

The Role of International Atomic Energy Agency (IAEA) in Japan's Fukushima Treated Water Release Policy

Alena Alenka*, Deasy Silvya Sari, Darmansjah Djumala

Universitas Padjadjaran, Indonesia

Email: alena23002@mail.unpad.ac.id*, deasy.silvya@unpad.ac.id,

darmansyah.djumala@unpad.ac.id

ABSTRACT

Japan's policy of releasing treated water from the Fukushima Daiichi Nuclear Power Plant has sparked a global debate over its environmental safety and legitimacy. This issue is not only about the technical aspects of radioactive waste management but also reflects the dynamics of the relationship between science, politics, and international belief. This study aims to analyze the role of the International Atomic Energy Agency (IAEA) in supervising and verifying Japanese policies through the framework of institutional neoliberalism and the classification of the role of international organizations according to Clive Archer. Using a qualitative approach based on an analysis of official documents, IAEA submissions, and related stakeholder responses, the study found that the IAEA plays a role in three main categories: as an instrument, Japan uses the IAEA to gain scientific legitimacy; as an arena, this organization becomes a space for diplomacy between international actors and the exchange of technical information; and as an actor, the IAEA demonstrates autonomous capacity through the establishment of scientific safety standards and the production of global legitimacy. Although the IAEA report guarantees the safety of the Fukushima wastewater release, the responses of China, South Korea, and Pacific nations reflect a disconnect between scientific and moral legitimacy. Thus, this study confirms that the success of international organizations such as the IAEA depends on their ability to build cross-border trust and sensitivity to global values.

KEYWORDS

Fukushima, IAEA, treated water release



This work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International

INTRODUCTION

The natural disaster that hit Japan on March 11, 2011, was one of the most tragic events in modern history, especially in the context of the use of nuclear energy. An earthquake measuring 9.0 on the Richter scale that occurred off the northeast coast of Japan triggered tsunami waves nearly 15 meters high (Mustaqim, 2023; Reuters, 2023). The combination of these two natural disasters caused severe damage to infrastructure, claimed an estimated 20,500 lives, and triggered a nuclear crisis at the Fukushima Daiichi Nuclear Power Plant (NPP). In this case, three of the six reactors in the nuclear power plant complex suffered severe damage, including a core meltdown, resulting in the leakage of radioactive substances into the surrounding environment.

As an emergency response, Tokyo Electric Power Company (TEPCO), as the operator of the Fukushima nuclear power plant, made efforts to cool the reactor by pumping seawater into the damaged reactor. Although this step was successful in preventing further damage, the consequence was the formation of large volumes of water contaminated with radioactive material. This water cannot be discharged directly into the environment because it contains harmful isotopes such as tritium, strontium-90, and cesium-137 (Giwa et al., 2025). Therefore, TEPCO developed an advanced processing system known as the Advanced Liquid Processing System (ALPS) to filter most of the radioactive substances from the wastewater (Okaiyeto et al., 2024).

ALPS is able to reduce the concentration of most radionuclides to below the threshold set by international safety standards (Kanagawa et al., 2022). However, these systems cannot effectively remove tritium due to its chemical properties that resemble regular water (Park & Ulus, 2024). Treated water containing low levels of tritium is considered safe to be released into the environment according to *International Atomic Energy Agency (IAEA)* standards (Sartayev & Hayashida, 2025). Over time, the treated water from the ALPS process has continued to accumulate, and for more than a decade post-disaster, about 1.3 million tons of water have been stored in more than 1,000 tanks in the nuclear power plant area, particularly in Okuma and Futaba Cities, Fukushima Prefecture (Khadka, 2023; Lu et al., 2021; Matsunaga et al., 2025; O'Neill & Scott, 2023; D. Wang et al., 2024; R. Wang, 2025).

This treated water storage capacity was expected to reach the maximum limit in 2022 (Buessler, 2020; Chung, 2023; Normile, 2021), creating urgency for the Government of Japan and TEPCO to find a sustainable long-term solution. After various technical studies and consultations with stakeholders, in April 2021, the Government of Japan announced plans to release the treated water into the Pacific Ocean in stages (*IAEA*, n.d.; Liu et al., 2025). This release process was scheduled to begin in August 2023 and will last for decades, with close monitoring and periodic testing to ensure that the concentration of radioactive substances remains within safe limits (Mabon & Kawabe, 2022; Maderich et al., 2024).

This policy received mixed reactions from the domestic and international communities. In Japan, most concerns come from coastal and fishing communities that depend on marine products for their livelihoods (ICSF, n.d.; Mada, 2023; Masayuki, 2017). A survey conducted by the *Asahi Shimbun* showed that about 41% of Japanese people reject this treated water release policy (Qi et al., 2022; Toshio, 2023). The rejection is based on concerns about the impact on the reputation of Japanese marine products in domestic and international markets, as well as potential economic losses for the fisheries sector. Additionally, there are concerns about a decline in public trust in nuclear waste management by the government and nuclear power plant operators (Nakamura et al., 2024; Ng et al., 2022).

At the international level, neighboring countries such as China, South Korea, and some Pacific region countries have voiced similar concerns. They question the transparency of wastewater treatment processes and the potential long-term impacts on marine ecosystems and human health (Greenpeace International, 2021; PEV, 2023; Yamaguchi, 2023). Some countries have lodged diplomatic protests and considered restrictions on importing fishery products from Japan (Liang et al., 2024; Ren et al., 2025). This reaction shows that the release of Fukushima's treated water is not only a technical issue but also a social, economic, and geopolitical one.

To address these concerns and strengthen the scientific legitimacy of the policies, the Government of Japan involved the *IAEA* in the monitoring and verification process (*IAEA*, 2021a, 2021b, 2023). The *IAEA* is mandated to monitor all stages of the release of treated water, from the decontamination process and water quality testing to the method of discharge into the sea. *IAEA's* involvement aims to ensure that all procedures comply with international safety standards and that the information submitted to the public is transparent and independently verifiable (Das, 2022; Sartayev & Hayashida, 2025).

The role of the *IAEA* in this context has become very important, not only as a technical institution but also as a diplomatic actor bridging Japan's interests with the international community. As an international institution with a reputation for nuclear supervision, the *IAEA*

is expected to mediate between Japan and the global community. Thus, the *IAEA's* role in overseeing Japan's release of Fukushima's treated water is highly relevant to research.

This study aims to: (1) analyze the multidimensional role of the *IAEA* in supervising Japan's Fukushima treated water release policy through the framework of institutional neoliberalism and Clive Archer's organizational role typology; (2) examine how the *IAEA* functions simultaneously as an instrument of state legitimacy, an arena for diplomatic negotiation, and an autonomous actor in global nuclear governance; and (3) evaluate the effectiveness of international organizations in bridging the gap between scientific safety standards and socio-political legitimacy in transnational environmental controversies.

The significance of this research is threefold: academically, it contributes to the theoretical understanding of international organizations' roles in managing technical-political disputes in the nuclear energy domain; practically, it provides insights for policymakers on mechanisms through which international institutions can facilitate cooperation in contentious environmental issues; and theoretically, it advances the discourse on institutional neoliberalism by showing how international organizations navigate between state interests and global normative expectations. By examining the *IAEA's* performance across multiple role dimensions, this study illuminates both the potentials and limitations of international institutions in addressing complex socio-technical challenges that transcend national boundaries.

RESEARCH METHOD

This study employed a qualitative research methodology with a descriptive analytical approach to examine the role of the International Atomic Energy Agency (*IAEA*) in overseeing Japan's Fukushima treated water release policy. Qualitative research was appropriate for this investigation as it allowed for an in-depth exploration of complex institutional dynamics, policy processes, and stakeholder interactions that characterized the *IAEA's* multifaceted involvement in the Fukushima issue (Lamont, 2015). The descriptive nature of this study facilitated comprehensive documentation and interpretation of the *IAEA's* functions as an instrument, arena, and actor within the institutional neoliberalism framework.

Data collection for this research utilized two primary techniques as identified by Lamont (2015): archival or document-based research and internet-based research. Archival research involved a systematic analysis of official documents including international agreements, policy statements, *IAEA* official reports and safety assessments, Japanese government policy documents, diplomatic correspondence, and media reports from reputable international news agencies. Internet-based research encompassed academic platforms such as JSTOR and Google Scholar for peer-reviewed literature, official websites of governmental agencies (Japanese Ministry of Economy, Trade and Industry; Ministry of Foreign Affairs of China and South Korea) and international organizations (*IAEA*, United Nations), and reports published by non-governmental organizations including Greenpeace International and Pacific Islands Forum. This multi-source data collection strategy ensured triangulation and comprehensive coverage of the research phenomenon.

The unit of analysis in this study was the role of the *IAEA* in supervising the release of Fukushima treated water, examined through three dimensions: instrumental function (tool for state legitimacy), arena function (platform for diplomatic interaction), and actor function

(autonomous institutional capacity). The level of analysis was positioned at the group level, following Mas'ood's analytical framework, which conceptualizes international relations as interactions between various groups and organizations across national boundaries. This analytical level was particularly appropriate for examining the IAEA as an international organization whose behavior and influence extended beyond individual state actions to encompass multilateral institutional dynamics, normative frameworks, and transnational epistemic communities. The group-level analysis enabled a systematic investigation of how organizational structures, institutional mandates, and collective decision-making processes shaped the IAEA's capacity to perform its oversight functions and mediate between competing state interests in the Fukushima controversy.

Data analysis followed a thematic analytical framework aligned with institutional neoliberalism theory and Clive Archer's (2001) organizational role typology. The analytical process involved: (1) systematic coding of collected documents to identify themes related to legitimacy-seeking behavior, diplomatic interactions, and institutional autonomy; (2) categorization of IAEA activities according to the three role dimensions (instrument, arena, actor); (3) comparative analysis of stakeholder responses (Japan, China, South Korea, Pacific nations) to assess the effectiveness of IAEA interventions; and (4) theoretical interpretation linking empirical findings to institutional neoliberalism's propositions regarding international cooperation, uncertainty reduction, and norm diffusion. Validity and reliability were ensured through source triangulation (comparing multiple document types), temporal consistency checking (examining longitudinal patterns from 2011-2025), and theoretical triangulation (applying multiple analytical frameworks to interpret findings).

RESULT AND DISCUSSION

Dynamics of Japan's Fukushima Treated Water Release

The earthquake and tsunami that struck northeastern Japan in 2011 has become one of the worst nuclear disasters in the modern world, opening a new chapter in the global debate on nuclear safety and environmental responsibility. In this case, the disaster has resulted in severe damage to three nuclear reactors of the Fukushima Daiichi Nuclear Power Plant (NPP), causing a massive leak of radioactive elements into the environment.

Tokyo Electric Power Company (TEPCO) as the operator of the nuclear power plant made efforts to stabilize the melted reactor to overcome further damage. In its efforts, TEPCO used pumping seawater in the decontamination process, which then produced large amounts of contaminated water and was stored in thousands of tanks using temporary storage facilities located in Okuma and Futaba Cities, Fukushima Prefecture (Matsunaga et al., 2025).



Figure 1. Map of temporary storage facilities (Matsunaga et al., 2025)

However, after more than a decade, the storage capacity finally reached a maximum limit of more than 1,000 tanks, with a volume of about 1.3 million tons (Khadka, 2023; Lu et al., 2021; O'Neill & Scott, 2023; D. Wang et al., 2024; R. Wang, 2025). Under these conditions, in April 2021, the Government of Japan announced a plan to release nuclear treated water that has been filtered using the Advanced Liquid Processing System (ALPS) into the Pacific Ocean (IAEA, n.d.; Liu et al., 2025). The system is claimed to be able to filter most of the hazardous materials in the waste – except for tritium which is difficult to separate because it is chemically identical to water (Kanagawa et al., 2022; Park & Ulus, 2024). According to the Ministry of Economy, Trade, and Industry (METI), the concentration of tritium in treated water is at a very low level, even well below the safe limits set by the World Health Organization (WHO) and the International Atomic Energy Agency (IAEA) (Kashiwaya et al., 2017; Khadka, 2023). The Japanese government also emphasized that this policy is the most realistic and safe option after passing the results of evaluation of several options over six years by experts (Conca, 2019; IAEA, 2020; MITI, 2023).

Reasons for selecting of Discharge into the sea

Options Considered	Consideration results
<p>Selected the safest and most risk-manageable method in accordance with IAEA safety standards.</p> <ul style="list-style-type: none"> The IAEA safety standards require ①safe disposal, and ②continuous monitoring of environmental impact and safety. Based on experts' assessment over 6 years, discharge into the sea was selected, because (1) it has a proven track record in domestic and overseas nuclear facilities and can ensure safe disposals, and (2) it is easiest to monitor and allows continued evaluation of any impact to the environment. It is not selected due to economic costs. Continued storage in tanks will hinder decommissioning work and the room for expansion is limited. In addition, there is a risk of leakage due to deterioration, etc. in long-term storage. 	
Discharge into the sea	It can be implemented more reliably because it has proven track record in domestic and overseas nuclear facilities, it is easy to forecast the diffusion behavior, and it is the easiest to monitor.
Geosphere injection	There is no monitoring technology to assess the environmental impacts, and there are no regulatory standards for suitable sites.
Vapor release	It is less reliable due to lack of track record and technical challenges in monitoring caused by difficulty in predicting the diffusion behavior.
Hydrogen release	Technologies such as pretreatment and scale expansion have not been established.
Underground burial (Solidification into concrete)	Moisture containing tritium evaporates during solidification, and since it must be managed as radioactive waste, it interferes with decommissioning.
Long-term storage	There is limited room for additional tanks to expand storage capacity on site. There are risks of Leakage due to tank deterioration, etc.
Off-site storage	There are risks of leakage due to tank deterioration, etc.

Figure 2. Comparison of Treated Water Disposal Methods

Source: Ministry of Economy, Trade, and Industry (2023)

Based on the figure, other methods such as geosphere injection, steam release, underground burial, and off-site confinement are considered less suitable because they have significant technical, regulatory, and environmental risks.

However, these claims were not immediately accepted by the international community. In this case, many people consider the policy not only to be a technical issue, but also to environmental ethics, international responsibility, and public trust in Japan's nuclear governance. In terms of domesticity itself, a survey conducted by the Asahi Shimbun shows that as many as 41% of Japanese people (Qi et al., 2022; Toshio, 2023), especially fishermen and coastal communities rejecting the policy, highlighting its impact on the reputation of Japan's marine products and their livelihoods (ICSF, n.d.; Mada, 2023; Masayuki, 2017).

In the international sphere, China has been the most vocal country against the policy. On April 13, 2021, China's Ministry of Foreign Affairs issued a statement that Japan's decision was a selfish and irresponsible act (Kurushina, 2023). In addition, China also assesses that Japan's move was carried out unilaterally without adequate consultation with surrounding countries (MFA, 2024). China then imposed a total import ban on Japanese marine products, as well as conducting a domestic media campaign that emphasized the potential impact of radiation on consumers (Guzman, 2023; Wong, 2023). Based on this, Japan will experience a loss of seafood exports of up to 43.8% in early 2024 (R. Wang, 2025). China's tough stance not only reflects environmental concerns, but also concerns the political dimension, where there is a struggle for moral legitimacy between Japan and China.

Meanwhile, South Korea also responded critically to this policy through protests, statements by local officials, and public opinion surveys.

Table 1. South Korea's Response to Fukushima's Treated Water Release Policy

Date	Parties Involved	Form of Action / Statement	Contents / Objectives	Source
April 2021	Activist & Student Groups	Demonstrations, banners, symbolic haircuts (in front of the Japanese Embassy, Seoul).	It rejected the dumping of nuclear waste into the sea and urged Japan to cancel the plan.	(Kyodo News, 2021; Teh, 2021; The Korean Times, 2021)
April 2021	Mayors & Governors of South Korea (Local Officials)	Official statement of stance and threat of boycott of Japanese products.	Declaring Japan's actions as "crimes against nature and man" and threatening people's lives.	(Cheong-moo, 2021)
August 2021	South Korean Society (Gallup Korea Survey)	The results of a public opinion survey.	78% of South Koreans oppose Japan's nuclear waste disposal plan.	(Gallup Korea, 2023)

Based on the table above, there are collective concerns at various levels of South Korean society about the potential ecological and social impacts, and affirm the importance of transparency and accountability in this policy.

On the other hand, several countries from the Pacific islands also strongly opposed Japan's policy. Through the Pacific Islands Forum (PIF), they emphasized that such a move could threaten the principles of environmental justice and regional solidarity (PIF, 2023). In this context, the ocean is considered not only a resource, but also part of the identity and sustainability of their people's lives (PEV, 2023).

Based on these dynamics, the Fukushima issue can include various dimensions such as cynicism, justice, trust, and global legitimacy. According to Hurd, international legitimacy is a form of power that depends on social acceptance of authority. In this context, Japan needs scientific legitimacy in implementing its domestic policy, while the international community demands more outward moral legitimacy. This is what then makes Japan's decision continue to be debated, even after it is declared safe.

Meanwhile, international environmental organizations such as Greenpeace also consider that the IAEA's analysis focuses too much on physical and chemical parameters, without considering the rights of local communities, especially fishermen, and contradicts Japan's obligation to take sides in the protection of marine ecosystems under the United Nations Convention on the Law of the Sea (UNCLOS) (Greenpeace International, 2021; Qi et al., 2022).

Nevertheless, Japan's steps are a rational effort that can sort out uncertainty through institutional cooperation and increase credibility on the global stage. In this context, organizations such as the IAEA are not only tasked with ensuring technical safety, but must also act as a mediator of legitimacy between states, science, and the international community.

Potential Impact of Japan's Fukushima Treated Water Release

Environmental Impact: Between Claims and Long-Term Uncertainty

Based on the official report of the International Atomic Energy Agency (IAEA) (2023c), the release of Fukushima's nuclear treated water into the Pacific Ocean is consistent with existing international safety standards. The IAEA highlighted that the concentration of tritium in treated water has been diluted to about 1,500 becquerels per liter, or well below the safe limit – 10,000 becquerels per liter – recommended by the World Health Organization (WHO) (TEPCO, 2022). Based on radiological calculations, the amount of radiation exposure to humans is considered 'insignificant' compared to the daily exposure (Hande et al., 2023; Reuters, 2023; Smith et al., 2023). Nonetheless, there are concerns about the long-term impact of this activity (Okaiyeto et al., 2024; Vives and Batlle, 2022). In this context, water stored over many years has varying qualities, so the phrase 'safe' is not necessarily uniform in every tank (Blume, 2023; Suzuki, 2024).

On the other hand, the risk of spread to marine ecology is also a concern. In this case, large ocean currents such as the Kuroshio Current can carry radioactive particles to regions far from Japan (Blume, 2023). Simulation models from the Institute for Radiological Protection and Nuclear Safety (2022) estimate that residual tritium from Fukushima could spread across the Pacific Ocean within 10 years, with low concentrations but still detectable. Although the radiation levels may be small, the symbolism of the spread raises new concerns in many countries that depend on the sea.

Economic Impact: The Crisis of Confidence and Its Impact on the Market

This treatment water release policy also has a direct impact on the economic sector, especially fisheries and international trade, which amounts to up to US\$219.8 billion (Guo et al., 2022a). In this regard, the head of the Fukushima Prefectural Federation of Fisheries Cooperative Associations, Tetsu Naozaki, opposed Fukushima's treatment water release policy because it concerned damage to the reputation of their products (Kyodo News, 2023).

This concern was true when China imposed a ban on the import of all Japanese marine products in August 2023 after the Fukushima treated water release policy was established (China Daily, 2025). Prior to the ban, China was the largest importer of Japanese seafood, resulting in a 43% decline in Japan's seafood exports by early 2024 (R. Wang, 2025). This is due to a lack of trust in the measures taken by Japan and in order to ensure the food security of its own people (China Daily, 2025).

Social Impact: Public perception

Although IAEA data shows that the radiological impact on Fukushima's treated water is not significant, concerns remain among Fukushima residents. This not only reflects fear of health risks, but is also influenced by psychological and cultural factors that influence risk perceptions and social attitudes towards nuclear disasters (Hande et al., 2023b; Zabirowa et al., 2024).

These concerns then extend regionally, suggesting that the social impact of the treatment water release policy is not limited to the directly affected areas, but also drives a diplomatic and geopolitical response in the region. In this regard, the exodus from neighboring countries such as China and South Korea reflects how domestic environmental policies can create cross-border tensions. (Guo et al., 2022b; Li, 2023).

IAEA's role in overseeing Japan's Fukushima Wastewater Release

IAEA as an Instrument: Political Rationalists and Japan's Search for Legitimacy

Based on the framework of institutional neoliberalism, international organizations are seen as mechanisms that allow countries to reduce uncertainty and increase predictability in an anarchist international system (Sterling-Folker, 2021). In this case, the state can make rational use of these various organizations in reducing transaction costs, reducing mistrust, and gaining legitimacy from the international community. According to Archer (2001), this function can be understood as the role of international organizations in the form of instruments, where when the organization is used by the state as a tool to achieve certain goals.

In this case, the release of Fukushima nuclear treated water is a vivid picture of how Japan is optimizing the role of the International Atomic Energy Agency (IAEA) as an instrument of legitimacy, both politically and scientifically. After the nuclear disaster in 2011, the Japanese government faced various challenges, both domestically and internationally, including how to manage the growing radioactive contaminated water around the Fukushima Daiichi nuclear power plant complex (C. Wang et al., 2025; R. Wang, 2025). In 2021, Japan officially announced a plan to release more than 1.2 million tons of nuclear treated water into the Pacific Ocean in stages over 30 years starting in August 2023 (Mabon, 2024; Mabon & Kawabe, 2022; Ngo-Hoang, 2021; Nguyen, 2021). This policy then triggered a critical response from various parties, especially China and South Korea, who considered the decision to be a unilateral action and potentially have negative impacts on regional marine ecosystems and human survival (Chang & Zhao, 2024; Kyodo News, 2021; The Korean Times, 2021; Q. Wang et al., 2022).

In this context, Japan strategically involves the IAEA as an international technical authority in assessing and verifying the safety of the release process (IAEA, 2023b; United Nations News, 2023). This reflects a rationality that is in line with the logic of institutional neoliberalism, where states seek mechanisms that are able to provide guarantees for their domestic policies. In this case, Japan has sought to provide scientific assessment evidence through cooperation with the IAEA since 2012 (Fukushima Prefectural Government, 2016).

Furthermore, the IAEA also published a comprehensive report in July 2023, stating that the process of releasing Fukushima's treated water has met international safety standards and has negligible radiological impacts on humans and the environment (IAEA, 2023c). Thus, this report could serve as a basis for Japan to resume its release policy by the end of August 2023.

IAEA as an Arena: Diplomacy, Transparency, and Negotiation

In addition to serving as an instrument of legitimacy for Japan, the IAEA also plays an important role as an arena in international interaction. According to Archer, the role of international organizations as an arena can be interpreted as a forum where countries interact, debate, negotiate interests, and build common norms. This view is also in line with the framework of institutional neoliberalism which emphasizes the importance of international institutions as facilitators of communication and mechanisms in forming trust between actors in the international system.

In the context of the Fukushima wastewater spill, the IAEA is one of the important platforms where countries seek to express their stances, convey risks, and build a shared

perception of the safety and legitimacy of Japanese policies. In this case, the role of the IAEA is crucial because the Fukushima issue has a wide impact, including on the regional environment and global trust in nuclear governance. Based on this, the IAEA serves as a forum that can bridge differences of interest, although it is not always able to completely eliminate political tensions (IAEA, n.d.-b).

The implementation of the IAEA's role can be seen from the beginning of its involvement in the Fukushima verification project in 2021. In this context, the IAEA actively facilitates dialogue between international actors through technical meetings, field visits, and temporary scientific publications (IAEA, 2023a). The IAEA also involved several experts from 11 member states, including China and South Korea. This approach aims to ensure the transparency of the process in the face of the results of scientific evaluation (Lee, 2023; Mari, 2023; NE, 2025).

In the analysis of institutional neoliberalism, this approach reflects how international organizations function in creating a transparency effect – the ability to transform uncertainty into openness through communication mechanisms. With the IAEA, countries will gain access to the same information about the technical conditions of Fukushima's treated water, so that they can form a perspective based on data, not just perception.

However, the IAEA's role as an arena also shows limitations (Kim, 2023). In this case, the IAEA's success in facilitating communication and providing credible scientific information does not automatically create interstate recognition of policy security. This reflects the structural limitations of international organizations operating in an anatomy system. In this context, Archer argues that international organizations can provide forums for inter-stakeholder interactions, but the success of such forums depends on the extent to which countries are willing to implement the results of these interactions into their national policies.

IAEA as an Actor: Scientific and Political Authority of Legitimacy

In addition to playing a role as a policy instrument and arena of multilateral diplomacy, the IAEA also functions as an independent actor. Based on Clive Archer's classification, an intentional organization is referred to as an actor when it has the capacity to act autonomously. In this case, the actor capacity of an international organization depends on the extent to which 'resolutions, recommendations, or orders emanating from its organs' are able to compel some or all member governments to act differently from the way in which they would otherwise act'. In the context of institutional neoliberalism, this condition shows how international organizations not only prioritize the interests of the state, but also become rational agents that contribute to the reduction of uncertainty and the increase of global trust.

Based on this, the IAEA's role as an actor is reflected in the verification and public communication process related to the release of Fukushima treated water. In this context, the IAEA not only assesses TEPCO's technical reports, but also produces independent reports published annually as a reference for the international community (United Nations News, 2023). The preparation of this report is known based on the IAEA's direct visit to the Fukushima facility, multi-country laboratory analysis, and evaluation process by an independent expert group so that its credibility can be held accountable (IAEA, 2023a).

Furthermore, since the Fukushima crisis, the IAEA has also played a central role in verifying the safety of treated water through an independent scientific assessment process. The

IAEA Comprehensive Review report (2023a) is an important reference that states that the concentration of tritium in treated water is below the international safe limit. In addition, the international safety standards (ISS) adopted by the IAEA also reflect how this organization plays an independent actor.



Figure 3. The IAEA international safety standards
IAEA Annual Report (2023a)

Referring to the international safety standards above, the IAEA review process includes three main documents – fundamentals, requirements, and guides in applying principles, requirements, and technical guidelines in protecting health, environment, and occupational safety. The three documents were prepared in collaboration with UN agencies, thereby strengthening their legitimacy and credibility as a reference in nuclear policy reviews (IAEA, 2023a).

Based on the above efforts, the IAEA has shown its role as a global actor that can shape norms through scientific and moral authority. In the context of Fukushima, the IAEA's actions appear not to be coercive, but rather its ability to build trust and define the discourse on nuclear safety internationally.

CONCLUSION

The debate over Fukushima's treated water release policy highlights that environmental issues often intertwine technical, political, and normative dimensions. The International Atomic Energy Agency (IAEA) has played a crucial role in helping Japan gain scientific and political legitimacy by functioning simultaneously as an instrument of state legitimacy, a diplomatic arena, and an autonomous actor shaping nuclear safety norms globally. However, despite the IAEA's scientific endorsements, social acceptance remains contested due to perceptions of justice and public trust influencing global environmental governance. Thus, effective nuclear governance relies not only on meeting international safety standards but also on international organizations' ability to build global moral credibility. The IAEA exemplifies how science and politics are interdependent in balancing technical security with legitimacy. Future research could investigate how international organizations like the IAEA can better integrate socio-political dimensions and public engagement strategies to enhance legitimacy and trust in contentious environmental governance issues such as nuclear waste management.

REFERENCES

- Blume, L. M. M. (2023, August 24). *Japan releases nuclear wastewater into the Pacific: How worried should we be?*
<https://www.nationalgeographic.com/premium/article/fukushima-japan-nuclear-wastewater-pacific-ocean>
- Buesseler, K. O. (2020). Opening the floodgates at Fukushima. *Science*, 369(6504), 621–622.
<https://doi.org/10.1126/science.abc1507>
- Chang, Y. C., & Zhao, X. (2024). Addressing Japan’s disposal of nuclear-contaminated water from the perspective of international human rights law. *Chinese Journal of Population Resources and Environment*, 22(1), 1–9. <https://doi.org/10.1016/j.cjpre.2024.03.001>
- Cheong-moo, Y. (2021, April 14). *S. Koreans escalate protests against Japan’s planned release of radioactive water*. The Yonhap News Agency.
<https://en.yna.co.kr/view/AEN20210414008300315>
- Chung, A. (2023, November 8). *How Japan fumbled the release of Fukushima water*.
<https://www.cpreview.org/articles/2023/11/how-japan-fumbled-the-release-of-fukushima-water>
- Conca, J. (2019, September 12). *It’s really ok if Japan dumps radioactive Fukushima water into the ocean*. <https://www.forbes.com/sites/jamesconca/2019/09/12/its-really-ok-if-japan-dumps-radioactive-fukushima-water-into-the-ocean/>
- Das, M. (2022). IAEA reviews plan to release treated water from Fukushima. *The Lancet Oncology*, 23(5), 574. [https://doi.org/10.1016/S1470-2045\(22\)00206-6](https://doi.org/10.1016/S1470-2045(22)00206-6)
- Gallup Korea. (2023). *Gallup Korea daily opinion*.
- Giwa, A., Eniola, J. O., Salem, A. B., Alshamsi, A. A., Omar, K. A., Alnuaimi, N. S., Al-Fahad, S. G., & Rashed, L. A. (2025). Navigating the nuclear tide: A comprehensive review of challenges, opportunities, and advances in managing marine contamination by radioactive contaminants. *Marine Pollution Bulletin*, 217.
<https://doi.org/10.1016/j.marpolbul.2025.118113>
- Greenpeace International. (2021). *The Japanese government’s decision to discharge Fukushima contaminated water ignores human rights and international maritime law*.
<https://www.greenpeace.org/international/press-release/47207/>
- Guo, J., Liu, Y., Wu, X., & Chen, J. (2022). Assessment of the impact of Fukushima nuclear wastewater discharge on the global economy based on GTAP. *Ocean and Coastal Management*, 228. <https://doi.org/10.1016/j.ocecoaman.2022.106296>
- Guzman, C. de. (2023, September 8). China’s concern about nuclear wastewater may be more about politics than science. *Time*. <https://time.com/6311984/china-japan-nuclear-wastewater-science-politics/>
- Hande, V., Orita, M., Matsunaga, H., Kashiwazaki, Y., Xiao, X., Schneider, T., Lochard, J., Taira, Y., & Takamura, N. (2023). Thoughts, perceptions, and concerns of coastal residents regarding the discharge of tritium-containing treated water from the Fukushima Daiichi Nuclear Power Plant into the Pacific Ocean. *BMC Public Health*, 23(1). <https://doi.org/10.1186/s12889-023-17349-1>
- ICSF. (n.d.). *Fukushima’s fishing industry survived a nuclear disaster: 12 years on, it fears Tokyo’s next move may finish it off*. Retrieved October 14, 2025, from <https://icsf.net/newss/fukushimas-fishing-industry...>

- Kanagawa, S., Hijikata, T., Nakase, M., Utsumi, K., & Takeshita, K. (2022). Development of stable solidification process of phosphates waste form for ALPS slurry wastes. *Proceedings of the International Topical Workshop on Fukushima Decommissioning Research, 2022*, 1002. https://doi.org/10.1299/jsmefdr.2022.0_1002
- Kashiwaya, K., Muto, Y., Kubo, T., Ikawa, R., Nakaya, S., Koike, K., & Marui, A. (2017). Spatial variations of tritium concentrations in groundwater collected in the southern coastal region of Fukushima, Japan, after the nuclear accident. *Scientific Reports*, 7(1). <https://doi.org/10.1038/s41598-017-12840-3>
- Khadka, N. S. (2023, August 26). *The science behind the Fukushima wastewater release*. BBC. <https://www.bbc.com/news/world-asia-66610977>
- Kim, H. (2023, July 5). (LEAD) DP questions credibility of IAEA report on Fukushima discharge plan. *Yonhap News*. <https://en.yna.co.kr/view/AEN20230705004451315>
- Kurushina, D. (2023). *The limits of cooperation in Northeast Asia: Japan–ROK–China relations after Fukushima*. <https://asiasociety.org/>
- Kyodo News. (2021, April 13). *Japan's neighbors react strongly to Fukushima water release decision*. <https://english.kyodonews.net/news/>
- Kyodo News. (2023, July 11). *Fukushima fishermen still oppose water release after IAEA report*. <https://english.kyodonews.net/articles/-/42158>
- Lamont, C. (2015). *Research methods in politics and international relations* (1st ed.). SAGE Publications.
- Lee, C. (2023, July 6). Experts: China sees Fukushima water release as tool to divide Seoul and Tokyo. *VOA*. <https://www.voanews.com/>
- Liang, X., Yang, S., Lou, Z., & Ali, A. (2024). The impact of Japan's discharge of nuclear-contaminated water on aquaculture production, trade, and food security in China and Japan. *Sustainability*, 16(3). <https://doi.org/10.3390/su16031285>
- Liu, M., Matsunaga, H., Orita, M., Kashiwazaki, Y., Xiao, X., & Takamura, N. (2025). Comparative analysis of public concerns before and after the initial release of treated water from Fukushima. *Journal of Radiation Research*, 66(1), 103–105. <https://doi.org/10.1093/jrr/rrae102>
- Lu, Y., Yuan, J., Du, D., Sun, B., & Yi, X. (2021). Monitoring long-term ecological impacts from release of Fukushima radiation water into ocean. *Geography and Sustainability*, 2(2), 95–98. <https://doi.org/10.1016/j.geosus.2021.04.002>
- Mabon, L. (2024). Treated water releases from the Fukushima Daiichi Nuclear Power Plant: An overview of the decision-making process and governing institutions. *Marine Policy*, 163. <https://doi.org/10.1016/j.marpol.2024.106120>
- Mabon, L., & Kawabe, M. (2022). Bring voices from the coast into the Fukushima treated water debate. *PNAS*, 119(45). <https://doi.org/10.1073/pnas.2205431119>
- Mada, K. (2023, August 23). *Japan discards nuclear waste, Pacific nations and fishermen refuse*. <https://www.kompas.id/>
- Maderich, V., Tsumune, D., Bezhenar, R., & de With, G. (2024). A critical review and update of modelling treated water discharging from Fukushima Daiichi NPP. *Marine Pollution Bulletin*, 198. <https://doi.org/10.1016/j.marpolbul.2023.115901>
- Mari, Y. (2023, October 19). *IAEA team gathers marine samples near Fukushima*. AP News. <https://apnews.com/>

- Masayuki, K. (2017, August 22). *Halting the free fall of Fukushima's fishing industry*. The Tokyo Foundation. <https://www.tokyofoundation.org/>
- Matsunaga, H., Zabirowa, A., Kashiwazaki, Y., Orita, M., & Takamura, N. (2025). Radiation risk perception of residents who provided land for interim storage facilities near Fukushima. *Applied Sciences*, 15(12). <https://doi.org/10.3390/app15126645>
- MFA. (2024, September 29). *China and Japan reach agreement on ocean discharge of Fukushima nuclear-contaminated water*. Ministry of Foreign Affairs PRC. <https://www.mfa.gov.cn/>
- MITI. (2023). *Ensuring safety of ALPS treated water discharged into the sea*.
- Mustaqim, A. H. (2023, August 26). *10 facts about the Fukushima nuclear tragedy*. SINDOnews.com. <https://international.sindonews.com/>
- Nakamura, T., Lloyd, S., Maruyama, A., & Masuda, S. (2024). Attitudes towards the release of ALPS water from Fukushima NPP. *Disaster Prevention and Management*, 34(2), 157–171. <https://doi.org/10.1108/DPM-11-2023-0295>
- Ngo-Hoang, D.-L. (2021). Introduce the negative influence in Vietnam if Japan discharges the nuclear sewage to Pacific. *SSRN*.
- Nguyen, A. (2021). *A case of MOX Plant 2.0 in the Pacific*. <https://api.semanticscholar.org/>
- Normile, D. (2021, April 13). Japan plans to release Fukushima's wastewater into the ocean. *Science*. <https://www.science.org/content/article/>
- Okaiyeto, S. A., Sutar, P. P., Mujumdar, A. S., & Xiao, H. (2024a). Fukushima wastewater release: Unanswered questions and global concerns. *International Journal of Agricultural and Biological Engineering*, 17(2), 289–290. <https://doi.org/10.25165/j.ijabe.20241702.9076>
- Park, H., & Ulus, Y. (2024). Overview of advanced liquid process system: Circulation of tritiated water in oceanic environment. *Journal of Student Research*. <https://api.semanticscholar.org/CorpusID:272167369>
- Pacific Elders' Voice. (2023). *No Fukushima nuclear discharge*. <https://pacificelders.org/statement/no-fukushima-nuclear-discharge/>
- Pacific Islands Forum. (2023). *Statement: 52nd PIF leaders statement on the Fukushima ALPS-treated nuclear wastewater issue*. <https://forumsec.org/publications/statement-52nd-pif-leaders-statement-fukushima-alps-treated-nuclear-wastewater-issue>
- Qi, Y., You, K., & Guo, S. (2022). The battle for public opinion of “Japan's nuclear wastewater sea discharge.” *Open Journal of Political Science*, 12(3), 363–372. <https://doi.org/10.4236/ojps.2022.123021>
- Ren, Y., Gao, R., Zhang, M., & Cheng, M. (2025). Willingness to pay for traceability in the post-Fukushima nuclear-contaminated water era: Chinese consumers' attitudes and preferences for seafood. *Agribusiness*. Advance online publication. <https://doi.org/10.1002/agr.70036>
- Reuters. (2023a, March 8). The science and global standards behind Fukushima's ALPS treated water. Reuters. <https://www.reuters.com/plus/the-science-and-global-standards-behind-fukushimas-alps-treated-water>
- Sartayev, Y., & Hayashida, N. (2025). Fukushima's tritiated water discharge: Health and environmental implications derived from historical nuclear incidents. *Journal of Environmental Radioactivity*, 290. <https://doi.org/10.1016/j.jenvrad.2025.107814>

- Smith, J., Marks, N., & Irwin, T. (2023). The risks of radioactive wastewater release. *Science*, 382(6666), 31-33.
- Sterling-Folker, J. (2021). Neoliberalism. Dalam *International relations theories: Discipline and diversity*. Oxford University Press. <https://doi.org/10.1093/hepl/9780198814443.003.0005>
- Suzuki, T. (2024). *Fukushima “waste water” controversy: The accident is not over yet*.
- Teh, C. (2021, April 19). US backs Japan’s plan to release radioactive water from Fukushima despite pushback from South Korea, China, and Russia. *Business Insider*. <https://www.insider.com/japan-radioactive-water-release-usa-support-protests-from-region-2021-4>
- Tokyo Electric Power Company. (2022). *Radiological impact assessment report regarding the discharge of ALPS treated water into the sea (Design stage / Revised version)*.
- Toshio, I. (2023, March 20). Survey: 51% support releasing treated nuclear water into ocean. *The Asahi Shimbun*. <https://www.asahi.com/ajw/articles/14865588>
- United Nations News. (2023, August 24). Japan: IAEA monitoring treated water release from Fukushima nuclear plant. <https://news.un.org/en/story/2023/08/1140037>
- Vives i Batlle, J. (2022). The potential impact of marine discharges from Fukushima 10 years after the accident. *Integrated Environmental Assessment and Management*, 18(6), 1530–1538. <https://doi.org/10.1002/ieam.4592>
- Wang, C., Zhao, Y., & Lassi, N. (2025). Fukushima nuclear wastewater discharge: An analysis of the international regulatory framework. *Marine Policy*, 171. <https://doi.org/10.1016/j.marpol.2024.106441>
- Wang, D., Zhou, Q., Yin, Y., Lu, D., Hu, L., Richmond, R. H., Moon, H. B., Yan, B., & Jiang, G. (2024). Implications of Fukushima’s radioactive water discharge on global environmental sustainability. *Environmental Science and Technology*, 58(7), 3061–3064. <https://doi.org/10.1021/acs.est.4c00955>
- Wong, T. (2023, August 24). Fukushima: China retaliates as Japan releases treated nuclear water. *BBC News*. <https://www.bbc.co.uk/news/world-asia-66577769>
- Yamaguchi, M. (2023, March 10). China condemns Japanese plan to release Fukushima water. *AP News*. <https://apnews.com/article/china-japan-fukushima-radioactive-water-release-885448891995b87e661b418c69c7ebfe>
- Zabirova, A., Matsunaga, H., Orita, M., Kashiwazaki, Y., Xiao, X., & Takamura, N. (2024). Differences in community awareness regarding the discharge of treated water from the Fukushima Daiichi nuclear power station. *Journal of Radiation Research*, 65(3), 413–415. <https://doi.org/10.1093/jrr/rrae027>