment of a stable marine product production system that responds to the post-disaster environment. They do so by introducing new energy-saving high-performance fishing boats in the fishery industry, or through joint efforts in the industry. The government will also provide a full-scale reconstruction and promotion of the area to increase visitors, settlers, and the sales of agricultural products.

If severe reputational damage arises and affects the fishery, tourism, commerce, and manufacturing industries in Fukushima and the other neighbouring prefectures, the government will provide support in developing and cultivating both local and overseas sales channels in major areas of consumption and in implementing initiatives to attract more tourists, in order to minimise the impacts.

The government also took steps in educating the youth on the topic. One example of such an effort was the distribution of fliers in schools detailing the government's plan and the safety of the ALPS-treated water.

7.1 Public hearing for retail and distribution staff

The government implemented a public hearing for retail and distribution staff at the Agency of Natural Resources and Energy in order to ensure the transactions followed proper guidelines. Some of the voices from retail and distribution staff include "It is important to make sure that the retail and distribution staff can explain the safety of their products to clients ahead of time." Based on the results of the hearing, the government will make sure to continue the investigation in order to realise the scale of reputational damage.

7.2 Inviting influencers to visit the Fukushima Daiichi nuclear power plant to promote information

In order to raise awareness about the upcoming release of the ALPS treated water, the Secretariat of the Team for Decommissioning, Contaminated Water and Treated Water invited influencers to visit the Fukushima Daiichi nuclear power plant to promote information on the upcoming release of the ALPS treated water. Invited guests included the Japanese representative of the 2022 Miss International Beauty Pageant in Saga, members of the Global Shapers

Community launched by the World Economic Forum, and more.
Government aims to spread the right understanding of decommissioning a nuclear reactor through these influencers.

7.3 Government fliers on the release of ALPS-treated water

In response to the widespread opposition, the Japanese Ministry of Economy, Trade and Industry handed out fliers to Japanese elementary and middle schools. About 2.3 million copies have been distributed since December 2021, along with supplementary radiation books that the Ministry of Education, Culture, Sports, Science and Technology distributes every year to first-year elementary, middle and high school students nationwide [27]. However, this was met with severe criticism and backlash. According to school boards of Iwate, Miyagi, and Fukushima (the three prefectures that were hit heavily by the Great East Japan Earthquake), many schools have stopped distributing these fliers to pupils, and some have even collected previously delivered fliers. Out of the twelve coastal municipalities in Iwate Prefecture, only an elementary school and junior high school in the Fudai village have distributed the fliers. A representative from the village board of education stated, "We left the handling up to each school" [27]. Five cities, towns and villages have taken measures such as keeping the materials in schools. Only a few schools in other cities and towns have distributed them, and some boards of education have instructed schools to keep them. It was distributed in at least 16 municipalities in Miyagi Prefecture. The Shichigahama Board of Education has taken steps to collect the handouts it has distributed, seeing them as "remarkably lacking in consideration for the many fishermen and local governments who oppose the discharge into the sea" [27]. A principal of an elementary school in a coastal area emphasized, "The writing makes people think that the treated water is absolutely safe. It's like deceiving an innocent child" [27].

8 Aftermath of the government's decision to release ALPS treated water

In April 2021, the Japanese Ministry of Economy, Trade, and Industry announced to the public that the Council of Ministers decided to release ALPS-treated water into the ocean. According to the Fukushima Fishery Association, several brokers stopped doing business with them "without a word" after the news spread.
The negative impacts of the ALPS-treated water are already visible years before its release. Brokers even cut off Fukushima's fishery industry before the water was even released. Although there is no telling what might happen between the time this paper is being written and the treated water is released, it would be naive to say Fukushima would remain unchanged.

8.1 Public reaction to the government's decision

The public was, for the most part, against the plan. According to a survey by the Asahi Shimbun, only 32% of people were for the release of the water, whereas 55% were against it. This opposition was there regardless of political standing, although there was less of it. According to the same survey, 39% of people for the Japanese cabinet at the time were for the release, and 50% were against it. People for the Japanese Liberal Democratic Party had less of a difference, with 47% of people being against it, only 41% of people were for it as well [28].

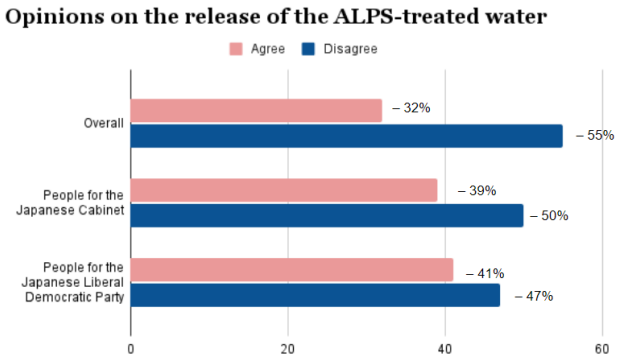

Figure 4: Opinions on the release of the ALPS-treated water

9 Independent Survey and Quiz

We conducted a survey in which participants were asked to solve a short quiz of 8 questions (see Appendix) testing their knowledge on ALPS-treated water, and to answer before and after taking the quiz whether they would buy food produced in Fukushima. We received responses from 150 people from six schools.
The aim of this survey was to test high school students' knowledge on ALPS-treated water, and see whether their opinion regarding Fukushima's reputation changed after taking the quiz. We believe such measures as this can help reduce reputational damage when the treated water is released.

9.1 Results of the Survey

Before taking the quiz

1. Do you know what "ALPS-treated water" is?

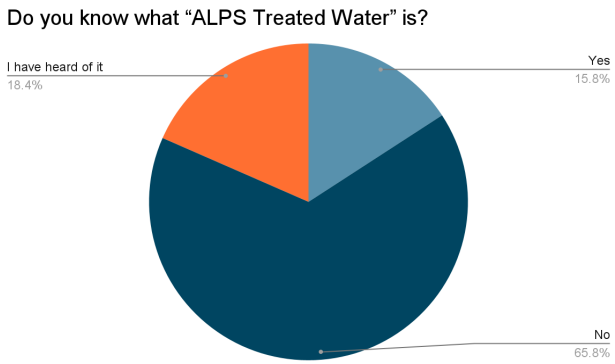

Figure 5:Do you know what ALPS-treated water is? (Light blue- yes, blue- no, orange- I have heard of it)

2. Would you rather buy peaches from Fukushima or Nagano?

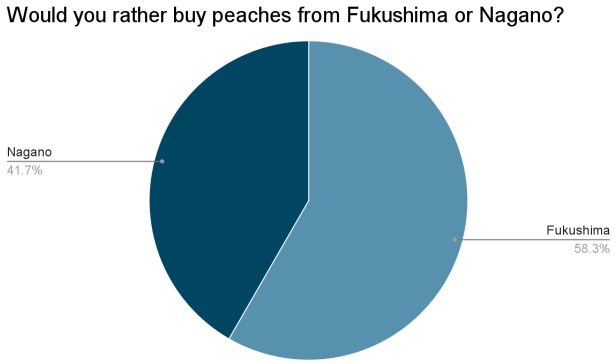

Figure 6: Would you rather buy peaches from Fukushima or Nagano? (Blue- Nagano, Light Blue- Fukushima)

More than half of the respondents preferred peaches from Fukushima over Nagano. Some reasons included “I often see news on TV about the reconstruction of Fukushima, so I want to support the farmers in Fukushima as much as possible,” and “I want to support disaster areas.” On the other hand, people who voted for Nagano stated they were concerned about the risk of radiation, and believed the former had a more hygienic image compared to Fukushima.

After taking the quiz

1. Would you buy food produced in Fukushima?

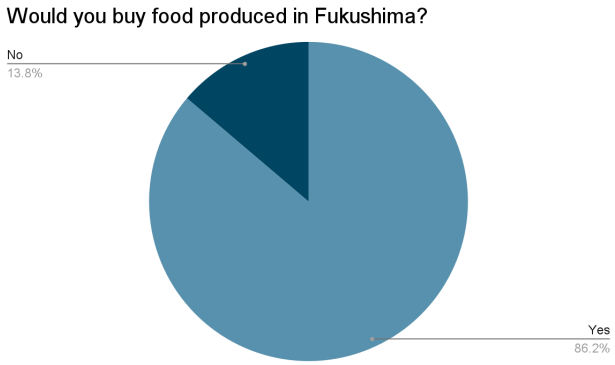

Figure 7: Would you buy food produced in Fukushima? (Light blue- yes, blue- no)

After taking the quiz, nearly 86% of respondents said they would buy food produced in Fukushima, compared to the initial 58%.

Comparison of the results of the survey before and after the quiz

9.2 Results of the Quiz

1. The government announced in 2021 that the ALPS-treated water will be released. What is the reason for this?
    a. Because it is essential for the decommissioning of the Fukushima Daiichi Nuclear Power Plant
    b. Because the treated water won't fit in the tanks.
    c. Because there is not enough land to place more tanks.
    d. All of the above

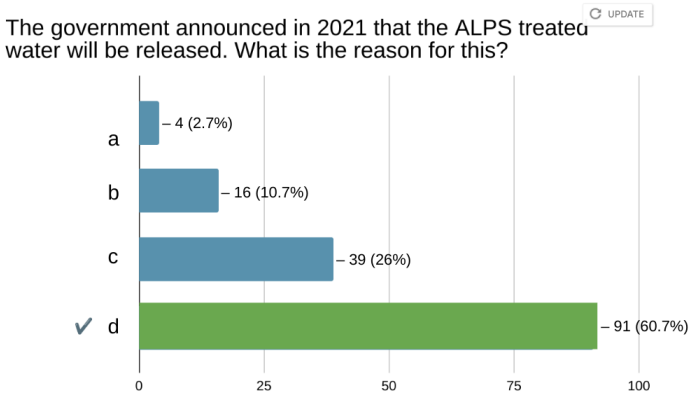

Figure 8: The government announced in 2021 that the ALPS treated water will be released. What is the reason for this?

2. There are arguments both for and against the release of the ALPS-treated water. Why do many fishermen oppose this?
    a. Damage to human body due to the released water
    b. Damage to the environment due to the released water
    c. Reputational damage to the Fukushima’s water being “contaminated” following the release

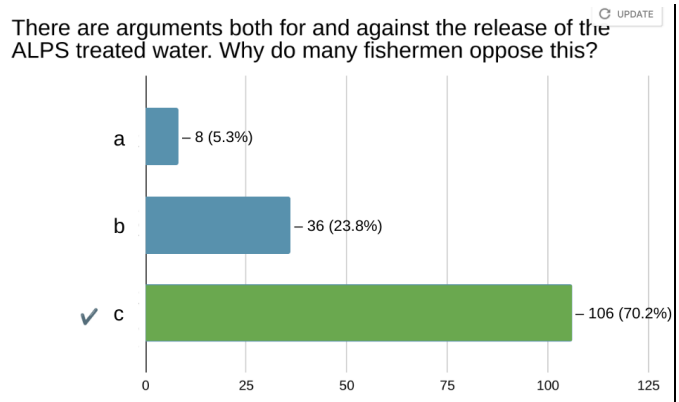

Figure 9: There are arguments both for and against the release of the ALPS-treated water. Why do many fishermen oppose this?

3. When will the ALPS-treated water be released?
    a. It has already been released
    b. 2023
    c. 2026
    d. 2030

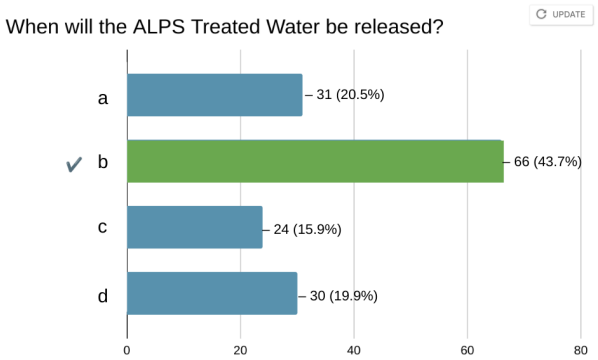

Figure 10: When will the ALPS-treated water be released?

4. What is the ratio of liquid discharges of 6. in Japan (Fukushima Daiichi Nuclear Power Plant) and France (La Hague Reprocessing Plant)?
    a. 5:1
    b. 1:5
    c. 1:500
    d. 1:50

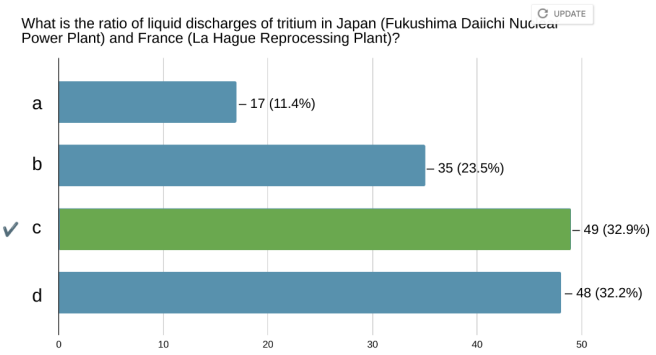

Figure 11: What is the ratio of liquid discharges of 6. in Japan (Fukushima Daiichi Nuclear Power Plant) and France (La Hague Reprocessing Plant)?

9.3 Analysis of the Results

Many of the respondents first answered through the opinion poll that while it had been more than 10 years since the accident, they were still afraid to buy products from Fukushima.

The quiz tested respondents on their knowledge of ALPS-treated water in various aspects, from the root cause of its controversy to comparisons between nuclear power plants in different countries. This allowed respondents to gain knowledge regarding the release of the treated water. There were some questions that more than half of the respondents answered correctly, such as the abbreviation of ALPS, and the government's reasoning behind the release of the treated water in 2023. On the other hand, many failed to answer questions related to the severity of the issue, such as the comparison of tritium levels to other nuclear power plants. This is mainly because the incident in 2011 led many to believe the situation was more severe in Japan compared to other countries. For example, when asked in the first opinion poll whether respondents would buy the peaches from Fukushima or Nagano, those who answered the latter had reasoning such as how they were afraid of the risks of radiation. Furthermore, due to media exposure Japan has faced much scrutiny globally regarding how they are handling the contaminated water. Through this quiz, respondents were able to gain knowledge and insight on Japan's situation regarding ALPS-treated water.

We can infer that nearly 25% of the respondents changed their opinion after taking the quiz because they were able to learn factual data such as the safety of the treated water, rather than a biased perspective through the media scrutiny Fukushima faced after the Great East Japan Earthquake. Therefore, we believe such quizzes as this in which information is spread can help prevent reputational damage.

10 Conclusion

Through this paper, we explained two proposals.

1. We were able to propose that the ALPS treated water set to be released in 2023 will not affect the safety of the local fishery.
2. We proposed that, due to the nature of the reputational damage that will most likely happen because of this release, we should make sure to get as much accurate information out there as possible. In this research, we carried out a survey regarding consumers' awareness of the issue and whether accurate information would change the way they think about products from the affected regions.

Although our method (most notably our survey and quiz) can potentially change the way consumers think about the issue, they are not the only part of the equation that matters. As we mentioned multiple times in our paper, the way actors such as retailers and government officials act also play a significant role in both the causation and prevention of

reputational damage. Therefore, in addition to getting accurate information to consumers, it should also be the responsibility of the government to both explain the safety to the retailers and increase the accessibility and recognition of the information that they've released regarding the ALPS treated water.

We understand that this is no easy task. According to surveys the Fukushima Fishery Association has conducted on a few countries, in every instance regardless of time or place, 10-20% of the respondents have answered , “I will never buy [Fukushima products]”. That is not something that we can change because these people are rigid in their beliefs. However, it is still possible for us to gain support from those who are still on the fence about the issue and the best way would be to garner trust and supply them with information.

As we can observe from the case of fliers, the public will react negatively if they think the issue is not handled sensitively or that the government isn’t being honest about the issue. As the date for its release draws closer, we hope that the government, the retailers, and other organisations learn from their mistakes and continue on with transparency. The public has both the right and the responsibility to know about the issue and share that information so regions like Fukushima can get over the tragedies of the past.

We hope that our paper will be able to serve as a basis for the prevention of reputational damage in not only Fukushima but also in other regions that may face similar issues in the future.

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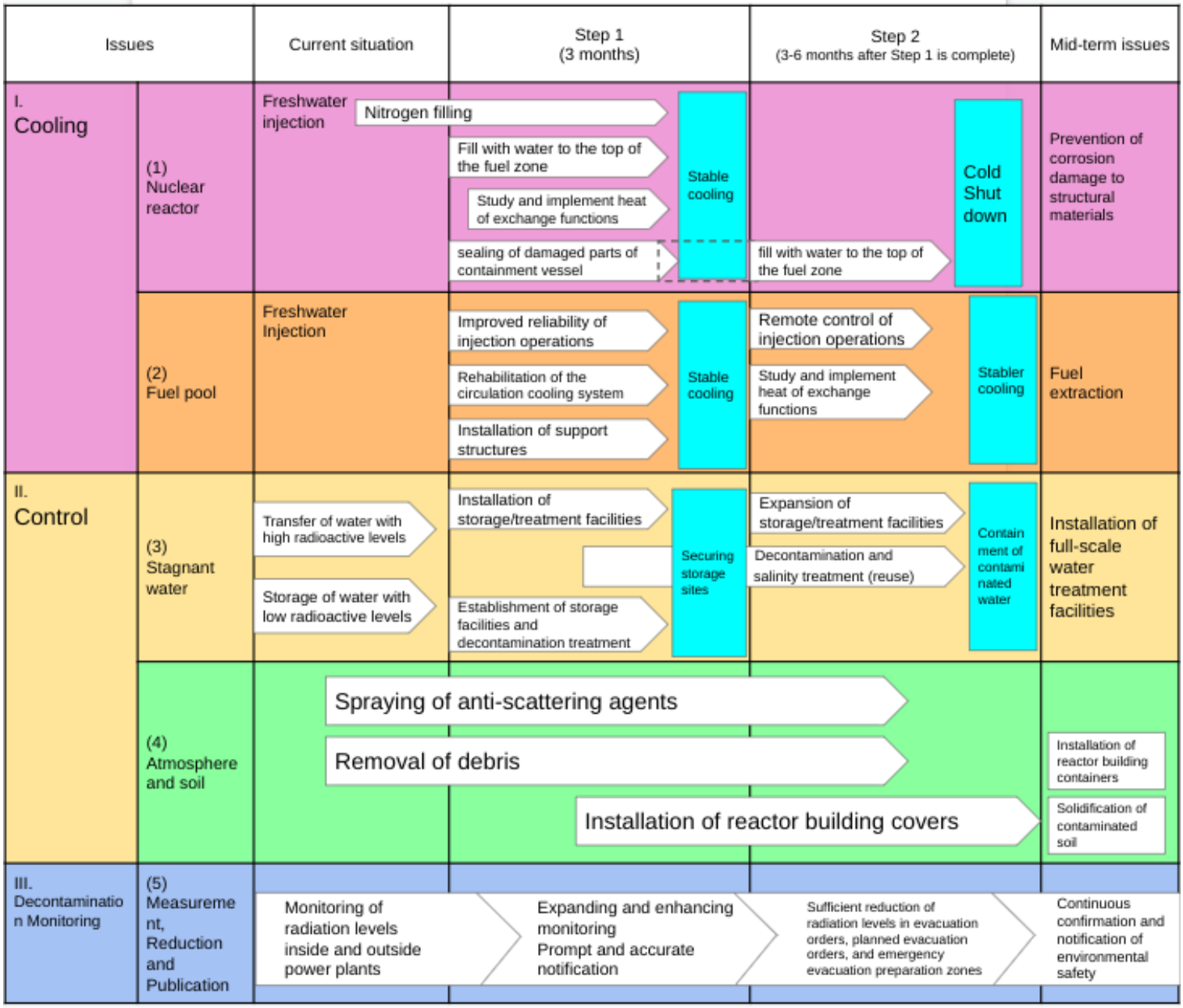
Issues
Current situation
Step 1
(3 months)
Step 2
(3-6 months after Step 1 is complete)
Mid-term issues
I.
Cooling
(1)
Nuclear reactor
Freshwater injection
Nitrogen filling
Fill with water to the top of the fuel zone
Study and implement heat of exchange functions
sealing of damaged parts of containment vessel
Stable cooling
fill with water to the top of the fuel zone
Cold Shut down
Prevention of corrosion damage to structural materials
(2)
Fuel pool
Freshwater Injection
Improved reliability of injection operations
Rehabilitation of the circulation cooling system
Installation of support structures
Stable cooling
Remote control of injection operations
Study and implement heat of exchange functions
Stabler cooling
Fuel extraction
II.
Control
(3)
Stagnant water
Transfer of water with high radioactive levels
Storage of water with low radioactive levels
Installation of storage/treatment facilities
Establishment of storage facilities and decontamination treatment
Securing storage sites
Expansion of storage/treatment facilities
Decontamination and salinity treatment (reuse)
Containment of contaminated water
Installation of full-scale water treatment facilities
(4)
Atmosphere and soil
Spraying of anti-scattering agents
Removal of debris
Installation of reactor building covers
Installation of reactor building containers
Solidification of contaminated soil
III.
Decontamination Monitoring
(5)
Measurement, Reduction and Publication
Monitoring of radiation levels inside and outside power plants
Expanding and enhancing monitoring
Prompt and accurate notification
Sufficient reduction of radiation levels in evacuation orders, planned evacuation orders, and emergency evacuation preparation zones
Continuous confirmation and notification of environmental safety