10-year Investigation Commission on the Fukushima Nuclear Accident

Final Report by Investigation Commission on the Fukushima Nuclear Accident

Asia Pacific Initiative

Foreword

Yoichi Funabashi

An investigation into "preparedness" and the "lessons"

The think tank Rebuild Japan Initiative Foundation established an Independent Investigation Commission on the Fukushima Nuclear Accident (the Independent Investigation Commission; Chairman: Koichi Kitazawa, former President of the Japan Science and Technology Agency, in the wake of the TEPCO Fukushima Daiichi Nuclear Power Plant accident on March 11, 2011, to examine the accident and the lessons to be learned, releasing an investigatory report of its findings on February 28, 2012. This represented six months of unrelenting work by the Committee's working group set up in the summer of 2011.

Eight years later, in the summer of 2019, we launched the 10-Year Deliberation Commission on the Fukushima Nuclear Accident. This constitutes a second independent investigation committee, so to speak.

Its goal was to unflinchingly revisit the truth of Fukushima by March 11, 2021, a decade after the accident, reviewing the issues and lessons uncovered by the Independent Investigation Commission; how much had Japan absorbed; what had in effect been put into practice; what had not been adequately digested and why not; in short, "what have we learned?"

In that process, the findings of each government, parliamentary and academic investigation were used as references, and we also examined to what extent their respective recommendations had been implemented. I would like to pay my respects and express my appreciation to the people in charge of each accident investigation.

The Independent Investigation Commission focussed, in a nutshell, on "response, preparedness, and prevention". On the other hand, the aim of this second independent accident investigation is to examine the "lessons".

The final chapter in the Independent Investigation Report (Lessons Learned from the Fukushima Daiichi Nuclear Power Plant Accident—Aiming for Resilience) concludes with the words that the Fukushima tragedy is "not to be forgotten". To constantly examine and learn from tragic events, accidents, and events in human society must be the most sincere way of "not forgetting". Re-establishing an independent investigation team ten years later to look into "Fukushima ten years on" is nothing but a part of that exercise.

However, in reality, I am acutely aware that it is a difficult task to keep practicing "not to forget". Looking at the efforts of the Shinzo Abe Administration countering COVID-19 since the spring of 2020, I am forced to wonder what was learned from the experience of the "management crisis", and not crisis management, that was exposed by the Fukushima nuclear accident.

The COVID-19 response has highlighted a myriad of issues including a lack of an effective command structure in the Kantei (the Prime Minister's official residence), a government bureaucracy unable to switch quickly to emergency mode, a patchwork of partial (local) optimizations, a labyrinth of uncoordinated administrative action, a lack of first responders (Japan has no dedicated institution like the US CDC), a conservatism that prevents partnerships between politicians and scientists as well as the ability to use technology quickly and accurately to respond to crises, an aversion to stochastic risk

assessment, poor public relations covering crisis communication and risk communication to Japan's citizens, and a lack of ideas on a "post-war" rebuilding strategy or blueprint all the while engaging in the "war-time" fight.

And these issues cannot simply be accounted for "because it was a Japan Democratic Party administration" or "because it was an LDP administration". Both Fukushima under a JDP administration and COVID-19 under the current LDP administration share the same fundamental issues of risk, governance, and leadership regarding crisis assessment and crisis management, which were exactly the questions raised by the Independent Investigation Report. The Independent Investigation Commission conducted a crisis investigation rather than an accident investigation.

Once again, the main target of this investigation bears closely on the state of national security and statecraft, in other words, the shape of the country, focussing on the attitude and safety/security systems of the government and the operator (the electric power company) in implementing within society the large-scale technology of nuclear power and harnessing it for the economy and people's lives; reliable and effective safety regulations independent of politics and the operators; risk preparedness including the "unexpected" (response, preparedness, prevention); first responders' roles and mutual cooperation; command functions in national crisis response; risk, governance and leadership in government and social crisis response and crisis management, especially the nature of resident evacuation including its cost-effectiveness; and a strategy for rebuilding and investing in the future in the face of large-scale disasters be they natural or man-made.

Truth, Independence, Humanity

The Independent Investigation Commission, which examined the Fukushima nuclear accident, compiled a report, setting its motto as "truth, independence, and humanity" when placing it into the public domain.

First of all, when fact-finding, we always tried to meet with and listen to the parties directly involved, which is the essential premise of all evidence-based investigations.

Next, we placed importance on the implications for the nation and society as a whole.

In Japan, both the government bureaucracy and companies tend to be "captives of their respective villages", which leads easily to an organizational culture of "small-minded governance by osmosis". Both task setting and solutions tend to be labyrinthine "partial optimizations". Rather, it is far more important to pursue an "overall optimal solution" that takes into consideration the interests and perspectives of multi-stakeholders. To do that effectively, you need an independent convening power that is captive to no one.

Furthermore, we aimed to share the insights gained from our investigation with the world, to enter into a dialogue with the world, to absorb that feedback, and use it in formulating global standards and rules.

Japan has long been a passive participant in the formation of global standards and rules. Sharing the experience of Fukushima and the lessons learned there with the world contributes to the improvement of global nuclear safety, and having triggered the largest nuclear accident in history at Level 7 on a par with the former Soviet Union's Chernobyl accident, this is nothing more than Japan's responsibility.

Once again, our investigative efforts this time were based on such an outlook.

It appears that neither the Government nor the Parliamentary Accident Investigations plan a ten-years-after re-examination. Both contributed to the investigation into the cause of the accident by carrying out high-quality examinations and analysis. In particular, given the revolutionary nature of the Parliamentary Accident Investigation as an oversight function of the Diet, it would have been better if they had also incorporated follow-up and re-examination functions at the outset.

However, this only makes the role and responsibility of the Independent Accident Investigation greater. Yotaro Hatamura, former Chairman of the Government Accident Investigation Committee, who responded to an interview, said, "Investigation isn't about making an end of things by issuing a report, but about how Japanese society accepts it and how they think about it. Re-examining it from the outside means we will make fewer mistakes. That's why I came today, to make some contribution to the efforts of you all."

In addition, Professor Shuya Nomura, a member of the Parliamentary Accident Investigation Committee, gave us a boost saying, "We would like to undertake this kind of examination, but we have the difficulty of needing legal authority to come together, so I am very envious of you (in the private sector) and your good work (…) Please keep it up."

Such warm words were a great encouragement to us.

In creating the 10-Year Deliberation Commission on the Fukushima Nuclear Accident, we asked Professor Kazuto Suzuki of Hokkaido University to act as chair. Professor Suzuki is at the cutting edge of world research in the field of international politics and science and technology, and as one of the members of the working group for the Independent Accident Investigation established in the summer of 2011, wrote a penetrating analysis on historical and structural factors especially the structure of the "safety myth" of nuclear power. Fortunately, Professor Suzuki was willing to take on the task. Another professor from the original working group was Professor Hiroshi Kainuma. Professor Kainuma is a leading figure in Fukushima revival theory, and has been working closely with Fukushima residents after the accident exploring the nature and philosophy of Fukushima's revitalization.

In addition, Koichi Isobe (Senior Fellow, Asia Pacific Initiative), Toshihiro Okuyama (Senior Staff Writer, Asahi Shimbun), Akihide Kugo (Senior Research Advisor, Mitsubishi Research Institute), Yuki Kobayashi (Researcher, Security Research Group, Sasakawa Peace Foundation), Naoya Sekiya (Associate Professor, Research Center for Disaster Prevention Information, Graduate School of Informatics, The University of Tokyo) and Yasuaki Chijiwa (Senior Researcher, Security Policy History Laboratory, War History Research Center, Defense Research Institute, Ministry of Defense) were invited to serve as committee members. All are experts capable of tackling the national issues that Fukushima has posited in their respective fields. We feel extremely fortunate to have been able to form a second independent accident investigation with such a ready force of professionals.

The secretariat consisted of Hiroyuki Tagawa (Staff Director, Junior Researcher, International and Advanced Japanese Studies Program, University of Tsukuba), Takashi Seto (Researcher associate, Asia Pacific Initiative), Narumi Shibata (Asia Pacific Initiative Program Officer), Yukari Utsumi (staff member, Asia Pacific Initiative). Takuma Hirai, an intern at the University of Tokyo, and Shinya Oguma, an intern at the Australian National University, also participated as research assistants.

Last but not least, I would like to reiterate my heartfelt gratitude to Professor Koichi Kitazawa, the original chair of the Independent Accident Investigation Commission. He passed away in September

2014. This was a very sad loss and we especially miss his expertise and guidance.

As a scientist, Professor Kitazawa had a strong sense of mission and responsibility towards society. There would not have been an Independent Investigation Report without him. I feel he has urged us on in pursuing our re-examination of "Fukushima ten years on".

The Rebuild Japan Initiative Foundation has continued to investigate and research the issues of Japanese governance crisis/crisis management based on ongoing research on the Fukushima nuclear accident and knowledge gained after the publication of its Independent Accident Investigation Report. It has published works such as Japan in Peril? 9 crisis scenarios (CLSA, 2014), *Anatomy of the Yoshida Testimony: The Fukushima Nuclear Crisis as seen through the Yoshida Hearings* (Toyo Publishing, 2015), Examining Japan's Lost Decades (Routledge, 2015), *Japan's Population Implosion: The 50 Million Shock* (Palgrave Macmillan, 2017), Personal Networks and Social Resilience: the evacuation of hospitals in the Fukushima sheltering zone (Toyo Publishing, 2017).

Of these, in Japan in Peril? 9 crisis scenarios, Mitsuyoshi Urashima, then Associate Professor (now professor) at Jikei University School of Medicine, wrote "Pandemic: the day when the doctors disappeared". His chapter starts with the following.

"With an unknown virus rampant, the medical field faces the danger of collapse due to a lack of doctors, medical staff and medical equipment such as ventilators. The key to solving the problem is whether we can decide the 'order of death' or not."

Professor Urashima concluded by raising the following issues.

"Japanese medical institutions all suffer from a lack of doctors, beds, ventilators, vaccines, etc. and are in danger of medical collapse in normal times. Given this situation, are specific measures being taken based on the New Influenza Special Measures Act?"

I am proud that this final report on the Independent Accident Investigation was able to utilize the results of such ongoing research.

The Rebuild Japan Initiative will be dissolved with the publication of this final report on Fukushima ten years on as we believe it has fulfilled its initial mission. Issues in Japan's social and national risk, governance and leadership will continue to be addressed by the Asia-Pacific Initiative (API), a think tank established in 2017 as an umbrella organization of the Rebuild Japan Initiative.

May 25,2020

Yoichi Funabashi

Introduction:
Issues for the Second Independent Accident Investigation:
Do not brook the "normal pattern"

Kazuto Suzuki

An enormous earthquake of Magnitude 9.0 struck the Pacific Coast of Japan from the Tohoku region to the Kanto region at 14:46 on March 11, 2011, causing a large tsunami. The huge amount of seawater that rushed over the seawall into the premises of the Tokyo Electric Power Company's Fukushima Daiichi Nuclear Power Plant located in the coastal area of Fukushima flooded the underground switchboard and emergency diesel generator. With the collapse of power towers, the transmission line from outside was cut off, the power supply inside was also lost, and a so-called total power outage (station blackout: SBO) took place. The Fukushima Daiichi Nuclear Power Plant lost its reactor cooling function, triggering a severe accident, which corresponded to an Article 15 event in the Act on Special Measures Concerning Nuclear Emergency Preparedness (Nuclear Emergency Act).

Not a single life was lost to direct radiation exposure in this unprecedented crisis thanks to the efforts of Director Masao Yoshida and others who struggled at the site of the Fukushima Daiichi Nuclear Power Plant in danger of their own lives, the people supporting them, and perhaps luck. However, the number of earthquake related deaths in Fukushima Prefecture from the Great East Japan Earthquake and evacuation accompanying the Fukushima Daiichi Nuclear Power Plant accident, was 2,301 (as of March 2020) with a peak of 160,000 residents being forced to evacuate. The consequences of the nuclear accident were extremely far-reaching with many of the evacuated residents forced into difficult circumstances, and as often reported, subjected to unfair bullying and discrimination in the places they evacuated to despite being victims themselves.

A report is not the end of matters

Regarding this accident, not only the Independent Investigation Commission on the Fukushima Nuclear Accident, the predecessor of this research project, but many other investigatory bodies were established, each examining the accident that took place at Fukushima Daiichi Nuclear Power Plant from their own perspective and drawing their own lessons and proposals, including the Investigation Committee on the Accident at the Fukushima Nuclear Power Stations (Government Accident Investigation), the National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission (NAIIC), the first of its kind in the history of constitutional government, the Investigation Committee on the Nuclear Accident at the Fukushima Dai-ichi NPP by the Atomic Energy Society of Japan (Academic Accident Investigation), and the TEPCO Accident Investigation Committee established by TEPCO itself.

However, as is the case with many accident investigations, it is common in Japan for investigations of such large-scale accidents to be disbanded once their findings are published. They are rarely examined in terms of the extent to which the proposals and lessons are accepted by society, how they transform governments and parties, and whether "preparedness" to prevent similar accidents from happening again has been put in place or not. As a result, when the shock in the immediate aftermath of the accident has not yet worn off, we take the recommendations and lessons of these reports seriously, work on various reforms and changes to prevent the same thing from happening again, putting new laws and systems in place. However, it is highly likely that the memories gradually fade after 10 years, that people forget why the accident happened, how they dealt with it and what lessons they learned from it, and revert to the old habits and ways of thinking from before the accident. The reports published by the accident investigation committees are stowed in a corner of the bookshelf

never to be reopened, nor will we have the opportunity to check if the lessons and recommendations have actually been realized.

The Fukushima Daiichi Nuclear Power Plant Accident was an accident of huge proportions that should not follow this "normal pattern". First of all, not only are there many people who are still unable to return to their hometowns with evacuation orders still in place, but those who for various reasons are building new lives in the places they have evacuated to have also had their lives derailed by the accident. The decommissioning work at the Fukushima Daiichi Nuclear Power Plant is still in its infancy, and there are many places that cannot be accessed because the radiation dose is still high, and the overall picture of the accident remains unclear. In other words, the Fukushima Daiichi Nuclear Power Plant accident is still an ongoing event, and the questions as to why the accident occurred, why it was not possible to avoid it, and why it couldn't be contained earlier are also still ongoing.

Secondly, despite the fact that the Fukushima Daiichi Nuclear Power Plant Accident has caused a major swelling of the post-nuclear and anti-nuclear power movements and the pressure exerted by such social forces, the government has demonstrated its intention to maintain its strategy of using nuclear power in its energy policy, and nine reactors have already been restarted (including the Ikata Nuclear Power Plant Unit 3 that was suspended by the Hiroshima High Court, and Sendai Nuclear Power Plant Unit 1 and 2 are suspended by noncompliance to the new safety regulations). Additionally, six nuclear power plants have been approved by the Nuclear Regulation Authority as conforming to its standards, and are likely to restart after coordination with local governments. If nuclear power plants are to continue to operate in the wake of the Fukushima Daiichi nuclear accident, the question is are the regulations permitting their operation appropriate? Have the operators running the nuclear power plants learnt their lesson properly? How should people using the electricity that is generated face the restart of nuclear power plants? In the process, we need to verify if the lessons learned from the Fukushima Daiichi Nuclear Power Plant accident and the recommendations of several accident investigation committees have been properly taken into consideration and are reflected in the regulation and operation of nuclear power plants, as well as "preparedness" should a similar accident occur.

Thirdly, the Fukushima Daiichi Nuclear Power Plant accident had a major impact on post-war Japan's economic growth and society, as well as the "shape of this country". After World War II, we vowed to be a peaceful nation under the new Japanese Constitution, and separating the development and utilization of science and technology from military purposes and focussing on economic development, Japan enjoyed dramatic economic growth. Against such a backdrop, nuclear power was positioned as a "dream energy" able to meet the rapidly growing demand for electricity, with an ultimate research and development goal of creating a nuclear fuel cycle that made new nuclear fuel out of spent nuclear fuel, something never realized in the world. However, the Fukushima Daiichi nuclear accident fundamentally shook people's faith in the "safety myth" that "nuclear power plants are safe" and brought it painfully home to them that nuclear power plants were an energy source that carried the risk of causing a huge nuclear disaster. The economic development and civilized life we have enjoyed to date thanks to power sources are accompanied by these risks, and we need to consider how we should solve questions such as how to deal with these risks and, if nuclear power generation disappears, other problems that may instead arise such as, for example, the mass emission of greenhouse effect gas from burning fossil fuels to generate electricity.

Follow-up project to the Independent Accident Investigation

In order to break through this "normal pattern"," our research project reviewed the accident, post-accident changes and the lessons learned using the tenth anniversary of the Fukushima Daiichi

Nuclear Power Plant accident as a catalyst. The goal was to analyze and study how much we have learned, how far proposals have been put into practice, and if any given proposal has not been realized, why it has not changed, or is not changing.

In the Independent Accident Investigation, the predecessor of this project, we examined many phenomena based on the initial message from our Chairman Koichi Kitazawa to "understanding the background of this unfortunate accident and thereby learn the lessons to make our country safer." In Part One, the history of the accident was organized chronologically and the cause of the accident was analyzed from a technical point of view based on the public information available at the time. Since the Independent Accident Investigation was unable to secure the cooperation of TEPCO, we were unable to hear from TEPCO's executives and staff, including Director Yoshida who was in charge of the scene of the accident, but we expressed the view that, judging from the publicly available information of the accident, the station blackout (SBO) had made it difficult to cool down the reactor, resulting in a severe accident. Apart from the nuclear accident, we also explained the environmental impact of the spread of radioactive material, the problem of internal exposure through food, and the risks posed by low-dose exposure as well as assessing the extent of the impact of the Fukushima Daiichi accident and sharing a basic understanding of what was required for coping in the aftermath of the accident.

In Part Two, we focused on the response to the nuclear power plant accident, clarifying public information about the process of response by the Kantei (the Prime Minister's Official Residence) and the thoughts of each actor in their decision making through interviews with Prime Minister Naoto Kan, the major cabinet members involved in decision-making, and executive officers who were gathered at the Kantei at the time. Significant problems existed here concerning the relationship between the Kantei and the Nuclear and Industrial Safety Agency (NISA), as well as the mechanism for information sharing between the government and TEPCO. Our analysis focused on the fact that the establishment of an integrated countermeasures headquarters for the government and TEPCO in an extra-legal manner facilitated the flow of information and helped the government to organize the response. We also pointed out that decision-making in the Kantei was overly influenced by Kan's individual play as well as the problems caused by micromanagement on the part of the Kantei (some may have called it "Naoto Kan Risk" which means the management of accident by Prime Minister would increase risk of confusion), suggesting that the nuclear disaster manual at the Kantei be reviewed.

Furthermore in Part Two, we analyzed the government's dissemination of information from the viewpoint of risk communication, examining the importance of such government information dissemination at times of public unease as well as the performance of government spokesperson for the Fukushima Daiichi Nuclear Power Plant accident, Chief Cabinet Secretary Yukio Edano, TEPCO, and NISA. Additionally, the Independent Accident Investigation not only focussed on Japan, but also analyzed how information was transmitted to the international community and how foreign countries perceived and understood the accident. We also examined what is now referred to as "fake news" by looking at misunderstandings about the risks, intentional hoaxes, and fear-based misconstructions spread via SNS.

Additionally, the Independent Accident Investigation focuses on the response to nuclear disasters in the field, and what role first responders, the Self-Defense Forces, the police, and the fire department play, highlighting problems stemming from the absence of a premise of mutual cooperation, including a lack of mutual communication and problems of command and the command system. In addition, we discussed on SPEEDI, a mechanism for predicting the diffusion of radioactive materials owned by the Ministry of Education, clarifying what SPEEDI could and could not do, concluding it could

not be used as a yardstick for ordering evacuations when the type and volume of emissions were unknown. Furthermore, by investigating the government's evacuation instructions and the response of local governments, we made it clear that the "safety myth" had created an absence of assumptions about possible accidents and a lack of "preparedness", which spurred confusion at the site and created various problems.

Part Three analyzed the historical and structural factors that caused the Fukushima Daiichi Nuclear Power Plant accident. First of all, we showed that acting as the ideological background for nuclear safety, Design Basis Events (DBE) and deterministic safety evaluation lie at the root of safety regulation, the underlying thinking here being that accident assumptions are blueprinted and a safety design then drawn up based on that blueprint. We revealed that because the Fukushima Daiichi Nuclear Power Plant accident far exceeded expectations, an "unexpected" response was required. However, since it was not expected that such an "unexpected" event would occur, "preparedness" for the accident went undone. Our proposal regarding this was to call for the introduction of the concepts of probabilistic risk assessment and defense in depth, as well as accident management (AM) responses.

Also in Part Three, the nature of nuclear safety regulation was historically examined from an administrative stance, discussing the responsibilities of those involved in setting regulations and to what extent tsunami, SBO, severe accidents, compound disasters and so on were envisioned and regulated for. We also analyzed the thinking of the regulatory authorities when designing said regulations, raising the issue of Japan's distinctive safety regulation governance. We pointed out that nuclear power business was not properly regulated and that this distinctiveness stemmed from the anomaly of introducing nuclear technology for peaceful use in Japan, an A-bomb victim, and a bureaucratic dichotomy, on the other hand, of the Science and Technology Agency (MEXT) being in charge of research and development including the "nuclear fuel cycle", and the then Ministry of International Trade and Industry (current Ministry of Economy, Trade and Industry) regulating the commercial operation of nuclear power plants; a dual system of policy decisions between the Nuclear Power Commission and the Nuclear Safety Commission (NSC); a dual system of safety regulation governance by NISA and the NSC; and pointed out the additional structural problem of a dual system between the government pursuing its "national policy/private operation" and the electric power companies created rigid regulations and administrative ambiguity, which meant the power companies were inadequately regulated.

In addition, we examined the ideological problems behind this kind of nuclear safety regulatory governance, and in particular, how the so-called "safety myth" was created and maintained. Here, we clarified what kind of discourse was used in the nuclear power promoting community known as the"nuclear village", which is composed of stakeholders such as the government, academia, businesses, manufacturers and the media. We also clarified how nuclear power plants were accepted by local governments and how residents were persuaded. Furthermore, we discussed how anti-nuclear power movements outside the central "nuclear power village" that promoted nuclear power generation and the "nuclear power village" of local governments that accepted plants, were deployed and often used litigation tactics, but that nuclear safety was switched into an issue of legal compliance by their resultant reliance on the judiciary, which placed decisions in the hands of judges who were not nuclear experts.

In Part Four, we analyzed the global context, which was not a direct cause of the Fukushima Daiichi Nuclear Power Plant accident, but is important in considering post-accident actions. We examined the distinctive nature of Japan's nuclear regulation in the context of international organizations such as the IAEA and other countries, noting that Japan had long ignored experts in other countries when

they pointed out issues of safety regulation. Furthermore, US-Japan relations played an important part in dealing with the nuclear accident, and as the United States took various measures from the perspective of protecting its own people, we looked at Japanese domestic responses to the communication gap between Japan and the United States and the measures taken by the United States, highlighting issues involved in accepting international support.

Based on these discussions, the Independent Accident Investigation outlined the various "proximate, intermediate and remote causes" behind the Fukushima Daiichi Nuclear Power Plant accident, concluding that fragmented optimizations in Japanese regulations created the loss of a global optimal solution. We argued that what lay at the root of the Fukushima Daiichi nuclear accident was that nuclear safety had lost what should be its ultimate goal of "continuous efforts to enhance safety" due to the use of a design ideology of ignoring the "unexpected" based on design assumption events and the absence of an idea of improving safety with the emphasis on hardware regulatory compliance stemming from judicial responses; the "safety myth" that was created by the interdependence of central and local governments in the "nuclear power village"; and the response of a government and Kantei unprepared for an "unexpected" event; all of which were partial optimizations and could not be deemed to be an overall solution. Our message was that the lesson Japan should learn was to increase its "resilience" towards crises. Crises such as natural disasters and the explosive spread of infectious diseases always occur. We proposed engaging in crisis management by building capabilities and systems to prepare for crises not only by government, but also businesses, first responders, local governments, and the public, and improving leadership to anticipate a variety of "unexpected" events so that even if there was a crisis, we would be able to recover from it.

While upholding the spirit and problem awareness of our predecessor, the Independent Accident Investigation, this second project will consider how society has changed, how the Japanese government has changed, how TEPCO has changed, and how these lessons and recommendations have been taken on board during the past ten years.

Subjects and themes to be examined

Based on the investigation analysis in the Independent Accident Investigation, this project deals with the following themes and looks back over the past 10 years (project member in charge given in parentheses).

- Nuclear safety regulations (Akihide Kugo): NISA was dismantled as a "special agency" of the Agency for Natural Resources and Energy, an external agency of the Ministry of Economy, Trade and Industry, which has to date been responsible for safety regulations after the Fukushima Daiichi nuclear accident, and merged into the Nuclear Regulatory Agency, an external agency of the Ministry of the Environment, this being a "one-way ticket" and not an agency secondment. In addition, the Nuclear Safety Commission whose task was to double-check nuclear safety was abolished, and a highly independent Nuclear Regulatory Commission, a so-called Article 3 commission, was newly established. This new nuclear safety regulation mechanism is to establish and implement safety regulations that are considered to be the "most stringent in the world", but it faces the challenge of whether it will be able to overcome the "safety myth" that was the cause of the Fukushima Daiichi nuclear accident. In this project, we will tackle issues regarding the nature of nuclear safety regulations, to what extent we have learned the lessons from the accident in the past 10 years, and whether a new "safety culture" has been created.

- TEPCO and its governance (Toshihiro Okuyama): TEPCO, the direct party involved in the Fukushima Daiichi Nuclear Power Plant accident, had overwhelming political power under the

regional monopoly and general cost method, and according to the Parliamentary Accident Report, it was an entity capable of creating "Regulatory Capture" and influencing the regulatory authorities. Under the "national policy/private operation" framework, it had an organizational structure comparable to a huge bureaucratic organization, and due to the technical characteristics of the nuclear sector, was characterized by an extremely closed and poorly ventilated corporate culture. Did the Fukushima Daiichi Nuclear Power Station change the nature of TEPCO? The Fukushima Nuclear Power Accident Summary and Nuclear Safety Reform Plan (commonly known as the Anekawa Plan), which was announced as a reform plan for the nuclear power division from inside TEPCO, advocated bold organizational reform and awareness reform, but did such attempts change TEPCO? Deregulation of the power industry is creating a competitive environment, but is it affecting TEPCO's corporate culture? Furthermore, will TEPCO, which ultimately bears the costs involved in dealing with the Fukushima Daiichi Nuclear Power Plant accident and compensation, evolve into a company that can withstand the payment?

- Risk Communication (Naoya Sekiya): In a nuclear accident, fear of damage from invisible radiation dominates people's minds. Everyone is concerned about how much risk an accident will cause and how much their life will be threatened. In the Fukushima Daiichi Nuclear Power Plant accident, Chief Cabinet Secretary Edano fronted the government and disseminated government information, but in the confusion at the time of the disaster, while his message "There is no immediate effect" was accurate, it failed to eradicate people's anxiety. The communication of information from TEPCO and NISA also attracted attention to the question of wording such as "core fusion", which fanned people's anxiety and distrust. Social networks (SNS) have developed in the field of risk communication in the last 10 years, and communication methods have changed significantly from those of 2011. In addition, the question of rumors experienced when the Fukushima Daiichi Nuclear Power Plant accident was yet to be under control is still an ongoing one. We will discuss the desirable nature of risk communication in these circumstances of modern times, and how the lessons learned from the Fukushima Daiichi Nuclear Power Plant Accident are being utilized for information dissemination by the government and TEPCO.

- Crisis management in the Kantei (Yasuaki Chijiwa): It is safe to say that the most well read part of the report was the section on crisis management at the Kantei, the core theme of the Independent Accident Investigation. Crisis management at the Kantei has been institutionally strengthened by the reorganization of the then Security and Crisis Management Office into the Situation Response and Crisis Management Office as well as by the addition of the National Security Secretariat (NSS). However, it is necessary to re-examine the human resources who drive the system, and to what extent the top management and executives who should assume leadership in crisis management are fully aware of "preparedness". At the time of the Fukushima Daiichi Nuclear Power Plant accident, it was a Democratic Party government, and it is now an LDP administration and a long-term one at that, so there are circumstantial differences including the experience gained in crisis management during various natural disasters and an improved ability to respond to situations. However, after excluding the peculiarities of such individual administrations, we will examine whether it is capable as a framework for and a system of crisis management when a nuclear disaster occurs - often involving crisis management in a complex crisis.

- Logistics (Yuki Kobayashi): It is no exaggeration to say that logistics make or break dealing with a situation in a nuclear disaster. The Fukushima Daiichi Nuclear Power Plant accident lacked physical "preparedness" for a nuclear disaster, and it is undeniable that the accident would have been much worse without physical equipment securing power on site, pump cars for water supply, and the high-pressure concrete pump car called the Giraffe that was miraculously effective in

cooling spent fuel pools. Such logistical aspects have been emphasized even in post-accident nuclear safety regulations, and thorough physical "preparedness" for power supply vehicles and fire engines is now a requirement for restarting nuclear power plants. Are these regulations appropriate after all? Will these logistics work properly in the event of a compound disaster? Furthermore, even if such hardware is in place, how well can it be operated? Have the lessons from the accident perhaps led to excessive "preparedness"? If only because of their visibility, physical logistics give a sense of security, but it is meaningless if they become merely a decoration to provide that sense of security. Here we will also discuss the pros and cons of a "Japanese version of FEMA" that was debated following the accident.

- First Responders (Koichi Isobe): A theme that was dealt with in the Independent Accident Report but hardly examined in other accident reports is the role of first responders such as the Self-Defense Forces, police, and fire fighters. Although the SDF, police, and fire fighters are not necessarily primary responders in a nuclear disaster, the sight of the Ground Self-Defense helicopter dropping seawater into Unit 3's spent fuel pool at the Fukushima Daiichi Nuclear Power Plant accident was widely reported, and regardless of its impact, the fact that the Self-Defense Forces were responding to a nuclear disaster provided people with a sense of security and courage to the parties actually dealing with the accident. The fire department also played an important role in injecting water into the reactor, and the police played a role in maintaining social order in various situations, including the evacuation of residents. However, the issue was that no assumption was made as to what role these first responders would play in a nuclear disaster, and there was no way of dealing with it, either institutionally or in terms of mission. In addition, when these organizations, which normally have separate tasks, cooperate and deal with a single operation, a heavy load is placed on communication and coordination between the organizations. What lessons have been learned from the various problems experienced in the Fukushima Daiichi Nuclear Power Plant accident, and what kind of actions are now being taken? Further, when a nuclear disaster is in an extreme state, it is excessively difficult for a private business operator to order its employees to risk their lives to deal with the accident. At such a time, is it then up to SDF officers, who pledge to "to face events without regard to risk, to strive to the utmost of my abilities to complete the assigned tasks"?

- Rebuilding (Hiroshi Kainuma): An issue not touched upon in the Independent Accident Investigation was the question of rebuilding. In the Fukushima Daiichi accident, the evacuation area expanded from 5km to 10km then 20km, and 160,000 people were forced to evacuate their homes. Ten years later, the places where the evacuation order has been lifted have expanded, but there are still some places designated as evacuation areas. Additionally, people who have evacuated cannot immediately return to their homes, and the rebuilding of entire cities and infrastructure for daily life are major issues. What should we do about long-term rebuilding as part of the problem of a nuclear accident? Although it is hard to provide a clear answer to this topic, "preparedness" for a nuclear accident should also encompass "preparedness" for the evacuation of people and rebuilding. Although nuclear safety regulations now require the submission of resident evacuation plans, it is hard to say they are fully prepared for rebuilding. It will be the mission of this project to provide some direction in discussing this issue as well.

Investigatory goals

This concludes the summary and recommendations of the report on the Private Accident report. However, the investigatory goals of this project are not limited to the proposals of Independent Accident Investigation. The Government Accident Report, the Parliamentary Accident Report, and the Academic Accident Report also make meaningful recommendations, which we have included in our deliberations. It is not, however, the intention of this project to cover all of the lessons and

recommendations dealt with by these accident investigations, or to verify and re-verify them one by one. In this report, we will continue to examine the main themes to be investigated, such as nuclear safety regulations and TEPCO's governance, based on the recommendations presented by past accident reports.

To close, I have posted the reference material that summarizes the recommendations presented by each accident report according to this project's research topics.

Reference Material

Proposals from the Private, Government, Parliamentary and Academic Accident Investigations

The proposals announced by the Private, Government, Parliamentary and Atomic Energy Society of Japan Accident Investigations have been organized into themes for each chapter, the issues to be examined in each chapter also being listed. Even those issues not explicitly proposed as "recommendations" but hinted at in any of the accident reports are included.

Chapter 1 Safety Regulations

- Accident management (AM) regulatory requirements and institutional considerations (Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, p.266).
- Establishment of an effective nuclear safety regulatory body independent of the administration promoting nuclear power (Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, p.388).
- Overcoming the 2-3 year transfer problem: Developing professional human resources whose life work is safety regulation (Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, p.388).
- Formation of a Critical Expert Group on safety regulation governance (Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, p.321).
- Revision of assumptions in nuclear disaster countermeasure manuals, etc. (Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, p.100).
- Parliamentary monitoring of regulatory authorities (The National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission, 2012, p.2).
- Requirements for a new regulatory body (The National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission, 2012, p.3)
- Review of nuclear regulations (The National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission, 2012, p.6)
- Countermeasure proposals with a view to compound disasters (Cabinet Office, Government of Japan, 2012, p.433).
- Proposal for a switch in risk awareness (Cabinet Office, Government of Japan, 2012, p.433).
- Recommendations regarding the construction of accident prevention measures (Cabinet Office, Government of Japan, 2012, p.434).
- Proposal regarding the need for comprehensive risk assessment (Cabinet Office, Government of Japan, 2012, Report p.435).
- Proposals for severe accident countermeasures (Cabinet Office, Government of Japan, 2012, p.435).
- Recommendations for better monitoring operations (Cabinet Office, Government of Japan, 2012, p.436).
- Proposals for meeting international standards including the IAEA (Cabinet Office, Government of

Japan, 2012, p.439).
- Proposal regarding the ideal state of a nuclear safety regulatory body (Cabinet Office, Government of Japan, 2012, pp.439–441).
- Recommendations for rebuilding a safety culture (Cabinet Office, Government of Japan, 2012, p.441).
- Setting quantitative safety goals and efforts for social sharing and dialogue (Atomic Energy Society of Japan, 2014, p.358).
- Establishment of basic, systematic safety principles that go beyond individual technical development (Atomic Energy Society of Japan, 2014, p.359).
- Development of a "regulatory book" of ideas for defense in depth/Strengthening measures against external events/Strengthening measures from past accidents (Atomic Energy Society of Japan, 2014, pp.360–362).
- The approach of safety regulatory agencies (Atomic Energy Society of Japan, 2014, p.367).

Chapter 2 TEPCO and Its Governance
- Lack of an appropriate relationship between regulators and operators: the need for mutual understanding and respect between the two parties (Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, pp.289–290).
- Ambiguities of responsibility brought about by "privately administered national policy"/ Business responsibility for reviewing safety regulation governance (Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, pp.320–321).
- The limits of responsibility of the operators of privately administered policy–The irreplaceable role of the state (Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, p.388).
- Monitoring electric power companies (The National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission, 2012, pp.2–3).
- Proposals regarding the nature of TEPCO (Cabinet Office, Government of Japan, 2012, p.441).

Chapter 3 Risk Communication
- Consensus building in the ambiguity of scientific knowledge ・ Cross-border scientific communication (Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, p.66).
- Social media and risk communication during a nuclear crisis (Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, p.145).
- Recommendations regarding public relations and risk communication (Cabinet Office, Government of Japan, 2012, p.436).
- Proposal for incorporating new knowledge into disaster prevention plans (Cabinet Office, Government of Japan, 2012, p.434).
- Recommendations on how to evacuate residents (Cabinet Office, Government of Japan, 2012, pp.437–438).
- Recommendations regarding public understanding of radiation (Cabinet Office, Government of Japan, 2012, p.438).

Chapter 4 Crisis management in the Prime Minister's Office
- Lessons related to micro management in the Prime Minister's Office in dealing with the nuclear accident (Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, p.98).
- Lessons on various issues in the crisis management of complex disasters by the Prime Minister's

Office (Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, p.119).
- Institutional understanding of Prime Minister's Office staff capable of responding to nuclear disasters/education, training and systems that support advice to politicians (Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, p.101).
- Review of the government's crisis management system (The National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission, 2012, p.2).
- Proposal for rebuilding crisis management systems in the event of a disaster (Cabinet Office, Government of Japan, 2012, p.435).
- Proposal regarding the nature of the Nuclear Emergency Response Headquarters (Cabinet Office, Government of Japan, 2012, pp.435–436).

Chapter 5 The Logistics of Responding to a Nuclear Emergency
- Recommendations for various reviews of the off-site center system (Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, pp.168–169).
- Necessity of a FEMA-like nuclear disaster response unit as the last stand (Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, p.388).
- Proposals for an off-site center (Cabinet Office, Government of Japan, p.436).
- Emergency preparedness and strengthening response measures (Atomic Energy Society of Japan, 2014, p.363).

Chapter 6 First Responders
- Lessons and recommendations regarding each first responder's command system in the event of a large-scale disaster (Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, p.168).
- Issues concerning the on-site response of first responders in the event of a nuclear disaster (Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, p.168).
- Necessity of a FEMA-like nuclear disaster response unit organization as the last stand (Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, p.388).
- Suggestion for a whole-of-alliance approach in coordinating allies during crisis management (Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, p.380).
- Maintenance of a common base for cooperation between first responders (Atomic Energy Society of Japan, 2014, p.363).

Chapter 7 Rebuilding
- Necessity of follow-up survey for monitoring and managing the effects of radiation exposure on residents in the medium to long term (Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, p.67).
- Government response to disaster victims (The National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission, 2012, p.2).
- Proposal for SPEEDI system (Academic Accident Report p.363)
- Radiation monitoring and long-term dose evaluation (Atomic Energy Society of Japan, 2014, p.370).
- Legal regulations and guidelines for decontamination (Atomic Energy Society of Japan, 2014, p.370).
- Setting a decontamination target area (Atomic Energy Society of Japan, 2014, p.370).
- Decontamination and decontamination technology (Atomic Energy Society of Japan, 2014, p.370).

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Cabinet Office, Government of Japan. (2012). Seifu jiko chô saishû hôkokusho [Final Report of Investigation Committee on the Accident at Fukushima Nuclear Power Stations of Tokyo Electric Power Company]. Report, June 23. Tokyo: Cabinet. (In Japanese.)

Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident. (2012). Fukushima gennpatsu jiko dokuritsu kenshô înkai: chôsa, kenshô hôkoku sho [Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident: Report on the Inquiry and Investigation]. Tokyo: Rebuild Japan Initiative Foundation. (In Japanese.)

The National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission. (2012). *Tōkyō denryoku fukushima genshiryoku hatsudensho jiko chōsa iin kaihōkokusho* [The official report of the Fukushima Nuclear Accident Independent Investigation Commission] (Digest version). Report. Tokyo: Diet. (In Japanese.)

Chapter 1: Safety Regulations: An Approach to Uncertainty

Akihide Kugo

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Towards safety regulations that are not the "captive" of anything

After the accident, each of the published accident investigation reports provided the following lessons and recommendations regarding the ideal form of nuclear safety regulation.

The Independent Accident Investigation pointed out that the "national policy/privatize operation caused ambiguity of responsibility, which in turn weakened the crisis management capabilities of the operators as well as governance," eliciting in subsequent investigations and research that the background to this lay in the organizational culture characteristics of Japanese regulatory culture and customs, specifically "the village and governance by osmosis", and "preferring small peace of mind over great safety".

The Parliamentary Accident Investigation also points out that "between the [former] regulatory side and the operator side, there was an unhealthy relationship that was far from 'reducing essential risk' and 'securing safety' and that worked on academics and all sorts of fields when their interests matched in order to prevent plant shutdowns from lawsuits that negated past regulations and the safety of existing reactors."

Moreover, the Government Accident Investigation stressed, "the nuclear safety regulators must be able to effectively and independently make decisions related to nuclear safety and must be separated functionally from organizations that could unduly impact decision making."

In this respect, in September 2012, the Nuclear Regulation Authority was established as an independent regulatory body making decisions from a purely scientific and technical perspective. Based on the exceptional provisions in force during the declared emergency, the chairman and members of the committee were appointed without confirmation by the upper or lower parliamentary houses (the confirmation of both houses was obtained in February 2013).

Three months after its inception, "the newly established Nuclear Regulation Authority announced its organizational philosophy, consisting of its mission "to protect the general public and the environment" and five principles of activity.[1]

[1] Among its principles of action are 1: Independent decision making, 2: Effective action, 3: Transparent and open

This stated, "everyone involved in nuclear energy must have high ethical standards and always aim for the highest level of safety in the world. We are aware of this and pledge to work tirelessly", upholding as the first of its principles of activity entitled "independent decision-making" to "make independent decisions from a scientific/technical point of view irrespective of all else".

Members of the Regulatory Authority spoke of their renewed determination.

Shunichi Tanaka, who was elected as the first chairman of the Nuclear Regulation Authority, stated first off, "the most important thing for the Nuclear Regulation Authority is to restore trust in the administration of nuclear safety that hit rock bottom,"[2] speaking of his determination to thoroughly ensure transparency and neutrality.

Toyoshi Fuketa, who later succeeded Tanaka, also expressed his determination, saying "although it was acknowledged even before the Fukushima Daiichi Nuclear Power Plant accident that earthquakes, tsunami, and aircraft collisions were 'threats', their strength and probability of occurrence involved 'uncertainties' ［…］, and the magnitude of the 'uncertainties' led to wishful thinking and weakened determination to strengthen measures. The Nuclear Regulation Authority will continue to monitor and review in order to prevent these threats from being put off because of their 'uncertainties'."[3]

As the legal system underpinning this new regulatory system, the Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors, which forms the basis of nuclear safety regulations, was revised, and in response to this, the Nuclear Regulation Authority established new regulatory standards.[4]

Previous wording regarding the planned promotion of the use of nuclear power was deleted and the focus was strengthened to ensuring safety to protect the people and the environment through sound regulation of nuclear power, and regulations such as periodic inspections for nuclear power plants under the Electricity Business Act have been unified under the Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors.

Safety regulations have been changed, taking into consideration serious accidents that had previously been outside the scope of regulations until then. They also introduced a "back-fit system" that requires nuclear facilities that have already obtained permission to comply with the latest regulatory standards. This was a switch from the voluntary arrangements of the past, which was called "back check," where it was the responsibility of the operator when new technical knowledge came to light and regulatory standards were changed to accommodate them at a facility that had already obtained permission, to a compulsory system strongly enforced by the government to comply with the latest standards. If a

organizational structure, 4: Sense of responsibility and a desire to improve, and 5: Emergency readiness. In Nuclear Regulation Authority, (n.d.) *Soshiki rinen*［Company Principles］*,Genshiryoku kisei iinnkai (Iinnkai homupeji)*［Nuclear Regulation Authority (Authority Homepage)］Retrieved June 30, 2020 from https://www.nsr.go.jp/nra/gaiyou/idea.html (In Japanese.)

[2] Nuclear Regulation Authority, 2012.

[3] Toyoshi Fuketa 2015.

[4] The full name of the law is the Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors (Act No. 166, Showa 32). The revisions promulgated on June, Heisei 24 (2012) put in place new regulatory standards as well as a new inspection guide together with its enactment. The new regulatory standards are made up of three requirements regarding major accidents: measures against factors that can lead to major accidents, strengthening of major accident prevention and mitigation, and measures to avoid the leaking of radioactivity into the environment.

facility does not comply with the regulatory standards, the NRA can order the operator to cease operations or modify the facility, and if the order is violated, it can cancel the license or impose a penalty.

Moreover, the period during which the licensee can operate the power reactor was limited to 40 years in principle, starting from the day the operator passed the pre-use inspection. The operating period could be extended only once with approval from the Nuclear Regulation Authority within a period not exceeding 20 years, which was specified by a Cabinet Order.

The newly established regulatory standards required concrete countermeasures for severe accidents (development of facilities and systems for severe accident countermeasures) with extremely low probability, putting thorough in-depth protection first. In order to prevent the loss of safety functions due to common factors, the regulatory standards called for multiplexing and diversification of power sources and core cooling systems capable of coping with natural phenomena such as volcanoes, tornadoes, and forest fires, and non-natural phenomena such as power outages, fires, and internal flooding should a severe accident occur; and countermeasures centered on portable equipment (portable equipment/ distributed connection port arrangements) and the establishment of permanent facilities (designated severe accident response facilities) to back them up for intentional aircraft collisions, among other measures.

Furthermore, as an evaluation for improving the safety of operators, the Regulatory Act mandates that operators themselves implement a regular safety review system, which had been conventionally confirmed by regulatory authorities in daily safety inspections (Periodic Safety Review (PSR) system, which reflects the latest knowledge and regularly checks measures for managing aging), and add safety assessments using the probabilistic risk assessment method in addition to the safety margin assessment to comprehensively assess the safety of nuclear facilities and create a system for reporting to the national government.

In order to operate such a safety regulation system independently, the Nuclear Regulation Authority, which is the core of nuclear safety regulation, was set up as an external institution of the Ministry of the Environment. As a result, administrative matters such as nuclear safety regulations and safeguards for nuclear non-proliferation handled by the Ministry of Education, Culture, Sports, Science and Technology and the Ministry of Land, Infrastructure, Transport and Tourism were consolidated, and the safety regulation system reformed. Accompanying this, the Nuclear Safety Commission and the Nuclear Safety and Security Agency were abolished.

Decent nuclear safety regulation cannot be expected if it is not assured of an institutional barrier from the administrative agencies promoting nuclear power, and without fundamental reform of the enforcing governance and ambiguous relationship between the regulatory side and the regulated side. This was the “lesson” from the Fukushima Daiichi Nuclear Power Plant accident. Major reforms have been implemented regarding the nuclear regulatory system. It can be said that Japan has learned well here.

However, although the mechanism has been revamped, actual operations are still dragged down by the inertia of the old system. Ambiguous authority and responsibility in deciding matters and a highly bureaucratic organizational culture remain unchanged. Using an expression from the *Anatomy of the Yoshida Testimony: The Fukushima Nuclear Crisis as seen through the Yoshida Hearings*, published by the Rebuild Japan Initiative after the Independent Accident Investigation, “the village and governance by osmosis” and “preferring small peace of mind over great safety” are characteristics of Japanese regulatory culture and practices that are not easily eradicated.

Below, we will ask whether the "learning" gained from the circumstances leading up to the Fukushima Daiichi Nuclear Power Plant accident and the experience gained at the time have been effectively utilized in safety regulations, focusing on three themes: 1) new regulatory standards, 2) voluntary safety improvement activities, and 3) organizational culture.

1. From observing "homework" standards to voluntary safety *kaizen*

Out of remorse over the Fukushima Daiichi Nuclear Power Plant accident, safety regulations for nuclear power plants have introduced a backfit system, which is legally required by the Regulatory Act to reflect the latest knowledge in existing facilities. In addition, the newly established regulatory standards clearly state that safety measures include measures for severe accidents, and demand that measures be strengthened by significantly increasing the design criteria for large-scale natural disasters so that safety functions would not be lost due to common factors. They also ask measures to be strengthened for non-natural phenomena such as fires, internal flooding, and power outages that might cause a similar loss of function. Furthermore, the regulatory standards demand the preparation of equipment and procedures to cope with serious accidents and response to terrorism and aircraft collisions. Here, we consider the merits and demerits of the normative inspections that check the detailed specifications required under the regulatory standards as well as issues pertaining to the backfit system specified by the Regulatory Act.

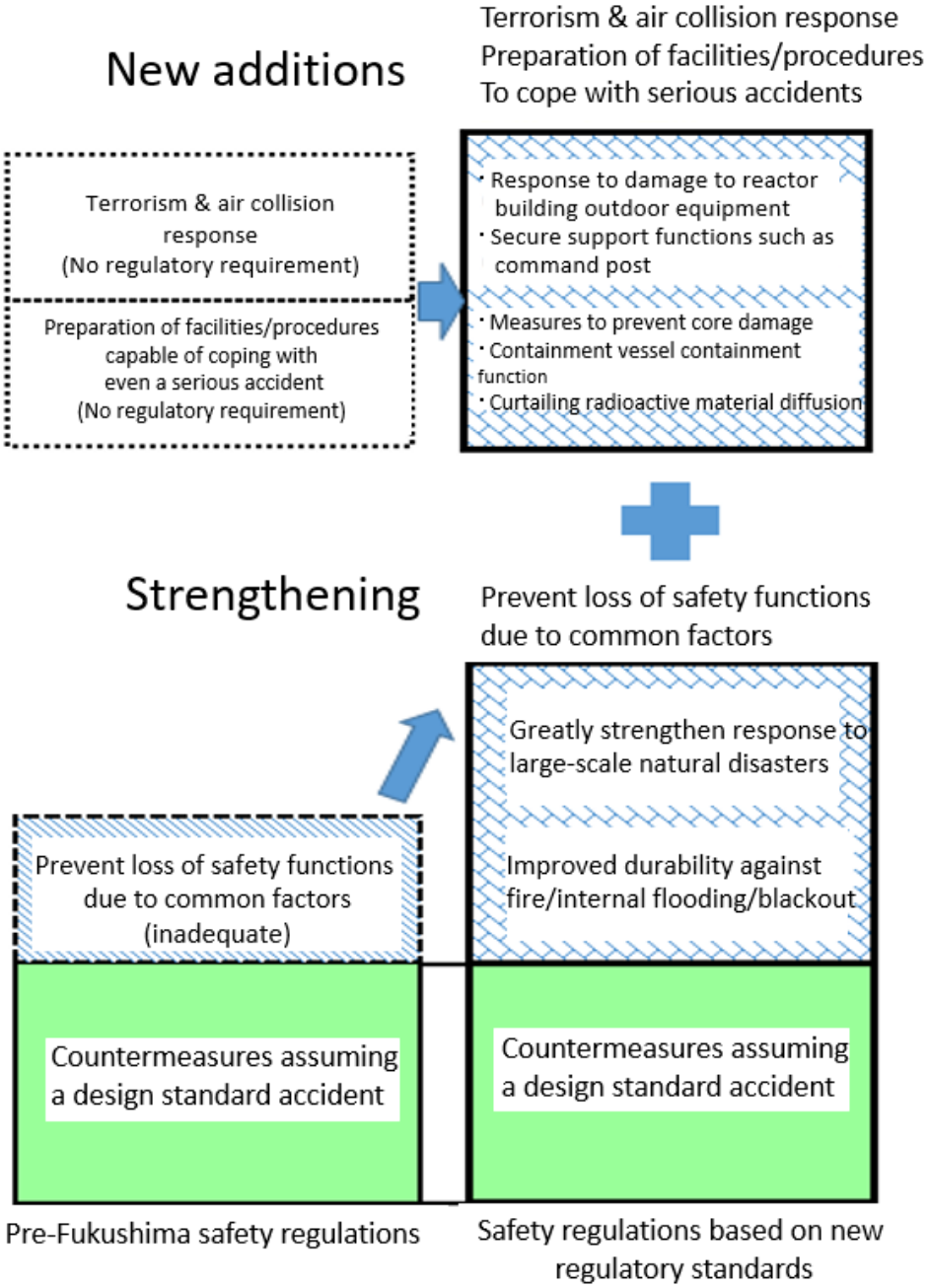
Merits and demerits of compliance inspection

The Fukushima Daiichi Nuclear Power Plant accident was a "parallel chain nuclear disaster" (Independent Accident Investigation) in which many safety functions were simultaneously or sequentially lost due to the overlap of a natural disaster involving a large-scale earthquake and tsunami. However, there was insufficient consideration of design and operations for such risks prior to the accident, and response measures for when a severe accident was reached were not covered by the regulations. This is because of the infallibility of regulations that maintained that accidents such as core fusion should rarely occur if the design conditions approved by the regulations are observed and safety is adequately ensured, and these were incompatible with an administrative policy of maintaining continuity and consistency with past measures. Therefore, even if the regulatory authority drew up a guideline (standard) incorporating new knowledge, it was not as a result possible to urge operators to comply with the latest guideline (standard).

Based on such regrets, the newly established Nuclear Regulation Authority has newly established a regulatory standard that it proclaims to be "the highest level of safety in the world"[5] (Tanaka, inaugural Chairman of the Nuclear Regulation Authority) (See Figure 1).

[5] Nuclear Regulatory Authority, 2013.

- Figure 1 Concept of new regulatory standards



Created with reference to the Nuclear Regulation Authority website
https://www.nsr.go.jp/data/000070101.pdf

The Nuclear Regulation Authority is a so-called Article 3 commission prescribed in Article 3 of the National Government Organization Act. It has the right to establish rules necessary for nuclear regulation from an independent and neutral standpoint[6]. In addition, Article 7 of the National Government Organization Act stipulates, “a secretariat can be set up within the commission.” This secretariat is the Nuclear Regulatory Agency. Although it is called an agency, it is not an “agency” in the sense of an administrative institution of the country under Clause 2 ofArticle 3 of the National Government Organization Act. The Nuclear Safety Commission before the nuclear accident was

[6] Refer to Article 3–2 of the National Government Organization Act (Act No.120, Showa 23), and Article 26 of the Act of Establishment of the Nuclear Regulation Authority (Act No.47, Heisei 24).

merely a council-based agency that advised and made recommendations to administrative bodies, investigated administrative matters regarding regulations for ensuring the safety of nuclear power use, and made recommendations to the head of the relevant administrative agencies through the Prime Minister when necessary. In addition, the Commission only pointed to weak guidelines (Nuclear Safety Commission internal regulations), which the regulatory agency referred to during the examination, and had no authority to directly implement administrative sanctions even if they discovered legal transgressions (a so-called Article 8 commission).

The Nuclear Regulation Authority has the same strong powers as other ministries such as the right to establish rules, the right to authorize licenses, the right to submit reports, and the right to admonish. The new regulatory standards and examination guidelines established by the Authority show a strong independence from the operators under the framework of the Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors, and the technical basis of safety verification has become direct and legally strong. Should the pursuance of its affairs under its jurisdiction require it, it can make recommendations to the head of the relevant administrative agency on matters relating to ensuring safety in the use of nuclear power and request a report be made on the measures taken based on that recommendation.[7] The chair has a fixed term of office of five years in a position free from external pressure, and imposes strong restrictions on firing and dismissals during that period, and guarantees a well-insured status.[8]

The government bill initially planned to set up the Nuclear Regulatory Agency within the Ministry of the Environment based on Clause 2, Article 3 of the National Government Organization Act. However, the Liberal Democratic Party and the Komeito, which were opposition parties at the time, believed it to be desirable that it be a collegial body guaranteed to exercise independent powers, not be under the command or supervision of the Minister of the Environment, where it was to be set up, and submitted a bill to the Diet to set up a commission. As a result of coordination with the government bill, the establishment of the Nuclear Regulation Authority and the Nuclear Regulatory Agency as a secretariat of the authority was approved by the Diet.

Yasuhisa Shiozaki, an LDP member of the House of Representatives, who worked hard to adjust the bill in the Diet to make the Nuclear Regulation Authority an Article 3 body, looked back saying, “I thought the independence of regulations was an urgent issue, and the LDP and Komeito made a joint proposal for the Act for Establishment of the Nuclear Regulation Authority guaranteeing the top post, and the amendment was approved by the LDP, Komeito and the DJP.”[9]

In response to this, Tanaka, who became the inaugural chairman of the Nuclear Regulation Authority commented, “When summoned to the Diet, I was prepared to clearly state as different what I thought was different,”[10] testifying that he tried to be independent from political pressure and stay true to the new organizational philosophy.

On the other hand, the operators have first of all made meeting the requirements of the new regulatory standards for restarting nuclear power generation their most important management task, and have reviewed design conditions, strengthened equipment, and worked on safety assessments. However, due to the strict and conservative attitude of the Nuclear Regulation Authority towards review and inspection, there are sometimes conflicts at the site. For example, from the viewpoint of

[7] Article 4-2 of the Act for Establishment of the Nuclear Regulation Authority (Act No.47, Heisei 24).
[8] Article 4-2 of the Act for Establishment of the Nuclear Regulation Authority (Act No.47, Heisei 24).
[9] Interview with Yasuhisa Shiozaki, March 17, 2020.
[10] Interview with Shunichi Tanaka, November 20, 2019.

diversification of countermeasures, examiners demanded that power supply vehicles and fire engines (water injection pumps) installed on high ground should be secured with chains to prevent falling in the event of an earthquake. An executive of a power company points out, "Intransigent regulatory demands for perfection (zero risk) in individual functions of power supply vehicles that are deployed in the expectation of mobility during a severe accident haven't been tested to see how effective they are for the duration of the entire event."[11] He further cast doubts on the fact that the regulatory authority's hard-and-fast rule like attitude remains unchanged,stating, "I think that after the establishment of the Regulation Authority, it was inevitable that the Regulation Agency's staff would question us as if they were the guard at the Ataka Station in the kabuki play Kanjincho grilling Yoshitsune and his party. It's just that it's been eight years, so now, I'd like them to concentrate as experts just on the one point of making things safer."[12]

In general, it is said that a good administrative officer is one who excels at quickly finding even small risks. It is a requisite quality for a professional inspector. However, it can increase other risks, such as in the example above, when time is lost to remove a chain in an emergency concerning power supply vehicles and fire engines. In this case, there is the danger that in focusing only on the risk right in front of you (partial optimization), such as preventing falling, you may lose sight of the overall larger risk (total optimization). Dissatisfaction and concerns exist in the field regarding the application and operation of these new regulatory standards at the inspector level.

On the other hand, Toyoshi Fuketa, who acts as chairman of the Nuclear Regulation Authority, a council organization of the Nuclear regulatory Authority, said, "If national regulations are only poking at trivial issues, it will discourage improvements. It's important to focus reviews and inspections on key areas of safety, to properly set out priorities and degrees of importance",[13] speaking of regulations that will foster the desire to improve safety, but in the field where reviews and inspections take place, the predominant atmosphere is one of seeking objective criteria that can be easily assessed onsite, in other words tangible specifications, and that this amounts to the fulfillment of regulatory responsibilities. Also, speaking from the perspective of an academic expert, Akio Yamamoto, Chairman of the Nuclear Fuel Safety Special Examination Committee, commented, "picking up from former design guidelines, the current new regulatory standards tend to be more hardware-oriented. The IAEA guidelines also separately cover software, so this kind of area needs to be expanded."[14] He suggests not paying too much attention to the technical details, but rather paying attention to the operation of the software side in the future. It should be noted that not only the operation of regulatory standards with an emphasis on equipment requirements, but also efforts related to organizational culture such as leadership and management are receiving international attention.

The IAEA's Regulatory Evaluation Service (IRRS) uses the term 'less prescriptive' (conformance to standards, but understanding the underlying concepts) regarding the stance of regulatory inspection, and rather than a regulatory inspection that tells you how to do the tiniest detail, recommends aiming at inspections that allow for independent thinking.[15] In addition, an overly conservative stance on the part of regulatory authorities has the side effect of prolonging inspections on conformity to regulatory standards and making it impossible to predict the length of inspection periods. For example, as a countermeasure to terrorism, regulatory standards require the establishment of a facility to cope with

[11] Interview with TEPCO executive, November 27, 2019.
[12] Ibid.
[13] Nuclear Regulation Authority, 2019b.
[14] Nuclear Regulation Authority, 2018a.
[15] IAEA, 2016.

a specific severe accident that can remotely operate the nuclear reactor separately from the control room. The Nuclear Regulatory Authority provided a five-year grace period for completion, but as the end of the period nears, many operators were asking for an extension of the period due to the prolonged examination.

Of course, the regulatory side has its own reasons. Eiji Hiraoka, who was Deputy General Manager of the Nuclear Safety and Safety Agency at the time of the Fukushima Daiichi Nuclear Power Plant accident, said about the current "dialogue" between the NRA and the operators, "the feeling that the regulatory body would give in if you lobbied them enough, which was the attitude of the electric power companies, doesn't seems to have changed that much from before the Fukushima Daiichi nuclear accident. I think the Regulation Authority thought it would be the same thing all over again with the delay in the seismic backcheck at NISA if they allowed this."[16] From the regulator's point of view, this looks like "cajoling" on the part of the operators, in which it only takes some lobbying to pull something off.

Current inspections on safety regulations mainly focus on confirming the status of compliance, which confirms that the facilities and operating conditions of the operators comply with the approved regulations and technical standards, and that they do not violate them. Consequently, the regulatory side is required to comprehensively and impartially check inspection items related to the regulations and standards, and has no discretion to emphasize items and concerns that contribute greatly to nuclear safety. On the operator side, satisfying the current regulatory standards is the priority, and they purposefully do not embark on additional measures to further enhance safety since they would just be a factor accompanied by new reviews and inspection procedures of regulatory standards, which would reduce management efficiency.

As such, the Nuclear Regulation Authority has again made it clear that the primary responsibility for nuclear safety lies with the operator, and is aiming to reform the existing inspection system into one which will motivate the operators into making progress on their own towards greater safety and not merely limiting themselves to meeting and confirming conformity to standards. This new inspection system, which began in fiscal 2020, is modeled on the U.S. inspection concept of performance-based regulations that emphasize the results of safety activities by operators, and risk-informed regulations[17] that ensure effective safety by utilizing risk information.[18] Former NRC Commissioner George Apostolakis said of the American model, "There are keywords in the U.S. regulations that have two purposes: 'adequate protection' and 'safety enhancement'. The former, 'adequate protection', is intentionally left undefined, and assumed to be achieved when compliance with (…) regulations occurs. There is a clear distinction between the two words. Adequate protection requires full compliance, whereas safety enhancements are voluntary."[19]

In addition, to express the degree of maturity in this inspection system, former U.S. NRC regional administrator Charles Casto, who can be said to have come up through the ranks in the field of nuclear safety regulation in the United States, said "there's a difference between being an inspector and a regulator. Inspectors are like auditors, and regulators use and add wisdom. Japan is still at the stage where inspectors audit the performance of the operators."[20]

[16] Interview with Eiji Hiraoka, November 19, 2019.
[17] This refers to risk-informed and grade-approach.
[18] International Atomic Energy Agency, 2020.
[19] Interview with George Apostolakis, January 29, 2020.
[20] Interview with Charles Casto, August 26, 2019.

A new inspection system involves a "change in thinking" from passive inspection, in which the operator has the state confirm safety, to an active inspection, in which the operator proves safety through its own safety activities. This system took several years or more even in the United States for both regulators and operators to understand its purpose and for it to mature[21], and it is crucial in Japan as well that the principles of regulations and operators are shared.

One of the "lessons" from the Fukushima Daiichi nuclear accident was that a thorough awareness about uncertain phenomena had to be shared by the regulatory side and the operators regarding the way of approaching and operating regulations maintaining all the while the independence of regulations.

Kenji Sumita, Vice Chair of the (then) Nuclear Safety Commission, who spearheaded the team at the scene of the criticality accident at the nuclear fuel processing facility in Tokaimura about 20 years ago, said, "There is a certain inevitability that governments all over the world have intervened greatly in nuclear safety administration and exert powers (...) However, the more regulations are tightened in this kind of way, the more the field loses its spontaneity and gives preference to formal compliance. If there's no balance somewhere, there's a great risk that the substance will be lost. I want you to value the feelings of the field as well,"[22] suggesting a balance between the strict operation of regulatory standards and the motivation of operators.

Regulators have yet to shake off the traditional culture of rigorous inspection of visible standards. Operators remain keen to stick to the basic compliance manual. It is difficult to generate regulatory *kaizen* and innovation through true cooperative work out of this.

It should be noted that yes, the regulatory standard is "to assess whether or not the installation and/or operation of a nuclear facility is permitted", but "this does not mean that absolute safety can be secured by satisfying this".[23] There is no end to the pursuit of nuclear safety, and aiming continually for higher levels is a must. They should be viewed as an attempt to warn operators —and importantly, regulators— not to reassure themselves that it is safe if the regulatory standards have been cleared. Tsuyoshi Shiina, an attorney who acted as the secretariat of the Parliamentary Accident Investigation, uses a student/teacher metaphor to describe this view of regulatory compliance as safety achieved by the operator (and the regulator) as the "homework response"[24]. If operators (and regulators) misunderstand the principles of the new regulatory standards and think that compliance with standards ensures absolute safety, they will not have learned the lessons of the Fukushima Daiichi nuclear accident.

2. From backcheck to backfit

The backfit system is a system for constantly reviewing safety regulations and continuously improving safety, and is an "opposing concept to the safety myth."[25]For example, regarding severe accident response measures (AM), out of remorse over the fact that even if new regulatory standards

[21] Atomic Energy Society of Japan (AESJ) Safety Department, 2019.

[22] Sumida, 2000.

[23] Nuclear Regulation Authority (n.d.) *Shin kisei kijun*［New Regulatory Standards］*Genshiryoku kisei iinnkai (Iinnkai homupeji)*［Nuclear Regulation Authority (Authority Homepage］Retrieved June 30, 2020 from https://www.nsr.go.jp/activity/regulation/tekigousei/ (In Japanese.)

[24] Interview with Tsuyoshi Shīna, October 9, 2019.

[25] Nuclear Regulation Authority, 2017b.

about, say, existing seismic guidelines had come into force, there was no legal basis for requiring new standards to be met by facilities that already had installation (change) permits, and as a result of being left up to the voluntary activities, this led to the Fukushima Daiichi Nuclear Power Plant, backfit was introduced into the 2012 revision of the Act on the Regulations of Nuclear Source Material, Nuclear Fuel Material and Reactors. Until then, there was only a measure called backcheck, in which the regulatory authority asked the operator to check the strength and durability of equipment according to the latest standards. Backcheck was based on the voluntary activities of the operators,but its effectiveness was weak. As pointed out in the Independent Accident Investigation report, when the NISA requested a major urgent safety confirmation based on the backcheck policy at the time when the earthquake-resistant guidelines were revised significantly in 2006, TEPCO had postponed the final report until 2016.

An example of a case where the backfit system, which requires operators to reflect the latest knowledge to existing facilities with legal force, was applied includes the decision by the Nuclear Regulation Authority[26] that demanded a review of the impact of volcanic ash and re-application for safety examination procedures for the Takahama, Ohi, and Mihama power plants, which had already undergone regulatory standard compliance assessment. In research commissioned by the Nuclear Regulation Authority, the scale of volcanic ash eruption originating from Daisen known as “Oyama Namatake Tephra (volcanic ejecta)” was greater than hitherto assumed in inspections. It was found that the safety assessment conditions (maximum ash layer thickness) for these three reactors, which had already completed the regulatory standard compliance assessment, were insufficient, and they were asked to undergo a reassessment of compliance standards.

This is a case that required new knowledge and regulatory standards to be promptly applied to existing reactors, and that the operator voluntarily satisfied the guideline requirements when the seismic guidelines were revised. This became a symbolic case showing the force of safety regulation[27] and a shift from the “guidance” prior to the Fukushima Daiichi Nuclear Power Plant accident that hoped operators would voluntarily meet the new standards indicated by revised seismic guidelines, to a “demand” based on legal grounds. Chairman Fuketa commented during a press conference, “this new finding is not an extremely large change that requires immediate suspension of facility use, but that doesn’t mean it’s just to be ignored, and it is an example of the Authority’s stance on discussing installation changes when a certain change in the situation has occurred.”[28]

However, backfitting involves some difficult problems. Chairman Fuketa emphasizes the significance of promptness, saying “if an improvement is found, prompt action is important for regulation and nuclear safety.”[29] Certainly, it is quite correct that such a quick and flexible attitude is important, but at the same time, there are many cases where an academic evaluation cannot be established regarding the “uncertainty” of natural phenomena. In such cases, the rationale for backfitting is not necessarily convincing.

On the other hand, both the regulator and the operator are responsible for collecting information on new experience based on operational experience, new knowledge about equipment reliability, research results, redefined external hazards, and various other factors. However, from the point of view of the operator, collecting information for this purpose is laborious and costly.

[26] Nuclear Regulation Authority, 2019a.
[27] Article 43-3-23 of the Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors (Act No.166, Showa 32).
[28] Nuclear Regulation Authority, 2019c.
[29] Ibid. p.5

The U.S. Nuclear Regulatory Commission (NRC) backfitting rules[30] are similar to the Japanese Nuclear Regulation Authority's operation of regulatory standards in that new information on nuclear safety must be reflected in existing facilities. However, what is significantly different from Japan is the existence of a process to set a target value and judge the effect of aiming for that while bearing in mind cost and balance. When the NRC makes this type of request, it is required to invite stakeholders to a hearing and provide a cost-benefit analysis showing that the estimated safety benefits outweigh the costs of systemic or operational changes. Although there are reasons as to why this would be difficult to introduce in Japan due to the high risk of natural phenomena and uncertainty coming from different views on hazard among experts, this cost-benefit perspective is rare in the requirements of Japanese regulators.

3. How far can "independence" be exercised? Independence incorporated into regulations

In order to ensure and enhance nuclear power safety, an effective means for operators to make voluntarily efforts and for those efforts to have a sustainable effect is to introduce and entrench probabilistic risk assessment methods. But here too there are challenges to overcome.

Sustainability of safety improvement evaluation system

The primary responsibility for safety lies with the operators of the nuclear business. Confidence in nuclear safety is created by the fact that the operator takes nuclear safety seriously, confirms it by a third party, and this figure is clearly visible to society. It is difficult to check the safety of a nuclear power generation system that has accumulated highly specialized technology from the perspective of the general public. Its role is left to security regulation by a third party, that is, the state. However, it is not safe and secure if nuclear safety is completely left in the hands of governmental regulatory authorities. In the wake of the Fukushima Daiichi nuclear accident, it became clear that the governance of both the operator and the national safety regulator was insufficient.

The relationship between the two is summarized in "defense in depth as a system", which will be touched on in the section on independence below, so we will only briefly mention it here, but the "primary responsibility for safety" of the operator is the responsibility of the operator to ensure the safety of nuclear power, to enhance it, to keep the risks of nuclear power as low as possible and contribute to the preservation of the lives, health and environment of the people and the security of Japan. In addition to this, to avoid falling into self-righteousness, it is also necessary to improve the quality of one's own activities through peer pressure and peer review from operators at home and abroad. On the other hand, regulation by the state supervises the activities of the above operators, but also fulfills its regulatory obligations through information sharing and advice support activities with overseas organizations and international organizations that have the same regulatory status. Furthermore, the social responsibility of nuclear safety is fulfilled through the functions of a multi-layered governance system in which social stakeholders such as local governments and the news media monitor these activities of the operators and regulators.

After the Fukushima Daiichi Nuclear Power Plant accident, recognizing that it was important for operators who have the primary responsibility for nuclear safety to improve their safety independently, and in order to utilize the autonomy of the operators as well as to monitor their activities at the same time, the Nuclear Regulation Authority set up a safety improvement evaluation system that requires operators to regularly evaluate facility safety themselves, notify the Nuclear Regulation Authority of the results, and publicize those results.

[30] Federal Court of Appeals Decision (United States Court of Appeal) (1987), The Commission may impose "safety enhancement" requirements, but these are subjected to cost-benefit analysis (back-fit rule). (10 CFR 50.109).

This arrangement not only raises operator awareness about safety regulation activities, which bind by compliance or not to new regulatory standards, but also awareness about the leeway for voluntary activities to enhance safety, it being a system that posits the conduct of continuous safety improvement activities by the operators themselves as an obligation within the regulatory legal system.[31] It can be said that this is a system aimed at establishing independence to escape from the trap of the safety myth, which posits that safety can be achieved if the hurdle of regulation is cleared; in other words, it aims to stop this trap of thinking based on self-satisfaction.

Under this system, operators are regularly required to conduct a comprehensive evaluation of activities such as incorporation of the latest findings, probabilistic risk assessment (PRA), safety margin assessment (stress test), and medium- to long-term assessment of safety improvements.

However, a similar system existed some 30 years ago. Initially, it was a regular activity to comprehensively evaluate voluntarily the safety and operational management of facilities against the latest knowledge. However, misconduct at a power station triggered a change in inspections by the regulatory authorities monitoring the activity status of the site. As a result, the original purpose of "incorporating the latest knowledge" into defense in depth concepts at the design stage regressed, and the focus of defense in depth verification shifted from design to operation. In relation to this point, the Government Accident Investigation writes, "the security inspection related to PSR [Periodic Safety Review] by the security inspector (...) failed to act as a direct catalyst for improving the content of AM [accident management] at TEPCO, and TEPCO never considered AM for external events such as earthquakes that exceeded design standard events as a voluntary initiative."

While voluntary activities that evaluate the safety and operational management of this facility in light of the latest knowledge have been changing its operational form, risk assessments using the failure rate of individual plants have not been added to PSR.

The voluntary review actions of the operators were limited to understanding the current state of the plant and the status of their business activities, and did not provide a mechanism for identifying what was lacking for further safety improvement. With the regular reviews, which were expected to analyze operating experience that had occurred inside the facility,take measures against problems specific to the facility, and reflect the latest knowledge in the facility, the original purpose of seeking new knowledge and incorporating it into designs when necessary was to enhance and rationalize the content of report and became a repetitious routine. Furthermore, under a system where the safety inspector inspected the results of the periodic safety evaluation on site, information on tangible results was inevitably verified, and the original idea of expecting mutual exploratory efforts to improve safety became a mere sham.[32]

Where did the problem lie? They needed to be keenly aware that the concept of defense in depth was lost at each of the design and operational stages, and that it was not enough to inspect the operators; they had to be motivated to establish a truly effective safety system together.

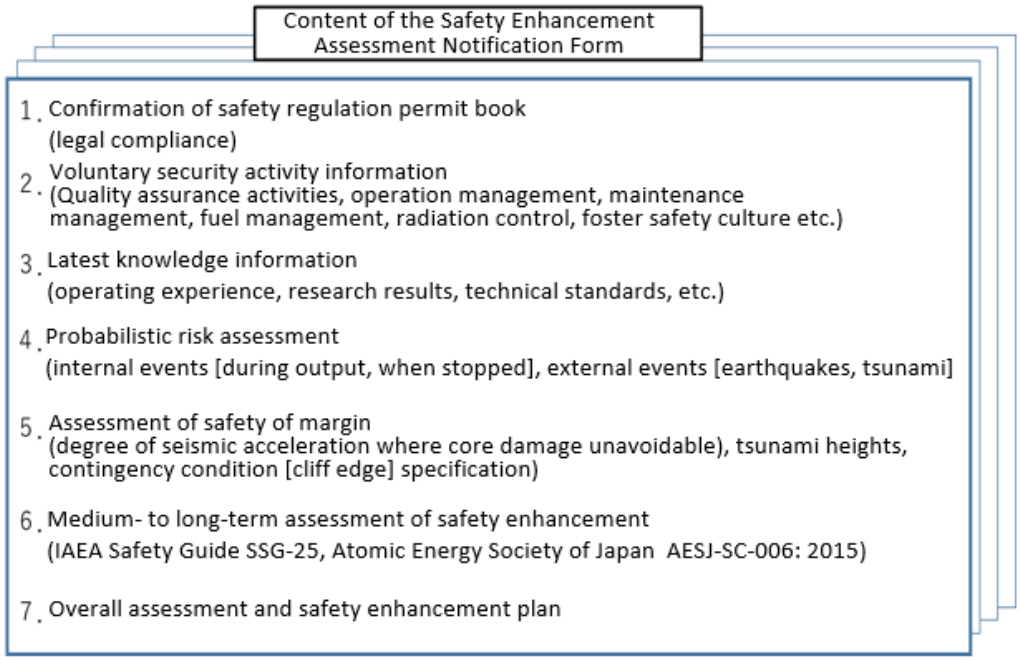
Reflecting on these points, the Nuclear Regulation Authority has made various reforms. Within 6 months of completion of the periodic inspection, a safety improvement evaluation system has been established in which the operator reports to the NRA without delay and this is publicly disclosed. It

[31] Nuclear Regulation Authority, 2017a.
[32] Yamamoto et al., 2018.

refers to the IAEA's regular safety review guidelines (SSG-25)[33] as "voluntary activities within the regulatory framework".

As shown in Fig. 2, in terms of basic design, it was decided to make a comprehensive evaluation by collating and incorporating the latest knowledge, evaluating risk probabilistically, comparing actual safety margins with a limit value[34], and conducting a mid- to long-term evaluation of safety enhancement. By creating an opportunity to make it public and expose it to criticism from society at large, it then became easier to understand the operators' thoughts on new knowledge and safety evaluation.

- Figure 2 Safety Enhancement Assessment Notification Form



On the other hand, regarding the operation of the system, from the outset, notification of safety enhancement assessment results, which is sent from the operator to the Nuclear Regulation Authority, has been made available on the Internet[35]. It is hoped that the notification form contains the results of new knowledge that has been collated. The regulatory authorities have sent a request to the operators that they would like not only passive result information such as accidents, but also proactive reporting on positive operational information.[36] This mechanism is known as "stakeholder oversight" as described in "measures for strengthening deep systems" proposed in document INSAG-27[37] of the

[33] International Atomic Energy Agency, 2013.

[34] This evaluation would assume the occurrence of a beyond design basis accident, including natural disasters, to assess the extent to which the reactor can survive without significant damage to the core or spent-fuel. This will be carried out every 5 years if no changes occur due to, for example, large scale construction.

[35] However, there have been no coordinated meetings regarding the contents of the notification form since the first six meetings. Nuclear Regulation Authority Homepage:
http://www.nsr.go.jp/disclosure/committee/yuushikisya/anzenpower_plants/index.html

[36] Nuclear Regulation Authority, 2018c.

[37] IAEA International Nuclear Safety Group, 2017.

International Nuclear Safety Advisory Group (INSAG), an advisory body of the IAEA Secretary-General, which will be discussed later, and can be said to embody one stage of the third layer.

However, to what extent are the values of this mechanism shared by both parties? Is it possible to create not an enforced safety enhancement assessment system, but the motivation to encourage voluntary activities by operators? If the safety enhancement assessment system, which is an "independent activity within the regulatory framework", consists of no more than questions and requests between the operator and the regulator, and if opinions and evaluations from outside parties are not widely amassed, stakeholder oversight, or "verification by a third party", will end up being pie in the sky.

One successful example of self-regulation is the Institute of Nuclear Power Operations (INPO), which was established after the Three Mile Island accident in the United States under the basic belief that "self-regulation by operators" was important, creating a mechanism for operators to voluntarily improve safety by using the psychological effect of "peer pressure". The U.S. electricity industry accepted INPO injecting strong navy leadership into the industry, and using this as a basis, INPO demanded discipline for the end of mutual aid from companies throughout the industry, positing that all share the same risk environment, regardless of size. The Japan Nuclear Safety Institute (JANSI), which was established by the Japanese industry consensus following the Fukushima Daiichi nuclear accident, is proceeding with the same steps as it learns from the precedent of INPO. However, an attribute of Japanese society's consensus-based decision-making is that it is not good to talk about the weaknesses of peers, and JANSI with the majority of its staff coming from the same industry must play a strict role and overcome this attribute. It is still only midway, however, to utilizing the psychological effect of "peer pressure" if weak points are identified but not frankly accepted.

4. Accepting all-or-nothing risk

In the United States, administrative decisions regarding nuclear safety are based on a balance between quantitative risk assessment and backfit costs.[38] However, the Japanese backfit system does not set goals as the United States does. In addition, due to the lack of reliable data r for verifying equipment failure and human error rates as well as the lack of expert training, probabilistic risk assessment is not explicitly used in the assessment process by the Nuclear Regulatory Authority under the new regulatory standards, considering the risk of misjudgment when comparing an uncertain evaluation result with the standard value. Under the assumption that there is uncertainty in the risk assessment of external events such as natural phenomena, a mature form of safety regulation would be that the regulators and operators discuss and formulate methodologies on how to use the system for safety screening and safety enhancement effectively.

Apostolakis said, "The Japanese people were negative towards nuclear power, (…) the NRA had to show that they were truly independent (…). So, that explains why these regulations are so strict. (…) I think we need more rational regulations and to make the rational you need risk insights."[39] He also pointed out, "the language between the regulators and the industry should be risk,"[40] being expectant especially of a basic agreement and mature dialogue on the concept of risk between regulators and operators, and even stakeholders.

[38] Garrick, 2017.
[39] Apostolakis, 2019.
[40] Ibid.

However, one of the keys regarding risk is whether the concept of probabilistic risk assessment (PRA) required in the safety enhancement assessment system has taken root in Japan after the Fukushima Daiichi accident.

In its report, the Government Accident Investigation examines the history of considering probabilistic risk assessments for external events such as earthquakes and tsunami, and analyzed the background as to why the assessment system could not be used for severe accident response measures (AM). It recommended that comprehensive safety assessments that considered external events be conducted, facility vulnerabilities be identified, effective countermeasures be studied and readied, and the probabilistic risk assessment method be used to evaluate the effectiveness of these countermeasures.[41]

The former method used is known as deterministic safety assessment, a concept that guarantees safety under the strictest design conditions that cover several conservatively assumed events by engineering judgment. On the other hand, the probabilistic risk assessment method, which was born in the United States, organizes the frequency of occurrence of all initiating events and the magnitude of damage that is considered to lead to severe accidents, and evaluates the effectiveness of design specifications based on probability theory.

Activities using probabilistic risk assessment methods for assessing the effectiveness of severe accident response measures (AM) began in Japan as well in the 1990s and early 2000s, but at the time, the best they could do was evaluate the failure of power plant facilities and human error events by staff involved in the operation, and there was insufficient reliable data available for probabilistic risk assessments on natural phenomena such as earthquakes (earthquake PRA). In this way, events that can trigger accidents leading to core damage, melting and loss of containment vessel functionality are called external events, and originate from parts that are not directly related to the operation of the inside and outside of a nuclear facility. External events are broadly classified into natural events such as earthquakes, tsunamis, floods and volcanoes, and human events such as aircraft falls and cyber terrorism. However, events that trigger core damage due to breakage of piping connected to the reactor, equipment failure and human error, etc. are called internal events.

At the time, the device failure rate in the United States was calculated using highly reliable data collected based on the law[42], but such a database is still in the development stage in Japan, and a framework for verifying the reliability of data from a fair and neutral stance as in the United States has not been established. Although the Atomic Energy Society of Japan has been vigorously developing standards[43] for the use of risk information, risk information usage by operators remains limited. Behind this lies the paucity of Japanese business and social environments that allow the use of "uncertain" data as conditions for reference in risk assessment. In Japan, in particular, stricter regulations for quality assurance were promoted to improve operational efficiency due to the detection of a criticality accident at the nuclear fuel processing facility of JCD Tokai Works in 1999 and misconduct by TEPCO in its voluntary inspections in 2002, which created circumstances where it was difficult for society to tolerate operators pursuing management efficiency.

The overall evaluation results after NISA received a summary report of severe accident response measures (AM) from the operator asked for calculations on the probability of core damage and damage to the PCV based on cause events for which data such as equipment failure rate and human error were prepared. If this was within a certain standard value, the severe accident response measure

[41] ICANPS, 2012, pp. 396–398.

[42] Nuclear Regulatory Commission)

[43] Atomic Energy Society of Japan Standards Committee: PSA Parameter Subcommittee, 2010.

(AM) was approved as having been successfully completed[44]. However, this evaluation result does not target risks events involving substantial "uncertainty" such as natural phenomena. This resulted in a mental block where further measures were not considered on the assumption that preparation for a severe accident that rarely occurs is based on convenient information, further strengthening the "safety myth" of nuclear power plants. This cognitive bias was also a cause of distancing the "uncertainty" of such natural disasters from risk assessment targets.

In the United States, external events have been the subject of evaluation in the probabilistic risk assessment of power plants since the 1980s. For example, in a certain plant, it was recognized that the risk of earthquake had a wide range of uncertainty, and so was confirmed as not contributing significantly to total core damage probability.

Checking the contents of the safety enhancement assessment report for a plant that has restarted operation in Japan, although we can see probability risk assessments have been done in addition to the effects of measures readied after the Fukushima Daiichi accident targeting internal events and external events such as earthquakes and tsunami, events experienced in the Fukushima Daiichi accident, such as the vitally important internal flooding, internal fires, superimposition of earthquakes and tsunami, and multiple simultaneous disasters go unreported as they are "to be gradually expanded as PRA methods become more mature." If the degree of "uncertainty" for internal flooding, fire, superimposition of earthquake and tsunami, etc., is not to be checked, and a certain extent of "uncertainty" in technological development is not to be given up, the "lessons" of the Fukushima Daiichi nuclear accident will remain unutilized forever.

Kazaru Saito of the International Institute for Environmental Economics commented, "AM development was designed with internal events in mind, and failed to function effectively for external events such as the earthquakes and tsunami at the Fukushima Daiichi Nuclear Power Plant accident. By not facing up to the question of what the dominant threat is, there will always be huge gaps no matter how much you learn about overseas thinking and methodologies,"[45] explaining the importance of confronting large risks.

In any event, in order to establish probabilistic risk assessment in Japan, operators will need to learn the U.S. NRC Regulations (10CFR50.65 "Requirements for monitoring the effectiveness of maintenance at nuclear power plants") and corresponding industry guidelines (NUMAR93-01 "Industry guideline for monitoring the effectiveness of maintenance at nuclear power plants") , in order to quantitatively show the regulators that using this method during online maintenance will not impair the total safety and reliability of plant equipment, and as a result, have society acknowledge that the utilization rate is improved. Based on U.S. experience, Commissioner Apostolakis noted, "proposals from operators are an important factor in increasing regulatory confidence."[46]

The Nuclear Regulation Authority (NRA) deems information evaluating the effectiveness of severe accident response measures (AM) and showing the weaknesses of facilities obtained from a probabilistic risk assessment to be essential for comprehensively assessing nuclear safety. The Operation Guide for Enhancing Safety of Operating Power Generation Reactors laid down by the NRA, demands as a specific method of investigation and analysis of voluntarily measures taken by operators to enhance safety that 1) an assessment of internal and external events, 2) a deterministic

[44] "With this case, all probabilistic safety assessments regarding AM (accident management) of the 52 existing reactors have been completed." Nuclear and Industrial Safety Agency, Ministry of Economy, Trade and Industry, 2004.
[45] Saitô, 2015.
[46] Nuclear Regulation Authority, 2018b.

safety assessment, 3) a safety margin assessment, and 4) a probabilistic risk assessment of internal and external events be carried out.

Nonetheless, the current probabilistic risk assessments that regulators require of operators are largely limited to internal events such as equipment failure and external events such as earthquakes and tsunami. Assessment of events experienced in the Fukushima Daiichi Nuclear Power Plant accident, such as floods and fires occurring inside the facility, the superimposition of earthquakes and tsunami, and simultaneous multiple disasters, are yet to be put into practical use, there being only a passive attitude of "waiting for future technological developments" as if it were someone else's problem.[47] In order to analyze and evaluate the risk of accidents caused by external events such as natural phenomena, it is necessary to approach risk from the perspective that uncertainties will arise from both physical variations in the natural world and insufficient knowledge. This approach will not be straightforward, but nonetheless this kind of attitude towards problem solving is required.

The fact that the Government Accident Investigation pointed out, "rationalizing the failure to check and implement severe accident measures by citing the immaturity of PSA methods will not be condoned"[48] should be taken very seriously (the Government Accident Investigation uses the term Probabilistic Safety Assessment).

5. Undetermined safety goals

We will also touch on safety goals, which are closely related to probabilistic risk assessment.

In the first of the preparatory meetings before the establishment of the Nuclear Regulation Authority, (then) committee member Fuketa said that discussion on safety goals tended to be avoided as it was a direct discussion that nuclear power damaged the environment and human life, but that we always had to remind ourselves that danger was inherent in using nuclear power, and that he "would like to continue discussing safety goals,"[49] repeatedly making a statement to this effect when the occasion arose.

In fact, in 2013 the Nuclear Regulation Authority designated its safety target: "the value we aim to achieve in pursuing regulation of nuclear facilities is keeping the frequency of an accident where the amount of Caesium-137 released exceeds 100 TBq, about one hundredth of the Fukushima Daiichi nuclear accident, to less than one in one million reactor years in the unlikely event of an accident." This target is significant because it clearly assigns a level of performance that should be sought at the facility, with the Fukushima Daiichi Nuclear Power Plant accident as the basis of that level.

Nevertheless, the NRA is cautious about proposing safety goals in stochastic terms. In other words, its position is that "safety achieved by conformity with regulatory standards cannot be unequivocally shown (in terms of probability theory)."[50] Therefore, in addition to the results of a probabilistic risk assessment, the safety enhancement assessment notification form, which is regularly submitted by

[47] The Nuclear Regulation Authority's Operation Guide states that "the incidents covered by this evaluation will be expanded step by step according to the development and implementation of PRA as a method." The report further clarifies that PRA has not yet been established for the magnitude of earthquakes and tsunamis that caused the Fukushima Daiichi Nuclear Power Plant accident, as well as simultaneous complex disasters. Nuclear Regulation Authority, 2013. Kyushu Electric Power Co., Inc., 2017

[48] ICANPS, 2012, p. 398.

[49] Nuclear Regulation, Authority, 2012, p.11.

[50] Nuclear Regulation Authority, 2018a, p.4.

operators after restarting operations, comprehensively measures safety on a multifaceted scale, including the safety margin, effectiveness assessment results of defense in depth by the deterministic method, operational experience considerations, and organizational factors.

Emphasis here is on the further efforts of operators regarding risk information. "The greatest value of setting quantitative safety targets (performance goals) is to explicitly indicate the existence of risks, and to make people aware of the denial of zero risk and safety myths,"[51] said the NRA Chairman Fuketa. He went on to say, regarding the relationship with the operator, "you can't have a discussion [between the regulator and the operators] if the utilization of risk information is not accompanied by efforts from the operators (…) For example, we haven't had any suggestions [from the operators] regarding standby exclusion time,"[52] stirring the operators along.

This is precisely the importance of the "the language between the regulators and the industry should be risk" pointed out by Apostolakis. Only when both parties use a common language to fight out their opinions will the power of the operator be visible to society, and the real image of voluntary safety enhancement emerge.

However, if that is the case, it may be even more necessary to explicitly place probability theory in the center.

In the United States, there is no logical framework to apply defense in depth without the foundation of safety goals, and they are positioned as a break on the unlimited layers of safety that could be added in their absence. On the other hand, in the case of Japan, operators have not reached the technical or maturity level to discuss the shape of nuclear safety using risk information, and as a result, they regulate directly by regulatory requirements and voluntary activities. The reality is that there is no debate between the authorities and the operators. As mentioned above, there is no debate between the two to recognize the meaning of comparing the risk assessment result of a highly uncertain event such as natural phenomena with a standard value from a safety goal, or on how to utilize risk information effectively for safety assessments and safety enhancement. In short, there is no common safety value measure (risk assessment) between the regulator and the operators, and as a result, communication between the two ends up in never-overlapping unilateral explanations by one another. Despite Fuketa's enthusiasm, the current situation of no debate between the regulatory side and the operator side on the extent to which "uncertainty" can be tolerated by directly looking at major risks remains essentially unchanged from before the Fukushima Daiichi nuclear accident.

6. Have "the village and governance by osmosis" changed? Changes in organizational culture

After the accident, it was the issue of TEPCO's organizational culture that all accident investigations pointed out. How much has TEPCO changed into a "learning organization" since then, has it made a new start as a risk-oriented organization, and through this, has it made defense in depth a sure thing as a system? Here, we consider the organizational culture of TEPCO and its compliance with regulations from these perspectives.

Towards a "learning organization"

The Independent Accident Investigation probed the historical and structural factors of the "safety myth" that led to the accident at the Fukushima Daiichi Nuclear Power Plant, its analysis pointing

[51] Ibid., p.13.

[52] This refers to a regulation that specifies the permissible period of time in which malfunctioning machinery must be fully repaired.

out administrative structures unsuitable for safety regulation and rigid stakeholder relationships[53]. It also considered and made recommendations regarding the lack of safety regulation governance, the ambiguity of "national policy/ private operation", safety without security, crisis management and leadership[54]. Of these, it highlights the importance of reforming latent problems of "organization" at both the operators and the regulators, as well as "not averting one's gaze from inconvenient matters".

Given that the factors that cause organizational accidents may be created not only by the operators but also by the regulatory authorities, the report by the Government Accident Investigation recommends as a challenge for administrative organizations the need for a separation of regulation and industry promotion, a sense of mission for safety, an enhancement of staff with specialized knowledge and understanding on a par with that of the operators, and having the leeway to being able to focus on the wood not just the trees.

Regarding these points, in March 2013 TEPCO launched its Fukushima Nuclear Accident Summary and Safety Reform Plan (hereafter abbreviated to the Anekawa Plan, which is taken from the name of the plan's main author).[55]

In its summary, TEPCO concluded, "we could not prevent an accident that should have been prevented" because of "insufficient ongoing efforts to reduce risk and preparation for severe accidents in terms of equipment and personnel".[56] Furthermore, in order to redress essential problems inherent to the TEPCO organization, that is, the background factors for the accident of a lack of safety awareness, technical skills, and dialogue skills, measures such as improving management's awareness of the special risks of nuclear power, maintaining safety discussions across the organization and building a mechanism to foster cost-effective defense in depth proposal capabilities were to be taken.[57]

The Anekawa Plan was a refutation of the hitherto insistence by TEPCO that the Fukushima Daiichi nuclear accident was "unexpected". It was positioned as a fundamental document symbolizing the rebirth of TEPCO, and its contents were highly commended.

At the same time, the Anekawa Plan appealed that "reforming management" to one "with a high safety awareness that strongly recognizes the special risks of nuclear power and is deeply aware of its responsibility" should be the starting point, citing not only the nuclear power department, but also "measures to break the negative chain of TEPCO's company-wide organizational structure" and the "need to strengthen governance and enhance internal communication". Subsequently, using the Anekawa Plan as a basis, TEPCO held a safety steering conference for management centering on the CEO and managers of the nuclear power and location headquarters, which discussed the causes and countermeasures of accidents and other troubles. In addition, they have begun to study "nuclear safety reform for the next generation" that will consolidate and systematize efforts to date (JFY2019 3rd quarter progress report).

I will leave a detailed analysis of whether or not this has really created a "learning organization" to Chapter 2, confining myself here to introducing one of the seven remarks made by Yotaro Hatamura,

[53] Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, Chapter 7,8,9.
[54] Ibid., p.320.
[55] Tokyo Electric Power Company, 2013, pp. 6–9.
[56] Ibid.
[57] Ibid., pp. 7–8.

chairman of the Government Accident Investigation at the end of its report.[58] Regarding organizational culture, Chairman Hatamura noted the pitfalls of "creating a mechanism but not sharing goals" as well as the importance of "creating a culture capable of facing danger head on and discussing it". TEPCO's aforementioned efforts tend to remain at the "mechanism" level. They show that it takes considerable time to reform organizational culture starting from management with a high awareness of nuclear safety, which requires "a will to universalize experience"[59].

An organizational culture that faces risks

The Government Accident Report asked for, "a shift in risk perception where even if an event had a low probability of occurring stochastically, it was necessary to take appropriate measures if the damage caused by an accident or fire was extremely large."[60]

This means changing an attitude of risk perception that discards events with extremely low probabilities of occurrence, but even if that was possible, communication practices would have to be changed in order for an assessment to be shared by the organization.

For example, when reporting to management an event (for example, a tsunami calculation result) that exceeds the preparedness limit and asking the supervisor about the need for countermeasures, there is a strong tendency in Japan to try to convey matters euphemistically to respect harmony and the feelings of the other person. This attitude of using indirect expressions to raise problems euphemistically and leave ambiguity in decision-making as well as a tendency to stress predetermined harmony and not face risks directly is a cultural characteristic of Japanese society. The opening message of the English report stated, "The Fukushima Daiichi Nuclear Power Plant accident was a Made in Japan accident, and its root causes are the reflexive obedience, acceptance of the authority gradient, emphasis on predetermined harmony, collectivism and island mentality inherent in Japanese culture." This was much criticized as being "an irresponsible system theory of national confession hiding behind the theory of 'Japan uniqueness'." Known as a pro-Japan scholar, Gerald Curtis, a professor at Columbia University, wrote in the U.K.'s *Financial Times* criticizing that "To pin the blame on culture is the ultimate cop-out. If culture explains behavior, then no one has to take responsibility", insisting that unless individual responsibility was pursued, it would not lead to a solution of the essential problem.[61] Journalist Yoichi Funabashi also stated in his book *Genpatsu Haisen* (Nuclear War Defeat) that while maintaining that the historical and structural background of institutional culture may illuminate the "essence of failure", "cultural theory (*Nihonjinron*) is not very persuasive when it comes to explaining the main causal relationships"," and was counterproductive to "learning from failure".[62]

However, the Organization for Economic Co-operation and Development/Nuclear Energy Agency (OECD/NEA), in cooperation with the World Association of Nuclear Operators (WANO), have looked at nuclear safety from the broad perspective of national character, and called each country's attention to ensuring that national character does not impact on a deterioration in safety. They have planned a forum[63] for public-private collaboration to consider how national character affects the safety of nuclear power, which they are rolling out to each country.

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[58] ICANPS, 2012, pp. 443–448.

[59] Funabashi, 2014, p. 116.

[60] ICANPS, 2012, p. 413.

[61] Curtis, 2012.

[62] Funabashi, 2014, p. 18, 249.

[63] For example, the Country-Specific Safety Culture Forum was held in January, 2018 in Sweden and in March, 2019 in Finland.

Incidentally, the international definition of the characteristics of safety culture at IAEA, OECD/NEA, WANO and so on has several attributes including “a questioning attitude”, “always learning”, and “open workplace”.

At a forum held in Sweden, bearing in mind these attributes, participants[64] played their respective “roles” in accordance with an accident scenario at a nuclear power plant from symptom stage to accident response, elucidating from their behavior attributes that appeared to be Swedish national characteristics, and discussed their impact on nuclear safety. As a result, the group of participants elucidated that people from their own country have values that emphasize oneness and collective duty performance (*samskap* in Swedish) and equality and justice (*allskap*). During the discussion, for example, it was reported that minutes of a meeting might not be made if the chair asked, “Got it?” and everyone answered “Yes”. And while this social attribute of emphasizing this sense of unity and fulfillment of collective duties is a strong advantage, the shared awareness was that caution was required about pressure blocking opposition, that is, the possibility of false agreement. In addition, although follow-up and feedback on decisions are standard practice in the international community, in Swedish society with its strong sense of the values of equality and fairness, there is a strong sense that you should not explore the work of others, the need for further consideration also being a shared awareness. In this way, this forum aims to objectively identify the merits and demerits of national character and to deepen thinking about enhancing nuclear safety in line with national character.

In his greeting to the Forum, Executive Secretary William D. Magwood commented, “Instead of considering the attributes of nuclear safety in a general theory of the world, safety organizations and the nature of individuals rooted in the national characteristics of each country should be considered, and should be considered in the language of that country.”[65]

The Japanese government is yet to hold this forum organized by the OECD/NEA. One reasons for this is that the Japanese society’s organizational culture for safety, which is said to be poor at looking at risks, has not been deeply discussed by the regulatory side and the operators.

In addition, in the new inspection program that started in 2020, the regulation authority focuses on cultivating and maintaining a safety culture as a cross-sectional activity area for operators. The guide for inspectors recommends looking at the organizational culture from four perspectives: to confirm the demonstration of leadership for fostering and maintaining a sound safety culture, to confirm the efforts of the operators, to confirm the evaluation and improvement of the condition regarding safety culture, and to confirm the ability to maintain a safety culture within the organization. The regulatory authority and the inspectors at the site are required to have a keen eye for verifying whether operators are cultivating an organizational culture that is aware of the lessons learned from the Fukushima Daiichi Nuclear Power Plant accident and is taking action to make universal use of those lessons, as well as other events.

Even if a similar event can be prevented through reflexive (whack-a-mole) measures based on the Fukushima Daiichi Nuclear Power Plant accident, different disasters and accidents will come again. As the Independent Accident Investigation noted in its concluding chapter, “the same crisis will never happen again”, and “the same luck will never happen again”."[66] The lesson of that tragedy was meant

[64] Executives from all domestic nuclear industries participated in the Swedish Forum, including Westinghouse Electric Sweden, The Swedish Nuclear Fuel and Waste Management Company, managers from all of the nuclear power plants, Vattenfall, Universe Sweden, and The Swedish Radiation Safety Authority, as well as international organizations.
[65] Magwood, 2018.
[66] Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, p. 396.

to be that we continually consider what it means to "face risks and prepare for the unexpected", and create an organizational culture that maintains the "will to universalize experience".

7. What is regulatory "independence"?

As I mentioned at the beginning, the Nuclear Regulation Authority, which was established after the Fukushima Daiichi Nuclear Power Plant accident, held up as its motto "to make independent decisions from a scientific/technical point of view irrespective of all else."

Out of remorse for the lack of safety regulation governance, where the introduction of serious accident response measures (AM) and examination of earthquake and tsunami countermeasures were pointed out to be the "captive of regulation", this is nothing less than an expression of readiness to begin anew and pledging to provide strong leadership regardless of external interference.

The chairman of the Nuclear Regulation Authority was required to have political independence, independence from the "nuclear village", high professionalism, and judgment and leadership possessed of personal insight that remained steady in an emergency. "We had a hard time selecting him,"[67] recalls Goshi Hosono, a member of the House of Representatives involved in this task under the then administration. He said that at the time, there was a strong opinion that given the importance of the independence of scientific and technological knowledge, the chair, as the head of an Article 3 commission, should be given strong authority that did not brook interference by the prime minister, but in the end this was overridden as a collegial system.[68]

As a result, the Nuclear Emergency Preparedness Council chaired by the Prime Minister, which coordinates related organizations in nuclear disaster preparedness measures, was established for normal times, the vice-chairs being the Chief Cabinet Secretary, the Minister of the Environment, Minister of State for Nuclear Emergency Preparedness, and the NRA Chair. In addition, in order to support scientific and objective judgments when nuclear operators, national governments, local governments, etc. formulate plans for nuclear disaster countermeasures and implement those countermeasures, the NRA Chairman plays a role in formulating nuclear disaster countermeasure guidelines that define specialized and technical matters. On the other hand, in the event of an emergency, a Nuclear Emergency Response Headquarters headed by the Prime Minister will be established. At this time, the Act on Special Measures Concerning Nuclear Emergency Preparedness especially stipulates that "judgments based on technical and specialized knowledge shall be excluded"[69] from the instruction authority of the Prime Minister (HQ head). The independence of the NRA Chairman responsible for making decisions based on technical and specialized knowledge in an emergency situation is established here.

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[67] Interview with Goshi Hosono, December 19, 2019.

[68] Shiozaki, 2016.

[69] Article 20, Paragraph 3 Act on Special Measures Concerning Nuclear Emergency Preparedness (Act No.156, Heisei 11) : (3) In addition to the instructions under the provisions of the preceding paragraph, when the director-general of the nuclear emergency response headquarters finds it especially necessary for implementing emergency response measures accurately and promptly in the emergency response measures implementation area covered by said nuclear emergency response headquarters, he/she may, within the limit necessary, give necessary instructions to the heads of the relevant designated administrative organs and the heads of the relevant designated local administrative organs, and the officials of said designated administrative organs and the officials of said designated local administrative organs to whom his/her authority has been delegated pursuant to the provisions of the preceding Article, the heads of local governments and other executive organs, designated public institutions and designated local public institutions, and nuclear operators.

At the same time, it was essential to maintain the independence of the secretariat, the Nuclear Regulatory Agency. Regarding staff, the Agency is working towards training its own professional experts and has thorough no-return rules, ensuring that the Agency does not just become a venue for seconding officers from their original ministries and prevents their return to their former "parents".

It was also necessary to ensure transparency to show independence in the relationship with operators. The NRA, in principle, publishes minutes of exchanges and meetings with operators and other stakeholders, and in some cases, videos of the meeting are available.

However, operators are bewildered by this principle of transparency. In Japanese society, there is a tendency to fear verbal gaffes in public and to hate having things put on record. In addition, there is a perception on the part of some operators that restarting their plants is "hostage" to the regulatory authorities, and it has been voiced that it is difficult to argue strongly with the regulator, who wields the license power.

However, what is important is that it is precisely the guarantee of transparency that allows a third party to assess whether something unreasonable is happening and to speak up as a referee. Based on the lessons learned from the Fukushima Daiichi Nuclear Power Plant accident, the International Nuclear Safety Advisory Group[70], which is an advisory body to the IAEA Executive Director, emphasizes the importance of "institutional oversight" with multi-layers of just such a mechanism.[71]

"Institutional oversight" is a governance mechanism in which a third party audits the activities of the parties from various layers. It is a multi-layered "check-and-balance system" that can openly point out what may be hard for one's self to notice. Points extend not only to technical lessons and systems, but also to personnel and organizational culture. Since the parties concerned "see only what they want to see", they are unaware of the risks they cannot see. Therefore, there must be a function for checking the values that support human behavior, and more specifically, checking whether or not self-justification bias within the organization is working leaving problems abandoned. Here lies the significance of oversight.

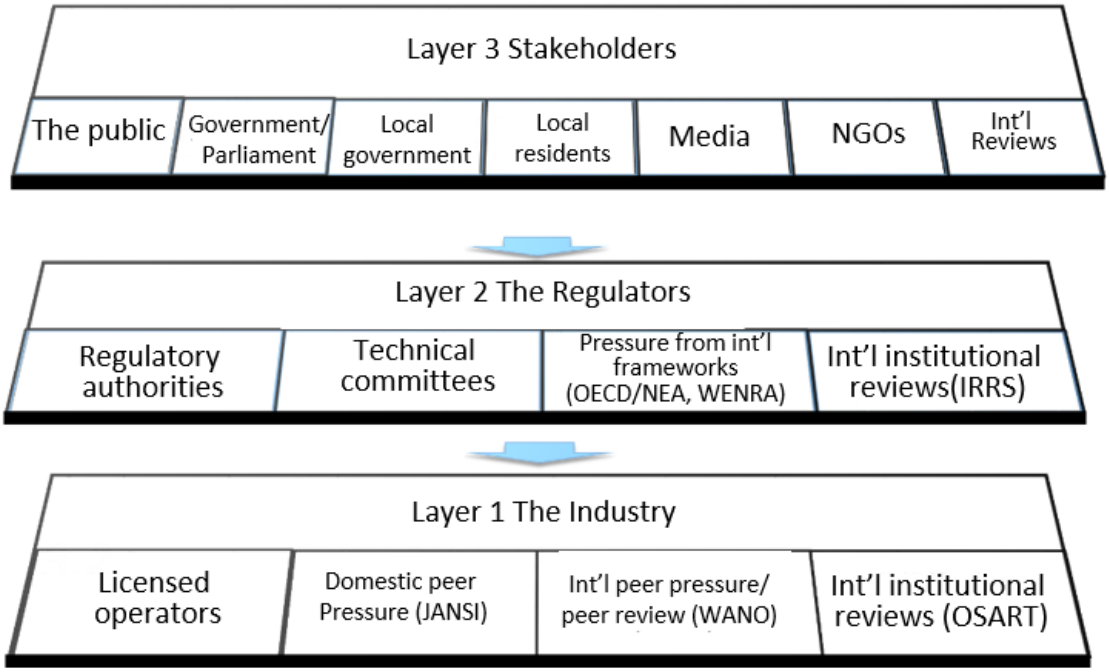
Fig. 3 shows the mechanism for operating the oversight function as a system proposed by the IAEA International Nuclear Safety Advisory Group. There, nuclear-related groups are categorized into three layers: operators, regulators, and society, the first layer being the group that surrounds the operators that have the primary responsibility, and the second layer being the regulators that have the responsibility of supervising the operators and the group surrounding them, and the third layer being the constituent groups of the general public, such as stakeholder communities that are directly affected and media. Each of these groups oversees and restrains the lower layers.

Each layer is comprised of many components and embodies the concept of defense in depth, which constitutes multiple and diverse barriers. For example, the activities of operators in the first layer are as follows: the first step is voluntary safety enhancement activities by operators, the second step is mutual support activity between domestic operators that places pressure on each operator, and the third step is safety assessment activities by international business organizations, and the fourth step recommends securing nuclear safety by conducting self-checks in a multi-step structure with safety assessment activities by various operators as well as inspection and advisory activities by international organizations such as the IAEA.

[70] Consultative body of the IAEA Director General Office (International Nuclear Safety Group, INSAG).
[71] IAEA International Safety Group, 2017.

As a first-layer check function, nuclear operators such as TEPCO carry out peer review activities through, say, the Japan Nuclear Safety Institute (JANSI) and undergo oversight checks by domestic peers, peer review by WANO, a group of international peers, and review by the IAEA Operational Safety Review Team (OSART) in addition to the activities of internal monitoring organizations such as the Nuclear Reform Monitoring Committee and the Nuclear Safety Oversight Office. The second layer monitoring function consists of guidance and supervision by the Nuclear Regulation Authority, the services of supporting international organizations such as OECD/NEA, and the IAEA Integrated Regulatory Review Service (IRRS). Furthermore, the stakeholder monitoring function in the third layer has a wide variety of governance functions that are checked by the government's nuclear-related administrative agencies and local governments, local community group councils, and the media.

- Figure 3 Defense in depth as a system



Compiled from INSAG-27 Ensuring Robust National Nuclear Safety System
-Institutional Strength in Depth –

However, the concept of oversight is a concept born in the West. This system will not function if imported wholesale in a society with the characteristics of it being easier to use ambiguous expressions when it is necessary to communicate something offensive to the other party, a social climate that cares for face and cannot easily accept suggestions from outsiders, and a community-based corporate culture that is far from a global style of management.

In order to make good use of the various guidance and advice obtained from abroad, rather than simply creating a form, there is a need to hold a safety culture forum that discusses nuclear safety, Japanese methods of making and checking points from the viewpoint of the aforementioned social characteristics of the country, as well as joint discussions between the public and private sectors on measures.

Another serious consideration is the establishment of a permanent oversight body for nuclear safety regulations in the Diet. The Parliamentary Accident Investigation recommended an investigation

committee should be set up as a permanent organization, consisting of experts centering on the private sector and independent of nuclear operators and administrative agencies, that would continuously follow up the issues pointed out in the accident investigation and verification (Parliamentary Accident Recommendation 7: Utilization of Independent Investigation Committee).[72]

Certainly, the Lower House has the Nuclear Power Task Force Special Committee (established January 28, 2013), and the Upper House has the Nuclear Power Task Force (established August 7, 2013)[73]. However, neither have the function of checking administrative measures with specialized knowledge, experience and high insight into ensuring safety in the use of nuclear power.

Regarding the current operation of the Nuclear Regulation Authority, Yasuhisa Shiozaki, a member of the House of Representatives, who drafted the LDP/Komeito proposal, compared the present with the ideal at the time of its establishment, and found that the independence of nuclear safety regulations was "still operated from a supply-side [government] perspective. It's not operated from a national perspective like overseas institutions."[74]

Tsuyoshi Shiina, a member of the secretariat of the Parliamentary Accident Investigation, said, "The Nuclear Regulation Authority, which was established with an emphasis on independence, doesn't come under ministerial jurisdiction because it's an Article 3 commission, but it's still an administrative organ. [The purport of the Parliamentary Accident Investigation recommendation was] we expected two roles: the basic idea of the separation of powers by the legislative body selected by the people to monitor the administration, and the asymmetry of information to be monitored by someone with the same level of expertise as the administration."[75]

In order to further increase the independence of nuclear safety regulations, it is desirable to strengthen the check and balance function between the administration and the Diet. The independence of safety regulations should be unequivocally ensured by governance operating through the multi-layered monitoring function from various viewpoints recommended by the International Nuclear Safety Advisory Group (INSAG), an advisory body of the IAEA Secretary General. This should increase the transparency of complex and highly specialized nuclear safety regulations, and thus credibility with the public.

Summary

Common to each accident investigation is the importance of regulatory independence. The greatest problem was regulatory methods and regulatory governance. Today, the system has been revamped, but operations still follow the old system. In terms of form, institutional reforms such as new

[72] "Recommendation 7: Utilization of an independent investigation committee A Special Investigation Committee on Nuclear Power (tentatively named) should be estab-lished in the Diet as a third party organization. It should be composed of experts mostly from the private sector and independent of the nuclear power operators and administrative organs so that the Committee investigates and discusses important themes that influence public livelihood, such as the investigation into the unexplained causes of the accident, the process towards the settlement of the accident, the prevention of damage escalation, mat-ters not discussed this time, including the decommissioning process of reactors and spent fuel issues. In addition, there should be a mechanism through which the Diet can create such independent investigation committees for different themes, and investigation and examinations should be continuously carried out, uninhibited by conventional ideas" The National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission, 2012, p. 22.

[73] Established at the 183rd session of the National Diet and subsumed by the Special Committee on Reconstruction after the Great East Japan Earthquake.

[74] Interview with Yasuhisa Shiozaki, March 17, 2020.

[75] Interview with Tsuyoshi Shīna, October 9, 2019.

regulatory standards, the backfit system, the safety enhancement assessment notification system, and a new inspection system have been made, but ambiguous authority and responsibility in decision-making, "the village and governance by osmosis", and a Japanese regulatory culture and practices of "preferring small peace of mind over great safety" remain unchanged. As pointed out by the IAEA's IRRS, it is still dragging along its culture of inspecting trivial specifications and visible forms. It will be difficult to generate regulatory *kaizen* and innovation through true cooperative work from such a situation. If operators (and regulators) misunderstand the principles of the new regulatory standards and think that compliance with standards will ensure absolute safety, this will mean precisely that they have not learned the lesson of the Fukushima Daiichi accident.

Whether a mechanism utilizing operator autonomy can be incorporated into and function within the regulatory system or not will depend on the motivation of the operators. Whether or not regular safety reviews descend into a sham and lessons reducing sensitivity to new knowledge at the basic design stage are utilized depends on how they are conducted in the future. Probabilistic risk assessment of events similar to those seen at the Fukushima Daiichi nuclear accident have not been carried out because of technological immaturity. There is also little debate about safety goals between the regulators and the operators. There is no difference from before the Fukushima Daiichi Nuclear Power Plant accident when no common language existed for discussing safety in terms of how much "uncertainty" could be tolerated by directly confronting major risks.

Although various actions have been carried out with due regard to the independence of the regulators, and we can witness the creation of an environment enhancing human resource expertise and reform in organizational culture, an organizational culture in which the regulators and operators share the same goal of never repeating the same mistakes has yet to be established. In addition, although there is no multi-layered oversight system along the lines of a permanent parliamentary committee, its creation could be expected to increase credibility with the populace.

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Chapter 2: TEPCO and its governance

Toshihiro Okuyama

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Introduction: What exactly did TEPCO reflect on?

What lessons did Japanese nuclear operators, including Tokyo Electric Power Company, Inc. (TEPCO), learn or not learn from the Fukushima nuclear disaster? And what kind of change and/or improvement has or has not been achieved following the disaster? In order to prevent the recurrence of a disaster caused by an accident like the one at the TEPCO’s Fukushima Daiichi Nuclear Power Station, are there any problems that currently remain or exist? These are the subjects of this chapter.

Focusing on TEPCO as an organization, we took a bird's eye view of the whole situation, paying particular attention to the facts surrounding the accident, especially facts newly revealed in the last five years. We extracted three lessons and evaluated the current situation in response to them. We reviewed the work from various reports published in the first four years after the accident, records of TEPCO’s internal video conferences during the disaster, transcripts of interviews and interrogations to key witnesses, as well as the TEPCO’s “Fukushima Nuclear Accident Summary and Nuclear Safety Reform Plan”. We examined whether, in the ten years following the accident, TEPCO had been able to respond to the lessons and recommendations put forward therein. We gathered and scrutinised the latest knowledge on the Fukushima accident and TEPCO, including the views of concerned parties and related court records, from the perspective of asking if lessons and recommendations have been missed or not.

In the first four years following the accident, various problems and issues regarding TEPCO's organization were pointed out.

The Independent Accident Investigation Report of February 2012 introduced the view that the government's system of “privately administered national policy”, in which the national policy of promoting the peaceful use of nuclear energy is carried out by private nuclear power operators, had negative consequences. The policy created a system that allowed the electric power companies to make excuses along the lines of “we kept the standards the government told us”, “we can't help it”, and “it's not our fault”. As a result, the soundness or the governance of the nuclear power operators as private companies was damaged.[1] It also pointed out that “TEPCO's crisis management capabilities,

[1] Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident. (2012). *Fukushima genpatsu jiko*

decision-making, and weak governance have made the public wonder whether such companies should be allowed to generate nuclear power."[2] A report by the National Diet of Japan's Accident Investigation Commission in July 2012 described TEPCO's governance as "bureaucratic, lacking autonomy and a sense of responsibility,"[3] denouncing "the manipulative management culture at TEPCO, which worked very closely with and had a large influence on the government regulatory agencies but, in the end, shirked their responsibility by passing accountability to the government agencies."[4]

Many reports took issue with TEPCO's safety culture, namely, the corporate culture, corporate mores or corporate fabric of the company, and above all, its poor internal communications and employee's general tendency of obeying superiors or authorities without questioning or challenging them. The final report of the Government Accident Investigation in July 2012 suggested there were problems with TEPCO's safety culture, saying "its workforce was vertically-segmented, and even in dealing with this accident a perspective of carrying out the necessary tasks based on a comprehensive overview of the situation was lacking; and the organizational information sharing system was not in place as can be seen in important steps relating to the handling of the accident being carried out without seeking direction from senior staff."[5] The August 2012 report of the Nuclear Power Operators' Association (INPO) in the United States emphasized the importance of "cultivating a questioning attitude and challenging assumptions" as a principle of safety culture, pointing out that, had TEPCO had such a safety culture, it may have benefitted in dealing with the tsunami and maintaining core cooling at the time of the accident.[6] Regarding this, the US Academy of Sciences Research Council stated in a 2014 report that "the lack of a strong safety culture was an important contributing factor to the Fukushima Daiichi accident."[7]

According to the National Diet of Japan's Accident Report, there was "distortion of risk management at TEPCO."[8] The final report of the Atomic Energy Society of Japan's Accident Investigation of

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dokuritsu kenshô înkai: chôsa, kenshô hôkoku sho [Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident: Report on the Inquiry and Investigation]. Tokyo: Rebuild Japan Initiative Foundation. (In Japanese.) p.320

[2] Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident. (2012). *Fukushima genpatsu jiko dokuritsu kenshô înkai: chôsa, kenshô hôkoku sho* [Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident: Report on the Inquiry and Investigation]. Tokyo: Rebuild Japan Initiative Foundation. (In Japanese.) p.388

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[6] Institute of Nuclear Power Operations. (2012). Special Report INPO 11-005, *Lessons Learned from the Nuclear Accident at the Fukushima Daiichi Nuclear Power Station*. August 1. Atlanta: INPO. Retrieved May 8, 2020 from https://www.nrc.gov/docs/ML1221/ML12219A131.pdf#page=40 p.34

[7] National Research Council. (2014). *Lessons Learned from the Fukushima Nuclear Accident for Improving Safety of U.S. Nuclear Plants*. Washington, DC: The National Academies Press. pp.232-237

[8] The National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission. (2012). *Tōkyō denryoku fukushima genshiryoku hatsudensho jiko chōsa iinkai hōkokusho* [The official report of the Fukushima

March 2014 states that "TEPCO cannot complain about criticism that it failed to face the risks identified by new knowledge about tsunamis and severe accidents and postponed required safety measures," pointing out TEPCO's lack of comprehensive management ability.[9]

The most important source of TEPCO's response to these lessons and recommendations lies in TEPCO's "Fukushima Nuclear Accident Summary & Nuclear Safety Reform Plan"[10] (the Anegawa Plan) compiled in March 2013, after TEPCO had been put virtually under governmental control with the majority of its capital in government hands.

In June 2012 of the previous year, TEPCO released an accident investigation report under the former management team, including chairman Tsunehisa Katsumata, that concluded that TEPCO's employees "never imagined a massive earthquake and tsunami such as this one, and actually they could not possibly have imagined it."[11] On the other hand, Takafumi Anegawa, who was called back within TEPCO from the electric vehicle department to his old post at the nuclear division after the accident and became the head of the nuclear asset management department at the end of the year, thought "It would be impossible for us to generate nuclear power again if this were the extent of our remorse," and started working voluntarily to create a supplementary version of the report, which eventually became officially recognized by the company.[12]

According to a former senior official of the Ministry of Economy, Trade and Industry (METI) who knows TEPCO well, there were disgruntled voices within TEPCO arguing that the Great East Japan Earthquake was a "natural disaster" with nearly twenty thousand dead or missing, and questioning "Why is it just our company that has to shoulder such burdens among other victims?" Whenever he heard such remarks, the former METI official testified that he often felt doubts, thinking that "perhaps this organization needs to be legally scrapped and restarted from scratch."[13] In the midst of this, there was fierce opposition from the Corporate Affairs and Corporate Planning departments within TEPCO because officially recognizing Anegawa's team by the company and TEPCO itself acknowledging that there was an aspect of a man-made disaster in the Fukushima nuclear accident would amount to "selling out" the former management including former TEPCO chairman Katsumata, who were possible defendants of lawsuits. Regardless of this opposition, Anegawa and others worked together to release the Summary and Reform Plan[14].

Despite a few ups and downs, this is how the issues that TEPCO's organization faced and the lessons to be learned seemed to be exhausted in the first four years after the accident, and TEPCO appeared

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Nuclear Accident Independent Investigation Commission]. Report, July 5. Tokyo: Diet. (In Japanese) p.525 https://warp.da.ndl.go.jp/info:ndljp/pid/3856371/naiic.go.jp/wp-content/uploads/2012/08/NAIIC_Eng_Chapter5_web.pdf#page=30

[9] Atomic Energy Society of Japan. (2014). *Fukushima Dai ichi genshiryoku hatsudensho jiko ni kansuru chôsa înkai* [Final Report on the Accident at Fukushima Daiichi Nuclear Power Plant]. Report, March 26. Tokyo: AESJ. (In Japanese.) pp.355-356, or AESJ. (2015). *The Fukushima Daiichi Nuclear Accident: Final Report of the AESJ*. p.472.

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[11] Tokyo Electric Power Company, Inc. (2012). *Fukushima Nuclear Accident Analysis Report (Final Report)*. Tokyo Electric Power Company. p.33
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[13] Interview with a former METI official, February 27, 2020.

[14] Interview with a former METI official, February 27, 2020.

to be moving to respond to them under its new management team. What is the reality, however? Have the lessons really been taken completely on board, and is TEPCO really answering those lessons? What progress is being made in responding to the lessons learned? And, in the first place, was anything missing from the lessons and recommendations gleaned in the first four years, and if something was missing, what should the response to that be? These will be examined below.

1. Criminal investigation and trials reveal TEPCO management's deferral of tsunami preparedness measures

New facts, which were virtually bypassed in TEPCO's self-examinations, including the Anegawa Plan, concerning the most crucial question of why TEPCO failed to prepare for a tsunami, came to light during the criminal trial process from 2017.

Prior to the accident, TEPCO's tsunami evaluation group recognized the need for tsunami countermeasures.

The civil engineering survey group in charge of tsunami evaluation at TEPCO's Nuclear Asset Management Department was aware of the need to drastically strengthen tsunami countermeasures at Fukushima Daiichi by 2008 at the latest in order to comply with government regulations based on the Seismic Design Regulatory Guide newly formulated in 2006 in light of lessons from the Great Hanshin Earthquake in 1995. However, upper corporate management did not share this awareness. In 2008, upper management rejected the proposal made by the group and postponed looking into measures. Nevertheless, the civil engineering survey group maintained the view that it was necessary to take some measures to comply with the regulations, and in 2009 proposed to establish a cross-sectional team to consider and implement measures internally. Given the decision to postpone the previous year, however, this proposal was also not accepted within the company.

The details of these facts were discovered by the Tokyo District Public Prosecutors' criminal investigation from 2012 to 2013, but they were not disclosed to the general public at that time. They became known to the public for the first time from 2017 to 2019 when the interrogations of TEPCO engineers as witnesses were conducted publicly in criminal trials and when the prosecutor's criminal investigation records were submitted to both criminal and civil courts, which included a lawsuit against Katsumata and other former directors of TEPCO brought by TEPCO's shareholders. The details of these facts are not described in the various accident reports or the Anegawa Plan. Therefore, no related lessons or countermeasures can be found anywhere.

Let us first confirm the facts.

<u>Rejected the civil engineering survey group's recommendations in 2008</u>
In September 2006, the Seismic Design Regulatory Guide applied to the safety examination of nuclear power plants were revised by the government, and NISA, the national regulatory body, asked each power utility to carry out "seismic back checks" to confirm the conformity of existing nuclear power plants. This included a requirement to confirm tsunami safety, bearing in mind that as an earthquake-related phenomenon, "tsunami which could be reasonably postulated to hit in a very low probability in the service period of the facilities".

In response, the civil engineering group (later reorganized into the civil engineering survey group on July 1, 2008) at TEPCO, which belongs to the Niigata-Chuetsu-Oki Earthquake Restoration Management Center in the nuclear asset management department at head office, examined how to

deal with a tsunami.

In their research, the question arose as to whether the "long-term evaluation of seismic activity from off the Sanriku Coast to off the Boso Peninsula" (long-term evaluation) published by the government's Headquarters for Earthquake Research Promotion (Earthquake Headquarters) at the end of July 2002, should be incorporated into the tsunami height design assumptions for Fukushima Daiichi and Fukushima Daini Nuclear Power Stations. Previously, the Tsunami Assessment Methodology compiled by the Japan Society of Civil Engineers in February 2002 had been used to calculate estimated tsunami heights for the Fukushima nuclear power plants on the assumption that no major tsunami earthquake would occur off Fukushima Prefecture. The Earthquake Headquarters long-term evaluation pointed out that a magnitude-8 class tsunami earthquake could occur anywhere along the Japan Trench from off Sanriku to off Boso, including off the coast of Fukushima Prefecture. If this was followed, it was likely that conventional tsunami height design assumptions would be considered inadequate. The policy of adopting the view of long-term evaluation was taken around December 2007 inside the civil engineering group.

In the spring of 2008, Tokyo Electric Power Services Co., Ltd. (TEPSCO), which was commissioned by the nuclear asset management department, calculated the tsunami height based on the long-term evaluation of the Earthquake Headquarters, the result being that a tsunami up to 15.7 meters could hit, which exceeded the site height of 10 meters at the Fukushima Daiichi Nuclear Power Station.

The civil engineering group recognized that it was necessary to significantly raise their tsunami height design assumptions and implement countermeasures to match it. They started to study plans such as constructing a breakwater off the coast and building a seawall on site.

However, Masao Yoshida, general manager and head of the nuclear asset management department that oversaw the civil engineering group, and Kazuhiko Yamashita, No. 2 in the same department and head of the Niigata-Chuetsu-Oki Earthquake Restoration Management Center, had different perceptions to the civil engineers.

Yamashita made the following statement at a hearing by the Tokyo District Prosecutor.

"I felt a strong sense of discomfort with the 15.7 meter figure, and thought that it would be unrealistic to implement countermeasures for such a water level, and I was somewhat opposed to it. Yoshida was at least not in favour of taking measures for that water level."[15]

Yoshida responded to an interview by the Government Accident Investigation as follows regarding the long-term evaluation by Earthquake Headquarters.

"Academics can say it's possible as much as they like, but when you ask if that's at the level of properly designing things, it isn't."[16]

At a meeting on July 31, 2008, Sakae Muto, then Deputy Chief Nuclear Officer and No. 2 of the Nuclear Power and Plant Siting Division, who was the boss of General Manager Yoshida and others,

[15] TEPCO Shareholder Lawsuit. Plaintiff's Exhibit 349.
[16] Investigation Committee on the Accident at the Fukushima Nuclear Power Stations of Tokyo Electric Power Company, Government of Japan. (2011). *Chōshu kekka-sho* [report of hearing results]. November 30. Tokyo: GOJ. Retrieved May 26, 2020 from http://warp.da.ndl.go.jp/info:ndljp/pid/10317644/www.cas.go.jp/jp/genpatsujiko/hearing_koukai/348_349_koukai.pdf#page=13 (In Japanese.) p.13

decided to ask the JSCE to carry out research on long-term evaluation and keep the tsunami height design assumptions as they were until the results were in hand.

Regarding that meeting, Makoto Takao, then manager of the civil engineering survey group reorganized from the civil engineering group, later testified in a court as follows.

“Given the situation up until the meeting, I hadn't expected that kind of conclusion, so to put it simply, I think it was a situation where I lost heart.”

The conclusion of the management differed from the engineering judgment of Takao and others in the field. Takao repeatedly used the words “I lost heart” in court.

“We had been looking into various options, so to have those things put on hold for a while, that was what was happening, so I felt like I'd lost heart.”[17]

His subordinate Toshimichi Kaneto testified as follows.

“I thought that engineering some countermeasures was necessary. This later led to asking the JSCE to conduct research, but even if the research was carried out, I was pretty sure they would still say a tsunami of a certain scale would occur. Because technically speaking, there was no material to overturn what the Earthquake Headquarters was saying, I thought that was what would happen and I believed we would build some countermeasures sometime though it might be delayed a little.”

Although it was not accepted by Deputy Chief Nuclear Officer Muto and the management of TEPCO, the engineering judgment of the civil engineering survey group remained the same. Toshiaki Sakai, the group manager, saw Muto’s decision as “buying time”.[18]

In 2009, the recommendation to establish a cross-sectional body was rejected

The ensuing examination of tsunami countermeasures did not proceed smoothly. The following summer, the civil engineering survey group proposed the creation of a system within the nuclear asset management department.

Takao, manager of the civil engineering survey group, testified as follows.

“I thought we needed some kind of body headed by someone who knew more about the overall safety of the plant to organically link and look at what each individual group was doing, not each group working on their own.”[19]

Kaneto testifies as follows.

“We all [at the Civil Engineering Survey Group] had a common understanding that we would have to take countermeasures sometime, but the understanding of [other] groups actually implementing the countermeasures was probably a little more ambivalent (...) they didn’t have such a strong conviction, so I thought it would be difficult to make progress.”[20]

[17] TEPCO Shareholder Lawsuit. Plaintiff's Exhibit 297-1, Witness Interrogation Report (2018, April 10). 5th Trial. pp.110-111
[18] TEPCO Shareholder Lawsuit. Plaintiff's Exhibit 298-1, Witness Interrogation Record (2018, April 24). 8th Trial. pp.95-96
[19] TEPCO Shareholder Lawsuit. Plaintiff's Exhibit 297-2, Witness Interrogation Report, (2018, April 11). 6th Trial. pp.32-33
[20] TEPCO Shareholder Lawsuit. Plaintiff's Exhibit 299-1, Witness Interrogation Report. p.100

The civil engineering survey group headed by Sakai, to which Takao and Kaneto belonged, was in charge of the tsunami assessment for the nuclear power plants, but they were not familiar with reactor plants themselves. They were not particularly familiar with matters such as what it would be like at the reactor plant if a tsunami exceeded the site height at Fukushima Daiichi. Although the civil engineering survey group was able to come up with ideas for measures related to "civil engineering" such as seawalls and breakwaters, the group was not skilled in fields other than civil engineering. Each group in the nuclear asset management department would have to autonomously come up with ideas for measures in a broader context.

According to Sakai's testimony, after receiving suggestions from his subordinates, when he consulted with the manager of the Component Seismic Design Group in the nuclear asset management department in July 2009, he was told that:

"Sakai-san, do you think you can show the manufacturers, who are so busy right now, an issue with an undetermined tsunami water level and ask them to think about it?"

Upon hearing this, Sakai thought the following. "In fact, you're right."

At the end of July of the previous year, The Nuclear Power and Plant Siting Division decided to request that the Japan Society of Civil Engineering conduct a study on estimated tsunami heights at the discretion of Deputy Chief Nuclear Manager Muto. Therefore, the civil engineering survey group, including Sakai, were obliged to follow this study and could not self-determine the tsunami height level. Although Sakai's group recognized the necessity of taking measures, they had no choice but to agree with the manager of the seismic resistance group as the reality was that "unless the water level is clarified, proper measures cannot be taken."

Sakai later testified about this conversation as follows.

"I thought it was tough, that it wasn't anyone's fault, or partly my fault, because it would be difficult to move forward if the civil engineering survey didn't establish a water level."[21]

In this instance, it can be said that the study on tsunami countermeasures led TEPCO to get tangled in their own net due to the decision made the previous year to postpone.

2. The politics behind putting off tsunami preparedness

TEPCO still claims its "pre-accident tsunami countermeasures were appropriate"

In this way, the proposal of the civil engineering survey group regarding the tsunami countermeasures for the Fukushima nuclear power plants within TEPCO was repeatedly rejected from the summer of 2008 to the summer of 2009. The greatest reason for this was the considerable gap that existed between the engineers in the civil engineering survey group and other engineers. Their areas of specialization were completely different, and there was a difference in the degree of awareness of the premises underpinning the necessity for tsunami countermeasures. This difference in perception was not resolved and the gap between the two went unfilled, then along came March 2011.

The following internal circumstances at TEPCO, for example, form a backdrop to this.
For example, it was not easy for the engineers in the civil engineering survey group to get the chance to meet and discuss with their superiors such as the head of the nuclear asset management

[21] TEPCO Shareholder Lawsuit. Plaintiff's Exhibit 298-1, Witness Interrogation Report, (2018, April 24). 8th Trial. p.117

department.[22] Sakai, the group manager, encouraged his subordinates to take up smoking to be able to interact with superiors and other engineers outside the group in the smoking room.[23] It appears that the engineers of the civil engineering survey group had only two chances to discuss the risk of a tsunami with Muto.

TEPCO also had a corporate culture averse to the widespread dissemination of important knowledge and proposals within the company before carrying out *nemawashi* (informal consensus building).

Take, for example, the episode where at an internal meeting on March 7, 2008, Takao, a manager of the civil engineering group, explained first and foremost to the engineers in charge of construction and component seismic design that the tsunami height expected at the Fukushima Daiichi Nuclear Power Station would be around 12 to 13 meters.[24] This story spread through the nuclear asset management department reaching Yoshida's ears, and Yoshida inquired of group manager Sakai, "That's considerably higher than previous numbers". Sakai seemed to have taken this as a sign of disfavor, and on March 10, he warned his subordinate, Takao, "Let's do it properly and explain it to the manager at a slightly earlier stage."[25]

When proposing a cross-sectional examination body within the nuclear asset management department on July 1, 2009, Sakai cautioned Kaneto, a subordinate, regarding "things that tend to happen at TEPCO."[26]

"Your way of working is kind of immature. Of course everyone's going to oppose it if you just shove it right out there."
"You've got to lay the groundwork beforehand. If you don't take it to the meeting after you've already got about 80% of the relevant departments on your side, they'll say, we weren't told, that's how things end up in Japan."[27]

This kind of decision-making style, which emphasizes communication in the smoking room and prior informal "nemawashi" negotiations, may delay or incompletely share a common cognitive approach via formal routes. It also has the effect of obfuscating responsibility within the organization. In this way, it is not logical judgment based on objective facts or scientific grounds that leads decisions, but rather a distorted judgment that reads the atmosphere of the place, excessively reflecting the opinion of people in high positions or with strong voices.

This may be due to circumstances in TEPCO's nuclear power division where engineers who specialize in nuclear reactor plants often take on important jobs, whereas civil engineers do not, and there is a difference in their power relations, such as their ability to voice opinions internally. The engineers in a position to make decisions were not specialized in tsunami evaluation or civil engineering. For example, Yoshida, who was the head of the nuclear equipment management department, later said, "I'm not familiar with this field originally" "I have never worked on creating the (design) conditions until now, so I don't understand it" "I'm almost an amateur."[28]

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[22] Sakai testifies that "the TEPCO managers are very busy. On a daily basis, people are lining up to speak with them." In TEPCO Shareholder Lawsuit. (n.d.). Plaintiff's Exhibit 298-1, Toshiaki Sakai Witness Interrogation Report. p.9.
[23] TEPCO Shareholder Lawsuit. Plaintiff's Exhibit 298-3.
[24] TEPCO Shareholder Lawsuit. Plaintiff's Exhibit 298-3, No.29, TEPCO's internal document dated March 7, 2008.
[25] TEPCO Shareholder Lawsuit. Plaintiff's Exhibit 298-1, Toshiaki Sakai Witness Interrogation Report. p.43
[26] TEPCO Shareholder Lawsuit. Plaintiff's Exhibit 298-3, No.106, email from Sakai dated July 1, 2009.
[27] TEPCO Shareholder Lawsuit. Plaintiff's Exhibit 298-1, Toshiaki Sakai Witness Interrogation Transcript. p.116
[28] Investigation Committee on the Accident at the Fukushima Nuclear Power Stations of Tokyo Electric Power Company, Government of Japan. (2011). *Chōshu kekka-sho* [report of hearing results]. November 30. Tokyo: GOJ. Retrieved July 30, 2020 from

From 2008 to 2009, despite the civil engineering survey group having more tsunami expertise and experience than management and the nuclear engineers inside TEPCO, the technical judgments of the civil engineering survey group were repeatedly overturned regarding tsunami countermeasures for the Fukushima Daiichi Nuclear Power Station. No scientific basis was provided for this overthrow. Yamashita, head of the Niigata-Chuetsu-Oki Earthquake Restoration Management Center and No. 2 in the nuclear asset management department, admitted to the Tokyo District Prosecutor that there were no particular scientific grounds.[29] One could say that amateurs overturned the experts' engineering judgment.

This story is reminiscent of the famous episode on the eve of the Space Shuttle Challenger explosion on January 28, 1986. At a meeting between rocket manufacturer Morton Thiokol and the Aerospace Agency (NASA), field engineers at the company opposed the launch the next day, which was expected to be cold, due to concerns over the properties of the rubber O-ring sealant. Vice President Bob Lund, who was in charge of engineering, also expressed the same opinion to NASA. In response, senior vice president Jerry Mason overturned the decision of his vice president in charge of engineering, saying to him, "we have to make a management decision" and asking him to take off his engineering hat and put on his management hat.[30] [31]

This case is almost always taken up in engineering ethics textbooks as a prime example of the guiding norm for engineers that when a person's life may be harmed or a large loss may be incurred, engineers should not acquiesce to management decisions, but resist unjustifiable management decisions.

It can be said that from 2008 to 2010 engineers in TEPCO's civil engineering survey group faced the same dilemma as Morton Thiokol's rocket engineers.

As a general theory, management judgments are made comprehensively by weighing various factors. The judgements regarding nuclear safety are also made comprehensively by taking into account a wide range of factors such as opinions of engineers in other fields, costs, and influence on local area and administration. As a result, it is possible that a decision different from the technical judgment of the civil engineering research group is reached, which should not be the sole reason for criticism. However, in making such a comprehensive decision, the decision-maker must fully understand the content of key technical decisions and weigh objectively without distortion. If an amateur who has no tacit knowledge of the technology is going to make a decision, the decision-maker should not rely on his/her intuition. In particular, when the decision is different from technical judgments, it is necessary to pay more attention than in other cases. TEPCO's decision making at the end of July 2008 does not seem to meet the requirements essential for making comprehensive judgments.

However, TEPCO continues to insist that tsunami countermeasures before the Fukushima accident were "appropriate and taken in light of the scientific and professional knowledge at each juncture"[32],

<http://warp.da.ndl.go.jp/info:ndljp/pid/10317644/www.cas.go.jp/jp/genpatsujiko/hearing_koukai/348_349_koukai.pdf#page=4> (In Japanese.) p.4, 6, 13.

[29] TEPCO Shareholder Lawsuit. Plaintiff's Exhibit 349, Affidavit by Kazuhiko Yamashita, (January 28, 2013). Tokyo District Public Prosecutor.

[30] Presidential Commission on the Space Shuttle Challenger Accident. (1986). *Report of the Presidential Commission on the space shuttle Challenger accident.* Last accessed May 12, 2020 at https://spaceflight.nasa.gov/outreach/SignificantIncidents/assets/rogers_commission_report.pdf#page=99

[31] Okuyama, T. (2004). *Naibu kokuhatsu no chikara - Kôeki tsûhôsha hogohô wa nani o mamoru no ka* [The power of whistleblowing: what does the Whistleblower Protection Act protect?]. Tokyo: Gendaijin Bunsha. (In Japanese.) pp.190-193

[32] TEPCO Shareholder Lawsuit. (2017, February 24). TEPCO auxiliary intervenor, preparatory document no.21.

"our actions were reasonable"[33].

3. In a business judgement where human lives are at stake, don't ignore the technical judgement of engineers without valid reason

Management tried to overturn technical assessments even in accident response

The case where TEPCO management overturned on-site engineering assessment can also be seen in its response to the situation in the immediate wake of the Fukushima nuclear accident.

Around 7:25 pm on March 12, 2011, Ichiro Takekuro, a former TEPCO vice president and Chief Nuclear Officer then fellow, instructed Masao Yoshida, site superintendent of the Fukushima Daiichi nuclear power plant, to stop the injection of seawater into Unit 1 where core meltdown was ongoing. At the time, there was ongoing debate in the Prime Minister's Office between Prime Minister Naoto Kan and Haruki Madarame, Chairman of the Nuclear Safety Commission, about possible adverse effects on the core if seawater was injected. According to TEPCO, Takekuro judged that "future coordination with necessary government organizations would be impeded even further if field work proceeded without the approval of the Prime Minister, as the PM is the chief of the Nuclear Disaster Response Headquarters."[34] President Masataka Shimizu of TEPCO supported Takekuro to do so.[35]

His judgement to give priority to consideration for the government over safety was quite unreasonable. In the end, aggravation of the situation was avoided because site superintendent Yoshida did not obediently obey him, but this episode graphically demonstrates the adverse effect of management judgments taken after rejecting onsite engineering assessments.

This is not the only such case.

On the evening of March 14, 2011, a conflict of opinion occurred concerning Unit 2, which had lost all its cooling function, as to whether priority should be given to starting water injection after depressurizing the reactor pressure vessel or venting the containment vessel. Yoshida said that he asked head office's opinion, telling them that Haruki Madarame, chairman of the government's Nuclear Safety Commission, had sent him a "suggestion" that water should be injected into the reactor pressure vessel before venting the containment vessel. It was the assessment of the onsite engineers at Fukushima Daiichi that priority should be given to venting the containment vessel, and engineers at the nuclear reactor safety engineering group at head office agreed with them. However, at 4:22 pm, President Masataka Shimizu of TEPCO interrupted the discussion and said,

"Yoshida-san. This is Shimizu. Please follow Chairman Madarame's method."

Yoshida said, in a somewhat taken aback manner, "I have received the head office President's instruction, technically speaking…," and spoke to the screen, "Executive General Manager Muto, is this alright?" However, there was no reply.[36] Muto, who was also executive vice president and chief nuclear officer, was traveling by helicopter from Fukushima to Tokyo at the time, so he was not

[33] Fukushima Evacuee Lawsuit. (2019, September 5). Group 1 preliminary appeal, preparatory document no.5 submitted by TEPCO Holdings' legal attorney. Retrieved from https://8b1b4cba-02ec-489e-99fb-71f4eee99d09.filesusr.com/ugd/8b6c85_d42489c05d60407c9ba883b92714106f.pdf#page=17 (In Japanese.) p.16
[34] Tokyo Electric Power Company, Inc. (2012). *Fukushima Nuclear Accident Analysis Report (Final Report)*. p.133 https://www.tepco.co.jp/en/press/corp-com/release/betu12_e/images/120620e0104.pdf#page=200
[35] Answer by Masataka Shimizu in a NAIIC meeting, June 8, 2012. https://warp.da.ndl.go.jp/info:ndljp/pid/3856371/naiic.go.jp/wp-content/uploads/2012/08/18th-report.pdf#page=6
[36] Asahi Shimbun. (2012). *Kenshô Tôden Terebi Kaigi* [Investigation: TEPCO's Televised Meeting]. Asahi Shimbun. (In Japanese.) pp.301-303

available by videoconference.

Unlike site superintendent Yoshida, who majored in nuclear engineering at the Tokyo Institute of Technology, and Chief Nuclear Officer Muto, a graduate of the University of Tokyo's Department of Nuclear Engineering and familiar with nuclear fuel and safety analysis, President Shimizu graduated from Keio University's Faculty of Economics and had never specialized in nuclear engineering. It was this President Shimizu who overturned the onsite engineering assessment and decided to give priority to depressurizing and injecting water into the pressure vessel.

TEPCO did not mention the fact that President Shimizu overturned the vent-prioritizing engineering judgement for Unit 2 in this way either in its 2012 Accident Investigation Report or the Anegawa Plan summary.[37] However, the Anegawa Plan clarified that "The field commander is given the ultimate responsibility for responding to the situation, and the people around him (even those from higher-ranking organizations or in higher-ranking positions) are assigned roles in which they work to support the field commander."[38] According to TEPCO, this system has been adopted into its drills.[39]

TEPCO's interference in the wording of the public statement on long-term evaluation by the government's Earthquake Headquarters

The history of TEPCO's attempted interference in the long-term evaluation of the nation's Earthquake Headquarters, something that should be compiled from a purely scientific point of view, shares similar problems to the case where TEPCO management overturned its onsite engineering assessment.

From 2010, the earthquake research committee of the government's Earthquake Headquarters had been examining the results of research on the underground traces of past tsunami in the Pacific Coasts of Miyagi Prefecture and Fukushima Prefecture, discussions taking place towards including them in the Long-term Evaluation of Seismic Activity from off the Sanriku Coast to off the Boso Peninsula (Second Edition) to be announced in the following spring of 2011.

According to the e-mail from Takao of the civil engineering survey group to TEPCO Executive Vice President and Chief Nuclear Officer Muto on February 22, 2011, an examiner at NISA told him, "It depends on how and what the Earthquake Headquarters announces, but if NISA finds to be not able to withstand, there's a possibility that it will issue some instruction to the operators." In response to this e-mail, Muto instructed Takao on the afternoon of February 26, "This may have a huge impact depending on how the discussions go, so I'm asking you to pay consideration to communicating with NISA on every level and sharing information."[40]

Five days later, on March 3, a meeting was held between officers from the Ministry of Education's Earthquake Headquarters Secretariat and electric power company engineers like Takao from TEPCO. Officers of the Ministry of Education distributed a draft of the long-term evaluation with a description along the lines of "It is necessary to keep in mind that a huge tsunami (...) has hit multiple times along the coast from central southern Miyagi to central Fukushima". According to TEPCO records, the

[37] Tokyo Electric Power Company, Inc.'s Fukushima Nuclear Accident Analysis Report 2012, p. 163, Appendix-2, pp. 73–74, pp. 79–80 has an explanation on the change of decisions but nothing on Mr. Shimizu. Retrieved from https://www.tepco.co.jp/en/press/corp-com/release/betu12_e/images/120620e0104.pdf#page=233, https://www.tepco.co.jp/en/press/corp-com/release/betu12_e/images/120620e0101.pdf#page=96, https://www.tepco.co.jp/en/press/corp-com/release/betu12_e/images/120620e0101.pdf#page=100
[38] Tokyo Electric Power Company. (2013). Fukushima Nuclear Accident Summary & Nuclear Safety Reform Plan. Retrieved from https://www4.tepco.co.jp/en/press/corp-com/release/betu13_e/images/130329e0801.pdf#page=93
[39] Answers to questions asked by Asia Pacific Initiative from TEPCO Holdings Inc., 2020, July 2.
[40] TEPCO Shareholder Lawsuit. Plaintiff's Exhibit 297-4, Witness Makoto Takao, No.1.

TEPCO side said, “We don’t intend to deny the science, but some people with rose-colored glasses sometimes quote part of the text of the Earthquake Headquarters and use it to their own advantage”, requesting the Ministry of Education to “please pay attention to the wording of the text so that it won’t be misused”, and “we would like you to change the wording because it can be read as if the Jogan Earthquake style earthquakes have occurred repeatedly.”[41]

In response to this, the Ministry of Education started to revise its long-term evaluation draft. The revised draft of March 8 was changed, as if in line with TEPCO's intention, to “There is insufficient data to ascertain as to whether the Jogan Earthquake style earthquakes have repeatedly occurred as a natural earthquake[42]” being added.[43]

The wording used in the long-term prediction of earthquakes and its official government documents should be determined purely on scientific grounds. Above all, there is a trade-off between how rigorously to express the degree of uncertainty in individual long-term projections and the reader's comprehension, and it is a delicate issue that requires the comprehensive judgement of scientists based on the latest and best knowledge. It would be acceptable if the revision were in response to various opinions requested under an open procedure, clearly expressing one's own position. However, the attempt of TEPCO, a stakeholder, to change the wording of a public statement on the long-term evaluation by the Earthquake Headquarters in a closed room cannot help but be taken as an interference that injects something other than science into a scientific matter. It is similar to the case of the Space Shuttle Challenger accident where management forced a change in engineering assessments and perverted scientific judgment. MEXT (Ministry of Education, Culture, Sports, Science, and Technology), who were going to accept the revision positively, and TEPCO should both reflect on this , but in reality, they do not.

Regarding this situation, TEPCO still maintains the view that “our company only stated that the statements should correctly reflect the current situation.”[44] In other words, TEPCO has not learned anything.

4. Diversify responses to preparedness and reduce risk substantially

Prior to the Fukushima accident, no Japanese electric power company or nuclear regulatory organization substantially and adequately adopted the approach of calculating the probabilistic risk of accidents and using that as an evaluation axis for taking safety measures to reduce that risk. A deterministic stance where it would be good enough to meet a predetermined standard formed the mainstream. TEPCO, therefore, recognized that the Fukushima Daiichi Nuclear Power Station had a relatively high risk of losing both AC and DC power supply due to a tsunami leading to a major

[41] Investigation Committee on the Accident at the Fukushima Nuclear Power Stations of Tokyo Electric Power Company. (2011, August 18). *Chōshu kekka-sho* [report of hearing results]. Retrieved from http://warp.da.ndl.go.jp/info:ndljp/pid/10317644/www.cas.go.jp/jp/genpatsujiko/hearing_koukai/348_349_koukai.pdf#page=13 (In Japanese.) p.13

[42] *Sanriku oki kara Bōsō oki ni kakete no jishin katsudō no chōki hyōka no heisei 23 nen sangatsu yoka jiten deno shusei soan ni tsuite* [Draft amendments to “long-term evaluation of seismic activity from the coasts of Sanriku to Bōsō” as of March 8, 2011]. (In Japanese.) The document was disclosed by the MEXT to the author in February 2020 on the basis of the application of the Law Concerning Access to Information held by Administrative Organs.

[43] Hashimoto, M., Shimazaki, K., & Sagitani, T. (2015). *2011-nen 3 tsuki 3-nichi no jishinchōsakenkyūsuishinhonbu jimukyoku to denryoku jigyō-sha ni yoru Nihon kaikō no chōki hyōka ni kansuru jōhō kōkan-kai no ikisatsu to mondaiten* [Background and problems of information exchange on the long-term evaluation of the Japan Trench between the Secretariat of the Earthquake Research Promotion Headquarters and electric power companies on March 3, 2011]. *Monograph of the Seismological Society of Japan*, 3, 34–45. Retrieved from https://www.zisin.jp/publications/pdf/monograph2015.pdf#page=37 (In Japanese.) p.37

[44] Answers to questions asked by Asia Pacific Initiative from TEPCO Holdings Inc., 2020, July 2.

accident, but did not try considering measures across departments and in fact, did not take any effective measures. As a result, the Fukushima Daiichi Nuclear Power Station had inadequate diversity in the location of power supply equipment, no effective preparation for emergency aid equipment or support from outside, and no manual or training to deal with a loss of both AC and DC power supply incident, which caused the accident to expand and spread.

The probability of a beyond-design-basis tsunami was anticipated to be at a level that could not be ignored in engineering terms

As of December 2004, TEPCO recognized that the probability of Units 1 to 4 at the Fukushima Daiichi Nuclear Power Station being hit by a tsunami exceeding the site height was slightly lower than once every 100,000 years.[45] It is said that a common yardstick for the frequency of event occurrence that can be generally ignored in nuclear safety design is once or less in a million years,[46]but the value was close to an order of magnitude higher than that.

On the other hand, according to a report on the results of probabilistic risk assessment released to the general public by electric power companies including TEPCO in May 2002 in line with the requests from the regulatory authority, the frequency of total containment damage at Fukushima Daiichi Nuclear Power Station No. 1 was 1.0 times per 100 million years and 1.2 times for Unit 2.[47] Similarly, according to a report released by TEPCO in March 2004, the total containment damage frequency for Unit 3 was 1.3 times and that for Unit 4 was 1.5 times[48]. As a side note, in a ranking table comparing the core damage frequency values of 29 boiling water reactors nationwide, the worst four were Units 1 to 4 at the Fukushima Daiichi Nuclear Power Station.[49]

There was a serious problem with this “1.0 to 1.5 times per 100 million years” containment vessel damage frequency of Units 1 to 4 at the Fukushima Daiichi. That is, the value was calculated without taking into consideration external events such as tsunami and earthquakes. The evaluation was limited to internal events such as loss of coolant accidents. In the earthquake-prone country of Japan, unrealistically understated values and underestimated probabilities were publically announced. The probability of a tsunami exceeding the site height with a high possibility of linking directly to core damage, in turn leading to containment failure was an order of magnitude higher than announced.

According to TEPCO data dated May 25, 2006, albeit a trial calculation for Unit 5, the probability of a tsunami with a height of 10 meters was once every tens of thousands of years, and the probability

[45] Tokyo Electric Power Services CO.,Ltd. (2004). Kisetsu pranto ni taisuru tsunami hazard kaiseki itaku houkokusho [Report on Tsunami Hazard Analysis for Existing Plants] (In Japanese.) pp.4-45. The document was disclosed by Nuclear regulation authority to the author in July 2020 on the basis of the application of the Law Concerning Access to Information held by Administrative Organs.
[46] Tokyo Electric Power Company. (2013). *Fukushima genshiryoku jiko no sōkatsuoyobi anzen kaikaku puran* [Fukushima Nuclear Accident Summary and Safety Reform Plan]. Report, March 29. Retrieved May 13 from https://www.tepco.co.jp/cc/press/betu13_j/images/130329j0401.pdf (In Japanese.) p.18
https://www4.tepco.co.jp/en/press/corp-com/release/betu13_e/images/130329e0801.pdf#page=21
[47] Tokyo Electric Power Company. (2002). *Akushidento manejimento seibi yūkōsei hyōka hōkoku-sho* [Accident Management Maintenance Effectiveness Evaluation Report]. (In Japanese.) pp.35-36
[48] Tokyo Electric Power Company. (2004). *Akushidento manejimento seibi-go kakuritsuronteki anzen hyōka hōkoku-sho* [Probabilistic Safety Assessment Report following Accident Management Improvement]. (In Japanese.) pp.20-21
[49] Ministry of Economy, Trade and Industry, Nuclear and Industrial Safety Agency. (2004, October 18). *Keisui-gata genshiryokuhatsudenjo ni okeru `akushidentomanejimento seibi-go Katashi-ritsu-ron-teki anzen hyōka' ni kansuru hyōka ni tsuite* [Concerning the evaluation of "probabilistic safety assessment following improvement of accident management" in light water nuclear power plants]. Retrieved from https://warp.da.ndl.go.jp/info:ndljp/pid/1368617/www.meti.go.jp/press/0005696/0/041018accident.pdf#page=10 (In Japanese.)

of a tsunami exceeding the tsunami height design assumption of 6 meters was once in thousands of years.[50] [51] In June 2007, a member of TEPCO's management team recognized that the probability of a tsunami exceeding design assumption was "expected to not reach a negligible level in engineering terms."[52]

According to the tsunami hazard curve (a graph showing the relationship between the water level of the tsunami and the probability of exceeding it) shown by Managing Director Muto, when the civil engineering research group recommended the installation of breakwaters and seawalls in the summer of 2008, the probability that the tsunami would exceed the estimated height of 5.4 to 5.7 meters at that time was approximately once per 1,000 years, and the probability that it would exceed 10 meters, which was equivalent to the site height of Units 1 to 4, was once per tens of thousands of years. [53] The probability of exceeding 13 meters, which was equivalent to the site height of Units 5 and 6, was once every several hundred thousand years. Compared to "1.0 to 1.5 times per 100 million years," these were extremely high probabilities.

On July 23, 2008, TEPCO's Takao held a liaison meeting with Tohoku Electric Power Company, which has nuclear facilities on the Pacific coast of eastern Japan, the Japan Atomic Power Company, and tsunami-related staff at the Japan Atomic Energy Agency. At the meeting, it was explained that the yearly probability of a tsunami exceeding the conventional expected tsunami height would be one thousandth (frequency is once every few hundred years), and the probability of a tsunami height of more than 10 meters would be one 100,000th (frequency is once every few tens of thousands years), in accordance with the view from the Earthquake Headquarters. Takao added that, "Since the earthquake hazard is one 100,000th, we are proceeding to internally coordinate on the assumption that the Earthquake Headquarter's tsunami prediction should also be considered." [54] In the seismic guidelines revised in 2006, the regulatory authority requires considering active faults, whose activity cannot be denied since the late Pleistocene (126,000 years ago), in the design. Similarly, the statement expressed that even if a tsunami exceeding height assumptions were to occur only once per approximately 100,000 years, it would be included in the design assumptions.[55]

The frequency of tsunami hazards referenced in these studies by TEPCO's Takao of the civil engineering research group was based on the results of a survey of seismologists, tsunami researchers, and TEPCO's civil engineering engineers. The survey quantified epistemological certainty through establishing an average value of the frequencies by weighing and combining different views, with an emphasis on the opinions of seismologists.

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[50] TEPCO Shareholder Lawsuit. Defendant's Exhibit B116.

[51] The National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission. (2012). *Tōkyō denryoku fukushima genshiryoku hatsudensho jiko chōsa iin kaihōkokusho* [The official report of the Fukushima Nuclear Accident Independent Investigation Commission]. Report, July 5. Tokyo: Diet. (In Japanese.) p.93 https://warp.da.ndl.go.jp/info:ndljp/pid/3856371/naiic.go.jp/wp-content/uploads/2012/08/NAIIC_Eng_Chapter1_web.pdf#page=32

[52] TEPCO Shareholder Lawsuit. Plaintiff's Exhibit 488.

[53] TEPCO Shareholder Lawsuit. Plaintiff's Exhibit 297- 4, document no.112, "Tsunami Hazard Curve (Fukushima Daiichi Unit 6)."

[54] TEPCO Shareholder Lawsuit, (2008, July 23), Plaintiff's Exhibit 297-4, document no.115, "Meetings of four companies information liaison meeting regarding tsunami", Japan Atomic Power; TEPCO Shareholder Lawsuit, Plaintiff's Exhibit 297-1, Takao Witness Interrogation Record in Criminal Procedure, pp. 102, 103.

[55] Kaneto, one of Takao's subordinates, said in his testimony at the criminal trial, "The probability of a tsunami exceeding 10 meters, or the probability of the water level of a tsunami exceeding that level, was set at 10 to the minus 5th power, and that number, 10 to the minus 5th power, was used as a reference for earthquake hazard in the formulation of the reference seismic motion. The reference result was about 10 to the minus 5th power, so the probability of the earthquake and the tsunami event we are considering now have about the same level of annual exceedance. TEPCO Shareholder Lawsuit, Plaintiff's Exhibit 299-1, p.58.

TEPCO engineers possibly were aware by the end of 2010 that the probability of a tsunami exceeding the site height of 10 meters at the Fukushima Daiichi Nuclear Power Station Unit 4 was slightly lower than once in 10,000 years.[56]

This figure is almost four orders of magnitude higher than the publicly released frequency of containment damage of "1.0 to 1.53 times in 100 million years"due to internal events. It is nearly two orders of magnitude higher than the "once in a million years" that is generally considered to be the frequency of events that can be ignored in nuclear safety design. In addition, it is an order of magnitude larger thanthe containment failure frequency of "approximately once in 100,000 years," which was a rough performance goal from the regulator for nuclear power plants.

TEPCO at the time in 2011 had a tsunami height design assumption of 5.7 to 6.1 meters for the Fukushima Daiichi Nuclear Power Station, but if it exceeded that even by one meter, it would lose its ability to remove heat from the reactor system, and if it exceeded the site height of 10-13 meters by just one meter for a certain period of time, the design was such that both AC and DC power supply would be lost and the reactor could not be controlled. This was recognized as a natural premise among some engineers in the nuclear asset management department.[57] [58] Nuclear circles refer to a "cliff edge" when things worsen little by little before the cliff's edge, but deteriorate suddenly and almost topsy-turvily the moment the edge of the cliff is breached. A six-meter high tsunami was the first cliff edge and a ten-meter high tsunami height was the second cliff edge. It was known in advance there was a high probability close to one in one that the core and containment would be damaged if the tsunami crossed the second cliff edge.

It is thought that in order to reduce the probability of core damage, this "one in one" had to be reduced to "one in ten" or "one in a hundred", which was possible without too much cost. In other words, in order to maintain the minimum safety equipment even if the tsunami exceeded expectations, there are some feasible options such as making building doors and pipe penetrations watertight, lifting air intake and exhaust ports to higher positions, making important rooms inside the buildings watertight, installing independent power sources at higher locations, preparing portable power supplies that can be carried by staff and replacing various pumps, preparing manuals of them, and training personnel

[56] Judgment in the first criminal trial in which former TEPCO chairman Katsumata and others were indicted for professional negligence resulting in deaths and injuries, Tokyo District Court Criminal Division 4, September 19, 2019, p.34.

[57] General Manager of TEPCO Nuclear Power & Plant Siting Division Matsumoto Junichi said the following in a press briefing on May 15, 2012:
"Obviously, you should consider the possibility that when water inundates the ground of the site the water will enter through the opening and flood the power supply, causing loss of function. (...) It is just common sense."
"Apparently, the result was the complete loss of power due to the tsunami reaching above ground-level. "
"Obviously, when water inundates the ground of the site the water will enter through the opening and flood the power supply, causing loss of function. This is common knowledge for nuclear power operators or engineers like myself. (...) We all know as nuclear engineers that when you lose power you can no longer cool down the reactor, and that if water floods into the site you will lose the function of your power supply. "
Nico Nico News. (May 15, 2012) *Tôkyô denryoku kisha kaiken* [TEPCO press conference]. [Video]. Retrieved June 15, 2020 from https://live.nicovideo.jp/watch/lv92597723 (In Japanese.)

[58] "Since the indefinite continuation of a tsunami at the height of ground level plus 1 meter would lead to the indefinite entry of seawater into station buildings from their openings, the result unsurprisingly pointed to the loss of functionality for many of the electrical facilities and motor-driven facilities," in TEPCO, 2012, p.38.
https://www.tepco.co.jp/en/press/corp-com/release/betu12_e/images/120620e0104.pdf#page=62

to use them in an emergency.[59] [60]
They could easily derive ideas if thought through not only by the civil engineering survey group, but also by gathering the wisdom of engineers in electrical, mechanical, architectural and nuclear engineering departments within TEPCO.

In fact, in the material prepared by the Nuclear Facilities Management Department for the "Imperial Conference" held at TEPCO on February 16, 2008 with the President and CEO, Katsumata, stated measures to be examined that accompanied the document "Change in tsunami height assumption," included "improvement of waterproofness of building", "improvement of sealability of penetrations and doors", and "preservation of pump motor spare parts" for "maintaining function of emergency seawater pump."[61] From December 2008 to September 2009, Japan Nuclear Power Company, another company in the same industry that TEPCO has invested in and dispatched engineers for, has actually implemented construction work such as waterproofing the building doors. Another nuclear operator voluntarily purchased a spare part of the seawater pump motor in 2008 and installed it in the power plant. These measures were prepared at a cost of tens of millions to billions of yen, not of tens of billions of yen.[62]

By combining such methods in multiple and various ways, it was possible to reduce “one in one” to “one in tens” and eliminate the cliff edge. In other words, even if an unexpected tsunami occurred, it would be possible in most cases to stop before core damage, and it was not impossible to sufficiently reduce the probability of tsunami-induced core damage to low enough levels.

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[59] "if we had taken the initiative to consider necessary measures and had implemented countermeasures such as waterproofing battery rooms or preparing back-up power sources, we might have mitigated to a certain extent the impact of the Tohoku-Chihou-Taiheiyo-Oki Earthquake and Tsunami and might have prevented the worst-case situation in which a large amount of radioactive materials were released." in TEPCO, 2013, p.18.
https://www4.tepco.co.jp/en/press/corp-com/release/betu13_e/images/130329e0801.pdf#page=21

[60] In a request for compensation from TEPCO and the government by people who fled Fukushima Prefecture during the Fukushima Daiichi Nuclear Disaster, on March 17, 2017, Maebashi District Court approved partial compensation and noted in its reasoning that "several concrete actions could have been taken to avoid this disaster, including (i) raising the air supply louvers to raise the lowest point of the opening, (ii) installing the switchgear and air-cooled emergency DGs on the upper floors of the building, and (iii) installing the switchgear and air-cooled emergency DGs (together with a power truck) on higher ground and laying permanent underground cables to connect them to the cooling system. Had either option (i) or (iii) been secured then cooling functions would not have been lost and the accident would not have occurred.
https://www.courts.go.jp/app/hanrei_jp/detail4?id=86691.,
https://www.courts.go.jp/app/files/hanrei_jp/691/086691_hanrei.pdf#page=174.

[61] TEPCO Shareholder Lawsuit, (2006, February 16), Plaintiff's Exhibit 298-.3, document no. 20, TEPCO internal document, “Launch of seismic safety assessment based on Ss,” TEPCO Nuclear Equipment Management Department Chuetsu-oki, Niigata Prefecture Earthquake Countermeasure Center.

[62] The Japan Nuclear Power Company's (JNPC) technical review document (approval date: December 2, 2008) attached to the investigation report (regarding making a copy of the file titled JNPC document 5 concerning tsunamis) (created by Yukie Yasuhara, Tokyo District Public Prosecutor's Office, dated July 10, 2018) of the TEPCO shareholder lawsuit plaintiff’s exhibit 466 (plaintiff’s exhibit A265 in the criminal trial) states with regards to the Tokai Daini Power Station and Tsuruga Power Station Units 1/2 that functional equipment related to reactor shutdown, cooling, or confinement (hereinafter referred to as "safety functional equipment") will be lost in the event of extreme flooding onsite (Tokai: Tsunami, Tsuruga: Tsunami, flood overflow). To prevent this, measures will be taken to stop tides reaching buildings that house safety functional equipment. In addition, measures to prevent tides along the boundaries of controlled areas (excluding those where there is no risk of pollution) will be implemented. With regards to the construction of tsunami prevention measures for the buildings, waterproof doors, tide shutters and dams are listed. According to the Japan Nuclear Power Company's written approval on December 3, 2008, which was attached to the investigation report, the cost for the above measures was estimated to be 186.32 million yen at the three power plants. Of these, the construction period for Tokai Daini was from December 8th, 2008 to September 30th, 2009. In fact, the completion notice was submitted by Shimizu Corporation on the same day, and it was found that the cost of building the tsunami prevention measures at the power plant totalled 33 million yen.

Nevertheless, TEPCO took no such measures and did not try to eliminate this cliff edge. Cost effective measures to reduce probabilistic risk were not considered and thought through seriously. It can be said that the reality was that TEPCO turned away from the magnitude of the probability of core damage taking into consideration the tsunami and did not try to implement measures to reduce the value.

With regard to these circumstances, TEPCO said, “As for the probabilistic safety assessment against tsunami, it had not been established as a concrete assessment method because it was still under research and development as of March 11, 2011.”[63]

However, the probabilistic evaluation of tsunami height (creating a tsunami hazard curve) was repeatedly attempted, and some of the results were shown to senior management, such as Managing Director Muto, who is in charge of business judgment, and regulatory authorities. If a TEPCO employee who knows the existence of a cliff edge has a stochastic risk that is orders of magnitude greater than the risk of internal phenomena, it can be easily read from the tsunami hazard curve. Nevertheless, if the results were disregarded as "still in the process of research and development," and the civil engineering survey group rejected the "in-house adjustment that the tsunami predicted by Earthquake Headquarters should be taken into account," it can be said that Muto, among other TEPCO senior executives, promoted an attitude of neglecting risk. The whole picture of these circumstances has finally been clarified by the evidence submitted to criminal and civil trials, and it is hard to say that TEPCO faced the facts and learned enough from them.

A lack of diversity caused the accident and delays in external support enlarged it

For these reasons, the Fukushima Daiichi Nuclear Power Station had the following weaknesses.

Namely, the locations of key power supply facilities at the Fukushima Daiichi Nuclear Power Station, such as an emergency diesel generator (AC power supply in the station), an emergency high-voltage switchboard, and a DC power supply panel, were located on the ground floor or underground. Nothing was located above the 2nd floor.

Plurality was prepared at each facility, “multiplicity” being secured in that respect. Units 2, 4, and 6 had air-cooled, not water-cooled, emergency diesel generators installed on the first floor above ground, not underground. Whether or not they were intentionally installed that way, they provided a certain degree of diversity. However, it wasn't enough.

All of the emergency generators for units 1, 3 and 5 were placed underground. All of the emergency high voltage switchboards for units 2, 3, 4, and 5 were placed underground. And all of the DC power sources for units 1, 2, and 4 were at the bottom of the basement floor. As a result, these facilities ceased to function as a whole due to the single cause of inundation of the basement floor by the tsunami, both AC power and DC power supply being lost immediately at Units 1, 2 and 4, resulting in a total power outage after the tsunami hit the Station.[64]

The single factor of a tsunami caused the entire dysfunction of Units 1, 2 and 4 to occur because of a lack of “diversity” in the location of the power supply equipment.

[63] Answers to questions asked by Asia Pacific Initiative from TEPCO Holdings Inc., 2020, July 2.
[64] Tokyo Electric Power Company. (2012). Attachment 7-4 "Damage Status at Fukushima Daiichi Nuclear Power Station (After Tsunami)." In *Fukushima Nuclear Accident Analysis Report*. Retrieved from https://www.tepco.co.jp/en/press/corp-com/release/betu12_e/images/120620e0106.pdf#page=323 p.323

In addition, there were only three fire engines, which were used for alternative water injection into the reactors at Fukushima Daiichi, and there were no spare parts for the batteries required for reactor control. There were also no spare seawater pumps that could be used after the tsunami, although there were some spare parts for the pumps.

There were no procedures and no training in preparation for the loss of both AC and DC power sources. No external support was planned enough. For this reason, in order to procure the portable 12 volt batteries required for nuclear reactor control at the Fukushima Daiichi, employees of the site had to take batteries from their own cars or travel around hardware stores in Iwaki city 30 to 70 km away from the plants to buy them, creating a delay until the morning of March 13, the third day after the earthquake. In order to take seawater from the Pacific Ocean to the reactors, four large fire trucks came from TEPCO's own thermal power plants in the Tokyo metropolitan area and arrived at the Fukushima Daiichi Nuclear Power Station on the morning of March 14, the fourth day of the disaster. It was on the night of March 14th that a sufficient amount of 12 volt batteries ordered by head office from Toshiba were delivered to the Fukushima Daiichi Nuclear Power Station. This delay caused fatal damage to Units 2, 3, and 4.

In this way, a lack of diversity in the arrangement of key power supply facilities caused the loss of both AC and DC power supplies, and the lack of ready spare emergency equipment such as batteries, as well as the delay in support from outside, contributed to enlarging the accident.

Prepare versatile external support and ensure diversity in response

The lesson of not only increasing the amount but also diversifying the type of safety equipment in order to reduce the probabilistic risk of an accident was firmly recognized by the Japanese nuclear community in the wake of Fukushima Daiichi accident, including TEPCO and nuclear regulatory organizations.

"We will shift from the conventional securing of reliability through redundancy to ensuring reliability with an emphasis on diversity and positional dispersion to reinforce defense in depth," says the Anegawa Plan[65].

However, looking at the current state of nuclear power plants in Japan, the situation seems to be limited to ensuring diversity required by regulations in order to comply with the new regulatory standards set in 2013, rather than seek to vigorously reduce probabilistic risks.

TEPCO's Kashiwazaki-Kariwa Nuclear Power Station significantly increased the number of fire engines deployed after the Fukushima accident, currently having 42 fire trucks. When asked if this was a rational safety measure, a TEPCO executive answered, "I think it is extremely irrational." He intended to deploy fire engines, but didn't think they needed more than 40. He went on to say that given demands from the regulatory side, they decided to acquiesce because it didn't cost much and safety would not decrease.[66]

Certainly "the more, the better", but personnel and funds are and will be required in order to maintain and manage them so that they can be operated at any time. If a high effect in reducing risk can be

[65] Tokyo Electric Power Company. (2013). *Fukushima genshiryoku jiko no sōkatsuoyobi anzen kaikaku puran* [Fukushima Nuclear Accident Summary and Safety Reform Plan]. Report, March 29. Retrieved May 13 from https://www.tepco.co.jp/cc/press/betu13_j/images/130329j0401.pdf (In Japanese.) p.55
https://www4.tepco.co.jp/en/press/corp-com/release/betu13_e/images/130329e0801.pdf#page=63
[66] Interview with TEPCO executive, November 27, 2019

expected by doing so, then personnel and funding should not be spared, but looking at the Kashiwazaki-Kariwa Nuclear Power Station site and aerial photographs of it, we see that these fire engines are parked together in two specific locations inside the Station premises. TEPCO explained, "The equipment is dispersed on high ground within the power station in order to avoid the risk of not being able to use it at the same time due to an earthquake or tsunami."[67] However, when you enter the site, you are greeted by the sight of some ten similar-looking red fire trucks all lined up. Even though there is multiplicity, there is insufficient diversity and incomplete dispersion. No matter how vast the site may be, deploying 42 fire trucks in one site diminishes the marginal utility to near zero.

In this regard, TEPCO seeks to justify the current situation on the grounds that regulators have approved TEPCO's way as follows. "To prevent fire engines [outside the reactor building] and safety equipment inside the reactor building from being damaged simultaneously by common factors (of a single cause), fire engines are dispersed and separated from the reactor building by a distance of 100 meters or more, so conformity to the new regulatory requirements has been confirmed by the Nuclear Regulation Authority's review. Therefore, we believe that a complete loss of function will not occur as the result of a single cause."[68]

Kansai Electric Power Company, Inc. (KEPCO) has also installed air-cooled diesel generator cars and water injection pumps according to the new regulatory requirements at its Takahama nuclear power plant. Looking at the site and aerial photographs, they are located only tens of meters away from the reactor building. According to documents submitted by KEPCO to the regulator, the water injection pump for Unit 4 is at the back of the Unit 3 reactor building, and the water injection pump for Unit 3 is at the back of the Unit 4 reactor building. KEPCO's explanation is that this meets the "100 meters distance from the reactor building" requirement[69], an arrangement that has gone unchallenged. Although not as many as the Kashiwazaki-Kariwa Nuclear Power Station, even at the Takahama nuclear power plant, two generator cars of the same type are lined up next to each other. If you are going to the effort of creating multiplicity, diversifying locations and types of equipment contributes to greater safety rather than arranging power sources for the same kind of equipment in the same place, but this is not the case.

Regarding this, the public relations group of the Nuclear Power Division of KEPCO explained that "Based on the regulatory standards, power supply vehicles and fire pumps are located 100 meters or more away from the reactor building of the target unit, with another set stored and distributed 100 meters from the reactor building (...) Furthermore, we are developing initiatives not limited to the regulatory framework to improve safety, such as voluntary deployment of equipment with power supply and cooling functions." As for the reason for defining "target units" for individual power supply vehicles and pumps, KEPCO believes that "it is possible to carry out more and more training and quickly conclude an accident without causing disorder."[70]

It is not uncommon to see emergency vehicles such as large-capacity pump cars and power supply

[67] Tokyo Electric Power Company. (n.d.). *Fukushima daiichi genshiryoku hatsudensho no jiko-ji no kyōkun to kadai wa?* [What are the lessons and challenges from the Fukushima Daiichi NPS accident?]. Retrieved from https://www.tepco.co.jp/kk-np/safety/images/how_image1.pdf (In Japanese.)
[68] Answers to questions asked by Asia Pacific Initiative from TEPCO Holdings Inc., 2020, July 2.
[69] Kansai Electric Power Company. (2013, December 20). *Shiryō 3–5 "Takahama 3-gō-ro oyobi 4-gō-ro kahangata jūdai jiko-tō taisho setsubi hokan basho oyobi akusesurūto ni tsuite*" [Documents 3–5, Takahama Units 3/4: portable equipment for severe accidents– storage locations and access routes]. Retrieved from https://warp.ndl.go.jp/info:ndljp/pid/10249547/www.nsr.go.jp/data/000034987.pdf#page=3 (In Japanese.)
[70] Kansai Electric Power Company, Nuclear Power Business Headquarters, Community Headquarters, Public Relations Group. (2020, May 15). Answers to inquiries regarding the arrangement of emergency response equipment at Kansai Electric Power's nuclear power plant.

cars without license plates on the premises of nuclear power plants. It means that no one can drive the vehicles on public roads outside the plants. Support for other power plants is not taken into serious consideration at all. The administrative executive of one of electric power companies says it is obliged to have as many pump cars and power supply cars as required by law on the premises of the power plant, and it is not possible to send them to other power plants for support, even if they are part of the same company. Although we think it would be preferable to allow large capacity pump cars and power supply cars to be interchanged between power plants to enhance defense in depth, they say it is not possible, citing regulations as the reason. In addition, KEPCO expresses that "If by any chance there is a need to accommodate another power plant, although it is not clearly defined by regulatory standards, on occasion it is also possible to carry necessary materials and equipment to other power plants by using a truck or tow truck, among other means, as a response."[71] However, this would require time and effort to prepare the towing vehicle in an emergency, and in reality it would be difficult without formulating a routine procedure and training.

From these examples, it can be said that, even after the Fukushima accident in Japan, the location of equipment for emergency response is not well dispersed, but rather concentrated, and the demand for ensuring diversity is thought lightly. It can also be said that they are less than fully remorseful about Fukushima Daiichi, where functions were lost across the board due to a single cause because TEPCO did not diversify the location of safety equipment. The centralized placement of safety equipment in an identical location increases the probabilistic risk that they would simultaneously be damaged and cease functioning. Efforts to reduce any such risk do not appear to have been fully undertaken.

Dispersing the locations of water injection pumps and generator cars should not be too expensive. Nevertheless, the reason such measures are not put in place is apparently because of the approach that complying with regulatory requirements is enough.

In the United States, in accordance with the regulatory requirements of the U.S. government's Nuclear Regulatory Commission (NRC) based on the lessons learned from the Fukushima Accident, National SAFER Response Center warehouses located in two locations, east and west, were set up in June 2014 and are jointly operated by nuclear power companies, storing five sets each of emergency aid equipment such as low-pressure pumps, medium-pressure pumps, high-pressure pumps, water purification equipment, gas turbine generators, air compressors, floodlights, etc. , all of which can be deployed at any time to arrive at any nuclear power plant in the United States within 24 hours. In line with this, the power supply and hose connection ports have been standardized to the same size and shape in order to enable the same equipment to be used at nuclear power plants across the United States[72]. Such a measure, known as "FLEX strategy", is an attempt to diversify and multi-layer the location of safety equipment.

In contrast, it seems that both Japan's regulators and private sectors pride themselves that Japan has a safer system than the United States by installing more than enough fire engines and power supply vehicles on the premises of nuclear power plants.

Belatedly from 2016, using the US FLEX strategy as a point of reference, the decision was taken even in Japan to create a shared database of power supplies, pumps and other equipment owned by each electric power company. Additionally, attempts are being made to ready attachments for connection ports so that portable water injection equipment and power supply vehicles can be used

[71] Ibid.
[72] Okuyama, T. (2016, March 30). *Nichibei de kon'nani chigau genpatsu jikonotaiō, Fukushima no kyōkun* [Lessons of Fukushima: The radically different responses to a nuclear emergency in Japan and the U.S.]. *Journal of Law and Economy Asahi Judiciary*. Retrieved from https://judiciary.asahi.com/fukabori/2016032400001.html (In Japanese.)

by other stations and companies. The Federation of Electric Power Companies also requested the Japan Atomic Power Company to open a Nuclear Emergency Assistance Center in Fukui Prefecture in March 2016, equipped with robots, wireless heavy equipment, and drones, ready to be dispatched to any nuclear power plants in Japan at any time, which it has done. However, unlike the US FLEX strategy, the center is not equipped with pumps or generators, and the interchange of materials and equipment between electric power companies is carried out on a voluntary basis without endorsement or inspection by the regulatory authorities. For these reasons, the effectiveness and sustainability of this measure is questionable. In other words, despite being a party to the Fukushima accident, Japan's response is three years behind that of the US, and the details are incomplete, leaving us in doubt.

5. Avoid succumbing to unspoken pressure and speak up upon noticing anything of concern

TEPCO has a top-down and inward-looking corporate culture of obeying superiors or authorities without questioning or challenging them, but of being passively resistant. So say a considerable number of stakeholders in a position to observe TEPCO management up close.

Japanese government's Atomic Energy Commission in the Cabinet Office pointed out the following as "Fundamental Issues Ingrained in Nuclear Energy-related Organizations" in its Base Policy for Nuclear Energy dated July 20, 2017[73].

"The unique mindset and groupthink in Japan, the pressure to conform tacitly or forcibly to the opinion of the majority, and the tendency to maintain the status quo are all very strong, and they can be a problem."

According to the Atomic Energy Commission, this tendency affected the safety of nuclear power.

"As a result of the sub-optimization of information sharing in terms of the contents and scope, truly needed information does not get appropriately shared. It is, therefore, necessary to create a culture in which people can exchange a variety of opinions based on solid grounds, regardless of their standing inside or outside the organization."

This is what was proposed by the Atomic Energy Commission, which the Cabinet resolved to respect in its meeting[74].

Yoshiaki Oka, chairman of the Japan Atomic Energy Commission, commented, "The painful lesson the Fukushima nuclear power plant accident has shown us is that it is especially necessary for objections to be voiced based on specific grounds as part of people's jobs."

"The Japanese are not good at expressing objections. Ignoring objections and focusing on apparent efficiency in the short-term perspective will lead to failure in the medium to long term. (…) Japanese people are bad at sharing evidence-based objections, but I strongly feel that efforts to overcome this weakness of national character are essential, not only for safety and an awareness of the various issues that stem from that, but also for nuclear personnel in their utilization of nuclear power."[75]

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[73] Japan Atomic Energy Commission. (July 20, 2017). *Basic Policy for Nuclear Energy*. Retrieved from http://www.aec.go.jp/jicst/NC/about/kettei/kettei170720_e.pdf#page=6 (In Japanese.)
[74] Japan Atomic Energy Commission. (n.d.). *Genshiryoku riyō ni kansuru kihon-teki kangaekata* [Basic Policy for Nuclear Energy]. Retrieved from http://www.aec.go.jp/jicst/NC/sitemap/bunya22.htm#kakugi (In Japanese.)
[75] Japan Atomic Energy Commission. (June 30, 2017). *Iin kara hitokoto* [A word from the committee]. *Atomic Energy Commission Mail Magazine*, no.224. Retrieved from http://www.aec.go.jp/jicst/NC/melmaga/2017-0224.html (In Japanese.)

Both the Atomic Energy Commission and Chairman Oka point out that these "Fundamental Issues Ingrained in Nuclear Energy-related Organizations" come from "characteristics of Japanese organization and citizens." However, it would be a leap in logic to describe TEPCO's organizational climate and culture as "corporate characteristics unique to Japan." Many large companies and organizations in Europe, the United States and China share the same tendency, and conversely, many Japanese companies do not, or only to a limited extent.

It would, nevertheless, be correct to say that TEPCO has a highly concentrated form of the "characteristics of Japanese organization and citizens" pointed out by the Atomic Energy Commission, and as a result, faces fundamental problems that continue to exist in nuclear-related organizations.

TEPCO's Anegawa Plan summary also addressed the issue of corporate culture.

According to the Plan, prior to the Fukushima accident, in response to reviews and audits by external trade associations such as the World Association of Nuclear Power Operators (WANO) and its in-house Nuclear Quality Management Department, there were TEPCO employees who focused efforts on "not getting any indicated items to deal with in the first place, rather than trying to make improvements by using the indicated items." There was an absence of any attitude of deepening discussions on safety through audits and seriously accepting external suggestions.[76] Regarding its response to regulation by NISA, TEPCO had a tendency to "think that it was sufficient to follow the directives of the safety inspectors, or, in other words, to just satisfy regulatory requirements" and "to perform an operation according to the stipulations specified in the manual."[77] A TEPCO executive looking back said, "they tried to stick to their own patch and if something went wrong, they would all make an excuse in unison, 'that's not my role', creating a group that 'didn't think themselves' emerging."[78]
Taking this situation into account, the Anegawa Plan summary concludes "despite the fact that TEPCO's safety culture was definitely not in a good state, this fact was overlooked(...) The decline of our safety culture went unnoticed with there not being ample activities for improving the situation." It pointed out the cause of the Fukushima nuclear accident as follows. "The nuclear power scandals were not considered to be an indication of the deterioration of the safety culture, but due to there not being ample communication skills and problem-solving techniques. Therefore, the measures were not ample to methodically improve safety awareness."[79]

After expressing regret for its past conduct in this manner, TEPCO pledged under the Anegawa Plan that it would create output in the form of sharing current situational understanding and deciding on measures to improve by practicing in their meetings at the start and end of each day a stance of managers and subordinates questioning (challenging) each other, ""Is this all right?" "Is it better to

[76] Tokyo Electric Power Company. (2013). *Fukushima genshiryoku jiko no sōkatsu oyobi anzen kaikaku puran* [Fukushima Nuclear Accident Summary and Safety Reform Plan]. Retrieved May 13, 2020 from https://www.tepco.co.jp/cc/press/betu13_j/images/130329j0401.pdf (In Japanese.) p.41
https://www4.tepco.co.jp/en/press/corp-com/release/betu13_e/images/130329e0801.pdf#page=44
[77] Tokyo Electric Power Company. (2013). *Fukushima genshiryoku jiko no sōkatsu oyobi anzen kaikaku puran* [Fukushima Nuclear Accident Summary and Safety Reform Plan]. Retrieved May 13, 2020 from https://www.tepco.co.jp/cc/press/betu13_j/images/130329j0401.pdf (In Japanese.) pp.41-42
https://www4.tepco.co.jp/en/press/corp-com/release/betu13_e/images/130329e0801.pdf#page=48
[78] Interview with TEPCO executive, November 27, 2019
[79] Tokyo Electric Power Company. (2013). *Fukushima genshiryoku jiko no sōkatsu oyobi anzen kaikaku puran* [Fukushima Nuclear Accident Summary and Safety Reform Plan]. Retrieved May 13, 2020 from https://www.tepco.co.jp/cc/press/betu13_j/images/130329j0401.pdf (In Japanese.) p.50
https://www4.tepco.co.jp/en/press/corp-com/release/betu13_e/images/130329e0801.pdf#page=58

do this?"[80]

In particular, the Anegawa Plan demanded middle managers at the department general manager level and group manager level "not underestimate their line responsibilities (division of duties and authority) and actively put forth their opinions".

"If a nuclear power leader underemphasize safety or appears to take an attitude toward excessively delaying a conclusion, middle management must speak up. They must understand the situation and provide the materials necessary for making a determination to management at an appropriate time without having excessive trust in the intentions of superiors or remaining silent out of fear of making waves. "[81]

This passage can be said to be express remorse for the fact that prior to the Fukushima accident, middle management did indeed read the innuendos, swallow their supervisors' opinions wholesale, anticipate their superiors' wishes and maintain silence so as not to rock the boat, which caused the requisite materials for making judgments that were not shared with management and results that were unduly delayed.

There is no doubt that the Anegawa Plan was a reflection of sincere thoughts and efforts to identify problems in the company's corporate disposition.

Nevertheless, there is no mention of the truth behind how the tsunami countermeasures were postponed, nor any probing analysis on the history of the Fukushima nuclear power plant accident and its enlargement, the deterioration in the safety culture, and the relationship between this management culture and corporate disposition.

Take, for example, the case of internal communication failure on March 11, 2011 regarding whether or not the isolation condenser (IC) in Unit 1 of the Fukushima Daiichi was operating. It was nothing but a tragic lack of communication that involved "the practice of mutually questioning and challenging each other".

From the late afternoon to the evening on the day of the earthquake, the reactor core in Unit 1 at Fukushima Daiichi actually started to melt, but TEPCO did not notice it and mistakenly thought cooling was continuing.

A tsunami struck Fukushima Daiichi around 3:36 pm on March 11, 2011, and shortly thereafter, all power including DC power supplies were lost at Unit 1. At that time, in Unit 1, all cooling devices including the isolation condenser (IC) stopped, and after the loss of all power, it was impossible to restart the cooling device by remote control from the main control room of Unit 1. The operator (main unit operator), who was in charge of operating the IC, and his supervisor, the deputy engineer, were aware of the fact that the IC had stopped. However, the shift supervisor and deputy manager, who were both in the same main control room, were not made aware of this fact. The shift supervisor strongly suspected that the IC might have stopped, but this perception was not transmitted to the site's

[80] Tokyo Electric Power Company. (2013). *Fukushima genshiryoku jiko no sōkatsu oyobi anzen kaikaku puran* [Fukushima Nuclear Accident Summary and Safety Reform Plan]. Retrieved May 13, 2020 from https://www.tepco.co.jp/cc/press/betu13_j/images/130329j0401.pdf (In Japanese.) pp.64-65
https://www4.tepco.co.jp/en/press/corp-com/release/betu13_e/images/130329e0801.pdf#page=73
[81] Tokyo Electric Power Company. (2013). *Fukushima genshiryoku jiko no sōkatsu oyobi anzen kaikaku puran* [Fukushima Nuclear Accident Summary and Safety Reform Plan]. Retrieved May 13, 2020 from https://www.tepco.co.jp/cc/press/betu13_j/images/130329j0401.pdf (In Japanese.) p.68
https://www4.tepco.co.jp/en/press/corp-com/release/betu13_e/images/130329e0801.pdf#page=77

Emergency Response Center (ERC) at the seismic isolated building in Fukushima Daiichi. As a result, site superintendent Yoshida, who was in the site's ERC, Akio Komori, Acting Chief of ERC in TEPCO's Emergency Response Center (ERC) in Tokyo headquarters, the government, and the press, all believed the IC was operating in Unit 1 and the cooling continuing. This misunderstanding of the IC operating status led to a "series of delays" in dealing with the accident. It can be said that human error caused the accident to spread.

However, the reason why such a thing happened is not yet clear. In particular, the details related to the fact that the information on IC outages was not shared in the main control room are only mentioned fragmentarily in the appendix to the TEPCO Accident Investigation Report and the main part of the report contains no mention. Nor is there any mention in the Anegawa Plan summary.

A TEPCO executive involved in compiling the Anegawa Plan noted the following "lesson" after stating the reason for the misunderstanding over the state of IC operation in Unit 1 as, "It wasn't a question of corporate culture. It was a question of information transmission techniques during an emergency."

"None of us had any training in how to reliably share information between people in an emergency like that. Right now, they're saying the principle of three-way communication should be used. The person who mentions an abnormality in an important machine must confirm whether or not the person they want to convey the message to has heard. For example, the shift supervisor has to repeat back, 'the IC has stopped, right?' On hearing that, the operator has to say, 'Yes, that's right.' Keep saying it until you know it's been conveyed."[82]

However, it is clear that it is not possible to explain the misunderstanding over Unit 1's cooling by methodological problems alone.

In an interview with former Professor Emeritus Professor Hajimu Yamana of Kyoto University, Chairman of the Nuclear Damage Compensation and Decommissioning Facilitation Organization, when asked if he thought TEPCO's corporate culture or corporate mores had affected the course of the accident, he replied, "Of course I think so".

"Everyone is just looking up. Yes, instructions from the top were widespread, but there were some places where details were missing. At the very least, the details didn't make it to the top. It's all about the gap between the top and bottom."[83]

Yamana said he believes that there is still a need to investigate the human error involved with the accident in the immediate aftermath of the tsunami, which hit Fukushima Daiichi on March 11, 2011[84]. "The story of the ICs is typical, but there are some things that aren't clear. I think further interviews will be needed once the traces of the onsite hardware emerge."[85]

Kazuhiko Toyama, an external director of TEPCO Holdings from 2017 to 2020, also points out problems in TEPCO's management climate and corporate mores. Toyama, who once worked on reforming Japan Airlines (JAL), says that a characteristic common to both JAL and TEPCO was "a fierce inertia for maintaining the status quo".

[82] Interview with TEPCO executive, November 27, 2019
[83] Interview with Hajimu Yamana, December 11, 2019.
[84] Interview with Hajimu Yamana, December 11, 2019.
[85] Interview with Hajimu Yamana, December 11, 2019.

"Deciding on a new direction takes enormous energy to build a bottom-up consensus. It is very difficult. Everyone from a section head to the CEO has the right of veto. The problem at Fukushima was probably that they couldn't change what needed to change, and I think it was difficult in terms of the very nature of the organization. It's the same disease that organizations with a lot of Tokyo University graduates have."[86]

One of the former senior officials of the Ministry of Economy, Trade and Industry (METI) who is familiar with the ins and outs of TEPCO, while acknowledging in an interview that "I can't say for certain if it was a factor leading to the accident", cited "the lack of a 'culture to challenge' and a condescending outlook as TEPCO's corporate disposition."[87] "There's a mix of cultures that are inward-looking, passive resistant, and top-down. It's a problem found specifically at the power utilities."[88]

On the evening of March 11, 2011, all cooling devices including the isolation condenser (IC) shut down, and the reactor heat went completely untreated, but the even more frightening reality was that neither the shift supervisor, the site superintendent or head office knew the facts. There were multiple employees who knew the situation, so at least one of them should have made senior management aware of it, even if that meant yelling at the boss or grabbing him by the shirt. The reason this didn't occur cannot be attributed solely to "a question of information transmission techniques during an emergency". If that is so, then what was it? What was the real reason? TEPCO has to make this clear. It is no exaggeration to say that this is one of the greatest unsolved mysteries of the Fukushima Daiichi nuclear accident. TEPCO still doesn't take the question seriously.

6. TEPCO's political and economic clout

Electric power companies and the Federation of Electric Power Companies they have formed, and especially TEPCO, have or had traditionally wielded substantial political and economic influence that can have a wide-ranging impact on politics, the economy and society. TEPCO puts much effort into "lobbying" people involved in important decision-making in national politics and society, using a dedicated team for the purpose of explaining their thoughts, the background to issues, persuading, and building consensus, thereby exercising political and economic power. The influence of TEPCO and KEPCO extended even to the point of contacts with the underworld. This is considered to be a factor in the formation of the TEPCO corporate culture and structure described above.

According to Toyama, electric power companies in each region, including TEPCO, have been guaranteed an income for many years without being exposed to competition or the fear of bankruptcy, thanks to a quasi "National Polity" of regional monopoly, vertical integration, and the fully distributed cost method with a fair rate of return. Thanks to vertical integration, where power generation, transmission and distribution, and retail are all handled by one company, and a regional monopoly that guarantees the position of being the sole electricity seller in each region, electric power companies did not have to kowtow to their customers to get them to buy their electricity. And, on the other hand, they were in the dominant position of buying things from most of industry. Under the fully distributed cost method, almost all costs could be passed on to the electricity bill, so there was no need to lower purchase prices and they also had huge budgets. They were the "ultimate buyer" and "at the top of the purchasing hierarchy". Additionally, they joined related organizations in donating to various fields, hiring both retired bureaucrats and the offspring of influential people. As

[86] Interview with Kazuhiko Toyama, March 18, 2020.
[87] Interview with a former METI official, February 27, 2020.
[88] Interview with a former METI official, February 27, 2020.

a result, the electric power companies in the past reigned in both the central and regional economic worlds. Although there is close public oversight of the government, including how the budget is spent, there was no such oversight for the electric power companies. A power company was once a "huge power with no governance" and a "monster". Toyama concludes this was the consequence of "just how politically powerful" the power companies were[89].

Power utilities, including TEPCO, have not publicly made political contributions since 1974. This is because it "is not appropriate for companies operating in the public interest". However, funds are provided in obfuscated ways. For example, they cooperate through donations in the name of individual executives and senior management, the purchase of tickets for parties held by politicians,[90] and "outsourced research funds" to organizations related to politicians even if they are not specifically political organizations[91].

According to Chimori Naito, a vice-president and political liaison officer at Kansai Electric Power from 1962 to 1987, "Political contributions were made by TEPCO, KEPCO, and Chubu Electric in that order, KEPCO paying around 500 million yen a year when I was there. I think the construction of nuclear power plants accelerated this a fair bit. We gave to every prefectural and town council. Putting nuclear power in a region required power beyond reason."[92]

500 million yen was equivalent to several million dollars or more than 10 million dollars.

He said he handed out directly 20 million yen a year to former prime ministers at the two traditional times a year, and between two to seven million yen a time to other leading politicians.[93]

Regarding the reason for such payments to politicians, Naito said, "Because Japan is a bureaucratic state, having a very friendly relationship with the Prime Minister makes it possible to communicate with other administrative agencies very smoothly." As an example of the authority that an administrative body holds for an electric power company, he said, "(the assessment) of electricity charges is the most important thing (...) and then the construction of power plants."[94]

"The government holds the permits. Whether it's building a power plant or inspecting it, it's a matter of MITI's permission, so we can't get on their wrong side."

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[89] Interview with Kazuhiko Toyama, March 18, 2020.
[90] The Asahi Shimbun Special Press Department. (2014). *Genpatsu riken o ou* [Pursuing nuclear interests]. Asahi Shimbun Publishing. (In Japanese.) pp.162-175
[91] In response to Takeuchi's interview, Miyoji Iwano, who worked as the official secretary to former Prime Minister Takeo Miki, looked back on the funding provided by the utlities (which got treated as non-political), stating "TEPCO granted financial aid in the form of a research sponsorship. However, the amount was ultimately much higher than other political contributions. (...) KEPCO and Chuden also granted aid in the same manner." In Iwano, M. (2017). *Miki Takeo Hisho Kaikoroku* [Takeo Miki's Secretary Memoirs]. Tokyo: Yoshida Shoten. (In Japanese.)
[92] Murayama, O. (2020, February 21). Kansaidenryoku moto fuku shachō Naitō Chimori no shōgen Kansaidenryoku shunō kara rekidai shushō e no seiji kenkin to genpatsu kensetsu rasshu no kankei wa? [Testimony of Former Vice President of KEPCO, Chimori Naito: What is the relationship between the rush to build nuclear power plants and political contributions from KEPCO executives to successive Prime Ministers?*Journal of Law and Economy Asahi Judiciary*. Retrieved from https://judiciary.asahi.com/jiken/2020021900001.html (In Japanese.)
[93] The Asahi Shimbun Special Press Department. (2014). *Genpatsu riken o ou* [Pursuing nuclear interests]. Asahi Shimbun Publishing. (In Japanese.) pp.222-223
[94] Murayama, O. (2020, February 21). "*Kansaidenryoku moto fuku shachō Naitō Chimori no shōgen Kansaidenryoku shunō kara rekidai shushō e no seiji kenkin to genpatsu kensetsu rasshu no kankei wa*? [Testimony of Former Vice President of KEPCO, Chimori Naito: What is the relationship between the rush to build nuclear power plants and political contributions from KEPCO executives to successive Prime Ministers?" *Journal of Law and Economy Asahi Judiciary*. Retrieved from https://judiciary.asahi.com/jiken/2020021900001.html (In Japanese.)

"Take, for example, the assessment of the fully distributed cost of electricity charges. This takes time. Assessments in Tokyo ran all night for almost a week. There were issues like how much labor costs were allowed and the spring union negotiations. It wasn't just a matter of numbers. (…) You negotiated directly with the bureaucracy, but whenever there was some trouble, you would say, 'It's the opinion of statesman so-and-so'."

Regarding the role of political officers in electric power companies, Naito said the following.

"You know, there are always various regulations and various people who oppose you in any business. You can't go into business unless you manage to convince or contain them. So, to put it extremely, you spend every waking moment trying to get as many people as possible in political, government, and financial circles who understand the way of your company."[95]

In TEPCO, politics were dealt with by the Corporate Affairs Department and relations with the bureaucratic sector were up to the Corporate Planning department, which before the Fukushima accident was considered an elite course within the company, all the TEPCO presidentss from 1971 to 2008 being from one or the other. They all participated enthusiastically in cross industrial business circle activities, producing the chairman of Keidanren (Japan Federation of Economic Organizations) and the representative secretary of the Keizai Doyukai (Japan Association of Corporate Executives).

Against this backdrop of such economic and political power, the electric power industry, led by TEPCO, actively lobbied to achieve its goals. According to Toyama, since government had the power of life and death over the electric power companies including TEPCO, the government/ruling party was their "customer", and actual electricity users were on the other side of Kasumigaseki (Japan's Whitehall) and Nagatacho (Japan's Downing Street). According to a former senior METI official, the reality was that "lobbying rather than management determined actual profits and defined the business"[96], and therefore the electric power industry took on an "inward structure and lobbying priority".[97]

TEPCO was the most enthusiastic lobbyist in Japan, reaching out to government officials and politicians to persuade them to engage in specific policies and decisions.

Political scientist Ryunoshin Kamikawa points out that TEPCO's "inconceivably absolute power as a private company" lay behind the Fukushima nuclear accident.

"Although it was pointed out numerous times that there could be a large earthquake, a big tsunami, the loss of all AC power supplies, or a severe accident, why was it possible to ignore those warnings? It was because of the political and economic powers that allowed TEPCO to suppress the regulatory authorities, suppress opposition to nuclear power plants and create a "safety myth" for nuclear power plants."[98]

The corporate culture and mores of electric power companies like TEPCO cannot be separated from this kind of "monster bully" towards outsiders.

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[95] Murayama, O. (2020, March 1). *Kansaidenryoku moto fuku shachō Naitō Chimori no shōgen kansaidenryoku moto fuku shachō ga katatta Nakasone, Fukuda-ra moto shushō e no `bonkure' wa kanpōyaku* [Testimony of Former Vice President of KEPCO, Chimori Naito: "Bonkure" for former prime ministers is medicine]. *Journal of Law and Economy Asahi Judiciary*. Retrieved from https://judiciary.asahi.com/jiken/2020022100004.html (In Japanese.)
[96] Interview with a former METI official, February 27, 2020.
[97] Interview with a former METI official, February 27, 2020.
[98] Kamikawa, R. (2018). *Denryoku to seiji jō: Nihon no genshiryoku seisaku zenshi* [Electric power and Politics: Japan's History of Nuclear Policy]. Tokyo: Keiso Shobo Publishing. (In Japanese.) p.206

The structure of moral hazard that is indifferent to risk

It cannot be overlooked that not only the fully distributed cost method and regional monopoly, but also the nuclear damage compensation system itself has a structure that lowers sensitivity to the risk of accident.

Article 16 of the Act on Compensation for Nuclear Damage assumes in advance "necessary assistance" to nuclear power operators from the government. The amount of assistance will commensurately ease the pain of the accident for the power company. Putting this into reverse terms, incentives for a nuclear power operator to invest money in reducing the risk of accidents are correspondingly reduced.

In an extreme sense, even if a nuclear accident occurs, the country will take care of it anyway, so it would be an irrational business judgement to invest a huge amount of money to prevent an accident that may or may not occur. This is a so-called moral hazard in which the insured's motivation to avoid an accident covered by insurance is diminished. As a result, electric power company managers are less motivated to avoid accidents and less sensitive to accident risks.

In fact, TEPCO did not go bankrupt even when it caused a nuclear accident, and accident damages were covered by public funds. The Nuclear Damage Compensation and Decommissioning Support Organization redeems government bonds issued by the government and delivers the funds to TEPCO, which TEPCO records as "extraordinary profit" every year. In other words, TEPCO had paid a total of 9,542.6 billion yen in compensation by July 22, 2020[99], and in order to cover this sum, a cumulative total of 9,378.9 billion yen was received from the Support Organization from November 8, 2011 to July 22, 2020[100]. TEPCO, however, does not recognize this as a liability in its accounting book. TEPCO is said to be obliged to return more than 9 trillion yen by paying the burden to the Support Organization in the future, but even if that is the case, if it is successful in maintaining to a substantial degree its regional monopoly and the fully distributed cost method, it can covered this by passing the cost on to electricity bills.

In Japan in the late 1990s and early 20th century after the burst of the economic bubble in the early 90s, bankrupt financial institutions rescued with public funds were placed under government control, and former managers were asked to hand over their private property. On top of that, the responsibility of former management teams was pursued in both civil and criminal terms. In the eight years from 1995 to 2003, 134 current and former executives and employees of 37 financial institutions were arrested, 15 being given prison sentences[101]. This was implemented as a national policy to maintain the discipline of self-responsibility and prevent moral hazard.

In contrast, TEPCO has escaped such handling. The former management team of TEPCO was not required by the company to put up their private property, and neither were they sued nor accused by the company. 3 members of the former management team were prosecuted but not arrested. It can be said that the former management team of TEPCO set a precedent that this was enough even if a nuclear power plant accident had taken place.

In September 2019, it came to light that the chairman, president, and former nuclear power business

[99] TEPCO Holdings Co. Ltd. (2020). *Baishō-kin no oshiharai jōkyō* [Payment status of compensation]. Retrieved from https://www.tepco.co.jp/fukushima_hq/compensation/results/ (In Japanese.)
[100] TEPCO Holdings Co. Ltd. (2020). *Genshiryoku songai baishō hai-ro-tō shien kikō kara no shikin no kōfu ni tsuite* [concerning grants from organizations supporting decomissioning and compensating nuclear damage]. Retrieved from https://www.tepco.co.jp/about/ir/library/disclosure/pdf/200401-1.pdf (In Japanese.)
[101] Okuyama, T., & Murayama, O. (2019). *Baburu keizai jiken no shinsō* [Behind the incident of Japan's burst bubble]. Tokyo: Iwanami Shoten. (In Japanese.)

division head at Kansai Electric Power Company, the second largest power utility in Japan after TEPCO and headquartered in Osaka, had all individually accepted money and goods worth over 300 million yen from Eiji Moriyama, a former deputy mayor of Takahama, Fukui Prefecture, where the Takahama nuclear power plant is located. This abnormal "accomplice-like" and ambiguous give-and-take relationship between Moriyama, the leading local nuclear face, and the KEPCO executives had been ongoing since the 1980s, worsening in the wake of the Fukushima Daiichi nuclear accident. Here once again you can see the pestilence that afflicts the Japanese power industry.

Triggered by a tax investigation by the national tax authorities and a scoop by Kyodo News, KEPCO established a third-party committee to investigate the circumstances. The report by the third-party committee, written by a former prosecutor general, pointed out as follows that the cause was an "introverted corporate culture that did not face inconvenient truths."[102]

"There is a strong focus from both the management perspective and the perspective of providing a stable power supply on the stable operation and running of nuclear Power Stations, a supreme task that supersedes compliance, upholding traditions and self-protection being given precedence over the expectations of Kansai Electric Power's 'outside' stakeholders including users and shareholders."

In this way, in a corporate culture that placed utmost importance on operating nuclear power plants, KEPCO maintained an inappropriate and abnormal relationship. This did not stop at being a mere money scandal, but led to doubts about KEPCO's safety culture and the safety of its nuclear power plants given that it was incapable as an organization of properly assessing risks.

These issues as well as the suggestions of the KEPCO third-party committee also apply verbatim to TEPCO.

7. TEPCO's reform still only midway

We do not say that safety culture, safety regulations, and nuclear operators including TEPCO have not changed since the Fukushima nuclear accident.

Yamana said not only was remorse about the state of nuclear safety shown and protection at the site of nuclear power plants and measures against severe accidents reviewed as well as regulations strengthened, but the occurrence of the Fukushima Daiichi nuclear accident led to a "rethinking of the safety culture and engineering ethics."[103]

Of these, Yamana was very impressed with the Anegawa Plan, which was the starting point for TEPCO's turnaround, saying, "It was very well done. If you look at it, most of the gangrene was mentioned there, and I would like to see it get across properly to the whole company." At the same time, he voiced concern that "However, we need more work and a sense of urgency so that it reaches the very bottom of TEPCO."

When asked if TEPCO was qualified to run the Kashiwazaki-Kariwa Nuclear Power Station, Yamana answered, "As an ordinary citizen, I would have to say it is necessary for the Anegawa Plan to reach one hundred."

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[102] Kansai Electric Power Company. (2020, March 14). *Chōsa hōkoku-sho* [Survey report]. Retrieved from https://www.kepco.co.jp/corporate/pr/2020/pdf/0314_2j_01.pdf#page=163 (in Japanese) p.155, p.163, pp.188–189

[103] Interview with Hajimu Yamana, December 11, 2019.

The former chairman of the Nuclear Regulation Authority, Shunichi Tanaka warns that the memory of the Fukushima nuclear accident and the lessons learned are fading.

"The lessons learned from the earthquake disaster and from the Fukushima Daiichi accident are understood by some people in the electric power companies, but I feel that many people don't understand them or have forgotten them."

Tanaka cited as one example of this that TEPCO announced in the summer of 2019 that it would take steps with regard to the Kashiwazaki-Kariwa Nuclear Power Station that assumed the decommissioning of one or more of the remaining Units 1-5 within 5 years after restarting Units 6 and 7.

In an interview with the *Niigata Nippo*, a local newspaper, Tanaka said:

"Decommissioning Units 1 to 5 and restarting Units 6 and 7 are two different issues. If you want to operate Units 6 and 7, you need to explain about the restart to residents separately from the decommissioning. TEPCO lacks the openness to turn an earnest ear to local concerns."[104]

Tanaka also commented in our interview that "operating Units 6 and 7 and decommissioning are on completely different dimensions, and they really aren't qualified to operate nuclear power if they're still confabulating them just in case the mayor says something."[105]

Tanaka did not explicitly point this out, but it is apparent that winning over the mayor by making restarting and decommissioning part of the same "deal" was hardly the result of truly considering safety and public understanding. If there was an engineering assessment at the TEPCO site that there was no issue of safety in restarting Units 1 to 5, or even if the opposite engineering view prevailed on site, the "deal" had to be viewed as an example of a business judgement where TEPCO's management stressed the wishes of government at the expense of onsite engineering assessments.

Summary

From the verification results described in this chapter, we identified the following issues and lessons.

(1) Do not dismiss without justifiable reason engineering judgement for business reasons. Despite the fact that the recognition of the objective facts that form the premise or basis of a business decision should never be distorted at the convenience of upper management nor onsite engineering assessments be overturned by a management call without justifiable grounds when taking important decisions in a large-scale organization with many diverse stakeholders like TEPCO, this kind of "should-never" decision-making went unchallenged in TEPCO, resulting in the occurrence of the Fukushima nuclear accident and the confused accident response. In this respect, the present status is that lessons have not yet been fully taken into account and, as a result, measures are insufficient.

(2) In large-scale infrastructure facilities where an accident may harm the lives and well-being of many people, as much diversity as possible in safety equipment and measures to deal with the accident must be readied. Although cost-effective measures to reduce risk should greedily be pursued, TEPCO failed to do so, which led to the occurrence and spread of the Fukushima nuclear accident. This point

[104] *Genshiryoku kiseii zen iincho Tanaka Shunichishi ni kiku: Hairo to saikado betsumondai* [Interview with former Chairman of the Nuclear Regulation Authority Shunichi Tanaka on the problems of decommissioning and reoperating the plant] (2019, September 15). Niigata Nippo. (In Japanese)
[105] Interview with Shunichi Tanaka, November 20, 2019.

is shared as one of the major lessons of the Fukushima nuclear accident, and measures have been built up over the past 9 years. The reality, however, is that rather than reduce probabilistic risk, deterministic and rigid responses abound along the lines of it being adequate for “things to just meet the criteria”.

(3) There are many instances pointing to TEPCO and the nuclear power industry relying on a top-down style of communication with an aversion to brutally honest discussions and a preference for sounding each other out on where an acceptable consensus lies as well as a corporate culture of passive resistance as background factors for the Fukushima Daiichi Nuclear Power Station accident and its spread, as well as the confusion in information relay. However, TEPCO itself has not yet fully come to terms with this lesson. As such, the situation is one where concrete correctional measures have not been adequately implemented.

In compiling this report, we requested through TEPCO Holding’s public relations office face-to-face interviews with President Tomoaki Kobayakawa and Chief Nuclear Officer Shigenori Makino, but the company refused.

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Chapter 3: Risk Communication for Radiation Hazards

Naoya Sekiya

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Introduction
1. Crisis communication and risk communication
2. Reputational harm
3. Radiation disaster trilemma: exposure risk
4. Radiation disaster trilemma: subjective risk
5. Radiation disaster trilemma: economic risk
6. “Contaminated water” and tritium
7. Nuclear disaster prevention and wide-area evacuation plans

Summary: Re-emergence of the safety myth
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Introduction

Following the accident at TEPCO’s Fukushima Daiichi Nuclear Power Station, it was necessary to respond to a hydrogen explosion, a broken reactor, and the dispersal of radioactive material. Specifically, this included dealing with on-site accidents such as cooling and decommissioning, and off-site accidents such as decontamination, long-term evacuation, rumor measures, and compensation.

The government and public bodies repeatedly took an ad hoc approach to crisis communication immediately after the accident, as well as problems related to price drops in agriculture, forestry and marine products and a drop in the tourism industry due to reputational damage and so on (cesium-134, cesium-137), questions related to thyroid cancer (Iodine-131) in the typical health surveys of prefectural citizens, and “communication” regarding radioactive pollution including issues related to the accumulation of close to 1.1 million tons of treated water (mainly tritium).

A similar problem has also occurred in terms of a conflict of views between the government and public bodies and the sentiment of residents over offsite nuclear disaster prevention and wide-area evacuation plans following the restart of other nuclear power plants. Of all the issues and lessons learned from the accident at TEPCO's Fukushima Daiichi Nuclear Power Plant, the issue of how to confront and deal with radioactive contamination and related communication is an extremely difficult one.

This is because a “trilemma” exists of having to simultaneously solve three related, but different, issues concerning settings standards to “minimize the exposure risk of health damage to the general public”, issues concerning risk communication to “minimize the subjective risk of feelings of anxiety”, and issues concerning distribution and normalization of the market to “minimize the industrial risk of economic damage”.

In this chapter, we first organize the issues of confused communications and reputational damage following the accident. We then discuss the above-mentioned three issues highlighted therein, analyzing the radioactive contamination problems that still remain for food safety, the issue of “regulatory values” and “reference values”, and the tritium water issue.

1. Crisis communication and risk communication

The Government Accident Investigation makes the following recommendations regarding risk communication.

> In order to build a relationship of trust between the people and government agencies and to transmit appropriate information that does not cause confusion or distrust in society, the parties need to incorporate the risk communication approach of mutually exchanging risk information and opinions and building consensus all the while establishing a relationship of trust. The government needs to establish an appropriate organization and consider the provision of information to the people in an emergency that is quick, accurate, easy to understand, and does not cause misunderstanding. Depending on the method of public relations, it may unnecessarily cause anxiety among the populace (…)[1]

As for the cause of confusion over the use of the word "crisis communication," the Independent Accident Investigation report points to a loss of trust, even though the number of technical terms regarding the health damage caused by nuclear disasters and radioactivity increased.

> Most people cannot understand the radiation dose figures. It is hard to understand what the standard is and how dangerous it is or not. Although some yardstick was needed to indicate the risk, the accident response confused the public by giving various numbers for food contamination and schoolyard dose standards (...) The core of the crisis is probably that the government lost the people's trust in the government during the crisis. Just as crisis communication ultimately results in building trust between the government and the public, a crisis cannot be overcome without the cooperation of the government and the public.[2]

Reports from each accident investigation were submitted one year after the accident, when the accurate dose distribution and extent of radioactive contamination were not clear, and there was continued confusion in the communication of radiation health effects. These reports also mention the term risk communication, but it was crisis communication immediately after the accident that was pointed out as an emergency response.

Here again, we consider three issues of crisis communication immediately after the accident, looking back on the scientific community's loss of trust and the problem of refererence values, as well as crisis communication and risk communication, and the distinction between emergency response and long-term response.

(1) The scientific community's loss of trust: formulating "reference values" for safety

First of all, one of the communication challenges immediately after the TEPCO Fukushima Daiichi Nuclear Power Plant accident was the distrust towards the political and scientific communities that was set in the early stages. The cogent point is the fact that, following the TEPCO Fukushima Daiichi Nuclear Power Plant accident, this distrust went beyond the boundaries of the nuclear industry and nuclear experts ridiculed as the "nuclear village" to become a general mistrust of the scientific community, including those in radiation research, meteorology, and at specific universities. This was particularly pronounced in the process of formulating "reference values".

Facile labelling dubbing the side that emphasized radiation safety as "government bootlickers" and the side emphasizing radiation risk as "anti-government" is a typical example, and in the immediate wake of the earthquake, there was even a website called "Government Bootlickers wiki" that "classified those academics who stated the radiation risk should not be overestimated as 'bootlicking academics' and criticized them".[3]

[1] Cabinet Office, Government of Japan, 2012, p. 463.
[2] Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, p. 395.
[3] The word originally was meant to refer to scholars hired by the government, and not simply those that were a part of the establishment. Now it is used to refer to those who align themselves with the government and authorities, or who

Not only nuclear engineering, which promotes nuclear power, but also radiologists, who emphasize safety, were labeled as bootlicking academics. They were apparently seen as not close enough to the concerns of the populace, that is, they were taking the state's position. This could also be called a confrontation between a threshold hypothesis and a non-threshold hypothesis (Linear Non-Threshold [LNT] hypothesis) concerning low-level radiation.[4] The former takes the position that, regarding the deterministic effect ("the effect that always appears when a certain amount of radiation is received"), the degree of radiation increase due to radioactive material contamination has no effect from acute exposure, and stochastic effect and late effect are also extremely low.[5] The latter takes the position that based on precautionary principles, it is dangerous given that the dose limit in Japan is 1 mSv/year for stochastic effects and late effects.

Experts emphasizing the safety of radiation and those emphasizing the dangers repeatedly refuted each other on the Internet via Twitter, using it to insult each other as the "safety trolls" and "danger trolls".

Professor Shunichi Yamashita and Professor Noboru Takamura of Nagasaki University became radiation health risk management advisors in Fukushima Prefecture immediately after the accident, going around explaining, "we would like residents to have a sense of safety" and "the level is such that there is absolutely no need to worry about the health effects if measures to avoid unnecessary internal exposure are taken." Professor Takamura recalls that the day he gave his first lecture, he was asked for the first time, "Are you a government bootlicker?"[6] However, after giving a lecture in Iitate Village on March 25, 2011, which emphasized safety, Iitate Village was established as a planned evacuation zone several weeks later, the whole village being evacuated, so it is also true that their discourse did lead a certain number of people in Fukushima Prefecture to become distrustful. Additionally, rather than discussing the specific pollution and exposure situation, assertions made by Associate Professor Keiichi Nakagawa of the University of Tokyo were entirely focussed on "preaching" to residents based on risk assessments such as the causal relationship between radiation and carcinogenesis, and it has even been pointed out that this resulted in a greater distrust of experts.[7]

The process of the loss of experts' prestige was summarized briefly by Professor Sakura Osamu of the University of Tokyo as follows. "A nuclear power plant that had repeatedly been claimed to be safe had caused a severe accident and that triggered a drop in confidence. Trust was further decreased when even after the accident, the nuclear engineering experts repeatedly issued messages on TV etc. that everything was all right. Even the radiation protection specialists and doctors played a part in shifting responsibility from TEPCO and the government to the public with their messages of everything is all right, don't make a fuss. This chain was reproduced and expanded, consolidating distrust in the government, the electric power companies, and the experts."[8]

Furthermore, the pessimistic scenario presented by researchers other than radiologists, as well as the intense government attack clouded the general public's calm and rational judgment, and the fact that it also had an impact on the government itself had a large impact. Take, for example, the press conference at the First Diet Members' Office Building on April 29, 2011 for the resignation of

receive funds or payments from corporations and businesses. For example, the following source refers to scholars with this word to denote those that receive financial aid. See Sasaki, 2011, pp.102–104.

[4] Nakamura, 2013, pp.7–9.

[5] See Annals of the ICRP 28 (1978), 41 (1984), 60 (1991), 62 (1991).

[6] There are a number of studies that investigate the difference in how information is spread depending on one's position (conservative, sceptical, etc.). See, for example, Ichinose et al., 2018; Valaskivi et al., 2019; Tsubokura et al., 2018.

[7] Kagura, 2013.

[8] Sakura, 2016, pp.168–178.

Cabinet Office advisor Toshiso Kosako, a professor at the University of Tokyo. On April 19, the Ministry of Education, Culture, Sports, Science and Technology, set the dose standard for schoolyards at 3.8 μSv/hour (20 mSv/year) saying "there is no problem using the school building and playground as usual for schools where the air dose rate is less than 3.8 μSv/hour," based on advice from the Nuclear Safety Commission "concerning temporary thoughts regarding the use of schools and schoolyards in schools in Fukushima Prefecture". This 3.8 μSv/hour was the standard set when designating Iidate Village and Minamisoma City, Namie Town, and part of Kawamata Town as planned evacuation areas on April 11, in addition to the 20-kilometer area where evacuation orders were issued from March 12. It is assumed that the upper limit of a dose standard of 1 mSv to 20 mSv in an existing exposure situation in the ICRP Publication 103 of 2007 was adopted.

Professor Kosako attacked this as "adhoc".

"The number of radiation workers at nuclear power plants employing about 84,000 who reach this upper limit of a radiation dose of 20 millisieverts a year is extremely small. Asking this number for infants, toddlers, and elementary school students is not only unacceptable in academic terms, but also in terms of my personal humanism."

"Accepting this would mean the end of my academic career. I don't want my children to experience that."

"In addition to strongly protesting the use of the numerical value of 20 millisieverts per year as a standard for use in schoolyards such as elementary schools etc., I demand a review."

Professor Kosako asserted "it should be operated at a level close to normal radiation protection standards." In other words, they should be aiming for "1 mSv/year".

The questioning of Professor Tatsuhiko Kodama, Center for Advanced Science and Technology, The University of Tokyo, in the Lower House's Labor and Welfare Committee on July 27, 2011 also had a great impact. Commenting on avoiding exposure of children outside the area and the need for radiation measurement and decontamination for that, as well as the lack of government measures for these, Professor Kodama said, "I express my wholehearted anger." "What is the Diet doing when 70,000 people are wandering lost from their homes?" This statement was also taken up by much of the media.

The statements of these two men have something in common. First, the fact that both took place in the Diet-related venues of the Diet Members' Office Building and the Lower House Welfare and Labor Committee. Second, they both criticized the government, the government's policies, and delays in its measures. Third, both statements were extremely emotional and spontaneous.

Although Kosako resigned at the press conference where he made the above allegation, Hideaki Karaki, former Vice President of the Science Council of Japan, believes that a reconfirmation of "radiophobia" and a "1mSv myth" accompanied the Kosako's resignation.[9] Unlike debates in the mass media and the Internet, emotional expressions of criticism of the government and the Diet by scientists in public places such as the Diet and a direct appeal to public opinion had a serious impact in the midst of the crisis.

Regarding the air dose, the strict value at the reference level (20 to 100 mSv/year) in an emergency exposure situation indicated by the International Commission on Radiation Protection is set to 20

[9] Karaki, 2013.

mSv/year. Using this as a reference, an air dose of 3.8 μSv/hour was set as a guideline for restricting living assuming residence in a wooden house for 16 hours and outdoor activities for 8 hours, and based on this, a planned evacuation area was designated on April 11, 2011 and the schoolyard dose standard set on April 19.[10] However, the government subsequently set an additional exposure dose at 1 mSv/year, and this was converted into an air dose rate, calculating a standard of 0.23 μSv/hour.[11]

The remarks made by Kosako and Professor Kodama are one of the factors for the revision of the target value from 20 mSv/year (3.8 μSv/hour) to 1 mSv/year. For better or worse, this 0.23 μSv/hour had important policy implications.

First is the problem of decontamination and intermediate storage facilities. 0.23 μSv/hour became the rough standard for decontamination of contamination priority survey areas under the Act on Special Measures concerning the Handling of Pollution by Radioactive Materials.[12] This decontamination standard of 0.23 μSv/hr brought about an interpretation that it was unsafe if this value was not achieved, and became the rationale for generating a huge decontamination project. In addition, collecting radioactive materials through decontamination created problems in transferring contaminated soil to intermediate storage facilities, recycling soil, and long-term soil waste.

Shunichi Tanaka, former Chairman of the Nuclear Regulation Authority, points out the problem of decontamination as follows.

> The problem is that although it should be scientifically safe, an awareness that 'it's not safe unless it's been decontaminated" spread from political considerations.[13]

He is pointing out the problem that decontamination targets were fixed, which caused numerous problems.

Secondly, there is the problem of prolonged evacuation and lifting area evacuation orders.

An additional exposure dose of 1 mSv/year was set for returning home, and this converted into an air dose rate of 0.23 μSv/hour was an important criterion for lifting evacuation orders. Officially, the authorized standard for cancelling the evacuation order was 20 mSv/year (equivalent to 3.8 μSv/hour) or less, the government's standard for lifting an evacuation order, but this was deemed only an "essential condition that the annual cumulative dose estimated from the air dose rate in the area be less than 20 millisieverts" and basically, the criterion for ending evacuation was "to aim as a long-term goal for less than 1 millisievert per year of additional exposure dose received by an individual after residents return and conduct daily life."[14] In other words, in the long run, this 1 mSv/year became the basis for determining the end point for evacuation.

Third, it was also the basis for the "reference value" for radioactive substances in food that was changed in 2012. This will be described later in the next section.

The remarks made by Professors Kosako and Kodama were extremely influential, and were said to be the de facto standard for decontamination and calling of the evacuation in terms of reviewing the target value from 20 mSv/year (3.8 μSv/hour) to 1 mSv/year.. The infallibility of the administration,

[10] Ministry of Education, Culture, Sports, Science and Technology, 2011.
[11] The value per year was calculated at 0.19μSv/h from living in a wooden house for 16 hours with outdoor activity for 8 hours. Natural radiation (Japan's average 0.04μSv/h) was then added to reach 0.23μSv/h.
[12] Ministry of the Environment, 2011.
[13] Interview with Shunichi Tanaka, November 20, 2019.
[14] Cabinet Office, Government of Japan, 2018.

which makes it difficult to change what it has once decided, also had an impact on policies in the long run.

(2) Crisis communication and risk communication - the distinction between emergency response and long-term response: the infallibility of immediate response

One more problem with communication immediately after the Fukushima nuclear accident was that no distinction was made between crisis communication and risk communication (the distinction between emergency communication and communication for understanding long-term risk).

From immediately after the accident, the mass media began to report on the risks and safety of radioactive material diffusion in a balanced way. After March 11, the progression of the accident itself, evacuation, the spread of radioactive materials, and planned power outages were reported.. And while reporting measures against radiation exposure as well as "radioactivity has led to agricultural, water, marine, and soil pollution", they repeatedly reported that "there is no immediate health effect" and it was now "safe".[15]

A remote cause comes from the fact that after the accident, Yukio Edano, former Chief Cabinet Secretary, used the expression "no immediate effect". On November 8, 2011 in the Lower House's Budget Committee, former Chief Cabinet Secretary Edano stated, "I said there was no immediate harm to the human body or health a total of seven times. Of those, five times referred to food and drink, so I didn't say that it would have no immediate effect as a general statement, but there's a set reference value that will damage your health if you drink contaminated milk for a year, so I said repeatedly that there was no immediate problem if you just happened to drink it once or twice." Former Chief Cabinet Secretary Edano also said in a hearing with the Government Accident Investigation that these were his own words and not based on a memo penned by a bureaucrat. The expression "immediately" is a word that is often used as a legal term or a court term, and as such was a term that could be expected from former Chief Cabinet Secretary Edano, who was a lawyer. His statement "it has no immediate effect" was interpreted as a vague expression of the effects of radiation, and was subjected to various criticisms.

However, he has also testified that he was trying to convey simultaneously the two points that "acute exposure is not a problematic value, but we don't know if there is a cumulative effect of exposure", and "cumulative exposure for a long time (on the spot) may be a problem." Effects that appear at high doses within a short period of time within a few weeks are called "acute effects", and injuries that occur a few months to years after a relatively low dose exposure are called "late effects". The expression "no immediate effect" was by no means incorrect if his main implication was in terms of the degree of radiation dose to try to avert the "late effects of cumulative exposure" at low doses rather than the "late effects of acute exposure" at high doses in a situation where the degree of radiation dose immediately after the accident, the degree of diffusion of radioactive materials, and the degree of exposure were unknown, and, in fact, his statement can be said to accurately represent the situation that required attention at the time.

However, after the passage of a certain amount of time, this statement started to be perceived as a message that did not deny the possibility of "late effects", in other words, they may not be immediate but there will be effects later, "if the radiation dose increases, it will have an effect", "if you continue to be exposed, it will have an effect".[16] It most likely was a factor in prolonging anxiety. In other words, although it may have had significance as crisis communication in the immediate aftermath, it should be pointed out that more careful explanation was required to avoid misunderstanding and that

[15] Kagura, 2011; Sakô, 2013, pp. 156–171.
[16] Okamoto et al., 2012; Kawamoto, 2013.

long-term risk communication required different wording.

In an emergency, there is no problem with actively conducting inspections and measurements. Actively inspecting and measuring are significant in themselves in eliminating residents' anxieties and stabilizing the market.[17] Infrequent inspections and measurements in an emergency are in themselves perceived as not being proactive in grasping the degree of contamination, and risk creating doubts as to whether information is being hidden, or something is being overlooked or slipping through.

At the stage where the degree of pollution and the scientific mechanism for the transfer of radioactive substances to agricultural products are unclear, excessive measures regarding reference values and inspection systems are the ironclad rule where "a swing and miss" is tolerated, but "watching a ball go through" is not.

The problem was that they could not decide the timing and end points for reviewing the reference values and inspection system. On this point, Senior Research Fellow Ichiro Yamaguchi of the National Institute of Health Sciences, who was involved in the formulation of the "reference value" for radioactive substances in food in 2012, blames the lack of public interest and questions in the Diet, no such opinion being voiced by either the producers or the consumers.

> My expectation at the time was that there was a great deal of interest in society, so I thought that this discussion would continue, but it didn't last.
> You do this after you get opinions from local governments or opinions from producers and consumer groups, but we got zero opinions, so there was nothing to consider. Since there was also no rule to review it after a few years, there was nothing the bureaucrats could do.[18]

He also said it was not so easy for the government and politics to change what had once been decided.

> [Regarding why current food safety standards were too high and why they could not be lowered] There was concern about reputational damage including the local residents, so once it had been raised it was difficult to lower it easily. I know scientifically the various reference settings are wrong, but the problem is that the initial reference values were set too high.[19]

> They were set excessively out of consideration for safety, but I think there was a feeling of overkill. Our call was it would be okay to eat continuously or consume large amounts every day. We should have taken into account that regulation could lead to unbalanced diets as well as a long-term perspective, but there was no leeway for that. The standards should have been returned to normal after things returned to normal, but that's difficult because you'd be accused that 'the government has deceived us'.[20]

Communication that addresses residents' anxiety is a necessary measure in an emergency. However, with the passage of time and as it becomes probabilistically and scientifically clear that, to a certain extent, there is no problem and it is safe, it is necessary to review or switch styles. If this is not incorporated into the system, however, the infallibility of the government will lead to a prolonging of the immediate response. As a result, a standard once set determines the inspection system over the long-term, becoming a factor that causes enormous costs.[21]

The lack of trust in "science" during emergencies and the loss of trust in the government and scientific

[17] This switch also did not occur with regards to food safety problems, including radiation measurements, systematic testing, and BSE.
[18] Interview with Ichiro Yamaguchi, March 3,2020.
[19] Interview with Ex-Cabinet Office staff, November 29, 2019.
[20] Interview with Goshi Hosono, December 19, 2019.
[21] Sekiya, 2016b, pp.143–153.

community have left a long-standing problem of communication. It created the fundamental problem of public information such as the government not being trusted, and science was differentiated according to who was speaking, leading to the problem that proper scientific communication was also not trusted. In this regard, Goshi Hosono, former Special Advisor to the Prime Minister and inside the administration, recalled as follows.

> [About dealing with hoaxes and fake news at the time of the disaster] we held a long, open press conference at the time. There were people within the government of the opinion that "it's better to strongly refute it" or "it's better to restrict the reporters' questions", but I explained to the best of my ability in the conviction that the cause of the anxiety lay with the government. However, as a result, domestic rumors weren't suppressed and [the problem of treated water etc.] spread to South Korea. When I think about it now, we could have rubbed them out a little more strongly in the early stages.[22]

In other words, it is difficult to easily establish reliable communication once trust has been lost. The administration at the time was also fully aware of this, and was unable to give a strong message on safety issues even after the passage of time. As a result, false understandings and discourse were left unaddressed for a long time.[23]

This is a common issue in evacuation. Unless accurate information on radiation is available immediately after the accident itself, area evacuation and excessive protective measures in the case of an emergency are unavoidable. However, due to the lack of trust in the government and the scientific community, it was difficult to switch to a more appropriate response including immediate evacuation, post-accident inspection systems, health surveys, reviews of standards, waste problems, etc., thereby dragging out the emergency response for a long time. Former Special Advisor Hosono, who was involved in the emergency response at the time, recalled as follows.

> Considering that 10 years have passed, it's necessary to switch "modes" for thyroid and treated water from crisis assessment to recovery and normal time assessment. It's too harsh to make Fukushima Prefecture decide to switch; it's a question for the government to decide.[24]

This shows that the government entered a bottleneck because it was unable to create an exit strategy from crisis to normal times.

However, changing the criteria later is not easy. It is clear that when setting the standard, it is necessary to fix the "time axis" and "conditions" in the initial stage.

(3) The relationship between science and politics in a crisis

Pointing out that the science and technology advisory function by people with specialized knowledge was very weak immediately after the accident and that there were problems such as the long stream of Cabinet Secretariat advisors appointed, the Independent Accident Investigation recommended strengthening the science and technology advisory function as a solution to these problems.[25] In addition, according to the Government Accident Investigation, "given that depending on public relations public anxiety can be unnecessarily created, consideration should be given to assigning a

[22] Interview with Goshi Hosono, December 19, 2019.
[23] Furthermore, there are similarities with the line of argument regarding evacuees. The influx of evacuees into an area may potentially cause friction with the population and lead to the collapse of the community or a number of other social issues. As such, as long as correct information regarding the accident and radiation is being withheld overreacting and evacuating even if you are outside of the designated area is justified. Thus, although it is necessary to limit overreaction after some time has elapsed, the government and the scientific community may not be able to due to a loss of trust in their authority.
[24] Interview with Goshi Hosono, December 19, 2019.
[25] Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, p.349.

communication expert, for example, who can give appropriate advice to the Chief Cabinet Secretary in charge of public relations in a crisis or emergency."[26]

It is the government's chief science advisor in the United Kingdom and the director of the Office of Science and Technology Policy (Aide for Science and Technology) in the United States who are supposed to provide scientific advice during normal times and in times of emergency, also conveying information at times to the populace. The points made by both the above-mentioned Accident Investigations are most likely referring to this, but this kind of post remains unrealized even today.

In terms of a nuclear accident, in the event of an emergency, the only change we see is that the chairman of the Nuclear Regulation Authority has taken over the position of providing advice instead of the Nuclear Safety Commission chair, with no new organization or position in charge of communication being established. Leaflets on risk communication in normal times and risk communication forums have been held at the Consumer Affairs Agency and the Reconstruction Agency and so on, but apart from a committee on radiation debating existing reference values, no institution (function) has to date been established for officially conducting scientific evaluations of radiation problems after the accident or for communicating.

Currently, with regard to low-dose exposure to radioactive material contamination and food safety after the Fukushima nuclear accident, there have been endless discussions on safety/danger among researchers, in markets, media, and online, and rather than say controversies over the risks have converged, the current state is one of an "unsolved solution" as a result of the radiation dose and air dose contained in food having decreased significantly. Therefore, the phenomenon known as reputational damage still remains.

A failure to switch from this emergency precautionary crisis stage to the sharing of normal time risks, as well as the loss of trust in the professional community, is a remote cause of poor communication over the long run. It means that Japan has failed to switch from emergency crisis communication to normal risk communication.

2. Reputational damage

Against a backdrop of such communication, it is reputational damage that has made the people of Fukushima suffer over the past 10 years. Despite agricultural, forestry and marine products being below the provisional and reference values, they are avoided by consumers simply because they are produced in Fukushima Prefecture. It still suffers from such rumors. This is because there is still a sense of residual anxiety that radioactive materials may still contaminate them. A few years after the accident, as shown in Figures 1 and 2 below, the sense of anxiety in Japan started to fall, but it remains high overseas, especially in neighboring countries such as Korea and Taiwan.

(1) What is reputational damage?

In general, reputational damage refers to "economic damage caused by a cessation of consumption or tourism by people's perception as dangerous food, goods, and land that were supposed to be 'safe' with the large-scale media coverage of a certain incident, accident, environmental pollution, or disaster."[27]

In the initial stages of the accident, the economic damage caused by people not purchasing products

[26] Cabinet Office, Government of Japan, 2012, p.426.
[27] Sekiya, 2003, 2011.

below the standard set by the government at which it was officially deemed to be safe was referred to as “so-called reputational damage” (according to the guidelines for nuclear damage compensation, this was dubbed “so-called reputational damage”). “Safety” is a major premise at a time when reputational damage becomes a problem, and farmers, fishers, and distributors understand this to some extent. However, since it is difficult to gain the understanding of all consumers and people involved in the distribution business who take into account consumer trends, economic damage will continue. Even if there are no safety issues, agricultural products and marine products whose image has been slightly hurt are removed from the consumer's options, and product values will drop. If this continues, they will be removed from the distribution route.

In the post-war era, this phenomenon of reputational damage has been a problem in 1954 when contamination through nuclear fallout of the boat, the Daigo Fukuryu Maru, saw tuna become unsellable in a “radioactive panic” that damaged the fishing industry, the 1974 radiation leak accident on the nuclear ship Mutsu, and the 1981 release of cobalt-60 at the Tsuruga Nuclear Power Plant (some direct civil compensation was made in the Tsuruga nuclear accident). In the 1986 Civil Agreement signed between the operator and the local municipality when building the Hokkaido Electric Power Tomari Nuclear Power Plant, reputational damage and compensation were made explicit for the first time stating that when “a reduction in prices of agricultural, forestry and marine products and other economic losses occur due to reputation”, this will be called“reputational damage” and measures such as compensation will be taken as distinct from compensation for damage caused by the release of radioactive materials due to an accident.

The problem here is the distinction in a nuclear disaster between “actual damage” and “reputational damage only”. In the event of a nuclear accident or trouble, the release of radiation or radioactive material can be measured by a monitoring post, etc., so a distinction is made between “actual damage” caused by radiation (a higher radiation dose), and “reputational damage only”, for which there is no measurement. The Act on Compensation for Nuclear Damage states that the former case, the “actual damage” in the event of radiation (higher radiation dose), is to be compensated by the business operator and the government. Regarding the latter case of “reputational damage only” unaccompanied by radiation effects (increased radiation dose), the cause is deemed to be overreacting consumers fuelled by the media, and compensation is not provided because the operators and the state are not responsible. However, the issue raised by “reputational damage” is that compensation should be provided in some form as long as economic damage has occurred.

In the case of the 1999 JCO criticality accident, the approximately 15.4 billion yen in damages was mostly related to “reputational damage”. It was subsequently discussed at the Nuclear Damage Investigation Committee established by the Ministry of Education, Culture, Sports, Science and Technology, and other venues, and given the size of economic damage and the fact that the actual accident was the cause, the legal interpretation was changed, the Act on Compensation for Nuclear Damage being applied for the first time. Based on this, it was decided in the Intermediate Guidelines on the Determination of Nuclear Damage and the Third Addendum (damage related to reputational damage in the agriculture, forestry and fisheries and food industries) that even those that suffered economic damage that could be considered “so-called reputational damage” would be eligible for compensation for damages in the Fukushima nuclear accident as well.

(2) Reputational damage following the Fukushima Daiichi Nuclear Power Plant accident

Immediately after the Fukushima nuclear accident, a considerable amount of radioactive material was undeniably dispersed, the type of nuclide, amount, and diffusion range of the radioactive material being unknown, and, moreover, radioactive material was detected in crops and seafood, but it was not known to what extent it would increase. In such situations, it is often difficult to make a clear

distinction between the contaminated and uncontaminated, the safe and unsafe. Therefore, it is reasonable in both preventive and emotional terms to avoid them. This was the reputational damage in the immediate aftermath.

However, over a period of time, air dose measurement, soil measurement, radioactive material monitoring of agricultural products, and inspection of all rice bags in Fukushima Prefecture was carried out, and safety was secured as a result of various measures to prevent absorption as the different rates of absorption by product type became clear. An inspection system was established and information on the inspection results was provided. The aversion to agricultural products themselves also eased. Even so, distribution did not recover easily due to its prolonged hiatus after the accident. As a result, the total shipment value of safe crops did not recover. This was reputational damage after the passage of a certain amount of time.

At the current stage, almost all agricultural and marine products in circulation are in a state of "ND (Not Detected)" (the content of radiation is below the "detection limit value", which is the minimum value that can be measured by inspection equipment). At such a time, the general understanding is that some wild forest products such as mushrooms and edible wild plants, wild animals, and marine products are over the N.D. This is well known in Fukushima Prefecture, and few people see this as reputational damage.[28]

Furthermore, since 2015, agricultural products over the N.D. have not been produced as a result of reduced radiation doses and potassium fertilization of paddy fields for agricultural products in managed fields excluding these. Nevertheless, there is still a sense of aversion to these products. The current reputational damage is economic damage that occurs in this state of N.D.

And this reputational damage is the issue at the core of the trilemma, which will be explained next, and is a longstanding problem in Fukushima Prefecture.

3. Radiation disaster trilemma: exposure risk

First, let us consider "exposure risk", one of the trilemmas in a radiation disaster. Immediately after the accident, experts set reference values with the aim of "minimizing health damage as a radiation exposure risk for the general public". This was, in other words, an attempt by the government to define "safety (physical safety)" regarding environmental radioactivity.

On March 17, 2011, when the Fukushima Nuclear Power Plant accident occurred due to the Great East Japan Earthquake and concern over radioactive material pollution began, the amount of radioactive materials in foods was stipulated based on the provisions of Article 20, Paragraph 2 of the Act on Special Measures Concerning Nuclear Emergency Preparedness setting a "provisional regulation value", and regulatory measures such as food shipping restrictions were established. The standard was 500 Bq/kg (200 Bq/kg for dairy products).

Subsequently on October 27, 2011, the Food Safety Commission established as a food health impact assessment for radioactive substances that past epidemiological data indicated that "concerning additional radiation doses due to the ingestion of contaminated food, the value to be taken into consideration when managing food safety appropriately is set at approximately 100 mSv over a lifetime". On October 28 the following year, the Minister of Health, Labor and Welfare, Yoko Komiyama, stated at a press conference that she would set the standard annual exposure dose to 1

[28] Fukushima Prefectural Government, 2019.

mSv. In line with this, on April 1, 2012, the Food Safety Commission, based on Article 11 Paragraph 1 of the Food Sanitation Act, set their standards (general food: 100 Bq/kg, milk and baby food: 50 Bq/kg, drinking water: 10 Bq/kg) using an annual intake of 1 mSv as a base and taking into account the guideline standards applied to nuclear accidents by the codex committee (International Food Standards Organization). This was subsequently approved by the Radiation Council after later consultation.

In other words, in the sense that shipping restrictions were not applied on March 17, the government officially defined "safety" as "the provisional regulation value (500 Bq/kg, dairy products 200 Bq/kg) or less". However, criticism remained and aiming for internal exposure of 1 mSv, it was decided on April 1, 2012 to refer to a "reference value of 100 Bq/kg (dairy products 50 Bq/kg) based on discussions at the Food Safety Commission. However, reputational damage was still not dispelled.

On April 20, 2012, the Ministry of Agriculture, Forestry and Fisheries sent in the name of the Director of the Food Industry Bureau a notification to the directors of food industry associations to ensure businesses conducting voluntary radioactivity inspections used "reliable analyses" and albeit voluntary inspections also made decisions based on governmental standards. However, this was followed by a series of criticisms from the Japan Consumer Federation, the Food Safety and Surveillance Citizens Committee, and others.

These were all aimed at "minimizing health damage as a radiation exposure risk for the general public", and were set by the Nuclear Emergency Response Headquarters based on the technical advice of the Nuclear Safety Commission immediately after the earthquake, and a year later based on scientific agreement or scientific advice from committees of experts such as the Food Safety Commission and Nuclear Regulation Authority under the government's responsibility.

It is appropriate to lower the standard according to the level when moving from emergency to normal times. However, as can be seen from the background described above, various standards were created using the principle of "1 mSv/year".

4. Radiation disaster trilemma: subjective risk

Next, let us consider "subjective risk".

Subjective risk refers to how an individual perceives "safety/danger" and whether or not they have feelings of "security/anxiety". It exists separately from scientific security, and is formed by taking into account the communication and trust of the parties, and is not easily controllable.

In subsequent investigations and research such as the Independent Accident Investigation and the *Anatomy of the Yoshida Testimony*, the trap of the safety myth with regard to nuclear safety regulations was explained saying they "preferred small peace of mind over great safety". It was pointed out that because making preparations for emergencies and contingencies in order to ensure "great safety" caused "unnecessary anxiety and misunderstanding among residents", not implementing countermeasures and showing a defenceless front ensured a "small peace of mind" for residents, which brought about the perplexing situation of not being prepared being good preparation. However, this claim does not mean that "small peace of mind" should be neglected and "great security" be the sole focus. In the case of radiation disasters, the "minimization of emotions of anxiety as a subjective risk" must be achieved simultaneously, that is, the relationship is one where if "small peace of mind" is not taken into consideration when designing "safety" assurances, then "great safety" will

not be achieved either. That is the tricky aspect.

Since radioactive materials were undeniably dispersed in the Fukushima nuclear accident, it was natural for people to be anxious to a certain extent about radioactive materials that were detected. For example, suppose that 50 Bq/kg was detected in a certain food, relative to the reference value for radioactive cesium in food of 100 Bq/kg. For the government who defines "safety" and those who regard 100Bq/kg as "safe", this food is "safe" and if harm occurs, it will be "so-called reputational damage". However, for those who consider 0Bq/kg or 10Bq/kg to be "safe", this food is "dangerous" and means "not reputational damage but real damage". There is no difference in that both positions are based on the premise of "safety" and whether or not there is reputational damage. However, because different people have different safety standards, discommunication over "safety" occurs. This can be said to be a difference in perception regarding the "allowable amount" of risk an individual can tolerate, including the content in foods and the reference value for annual exposure.

Incidentally, after the accident, three patterns were seen among people who were concerned about the inspection system and food monitoring for radioactive substances.

First, there were those who asserted their distrust of monitoring, measurement methods, and inspection systems. It is a discourse asserting "they select and measure in low places (where contamination is unlikely to occur)", "inspections are omitted", and "some things might 'slip through' in the sampling". However, with the passage of time, the performance of this monitoring, measurement methods, and inspection system itself has been acknowledged, and the number of people with doubts has fallen.

Fukushima Prefecture has carried out surveys on every bag of rice and every head of cattle, which is more than the state required monitoring surveys. However, while conducting such close inspections was of great significance in disclosing safety in the early stages, with radioactive substances over the detection limit no longer being detected and compensation, etc. also assured, they could not continue spending and full inspection of every bag of rice will no longer be carried out in the whole prefecture from 2020, and head-by-head cow inspections will be switched to farm-by-farm inspections.

Second, there are those who argue that the risk of radiation should be as low as possible. They claim "a range exists below 100 Bq/kg (radioactive substances are included)," "It's real harm because there's some radioactive substance," "Even if it's below N.D., it's not zero," "The less radioactive substances, the better, so you should avoid products from Fukushima Prefecture." First and foremost, however, it is not known that almost all foods distributed are N.D. Currently, 80% of people do not know that the foods in circulation are almost N.D.[29]

However, even in this group, people from Fukushima Prefecture tended to make this kind of claim in an attempt to prevent internal exposure as much as possible, even those who understood that scientifically speaking the risk was small and the meaning of the reference value, and N.D. On the other hand, in the case of people outside the prefecture, many people made this type of claim without understanding the meaning of the reference value or N.D.

Thirdly, there are those people who are trying to renew their anger at TEPCO for causing the accident through rumormongering and who fan their resentment of TEPCO by taking this anger out on farmers and farm-related people. These people insist, "This is not about reputation," "I hate the word 'reputational damage, " and "I don't buy it just in case", "I don't buy it because I'm angry."

[29] Sekiya, 2016a, 2019a.

Although, for many people, invisible radiation pollution is "frightening" in itself, and they cannot be blamed for having that fear, even if the emotion is unscientific. Atavistically speaking, fear is one of the "safety valves" humans have innately acquired to protect themselves from unknown risks and threats. Furthermore, in the Fukushima nuclear accident, information on the diffusion of radioactive materials was not notified promptly or properly to the public at an early stage due to the delay in the release of SPEEDI calculation results based on the unit release amount, and it took time to publish the monitoring results immediately after the accident.[30] For that reason, it was unavoidable that people became suspicious.

It is also reasonable in some sense to take preventive measures in these early stages when the scientific facts are not subjectively clear, and at the stage where the scientific facts remain subjectively in doubt.[31]

A particular feature of radiation hazards is that they can physically be clearly asserted when the dose is low (unless the immediate consequences are not known as a result of a large release into the environment). Consequently, administrative bodies such as the ruling administration and local governments, people involved in affiliated companies, and scientists strongly assert that food, goods, and land are "safe". However, many people are not immediately convinced that they are safe for various reasons, such as the fact that safety is not understood, the sender of information is not trusted, or there is little information. These risk communication gaps have long existed.

After the earthquake, the government including the Ministry of Health, Labor and Welfare and the Consumer Affairs Agency, continued to attach great importance to making residents understand the standards aimed at minimizing this exposure risk. However, the current status ten years on is that the gap between the reference values implemented with the aim of "minimizing health damage as a radiation exposure risk to the general public" and the risk communication carried out with the aim of "minimizing anxiety as a subjective risk" remains unchanged. "Minimizing anxiety as a subjective risk" consists of guaranteeing reassurance, and ultimately establishing the trust of the people in the government and thereby "greater security".

5. Radiation disaster trilemma: economic risk

(1) Domestic economic damage

Accident response costs for the Fukushima Nuclear Power Plant amounted to 21.5 trillion yen in 2016 (8.0 trillion yen for decommissioning and contaminated water measures, 7.9 trillion yen for compensation, 4.0 trillion yen for decontamination, 1.6 trillion yen for the interim storage facility).[32] Note that the compensation amount as of March 2020 was 9.5 trillion yen (this is the agreed amount, not the amount of damage residents suffered).

Looking at the agreed amount by item of compensation, items related to corporations and sole proprietors amount to some 3 trillion yen. Disposal in the immediate aftermath, shipping restrictions, and relocation costs associated with the establishment of a warning zone are limited to the initial period. Therefore, most consist of profits not realized had there been no accident, lost business opportunities, lost sales channels or markets, lower prices, and inspection costs. So-called

[30] Cabinet Office, Government of Japan, 2012, p. 219.

[31] In addition to this, it is also necessary to consider lowering the actual standard of "safety". Before the Fukushima Daiichi nuclear accident, "safety" meant "zero release of radioactive materials". However, after the accident, the government officially declared that "safety" meant "anything less than the provisional regulation value of 500 Bq/kg, or 200 Bq/kg for dairy products," as a means of not imposing shipping restrictions. After April 1, 2012, the standard value became 100 Bq/kg, or 50 Bq/kg for dairy products.

[32] Ministry of Economy, Trade and Industry, 2016.

reputational damage accounts for a large portion.

- Table 1 Status of agreed amount by compensation item

	Agreed amount
1. Items related to individuals	\1,992.0 bil
Inspection expenses, etc.	\275.7 bil
Mental damages	\1,086.8 bil
Voluntary evacuation, etc.	\362.5 bil
Inability to work damages	\266.9 bil
2. Items related to corporate/sole proprietors	\3,011.6 bil
Operating loss	\529.5 bil
Shipping restriction damages & reputational damage	\1,824.6 bil
Collective compensation (operating loss, reputational damage)	\252.5 bil
Indirect damages, etc.	\404.8 bil
3. Common/Other	\1,878.9 bil
Loss or decrease in property values, etc.	\1,411.6 bil
Ensuring housing damages	\442.2 bil
Fukushima Public Health Management Fund	\25.0 bil
4. Decontamination, etc.	\2,601.3 bil
TOTAL	\9.483.9 bil

In the initial stages of the accident, it was officially stated that it was safe if it was below the standard set by the government, and the economic damage caused by people not purchasing products below this standard was referred to as “so-called reputational damage” (in the compensation guidelines, this is called “so-called reputational damage”).

“Safety” is a major premise when reputational damage becomes an issue, and farmers, fishermen, and distributors understand this to a certain extent. However, since it is difficult to gain the understanding of distributors, who take into account the trends of all the consumers and people involved, economic damage persists.

Even if there are no safety issues, agricultural products and marine products that have a slightly worse image, are removed from the consumer's options, and the value of the product falls. If this continues, it will be removed from the distribution route.

After the Fukushima nuclear accident, not only items subject to shipping restrictions, but also items subject to price drops and transaction refusals tended to expand to similar items as well as items from the same production area. For example, when it became clear that rice straw was contaminated and that cows from Fukushima Prefecture were contaminated, prices of agricultural products in neighboring prefectures, where pollution was not confirmed and shipping restrictions were not enforced, fell.[33] Depending on the item, the impact of reputational damage spread to price drops in Miyagi Prefecture, which had a low degree of pollution, seafood from Iwate Prefecture, and

[33] Furuya et al., 2011, pp.5–17.

agricultural products produced in Ibaraki Prefecture.

(2) Economic damage overseas: the problem of export restrictions

Especially overseas, some people had the image that the regions of eastern Japan outside Fukushima Prefecture, and even western Japan, were contaminated. In Japan six years on, anxiety over agricultural, forestry and marine products from Fukushima Prefecture had decreased. However, there was high concern in Asia and Europe, especially in neighboring countries. This was not limited to Fukushima, but also covered "eastern Japan" and "Japanese" agricultural products, marine products, drinking water, and visits. In particular, a certain level of anxiety persisted over "eastern Japan" (Figures 1 and 2).

Furthermore, such rumors led to a drop in the price of foods from Fukushima Prefecture and neighboring prefectures, food from eastern Japan, and export restrictions banning overseas transactions. When refusals of this kind persist, "fixed distribution" occurs. It is not easy to regain distribution when shelves at stores are taken over by other products. In the case of overseas, the barrier of import restrictions acts in the same way in the sense of obstructing distribution. As a result, economic damage persists.

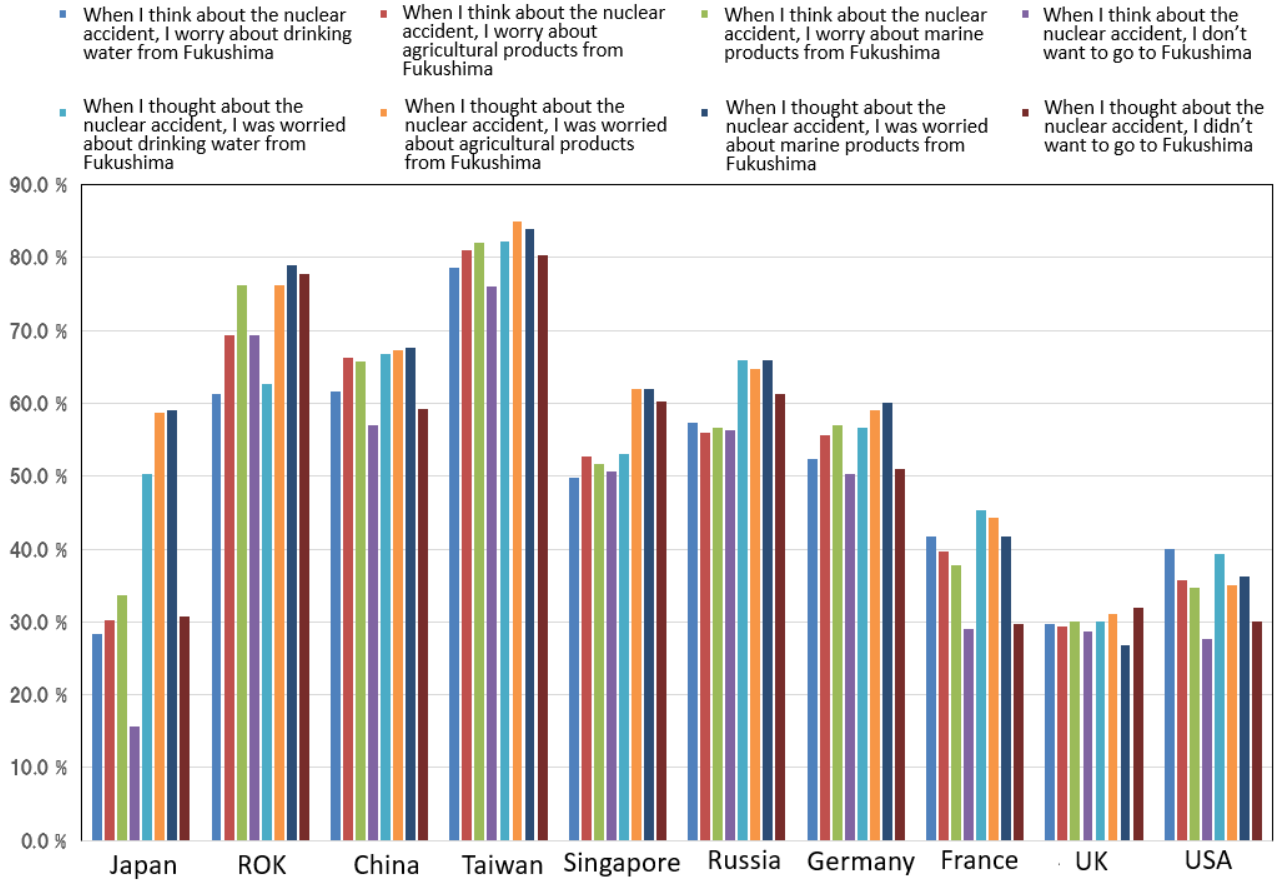
Thus, the trilemma of "exposure risk", "subjective risk" and "economic risk" remain entrenched.

When viewed in hindsight, the "bag-by-bag inspection" of rice and the "head-by-head inspection" of cattle can be said to have been measures to solve all of these risks. The "bag-by-bag inspection" of rice, which has been conducted in Fukushima Prefecture since 2012, inspected nearly 10 million bags annually, and since 2015 no cases have exceeded the reference value, and 99.99% have N.D. (below the detection limit value). The "head-by-head inspection" of cattle has also been conducted since JFY 2011, but there are no cases over the reference value.

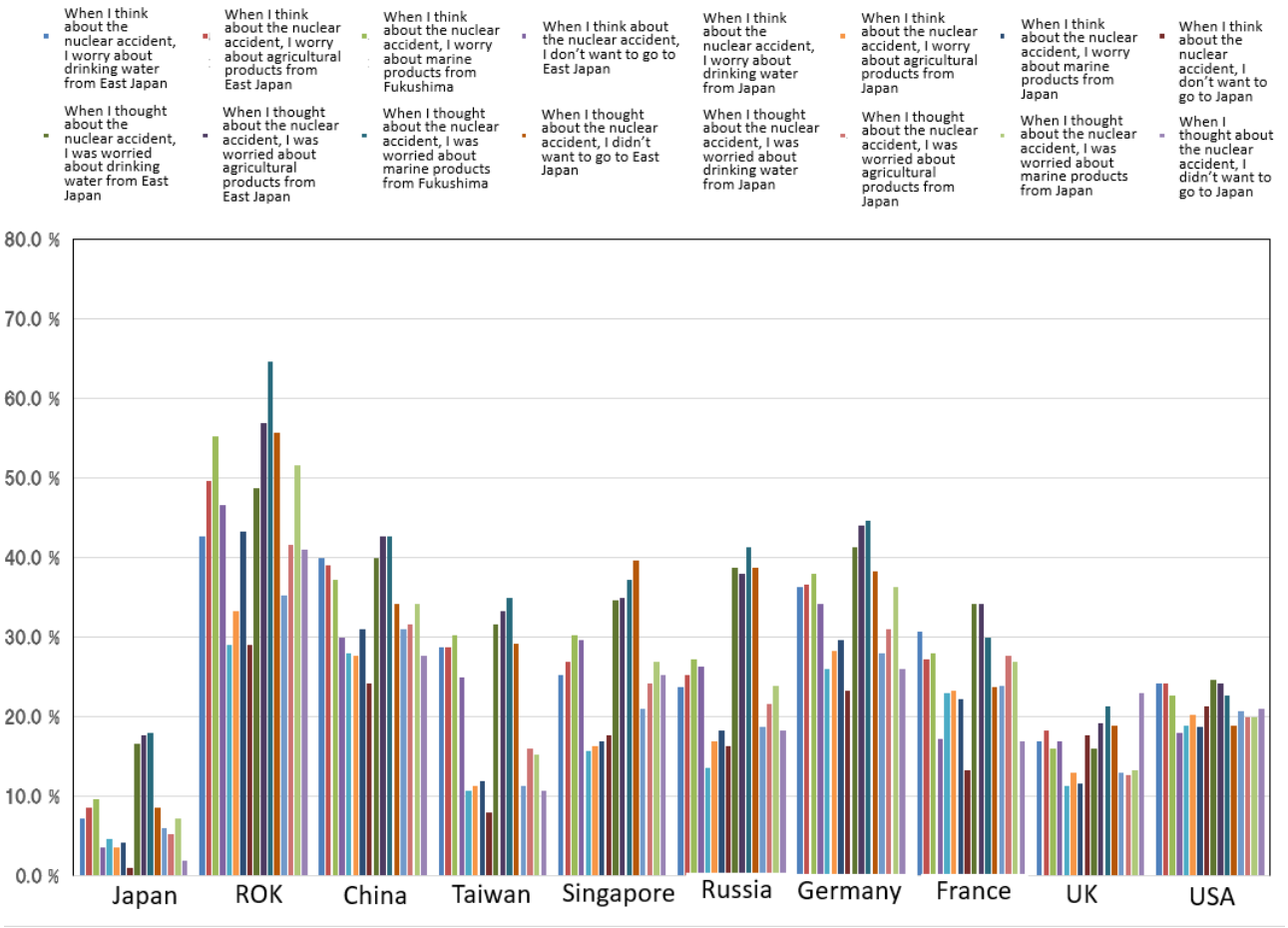
As a result, "exposure risk" was minimized. In addition, the guarantee of safety as a result of the inspection system and the inspection results greatly contributed to the minimization of "subjective risk". Anxiety levels for most Fukushima residents, who know the results of this bag-by-bag inspection, were noticeably reduced.[34] Along with this, the distribution of agricultural products also became active. Apart from the inspection costs, it is clear that inspection also contributed to the minimization of "economic risk".

[34] Sekiya, 2016b, pp.143–153.

- Figure 1 Anxiety about Fukushima Prefecture in foreign countries (present and past)



- Figure 2 Foreign countries' anxiety over East Japan and Japan as a whole (present and past)[35]



Additionally, even if briefing sessions and radiation education on risk communication conducted by government agencies etc. explain "exposure risk", this does no more than explain the risk assessment on the exposure situation, the pollution situation, and the causal relationship between radiation and cancer. Whether it contributes to the minimization of "subjective risk" depends on the individual. Furthermore, it is not directly linked to the "minimization of economic risk".

As long as the radiation hazard trilemma of "exposure risk", "subjective risk", and "economic risk"" remain an issue, countermeasures for reputational damage must simultaneously solve this trilemma. Inappropriate task setting can be said to have caused this confusion.

6. "Contaminated water" and tritium

Another major problem left after the Fukushima nuclear accident is the problem of contaminated water.

By infiltrating contaminated areas including buildings and nuclear reactors, tsunami seawater, water for cooling debris (molten fuel), rainwater, groundwater, and so on were all contaminated with

[35]This is according to an internet monitor survey conducted by the author in February 2017, which was implemented in the largest city of each country and divided according to age (20-60 years) and gender. Each country, including Japan (Tokyo), South Korea, Taiwan (Taipei, Kaohsiung), China (Beijing, Shanghai), Singapore, United States (New York), United Kingdom (London), Germany (Frankfurt), France (Paris), and Russia (Moscow), yielded 300 responses.

various nuclides. "On April 2, it became clear that highly contaminated water was flowing out into the sea from the concrete part near the water intake of Unit 2,"[36] and although the release of this contaminated water was carried out on April 4, 2011, this was later criticized and TEPCO was forced to store it.

To clean up such high concentrations of contaminated water, TEPCO started operating cesium removal devices such as Kurion and SARRY from 2011, as well as ALPS, a device for removing 62 types of multinuclides, and a mobile strontium removal device to decontaminate the site.

Following the accident, TEPCO has taken various measures to prevent an increase in this contaminated water. The operational target for the emission concentration of tritium is less than 1,500 Bq/L, groundwater bypass water being released in 2014 and subdrain water in 2015. In 2016, a frozen soil wall that freezes the area around the reactor building was started to prevent an inflow of groundwater. Be that as it may, it is still increasing. As part of the decommissioning process, the problem of what to do with the water that has been gradually increasing since the accident consists of "contaminated water countermeasures" and "contaminated water treatment".[37]

(1) Fishery issues and contaminated water

The issue of contaminated water is above all else an issue for the fishing industry. With an extremely low radiation dose, "exposure risk" is not the problem. However, the problem is that "economic risk" manifests itself because there is a feeling of anxiety known as "subjective risk" from certain people as well as overseas.

Reputation is a real "economic risk" for fisheries and locals, but the government, TEPCO, and experts do not explain how to control "economic risk," but instead repeat an insufficient explanation on "exposure risk", leading to discrepancies between the two.

The fishing industry in Fukushima Prefecture has been forced to undergo "trial operations" since 2012. The Fukushima Prefecture Fisheries Association has decided to set as a voluntary standard a policy of 50Bq/kg, which is half the reference value of 100Bq/kg for general foods in the country, and to not ship products that exceed 50Bq/kg. In addition to demonstrating their stance of guaranteeing the safety of their product by using tighter safety standards than the national standards, which is especially true for marine products that cannot be fully inspected, it takes into consideration the fact that the neighboring prefectures of Miyagi and Ibaraki Prefectures, which started operating earlier, voluntarily decided on a standard of 50 Bq/kg.[38]

It was then decided to perform a "screening test", which is an inspection to determine that the radioactive cesium concentration does not exceed the reference value of 100 Bq/kg. In order to achieve this reference value of 100 Bq/kg, the state's screening methods ensure there is no possibility of exceeding the reference value by stipulating 50 Bq/kg as the screening level to ensure that the value is definitely below 100 Bq/kg, and setting the detection limit to 25 Bq/kg, a quarter of this screening level. However, in Fukushima Prefecture, in order to achieve 50Bq/kg, which is half that figure, the screening level was set to 25Bq/kg and the detection limit to 12.5Bq/kg or under.[39] Since 2011, a total of more than 50,000 samples have been tested, and as a result, it was confirmed that the radiation dose contained in the catch has fallen.

[36] Cabinet Office, Government of Japan, 2012, p. 344.
[37] As of the end of November 2019, water treated in multi-nuclide removal facilities, as well as strontium treated water, reached a total of 1,173,142 tons stored in 989 tanks.
[38] Nemoto et al., 2018, pp.23–26.
[39] Ibid.

Immediately after the nuclear accident, about 21% of total catches exceeded the current reference value (100 Bq/kg) in the March-June 2011 period, but thereafter, those exceeding the reference value gradually decreased, and in January 2019, there was only one sample that exceeded the reference value.

The purpose of this trial operation was to catch a small amount of fish stocks that were allowed to be shipped, and to investigate the assessment of distribution in the local product and consumer markets. Three different fish types were trialled in 2012, but by the end of March 2017, the number had increased to 97. With the lifting of shipping restrictions on the common skete on February 25, 2020, all shipping restrictions for marine products in the sea area of Fukushima Prefecture were lifted, and "all fish stocks" became the subject of trial operations.

However, with a drop in the number of distributors such as local brokers and fishery processors and brokers in the surrounding area, the difficulty in recovering production, and the long time it took to recover, distribution routes were taken up by another product centers, making recovery of consumer markets insufficient, and so the catch has remained at around 20% of levels prior to the earthquake. In 2010 before the earthquake, Fukushima Prefecture was 17th in the country with 80,000 tons and a production value of 18.2 billion yen, making it one of Japan's leading fishing franchises, but after the earthquake, its appearance was completely changed and production value in 2016 was 7.9 billion yen, which was a large regression back to 29th place in Japan.

(2) The issue of contaminated water problem and ocean release

Under normal nuclear power plant operations, tritium is discharged into oceans and lakes as warm wastewater. The standard for this normal tritium emission is calculated based on a concentration of 1 mSv/year for an adult normally drinking a daily amount of water (2.6 L) for one year, and the declared concentration limit is 60,000 Bq/L, a lower value (1/40). Therefore, it is often said that ocean discharge is safe and the least expensive.

On December 10, 2013, the Contaminated Water Treatment Countermeasures Committee put together its "Preventive and multi-layered contaminated water treatment measures at TEPCO's Fukushima Daiichi Nuclear Power Station - Through comprehensive risk management", and from December 25, 2013, the Tritium Water Task Force was established and examined methods for treating contaminated water. Five disposal options were examined regarding this tritium water: "geological injection", "underground burying (concrete solidification)", "ocean release", "steam release", and "hydrogen release". Based on the discussions of this Task Force, it was assumed that there was no tritium separation technology that could be put to practical use at that stage, and while there would be no scientific impact on the living sphere (human bodies and surrounding organisms), it was argued that carrying out this disposal would inevitably have social and economic ramifications such as reputation damage and impact on the fisheries industry, discussions that were taken up by the Subcommittee on Treatment of Treated Water Including Polynuclide Removal Equipment. This Subcommittee's regulations state that its "objective is to carry out a comprehensive study, including social viewpoints such as reputational damage, based on knowledge gathered in the Tritium Water Task Force Report." It was established mainly to discuss economic impacts such as reputational damage and countermeasures therefor. This was precisely because it was believed that the social impacts of disposal would be significant.

The original purpose of the Subcommittee was, taking into account the five disposal methods and the current status of continuous storage, to consider what kind of economic impact would occur depending not only on disposal methods for the treated water, but also on when decisions were taken,

when disposal commenced, starting time, and the amount to be treated, as well as whether or not countermeasures existed. In the end, the details were sorted out, but they have failed to identify any direction other than environmental release.

Elsewhere, although not included in the five options, there were many opinions about continuing above-ground storage and long-term storage at the hearing held by the secretariat of the Subcommittee in 2018, which were added to their discussions.

Incidentally, methods other than ocean release also have their own significance. Taking into consideration the opinion of local residents, higher cost steam discharge was selected over lower cost river discharge for the contaminated water generated from dealing with the accident at the Three Mile Nuclear Power Plant in 1979. This is because local residents preferred this as the result of consensus building. As for "geological extraction" that injects more than 2,500 meters underground, there is no hope of burying the vitrified remains of high-level radioactive waste if a consensus cannot be reached. This is not just a matter of whether the cost is low or high, but is also a touchstone for whether consensus can be formed in future decommissioning and radioactive waste treatment.

(3) The issue of contaminated water and the trilemma

The main problem with this treatment of contaminated water is minimizing the "economic risk" revolving around fisheries.

Regulatory standards for minimizing "exposure risk" have been set (setting of reference values), and water has been released off-site at other nuclear power plants as well, and although there is the question of controlling total amounts, scientific safety is guaranteed.

In terms of minimizing "subjective risk", unlike the prefectural health survey on thyroid cancer related to radioactive iodine-131, and radioactive contamination such as cesium-134 and cesium-137, which was a problem immediately after the earthquake, the number expressing a great deal of concern is low.

This is an extremely serious issue that may have an additional adverse impact on Fukushima Prefecture's fishing industry, which is in the process of recovery, and that by hindering the recovery of Fukushima Prefecture's fishing industry, may have a decisively detrimental effect.

Regarding the disposal of contaminated water, it is necessary to consider a national consensus and understanding, the understanding of other countries, the degree of recovery in industries like fishery and marine product industries in the Hamadori area, as well as measures to curb the impact of disposal. At present, although people are highly interested in the treatment of contaminated water, their understanding of the nature of tritium itself, the concentration of other nuclides contained in the water after ALPS treatment (including retreatment), and disposal methods is poor.[40] In addition, a lack of understanding in other countries regarding the current situation in Fukushima Prefecture is also apparent, witness export restrictions in other countries and essentially defeats at the WTO (see Figures 1 and 2 above).

Additionally, only a short time has passed since shipping restrictions have been lifted on Fukushima's fishing industry's main fishing stocks, and the industry has not recovered to a stage of sufficient strength, and countermeasures for economic impacts have not been fully considered.

Moreover, as a measure to reduce the social impact of this contaminated water, nothing more than

[40] Sekiya, 2019b, pp.38–43.

conventional measures for reputational damage have been implemented, and while stronger qualitative and quantitative measures countering rumors are required, there has currently been no breakthrough. Given the current status of national consensus and understanding as well as the current status of understanding in foreign countries, economic impacts are inevitable.

What needs to be given precedence both inside and outside Japan is 1) the adequate dissemination of results from radiation dose measurements in Fukushima Prefecture, the current results of Fukushima Prefecture food product inspections, full information about the inspection system, and the formulation of measures for informing and spreading information; 2) the recovery of related industries such as Fukushima Prefecture's fisheries, and securing time to solidify the distribution base, and 3) considering the economic impact of treating contaminated water. If it is disposed of as it is, it will impose a further burden on related industries including Fukushima Prefecture and fishermen.

That is why even though reputation is a real "economic risk" for fisheries and locals, the government, TEPCO, and experts do not explain how to control "economic risk," but instead repeat an insufficient explanation on "exposure risk", leading to discrepancies between the two.

Reputational damage concerning cesium has not been completely eradicated either domestically or overseas. Nevertheless, the government and scientists still think that a scientific explanation can solve this problem of treated water including tritium. This is where the problem lies.

7. Nuclear disaster prevention and wide-area evacuation plans

Finally, I would like to consider nuclear disaster prevention

In 2011, based on the Disaster Prevention Measures for Nuclear Facilities (so-called Disaster Prevention Guidelines) formulated by the Nuclear Safety Commission, an EPZ of 8 kilometers was to be evacuated in the event of a nuclear power plant accident. However, following the accident, Fukushima Prefecture issued 2 kilometers, and the government, ignoring the above disaster prevention guidelines, issued 3, 10, and 20-kilometer evacuation orders in quick succession. While noting about this that "confirmation and support were insufficient, and the information and evaluations on which the instructions were based were inadequately provided", the Independent Accident Investigation also held that "it was a preventive response, and as a result, we recognize that they were able to prevent the radiation exposure of residents." The Parliamentary Accident Investigation was negative about multistage evacuation, stating in the early stages, "Had it been possible to read ahead, such as inducing evacuation outside the 20km area, this may possibly have eased the burden placed on residents by multistage evacuation." As for the Government Accident Investigation, it pointed out that the problem was that a PAZ (Precautionary Action Zone), a zone set up by the IAEA for "a severe accident as a prerequisite for disaster prevention measures based on lessons learned from the Chernobyl accident" and "to immediately evacuate when there is a risk of radioactive material release", was not introduced.

How, then, has the current nuclear disaster preparedness been modified based on these lessons learned from the TEPCO Fukushima Daiichi Nuclear Power Station accident? Let us consider them from three perspectives.

(1) Nuclear disaster prevention and "protective measures"
The first point is the concept of protective measures in the event of a nuclear accident.

One is the evacuation standard. In emergency response and nuclear disaster prevention plans based on the current Nuclear Emergency Preparedness Guidelines and using ideas introduced by the IAEA, multistage evacuation is not to be carried out, but is to take place using a PAZ immediately and a UPZ (Urgent Protective action planning Zone) at the stage when 500 μSv/hour is reached, which is the operational intervention level OIL1 for UPZ, using the value at the monitoring post as a standard. In other words, inhabitants are asked to stay where they are on the assumption that they will be exposed up to 500 μSv/hour. Considering the risk of turmoil in an evacuation, "exposure risk" is tolerated. However, from the residents' standpoint, they are being told to stay put while being exposed to exposure risk, so it is difficult to minimize their "subjective risk".

Another is the exit test (screening test). 1) Residents within the PAZ (5 km) will be evacuated immediately and not be inspected as this evacuation precedes the release of radioactive material. 2) Basically, when you evacuate outside the UPZ (30 km), you will undergo an "exit inspection". 3) In order to give precedence to speedy evacuation to outside the area, vehicles are first inspected without inspecting everyone individually. If it is not under 40,000 cpm (β ray), a representative occupant is inspected. If this representative is not below the operational intervention level OIL 4 of 40,000 cpm, then all occupants will be inspected. In short, not inspecting everyone is the basis.

This is one of the ways to increase the speed of exit inspection. People will be exposed if they stay for a long time in a place where the dose is rising. This is also an appropriate measure to minimize exposure risk because as many people as possible will be evacuated to a distance in a short time. However, since they are not tested, it is difficult to minimize subjective risk.

For example, in the case of the JCO criticality accident, Tokaimura conducted a simple screening for almost all the residents, although the radioactive material was not scattered in large quantities and there was almost no exposure. This played a major role in reducing feelings of anxiety in the long run. It contributed to minimizing subjective risk.

In the Great East Japan Earthquake, not all evacuated residents and citizens of the prefecture were screened. In the Fukushima nuclear accident, about 20% of people were not screened even in the warning zone, and since it was not mandatory, most people were not screened outside the warning zone immediately after the accident.[41] As a result, this led to a situation where the half-life was as short as one week, and the situation of radiation exposure immediately after the accident due to iodine that affects the thyroid gland was not known. Not knowing the radiation dose immediately after this is a factor causing long-term anxiety for residents, and is an issue that creates concern all the way up to prefectural health surveys.

The lesson of the Fukushima nuclear accident was meant to be that, in order to contain confusion immediately after the accident, it is necessary to simultaneously minimize both exposure risk through prevention via the evacuation of residents and subjective risk by curbing confusion via the confirmation that evacuation has taken place. It has not, however, been put to good use thereafter.

(2) Nuclear disaster prevention and "assumptions"

The second point is the concept of "assumptions". Assumptions in nuclear disasters do not fit into the concept of "disaster mitigation".

Natural disasters assume damage and sacrifice and cannot be prevented, and are premised on the fact that it is difficult for everyone to evacuate. Although various expressions exist like the scale is "the largest ever" or "the scientific maximum", the "maximum" is premised on the assumption that a

[41] Sekiya, 2019c.

disaster on an expected scale will not occur. That is why the idea of "disaster mitigation" is established in order to reduce the damage and sacrifice as much as possible.

On the other hand, in nuclear disaster prevention, "assumptions" are directly attached to the extremely highly valued safety of the nuclear power plant, and nuclear disaster prevention (at least nuclear disaster prevention after the Great East Japan Earthquake) presupposes that all target people evacuate.

The transformer fire that occurred during the 2007 Niigata Chuetsu-oki Earthquake in Unit 3 of the TEPCO Kashiwazaki-Kariwa Nuclear Power Plant was an accident that hinted at the need for measures to be taken against compound disasters in which a natural disaster and a nuclear accident occur simultaneously. Nevertheless, only Niigata Prefecture considered the possibility of compound disasters. NISA had called compound disasters "an extremely unlikely event"[42] and maintained up until March 2011 that the occurrence of a nuclear disaster and wide-area evacuation would not actually occur. It was common for both nuclear regulators and operators to avoid the very "assumption" of a major disaster such as a compound disaster.

Even today, there is a fixed assumption that accidents will be similar to the Fukushima nuclear accident. According to the Nuclear Regulatory Agency, IAEA standards were adopted when formulating guidelines for nuclear disaster countermeasures, and the maximum UPZ of 30 km specified by the IAEA was adopted. On top of that, it was based on a conservative view of seeking maximum safety for nuclear disaster prevention and the fact that damage from the Fukushima nuclear accident had subsided within a range of approximately 30 kilometers.

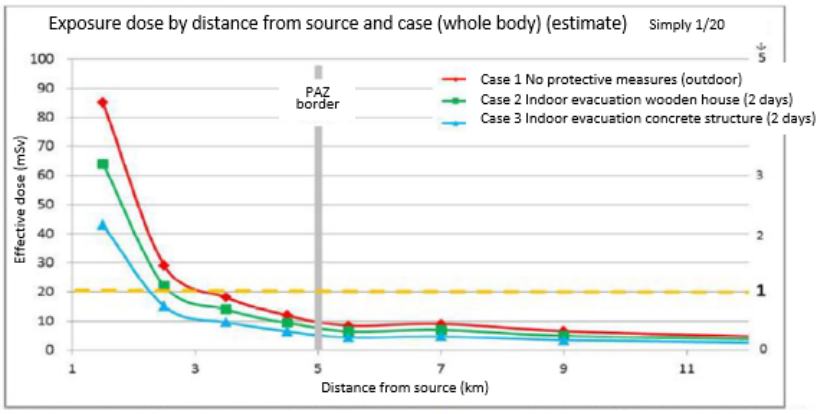
> The Japanese situation at the time was the idea of 'go conservatively, be on the safe side' and against the backdrop of the two facts that it actually exceeded 30 at Iitate in Fukushima, but said it was on the safe side. We thought no one would say it was tiny, and it would be enough to say it was on the safe side. That's what happened in Fukushima. I think that was the background.[43]

This problem of limiting "assumptions" also appears in assumptions about "emission amounts" in the regulatory standards. In the TEPCO Fukushima Daiichi nuclear accident, the amount of cesium-137 released was 15 petabecquerels (=15,000 terabecquerel)[44], but the Nuclear Regulation Authority confirmed that the amount of cesium-137 due to containment vessel damage in the Kawauchi Nuclear Power Plant inspection was assumed to be 5.6 terabecquerel.

Based on lessons learned from the Fukushima nuclear accident, the Nuclear Regulation Authority argues that "it does not mean that an accident on a larger scale will not occur", but as a reference, assuming that the release amount of "cesium-137 due to containment vessel damage" when a serious accident occurs is 100 terabecquerel, and the basic idea being that there is no problem because the effective dose is sufficiently low outside the PAZ (May 28, 2014, 9th Nuclear Regulation Authority meeting), individual assumptions are made for containment vessel damage.[45]

[42]Nuclear and Industrial Safety Agency, 2009.
[43] Interview with Ex-Cabinet Office staff, November 29, 2019..
[44] See, Nuclear and Industrial Safety Agency. (2011, June 6). Announcement; Government of Japan. (2011, June). Report for the IAEA Ministerial Conference on Nuclear Safety; in section 2.2. concerning nuclear disasters in chapter 2 on radiation exposure, unified basic data on health effects of radiation is organized according to figures such as "the comparison between estimated amounts of radionuclides released from the Chernobyl nuclear power plant accident and the TEPCO Fukushima Daiichi nuclear power plant accident."
[45] Nuclear Regulatory Authority Mid-level Hearing with Tetsuya Yamamoto and Shunichi Tanaka.

- Within 5 km from the emission source (within the PAZ), the dose reduction effect is great depending on the distance (thus, evacuation is effective as a preventive protective measure).
- On the other hand, at a distance of 5 km or more from the emission source, the dose reduction effect due to indoor evacuation, etc. can be reliably expected rather than the dose reduction effect depending on the distance.
- From the above, from the viewpoint of reducing radiation exposure when passing through the radioactive bloom, indoor evacuation is an effective means at a distance of 5 km or more.



- In light of the lessons learned from the Fukushima Daiichi Nuclear Power Station accident, the total amount of radioactive material released is confirmed by tests to be less than 100 terabecquerels of cesium 137 for the assumed containment vessel failure mode, even if a serious accident occurs. The above calculation is based on the assumption that 100 terabecquerels will be released. For the preconditions of the calculation, refer to Document 2 of the 9th NRA in 2014 (held May 28, 2014).
- In addition, in the tests on the Kawauchi Power Station, the emission amount of cesium 137 confirmed for the assumed containment vessel failure mode was 5.6 terabecquerel (7 days) (1/20th of 100 terabecquerel).

NB 1 terabecquerel = 1012 becquerels = 1 trillion becquerels: 1/1000th of a petabecquerel

Source: Former NRA Chair Tanaka, explanatory materials, February 2017

Although strict regulatory standards have been laid down in light of reflections on the accident with the aim of achieving a robust defense, they are based on the premise that this regulation perforce ensures that a large amount of radioactive substance will not be emitted. In other words, the more stringent the regulations and the more stringent the standards are, the more paradoxical becomes the paradox of underestimating the assumptions for an accident. Regarding this point, a former staff member of the Cabinet Office (nuclear disaster prevention), stated as follows.

> My awareness is that the NRA has returned to its former (zero-risk, no accident) thinking. The Regulatory Agency, including the chairman of the Authority, has explained to the public based on an assumption that almost no radioactive material will be released in any accident, and disaster prevention plans and resident briefing sessions have been built on this assumption.[46]

(3) Nuclear disaster prevention and “regulation”

The third point is that offsite nuclear disaster prevention was not subject to “regulatory requirements” or “examination”, but rather was closely linked to “promoting”.Based on the lessons learned from the Fukushima nuclear accident, NISA was abolished and the Nuclear Regulation Authority (NRA) was established as a regulatory body independent of the Ministry of Economy, Trade and Industry, in order to separate “promoting” and “regulating”.

However, the NRA neither includes evacuation plans in its regulatory requirements like in the United States, nor does it make requests about the evacuation plans of the Cabinet Office (Disaster Prevention) and each prefecture as the U.S. NRC submits to the FEMA. It is said that it commented that the reasons for this were “1) legally, the new regulatory standard is a standard for operators and cannot be used to impose obligations/burdens on local governments; 2) it is almost impossible for

[46] Interview with former staff in charge of nuclear disaster prevention, Cabinet Office, November 29, 2019.

local governments to handle tasks such as assessing conformity to new regulatory standards as current operators do; and 3) there is no zero risk, and as long as there is no end to disaster prevention measures, it is impossible to assess 'effective evacuation plans' that evaluate regulatory compliance."[47]

Regarding these, the stance on the regulatory agency side was to explain only that "the evacuation plans are effective in light of the nuclear disaster prevention guidelines". Verification is insufficient (currently, only Niigata Prefecture is verifying evacuation).

At present, nuclear disasters and natural disasters come under the jurisdiction of different bodies at the government level: the Cabinet Office (Nuclear Disaster Prevention) and the Cabinet Office (Disaster Prevention). The core of the Cabinet Office (Nuclear Disaster Prevention) comprises mainly co-assigned staff and officers seconded from the Agency for Natural Resources and Energy at the Ministry of Economy, Trade and Industry, and has a strong relationship between "promoting" and "regulating".

In addition, the relationship with the Cabinet Office (Disaster Prevention) is weak, and there is no mechanism for utilizing natural disaster response expertise for nuclear disaster response. This is not only a question of a vertical structure in the government's crisis management organization, but also creates a mismatch between nuclear disaster prevention and natural disaster prevention.

As for nuclear disaster prevention at the government level, the Cabinet Office (Nuclear Disaster Prevention) has prepared an "emergency response" for each nuclear power plant location. Consistent with that, disaster prevention plans for each prefecture and each municipality are made, and the government's involvement is more direct than with natural disasters. In the case of nuclear disaster prevention, it is assumed that the prefectures and local governments will match up 100% the areas being evacuation from and to without making individual judgments, and that all the people requiring assistance will be listed up and transferred.

However, at TEPCO's Fukushima Daiichi Nuclear Power Plant, more than half of the people were evacuated to direct relatives and relatives' homes over a wide area nationwide, rather than as directed by the government.[48] In the first place, there are almost no cases of 100% evacuation due to natural disasters, not just nuclear accidents.[49] The plans are such that have never taken place in the past, not only for nuclear accidents, but also natural disasters. Of course, efforts to realize policies (ideals) where no one is left behind can be appreciated, but, at the very least, the fact is that they are trying to realize impossible plans that are not implemented in natural disasters.

Also, assumptions and scenarios are emphasized in training drills, and in natural disasters, blind-type drills where natural assumptions and scenarios are hidden from the implementers are not often performed.[50] Additionally, most of the radiation measurement personnel for exit inspections at each site rely on personnel dispatched from the various electric power companies (support from other electric power companies via the electric power company actually), there being many areas where electric power companies provide welfare vehicles for the evacuation of people.

Of course, it is natural for operators to take a central role and great responsibility in nuclear disaster

[47] Ibid.
[48] Sekiya, 2019c.
[49] An exception is damage from a volcanic eruption. However, eruptions have mostly occurred in the past on remote islands or other areas with small populations, avoiding the unprecedented scale of damage that a nuclear power plant accident can cause.
[50] Only Hokkaido and Niigata did blind nuclear power plant disaster prevention exercises in the fiscal year 2019.

prevention, but in reality nuclear disaster prevention and training appear to be premised on the condition that nuclear power plants will restart and the promotion of nuclear power. In fact, this nuclear disaster prevention has a structure that is dependent on the electric power companies as being part of a set with the restart and promotion of nuclear power.

Taking into account lessons learned after the Great East Japan Earthquake, the Nuclear Regulatory Agency was established by differentiating between nuclear "promotion" and "regulation", but harmful effects have been brought about by the fact that nuclear disaster prevention was excluded from the regulatory requirements (under the jurisdiction of the Cabinet Office not the Nuclear Regulation Authority).It can be seen that the "purpose" of nuclear disaster prevention, such as accident response and minimizing exposure risk to residents, has been replaced by the "means" for restarting nuclear power plants, thus rebuilding a "safety myth" triggered by nuclear disaster preparedness.

This is because it does not assume economic damage. The amount of damage from the Fukushima nuclear accident was estimated to be 21.5 trillion yen in 2016. Emergency response after a nuclear accident and disaster prevention plans have been prepared for each area of a nuclear power plant, but economic damage has not been calculated. This is in sharp contrast to the assumption of economic damage in the case of an earthquake in Metropolitan Tokyo or a giant earthquake in the Nankai Trough. In other words, before one can even start minimizing economic risk in a nuclear accident, it is treated as if it does not exist. The "safety myth" of not "assuming" economic damage is being incorporated into the nuclear disaster preparedness system once again.

The lessons pointed out by the three Accident Investigations, and many people, were response to the unexpected, compound disaster response and coordinating compound disaster response with natural disaster response. That has not materialized, however. At the very least, the current situation must be said to be one where "assumptions" for disaster response in the case of a nuclear accident, multi-faceted studies on off-site response including evacuation of residents bearing in mind compound disasters and based on knowledge of natural disasters, and an organizational framework to realize these are all inadequate.

Basically, the issue in nuclear disaster prevention can be said to be the conflict between "minimizing harm to health as a radiation exposure risk" and "minimizing feelings of anxiety as a subjective risk", which remain unresolved.

Summary: Re-emergence of the safety myth

Nine years have passed since the earthquake, and the following three issues have emerged.

First, the loss in credibility of the scientific community and the government has caused long-term communication deficits, and an absolute standard of 1 mSv/year has been established in the turmoil of the immediate aftermath. This has had very important policy implications that have resulted in prolonging decontamination, intermediate storage facilities, soil waste, and evacuation. Additionally, Japan has failed to switch from crisis communication to risk communication in normal times, and has been unable to switch from the crisis stage of taking preventive measures in an emergency to the stage of sharing risk in normal times.

The second is grasping the trilemma. In order to recover from radiation disasters, "minimizing health damage as a radiation exposure risk for the general public", "minimizing feelings of anxiety as a subjective risk", and "minimizing economic damage as an industrial risk" must be achieved. However,

bureaucrats and scientists assert that “minimizing health damage as a radiation exposure risk for the general public” is enough, and they continue to ignore “minimizing feelings of anxiety as a subjective risk” and “minimizing economic damage as an industrial risk” as the concern of a mere few. The trilemma goes unsolved, each solution being deemed good enough as a science-based “setting of reference values”, “risk communication” by the Ministry of Health, Labor and Welfare and the Consumer Affairs Agency to explain the health effects of radiation, and “promotion” of agriculture, forestry and marine products by the Ministry of Agriculture, Forestry and Fisheries and local governments, and we are about to reach ten years on in the absence of real risk communication.

However, explanations of radiation did not directly lead to “minimizing feelings of anxiety as a subjective risk,” and without being incorporated into the distribution structure at the root of reputational damage, promotion did not lead to “minimizing economic damage as an industrial risk.” Soon ten years will have passed without solving this trilemma.

Thirdly, the strengthening of regulations after the Fukushima nuclear accident, and the separation of regulations and nuclear disaster prevention, has replaced the “goals” of nuclear disaster prevention such as accident response and minimizing the exposure of residents, with the “means” for promoting and restarting nuclear power. “Minimizing economic damage as an industrial risk” is ignored because ultimately accidents do not occur, and the stringency of regulations and standards force accident assumptions into a Fukushima nuclear power plant template for nuclear disasters and creates the paradox of underestimating the scale of release. This creates a structure where greater priority is given to achieving “small peace of mind” by eliminating fears that might hinder restarting nuclear power rather than achieving the “great safety” of evacuation in the event of a nuclear power plant accident.

In other words, a new “safety myth” is being rebuilt.

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Chapter 4: The crisis management system in the Kantei

Yasuaki Chijiwa

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Preface: Did the Cabinet-led overall coordination work?

Following the Great East Japan Earthquake, the government set up the Extreme Disaster Management Headquarters and the Nuclear Disaster Management Headquarters headed by Prime Minister Naoto Kan. In the Kantei (the Prime Minister's official residence), the Emergency Assembly Team was convened under the Deputy Chief Cabinet Secretary for Crisis Management, Tetsuro Ito, and a staff group (usually referred to as the Cabinet Security and Crisis Management Office or "*anki*") of the Assistant Deputy Chief Cabinet Secretary (Security and Crisis Management) and related ministries and agency liaisons were in charge of information gathering and communication coordination. During this period, some 100,000 people were deployed in the Self-Defense Forces' disaster deployment, the largest ever scale. The Great East Japan Earthquake and the Fukushima Nuclear Power Plant accident brought to light the importance of and issues in the ability of the government and the Kantei to cope in an emergency, and by extension, the state of national governance.

The Fukushima nuclear accident was the largest national crisis Japan had experienced since the end of World War II, when the United States used nuclear weapons against Hiroshima and Nagasaki, and the Soviet Union entered the war against Japan. In a national crisis, the government must create a command tower for crisis response and mobilize the nation's resources to the fullest extent. An important function of the Cabinet from the standpoint of ensuring the unity and integration of administration is to supervise ministries that are divided, but that function must be maximized in times of crisis. However, Japan has a major obstacle to national governance when facing a crisis: a governance mechanism that distributes political power among governmental institutions. It is an attribute of the traditional governance system from prewar Japan, but its character has remained basically unchanged even after the war. Article 66, Paragraph 3 of the Constitution adopts the "shared management principle" as the basic principle of the governance system. In other words, administrative authority belongs to the Cabinet, but the specific administrative work is shared and managed by each ministry.

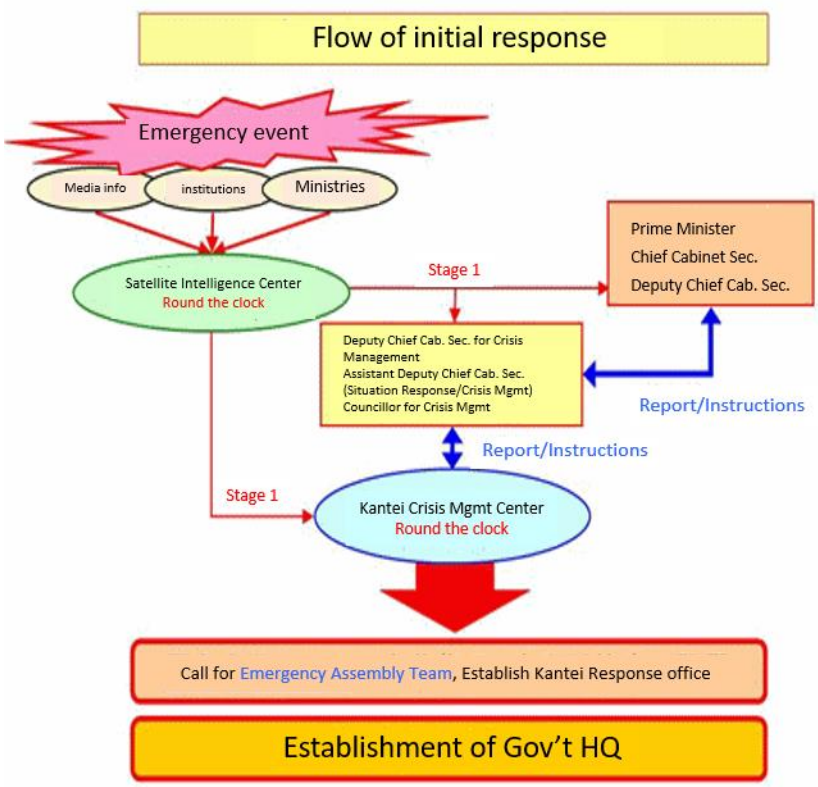
Nevertheless, since the beginning of the 1990s, the Cabinet-led integration and coordination function has been strengthened. The Administrative Reform Council established by the Ryutaro Hashimoto Administration compiled its final report in December 1997, and expressed its basic position that "under the Constitution of Japan, the Cabinet has a high degree of governance and political function of "overseeing the state", in other words, it is necessary to take seriously the fact that the state is in a position to give comprehensive and strategic direction to the nation, taking into account information

from various administrative departments, and to strengthen the cabinet function."[1] It is in this context that a crisis management system in the Kantei came to be advocated. As a means of governance in a national crisis, this was intended to fulfill the role of the Cabinet's integrated coordination function for crisis management led by the Kantei, thereby overcoming the so-called "vertical division" that is an inherent risk of the shared management principle.

In the response to the Fukushima nuclear accident, how well did such a government-led crisis response function? What did we learn from it? And ten years on, how are those lessons being applied to prepare for the future?

In this chapter, I will discuss the "lessons" after the Fukushima nuclear accident for the Kantei crisis management system. Of these, we will examine the legal system, organization, human resources, assistance and advisory functions, public relations and communication, and the National Security Council (NSC) related to the Kantei's crisis management system, and further examine the subsequent Kumamoto Earthquake, heavy rains in Western Japan, and the spread of infection from the new coronavirus (COVID-19). Based on these observations, I would like to posit ten implications for the crisis management system in the Kantei.

This system comprises the heads of the Kantei related to crisis management, namely, the Prime Minister, the Chief Cabinet Secretary, the Deputy Secretaries of the Cabinet Secretariat in charge of political affairs and administrative work, and the Special Advisor to the Prime Minister, and overlaps somewhat with the Cabinet crisis management supervisory system comprising the Deputy Chief Cabinet Secretary for Crisis Management, the Assistant Deputy Chief Cabinet Secretary (Situation Response/Crisis Management) and his staff group (usually referred to as the Situation Response Office or "*jitaishitsu*"), the Information Liaison Office and/or the Kantei Liaison Office or the Kantei Response Office, NSC/National Security Secretariat (NSS) in Cabinet Secretariat, Nuclear Disaster Management Headquarters, Extreme Disaster Management Headquarters, and so on.



[1] Cabinet Office, Government of Japan, 1997.

[Figure 1] Flow of initial response
(Source) Cabinet Secretariat homepage,
https://www.cas.go.jp/jp/gaiyou/jimu/fukutyoukanho.html

1. What was the issue with the Kantei crisis management

The Government Accident Investigation, the National DietAccident Investigation, and the Independent Accident Investigation have all examined the state of crisis management in the Kantei at the time of the Fukushima nuclear accident.

The Government Accident Investigation proposed a review of the nuclear disaster response manual and the establishment of a mechanism allowing the Nuclear Disaster Management Headquarters to access information while remaining inside government facilities.

The National Diet Accident Investigation called for a radical review of the government's crisis management system, including the establishment of a system capable of acting in times of crisis and the institutional establishment of a unified command and control system.

The Independent Accident Investigation raised issues centering on the risk of micro-management in the Kantei in dealing with the nuclear accident, and the advisory system for political leaders including the fields of science and technology.[2]

Prehistory: Great Hanshin-Awaji Earthquake and Tokaimura JCO criticality accident
Before broaching the main theme of "lessons" for Kantei crisis management in the decade following the Fukushima nuclear accident, we need to look back on what was learned from two previous major disasters in Japan: the Great Hanshin-Awaji Earthquake of 1995 and the Tokaimura JCO Criticality Accident of 1999. There is a prehistory to the "post-disaster" history of the last ten years.

Learning the "lessons" imparted there will better help us understand the character of subsequent "learning".

It was the Great Hanshin-Awaji Earthquake that occurred on January 17, 1995 that greatly changed the crisis management awareness of the Japanese people. However, the National Land Agency, which was said to be in charge of natural disasters at the time, did not have an on-duty watch system, and a private security guard who noticed the fax contacted the home of an Agency officer twenty minutes after the disaster.[3] Moreover, it took three days from the disaster to set up an emergency management headquarters. At the time, the accepted principle was that local governments should respond to disasters, and it was not expected that they report the situation at the site to the Kantei.[4] There was no regular training in crisis management at the Kantei, and even if an emergency occurred, it took at least two hours for the Kantei Response Office to start up, and three or four hours if it was after hours. And as for the Kantei Response Office, staff from the Prime Minister's Office usually gathered in a room they normally used for other purposes.[5]

As one of the lessons of the Great Hanshin-Awaji Earthquake, a crisis management system was established in the Kantei. Initially, the Emergency Assembly Team Meeting was established, led by the Deputy Chief Cabinet Secretary (later the Deputy Chief Cabinet Secretary for Crisis

[2] Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012; Cabinet Office, Government of Japan, 2012; The National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission, 2012.
[3] Sankei Shimbun, 2017.
[4] Noda, 2015, pp. 63–64.
[5] Ibid., pp. 64–65.

Management), which acted as a meeting for information gathering consisting of bureau-director level executives from the relevant ministries. In addition, the Deputy Chief Cabinet Secretary for Crisis Management was set up with the task of making primary decisions on measures required by the Cabinet in an emergency and conducting a quick comprehensive coordination with the relevant ministries and agencies regarding initial measures. The Cabinet Security and Crisis Management Office was established (later transferred to the Assistant Deputy Chief Cabinet Secretary (Security and Crisis Management)). On the hardware side, the Kantei Crisis Management Center was set up on the first basement floor of the Kantei as the central facility for the government's crisis management activities.

The "lessons" after 1.17 were great. Until then, the crisis management system in the Kantei was hardly developed, and it could be said that there was a "room for growth", but this was also underpinned by the fact that it was part of the process of administrative reform in the 1990s. Moreover, the leadership of Prime Minister Hashimoto and the existence of key persons such as Deputy Chief Cabinet Secretary Teijiro Furukawa cannot be ignored.[6] Until then, as for the crisis management function of the Cabinet, informal information analysis and exchange of opinions were conducted by the parties concerned mainly under the Deputy Chief Cabinet Secretary, but Furukawa believed this was not enough. He proposed the establishment of the Deputy Chief Cabinet Secretary for Crisis Management and gained the approval of Prime Minister Hashimoto.

On the other hand, "learning" after 3.11 does not seem to be so substantial. However, as I will mention later, the NSS was installed in 2014. This had a great significance for crisis management at the Kantei.

On the other hand, regarding a nuclear disaster, it was decided to set up a Nuclear Disaster Management Headquarters if the Prime Minister issued a Nuclear Emergency Declaration under the Act on Special Measures Concerning Nuclear Emergency Preparedness enacted on December 17 of the same year the Tokaimura JCO criticality accident that occurred on September 30, 1999. (The first time such headquarters were actually set up was the Great East Japan Earthquake.) After the Tokaimura accident, the Cabinet Security and Crisis Management Office prepared a report summarizing opinions on the government's efforts, and in this report, it proposed the installation of an off-site center, robot development, and improved nuclear disaster training, but although an off-site center was realized, the other proposals were not taken up.[7] Moreover, after the Fukushima nuclear accident, a "situation room function" at the Kantei, as recommended by the Independent Accident Investigation, and a science and technology evaluation institution (function) that political leaders can utilize have yet to be established.[8]

2. What has changed in the Kantei: Legal system, organization, personnel

Legal system

As pointed out by the Independent Accident Investigation, in the Fukushima nuclear accident, Prime Minister Kan was criticized for "excessive micro management"[9] and being involved in detailed technical judgments and the information gathering process, raising questions about the nature of prime ministerial leadership in crisis management. The Final Report of the Government Accident Investigation also states "direct intervention in the field by [the prime minister] himself may cause confusion in the field as well as result in incorrect decisions or the loss of important decisions. As

[6] Furukawa, 2005, p. 8.
[7] Funabashi, 2014, pp. 11–14.
[8] Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, p. 105, 394.
[9] Ibid., p. 109.

such, it should be said that the harm is greater."[10]

As a legal change concerning political leadership, in the amended Act on Special Measures Concerning Nuclear Emergency Preparedness enacted on June 27, 2012, Article 20, Paragraph 3 stipulates that the Prime Minister's directives regarding a nuclear disaster do not cover "matters relating to the content of judgments that the Nuclear Regulation Authority should make to ensure the safety of nuclear facilities based on technical and professional knowledge regarding the affairs under its jurisdiction." This is because in the process of establishing the Nuclear Regulation Authority (discussed below), LDP Lower House Member Yasuhisa Shiozaki criticized Prime Minister Kan's response to the Fukushima nuclear accident calling it the "Naoto Kan Risk".[11]

When the Nuclear Disaster Management Headquarters were expanded under the revised Act on Special Measures Concerning Nuclear Emergency Preparedness on September 19, 2012, in addition to the Cabinet Secretary, the Environment Minister, the Minister of State for Nuclear Emergency Preparedness, and the Nuclear Regulation Authority Chairman were newly appointed as deputy directors of the headquarters.[12] At the time of the Fukushima nuclear accident, the Chief Cabinet Secretary was merely an ordinary member of the Nuclear Disaster Management Headquarters and was not legally in a position to take command of the nuclear accident response.[13] What is important here is that all ministers became members of the headquarters (in addition to the deputy minister and parliamentary secretary of the Cabinet Office, the Deputy Chief Cabinet Secretary for Crisis Management, etc.). Regarding this point, Kiyotaka Takahashi, the Cabinet Secretariat Councillor for Crisis Management at the time of the Fukushima nuclear accident and later Deputy Chief Cabinet Secretary for Crisis Management, said, "The fact that all the ministers were legally added to the headquarters was an improvement based on reflections from 3.11", adding "not only does it mean that all ministries and agencies will naturally be involved when such a serious situation occurs, but it's important for daily preparation and training."[14]

In the context of discussion for founding a "Japanese version of FEMA" (U.S. Federal Emergency Management Agency), there was some discussion that the Chief Cabinet Secretary should be granted the authority to issue "directives", but in *The State of Government Crisis Management Organizations (Final Report)* put together by the Related Deputy Ministers' Meeting on the State of Government Crisis Management Organization on March 30, 2015, it was concluded that this would require careful consideration given that the Prime Minister's powers to command and oversee derive from Cabinet decisions.[15]

In addition, with the amended Atomic Energy Basic Act, enacted on June 27, 2012, the Nuclear Disaster Management Council was established in Cabinet on September 19, 2012 as a body to promote nuclear disaster management measures throughout the entire government, the Prime Minister being appointed chair, the Chief Cabinet Secretary (and the Minister of the Environment, Chairman of the Nuclear Regulation Authority) vice-chair, and the Deputy Chief Cabinet Secretary for Crisis Management (and all ministers) appointed as members.

Organization

Regarding the division of roles for government officials involved in crisis management, in the Great East Japan Earthquake, Chief Cabinet Secretary Yukio Edano was in charge of difficult-to-return

[10] Cabinet Office, Government of Japan, 2012, p. 424.
[11] Kamikawa, 2018, pp. 85–89.
[12] Cabinet Office, Government of Japan, 2019, pp. 6–8.
[13] Interview with Yukio Edano, December 10, 2011.
[14] Interview with Kiyotaka Takahashi, November 15, 2019.
[15] Related Deputy Ministers' Meeting on the State of Government Crisis Management Organization, 2015.

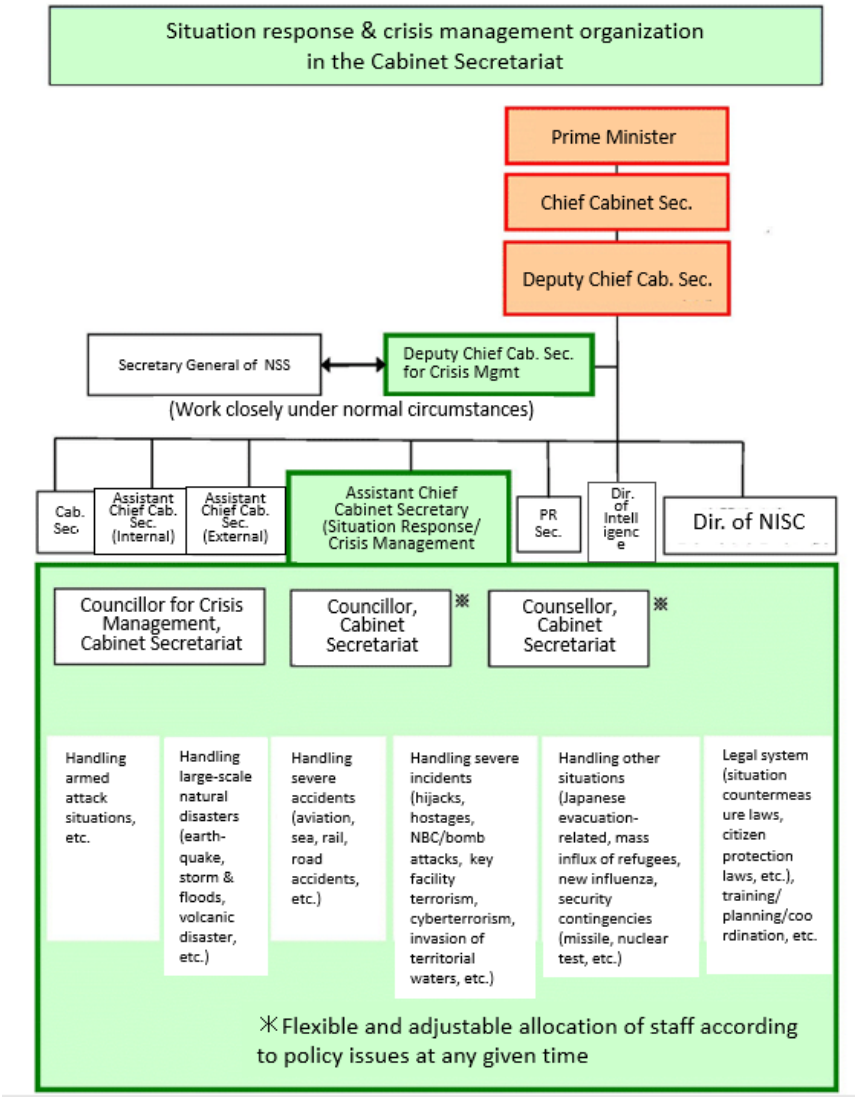
evacuees and public relations (crisis communication),[16] Deputy Chief Cabinet Secretary for Crisis Management Tetsuro Ito and Deputy Chief Cabinet Secretary Tetsuro Fukuyama (Political Affairs), and Goshi Hosono, Special Advisor to the Prime Minister, took charge of the nuclear accident and the evacuation of residents[17], Assistant Deputy Chief Cabinet Secretary Tetsuya Nishikawa (Security and Crisis Management), and Special Advisor to the Prime Minister, Manabu Terada took charge of the earthquake and tsunami[18] (another Deputy Chief Cabinet Secretary in charge of political affairs changed from Hirohisa Fujii to Yoshito Sengoku on March 17, and Sengoku was in charge of disaster area support[19].) After that, when the Japan-U.S. Joint Coordination Meeting began as a forum for bilateral talks over the Fukushima nuclear accident from March 22nd with the U.S., Hosono effectively served as Japan's top leader[20] (chaired by Fukuyama[21]). While it can be said to have been successful in responding to the compound crisis of a natural disaster and a nuclear disaster, initial nuclear accident response work focused as a result around Deputy Chief Cabinet Secretary for Crisis Management Ito[22] on formulating resident evacuation plans, securing safe evacuation locations, and cooperating with the Self-Defense Forces and fire agency.

Today, it is said that the Chief Cabinet Secretary plays the central role in the event of an emergency, and there is a system in place to coordinate and communicate between the top Kantei officers.[23]

The Deputy Chief Cabinet Secretary for Crisis Management and the Cabinet Security and Crisis Management Office engaged in crisis management working under the leadership of these Kantei heads have traditionally been limited in manpower compared to the increase in their workload, and they are also in charge of security.

When the NSC replaced the old Security Council on December 4, 2013 and along with that, the NSS was established on January 7, 2014, the Cabinet Security and Crisis Management Office was reorganized into the Situation Response Office and an Assistant Deputy Chief Cabinet Secretary (Situation Response and Crisis Management)[24]. Only a part of the old Cabinet Security and Crisis Management Office joined the NSS (other staff were a net increase), and the rest of the old Cabinet Security and Crisis Management Office were able to specialize in situation response and crisis management in the Situation Response Office.

[16] Funabashi, 2013, p. 82; Funabashi 2014, p. 243.
[17] Funabashi, 2013, p. 182; Hosono et al., 2012, p. 33.
[18] Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, p. 33; Interview with Takahashi Kiyotaka, November 15, 2019; Hosono et al., 2012, p. 33.
[19] Nihon Keizai Shimbun, 2011.
[20] Isobe, 2019, pp. 192–193.
[21] Fukuyama, 2012, p. 133.
[22] Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, p. 112.
[23] Interview with Kiyotaka Takahashi, November 15, 2019.
[24] Regarding the NSC see: Chijiwa, 2015.



[Figure 2] Situation response & crisis management organization in the Cabinet Secretariat
(Source) Cabinet Secretariat homepage,
https://www.cas.go.jp/jp/gaiyou/jimu/fukutyoukanho.html

If a nuclear disaster occurs and a management headquarters is established, the Deputy Chief Cabinet Secretary for Crisis Management will continue to serve in these headquarters. In addition, following the Fukushima nuclear accident, a system is now in place to set up a Kantei Team (described later) at the secretariat of the Nuclear Disaster Management Headquarters, its deputy head being the Councillor for Crisis Management of the Situation Response Office. In the Related Ministerial Bureau Directors Meeting (Kantei Crisis Management Center[25]), which is to be newly placed under the Management Headquarters, in addition to the Councillor for Crisis Management of the Situation Response Office being a member, the Deputy Chief Cabinet Secretary for Crisis Management also attends at the request of the chairman (Cabinet Office Director General for Nuclear Disaster Management (see below)[26]. According to Tetsuya Yamamoto, who served as the Director General for Nuclear Disaster Management in the Cabinet Office from 2017 to 2019, at the meeting of the concerned bureau directors, since "the cooperation of the bureau directors [of the related ministries] cannot be obtained only by the statement of the director general, who is the secretariat in charge of the Cabinet Office's Nuclear Disaster Management," using some "initiative" and the presence of the Deputy Chief Cabinet Secretary for Crisis Management there, it was thought overall coordination

[25] Interview with Tetsuya Yamamoto, November 22, 2019.
[26] Cabinet Office, Government of Japan, 2019, p. 67, 69.

among the related ministries could be expected[27], and the leadership of the Deputy Chief Cabinet Secretary for Crisis Management was important even in such situations (it has been pointed out that this is related to the seniority and rank of the director general[28]). In addition, when a management headquarters other than a Nuclear Disaster Management Headquarters is set up, the Situation Response Office will function as the secretariat together with the Cabinet Office (Disaster Management).

Regarding the level of staff training in the Cabinet crisis management department, it can be said to have been favorably evaluated regarding the response of the Emergency Assembly Team for the Fukushima nuclear accident with the National Diet Accident Investigation regarding the team as being accustomed to emergency response, and coordination between related ministries and agencies promptly.[29] According to Kiyotaka Takahashi, former Deputy Chief Cabinet Secretary for Crisis Management, "the level of initial response has definitely improved during the Heisei Era (1989-2019)"[30] and "measures for natural disasters are more sophisticated."[31]

In addition, in the Fukushima nuclear accident, a point was raised about the usability of the Kantei Crisis Management Center (In fact, in the case of a suspicious ship off Noto Peninsula on March 23, 1999, when the Defense Agency actually used the central command post, a defect was discovered that external phone lines could not call in.[32]) Partly because mobile phones cannot be used in the Kantei Crisis Management Center for information protection[33], in the Fukushima Nuclear Power Plant accident, the crisis management command tower was split off from the Crisis Management Center and set up on the fifth floor of the Kantei (Prime Minister Kan and other top Kantei officials left the Crisis Manager Center and used the fifth floor of the Kantei as a command post). On the other hand, information was gathered around the Deputy Chief Cabinet Secretary for Crisis Management[34], but he could not always participate in discussions on the fifth floor of the Kantei when the Emergency Assembly Team he was in charge of were chasing after the earthquake and tsunami. Conversely, it seems that the Emergency Assembly Team in the Crisis Management Center could not fully grasp the results of discussions on the fifth floor.[35] As a result, a participant said, "If the top political chiefs at the Kantei couldn't do it, then the Deputy Chief Cabinet Secretary for Crisis Management was called." [36] Because of this inadequate information transmission, evacuation order plans were considered separately on the fifth floor of Kantei and the Crisis Management Center.[37] In addition, the top political chiefs at the Kantei independently made arrangements for the power supply vehicles to restore the power supply, an area that the Crisis Management Center was capable of handling and was, in fact, currently addressing.[38]

Regarding this point, the Prime Minister and the Chief Cabinet Secretary now enter the Crisis Management Center for the initial action in emergency situations and subsequent milestones, and in other cases, staff members from the Deputy Chief Cabinet Secretary for Crisis Management down are to go the fifth floor of the Kantei and explain,[39] the establishment of a "situation room function" proposed by the Independent Accident Investigation not yet being installed. However, unlike the

[27] Interview with Tetsuya Yamamoto, November 22, 2019.
[28] Interview with Nobushige Takamizawa, February 4, 2020.
[29] The National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission, 2012, p. 296.
[30] Nihon Keizai Shimbun, 2018.
[31] Nihon Keizai Shimbun, 2018.
[32] National Institute for Defense Studies, 2017, p. 184.
[33] Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, p. 105.
[34] Funabashi, 2013, p. 383.
[35] Cabinet Office, Government of Japan, 2012, p. 369.
[36] Isobe, 2019, p. 184.
[37] Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, p. 190.
[38] The National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission, 2012, p.327.
[39] Interview with Kiyotaka Takahashi, November 15, 2019.

Ministry of Economy, Trade and Industry's Nuclear and Industrial Safety Agency (NISA), which was supposed to assist the Kantei with a nuclear disaster at the time of the Fukushima nuclear accident but "had no foothold in the Kantei", a room has subsequently been prepared in advance in the Kantei's Crisis Management Center for the Nuclear Regulatory Agency and the Cabinet Office (Nuclear Disaster Management) where agency staff can standby, and on-site data can also be sent directly to the Kantei.[40]

The Fukushima nuclear accident also led to a review of the relationship between the national government and local governments regarding crisis management. In the Fukushima nuclear accident, it has been pointed out that there was insufficient cooperation between the Kantei and local governments[41] since not only was the local off-site center damaged, but the Kantei was also not fully aware of the function of the off-site center, so the function of local management headquarters was not restored, and this led to an attitude on the local government side that the state would take the lead in disaster response.

Today, a local management headquarters is to be established at the off-site center in cooperation with the Nuclear Disaster Management Headquarters Secretariat, and a system is in place to dispatch a deputy minister (or parliamentary secretary) of the Cabinet Office as the general manager to coordinate.[42] Operations have been revised so that the off-site center does not have large powers of delegation, and major judgments regarding the evacuation of residents will be made at the Kantei.[43]

Furthermore, in recent years, in addition to relevant ministries and agencies, annual disaster management training has been conducted by assembling crisis management officers from prefectures and designated cities, meetings are held with the Cabinet Secretariat, the Cabinet Office (Disaster Management), Metropolitan Tokyo and neighboring prefectures for the case of an earthquake directly under the capital, and central government personnel with experience in crisis management are dispatched as advisors to the heads of city, town and village municipalities.[44]

In addition, the revision of the Disaster Management Basic Plan by the Central Disaster Management Council on March 31, 2015, stipulated the strengthening of cooperation and integrated operations between the Nuclear Disaster Management Headquarters and the Extreme Disaster Management Headquarters. Separating the management headquarters for each situation is rational in dealing with a compound crisis. Since the members of both headquarters are almost the same, holding a joint conference for both headquarters would centralize decision-making. In actual fact, on September 3rd and 4th, 2017, a comprehensive nuclear disaster management drill for the Kyushu Electric Power Genkai Nuclear Power Plant took place with a joint meeting of the Nuclear Disaster Management Headquarters and (in case of an emergency) the Major Disaster Management Headquarters set up in the Cabinet Office (Disaster Management) (an Extreme Disaster Management Headquarters would be set up in the case of a "remarkable and serious emergency disaster").[45]

Human Resources

Political leadership seems to have a large personal element. In the long-term administration that has followed, not only was crisis management listed as a selling point, but the Prime Minister eventually gained a wealth of experience in crisis management. In fact, under the Kan Administration, the Deputy Chief Cabinet Secretary for Crisis Management changed once, the Assistant Chief Cabinet Secretary (Security and Crisis Management) twice, and under the Yoshihiko Noda Administration,

[40] Ibid; E-mail interview with Tetsuya Yamamoto, June 16, 2020.
[41] Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, pp. 157–158.
[42] Cabinet Office, Government of Japan, n.d.
[43] Interview with Tetsuya Yamamoto, November 22, 2019.
[44] Interview with Kiyotaka Takahashi, November 15, 2019.
[45] Cabinet Office, Government of Japan, 2019, pp. 6–8.

both changed once. In the Second Administration of Shinzo Abe, under a single Prime Minister and Chief Cabinet Secretary, the Deputy Chief Cabinet Secretary for Crisis Management was replaced four times and the Assistant Chief Cabinet Secretary (Security and Crisis Management)/(Situation Response/Crisis Management) was replaced five times.

Looking at personnel policy in the bureaucracy, it is customary that most government employees move to their next post within a period of about two years, but in March 2015, *The State of Government Crisis Management Organizations (Final Report)* pointed out that for the Situation Response Office and the Cabinet Office (Disaster Management) "this tendency is remarkable because although actual staff numbers are not high, the number of staff seconded from other ministries is great," and as such, "it is difficult for the organization to accumulate expertise in disaster management and crisis management." According to Nobushige Takamizawa (Director of the Defense Policy Bureau at the Ministry of Defense at the time of the Fukushima nuclear accident), who was the Assistant Chief Cabinet Secretary (Situation Response/Crisis Management) from 2013 to 2016, staff have had extended tenures, returned to Japan, made a temporary comeback, or been relocated from public corporations in crisis management measures following the Kumamoto earthquake. In addition, the importance of building a database was recognized, in which the current location of crisis management personnel, those who know the area, are in special fields, and have personal connections and experience is given.[46] Furthermore, the Cabine **What has changed in the Kantei: Legal system, organization, personnel** t Office (Disaster Management) is establishing a (reserves) register of staff seconded to the Cabinet Office (Disaster Management) from other areas of the Cabinet Office, the Ministry of Internal Affairs and Communications and the Ministry of Land, Infrastructure and Transport in an effort to secure human resources in the event of a disaster. However, methods for securing personnel to be deployed to each management headquarters secretariat and to the field are still under consideration, including replacement personnel.[47] It appears that some ministries and agencies actually register personnel involved in the comprehensive nuclear disaster management drill as a "post title" rather than as a "person's name" for staff who have been seconded to the Cabinet Office (Nuclear Disaster Management).[48]

3. What has changed in the Kantei: Legal system, organization, personnel

It is said that the secretariat of the Nuclear Disaster Management Headquarters (NISA) did not function in the Fukushima nuclear accident.[49] On the day of the disaster, it took more than two hours from the time TEPCO notified the Kantei of a Special Measures Concerning Nuclear Emergency Preparedness Act Article 15 event until the declaration of a nuclear emergency. However, Prime Minister Kan did not fully understand that issuing this declaration was a prerequisite for all accident response (public announcement of areas where emergency measures should be implemented to protect residents, establishment of nuclear disaster management headquarters/secretariat/local management headquarters, etc.), and the people surrounding the Prime Minister, including those in charge of the NISA who were there, did not have basic knowledge about issuing a nuclear emergency declaration, and could not fully explain the meaning to the Prime Minister.[50] In addition, when the fifth floor of the Kantei, including the Minister of Economy, Trade and Industry, Banri Kaieda, questioned the Secretariat of the Nuclear Disaster Management Headquarters on March 12 about why a direct vent to outside was not being implemented to lower pressure in the containment vessel, they

[46] Interview with Nobushige Takamizawa, February 4, 2020.
[47] Related Deputy Ministers' Meeting on the State of Government Crisis Management Organization, 2015, pp. 6, 14, 17–18.
[48] Interview with former Deputy Manager of the Cabinet Office (Nuclear Disaster Management), November 29, 2019.
[49] Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, p. 394; Funabashi, 2013, p. 357.
[50] The National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission, 2012, p. 302, 306.

did not explain the situation.[51] They were also unable to make a proposal to the fifth floor of the Kantei about setting evacuation areas after March 11.[52]

Therefore, under the Act to Establish a Nuclear Regulation Authority enacted on June 20, 2012, the Nuclear Regulation Authority that took over the functions of the former NISA and the Cabinet Office's Nuclear Safety Commission on September 19 of the same year, and its secretariat, the Nuclear Regulatory Agency, was newly established as an external agency of the Ministry of the Environment, the agency to serve as the secretariat of the Nuclear Disaster Management Headquarters. In addition, on October 14, 2014, the Order for Organization of the Cabinet Office was revised, and a Cabinet Office Director General for Nuclear Disaster Management responsible for centralizing overall coordination with related ministries and agencies for nuclear disaster management during normal times and in emergencies, and a staff group (Cabinet Office (Nuclear Disaster Management)) were established to serve the secretariat function of the Nuclear Disaster Management Headquarters together with the Nuclear Regulatory Agency. The establishment of the Nuclear Regulatory Agency and a Cabinet Office Director General for Nuclear Disaster Management is recognized by the Cabinet crisis management department as "a very big thing".[53]

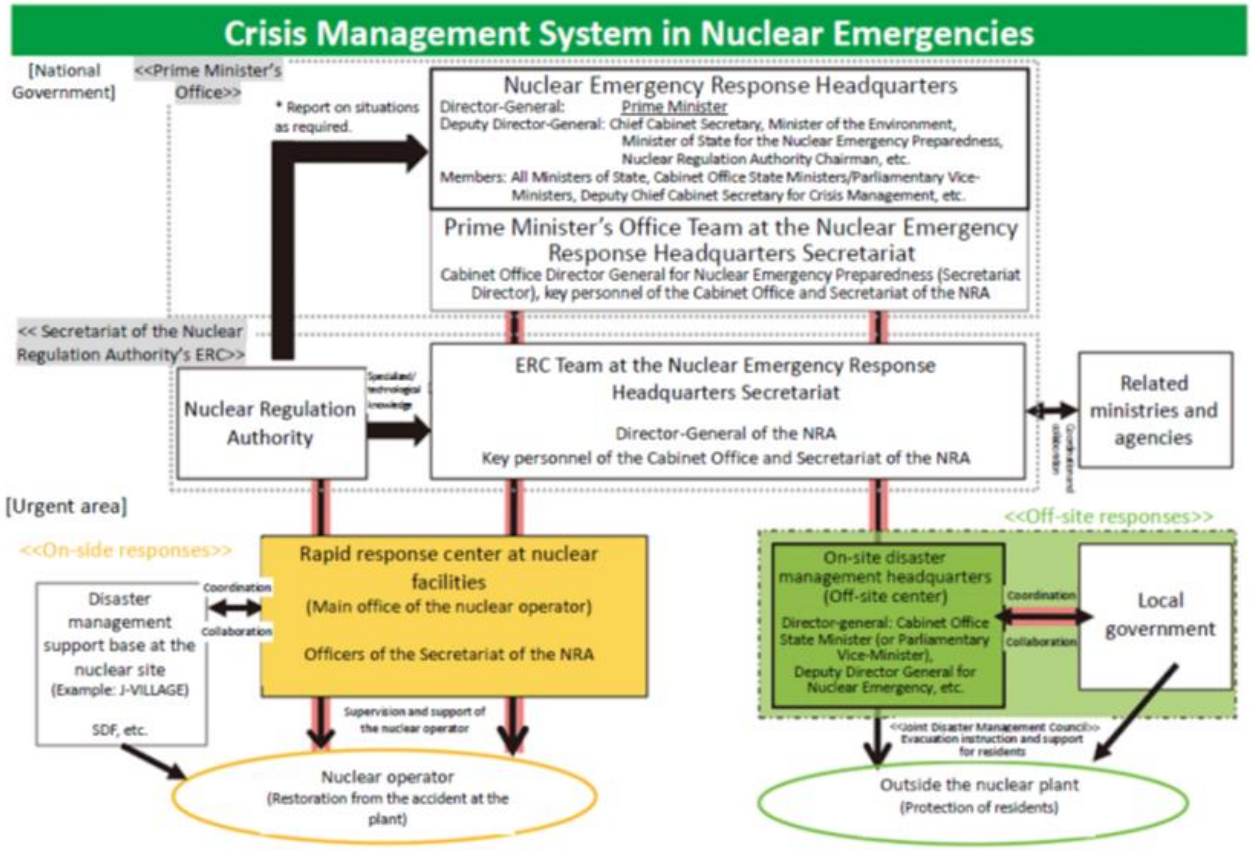
At the Nuclear Disaster Management Headquarters Secretariat, the Cabinet Office (Nuclear Disaster Management) is in charge of establishing and operating the headquarters, and the Nuclear Regulatory Agency provides specialist and technical knowledge.[54] Originally, when the Nuclear Regulatory Agency was inaugurated, the staff of the Nuclear Regulation Authority was concurrently assigned to the Cabinet Office (Nuclear Disaster Management), but according to Tetsuya Yamamoto, a former Cabinet Office Director General for Nuclear Disaster Management, it was decided to separate the two and establish a dedicated organization for a director general in the Cabinet Office because Kasumigaseki (Japan's Whitehall) felt that it was "very uncomfortable" that a regulatory agency called the Nuclear Regulatory Agency fulfilled the overall coordination function between related ministries.[55]

It has been pointed out that in the Fukushima nuclear accident, there was insufficient coordination between NISA and the Kantei (the Emergency Assembly Team). For example, information on the plant was originally to be collected by the secretariat of the Nuclear Disaster Management Headquarters at the Emergency Response Center (ERC) of the NISA, transmitted to the NISA staff dispatched to the Kantei's Response Office and shared with the Kantei. However, because NISA's executives were dealing with the secretariat of the Nuclear Disaster Management Headquarters and the fifth floor of the Kantei, it was not possible to have the executives stay with the Emergency Assembly Team.[56]

Today, there is a system in place where the Nuclear Disaster Management Headquarters Secretariat has not only a "Nuclear Regulatory Agency ERC Team" led by a councillor from the Nuclear Regulatory Agency, but also a Kantei Team led by the Cabinet Office Director General for Nuclear Disaster Management.[57] However, the Kantei Team consists of 20-30 liaison officers, and the core of the secretariat is the ERC Team, which consists of 100-200 people.[58] In addition, when advanced coordination by relevant ministries and agencies is required under the Nuclear Disaster Management Headquarters, the Cabinet Office Director General for Nuclear Disaster Management is to hold the

[51] Ibid., p. 310.
[52] Ibid., p. 321.
[53] Interview with Kiyotaka Takahashi, November 15, 2019.
[54] Cabinet Office, Government of Japan, n.d.
[55] Interview with Tetsuya Yamamoto, November 22, 2019.
[56] The National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission, 2012, p. 296.
[57] Cabinet Office, Government of Japan, n.d.
[58] Interview with Tetsuya Yamamoto, November 22, 2019.

afore-mentioned related bureau directors meeting separately from the secretariat and coordinate overall.[59] Furthermore, the Nuclear Regulation Authority reports on the situation directly to the Nuclear Disaster Management Headquarters, if necessary, providing a redundant mechanism.[60]



[Figure 3] Crisis management system in nuclear emergencies
(Source) *White Paper on Disaster Management* 2019,
http://www.bousai.go.jp/en/documentation/white_paper/2019.html

Liaisons are to be dispatched to each of the two secretariats (the Nuclear Regulatory Agency ERC and the Cabinet Office (for Disaster Management)) and information sharing networks are to be mutually introduced to centralize information collection as well as to direct and coordinate local operational organizations and unify rescue and life-saving activities, and support for victims.[61] In September 2017, the nuclear disaster management drill for the Kyushu Electric Power Genkai Nuclear Power Plant tested not only the joint meeting between the task force headquarters but also integrated operations at the secretariat level.[62] Additionally, bearing in mind rapid decision-making by unifying the initial response at the Kantei, in a decision by the Nuclear Disaster Management Council Secretary Meeting on October 19, 2012, the Nuclear Disaster Response Manual saw strengthening the secretariat system in the Nuclear Disaster Management Headquarters to support the Kantei's decision-making, and ensuring quick information gathering and decision-making at the Kantei as a lesson from the Fukushima nuclear accident. As Kiyotaka Takahashi, former Deputy Chief Cabinet Secretary for Crisis Management and also a Cabinet Secretariat Councillor for Crisis Management at the time of the Fukushima nuclear accident, said, "What was the most troublesome thing when actually dealing with 3.11 was that there wasn't any kind of 'manual' ", so he regards this

[59] Cabinet Office, Government of Japan, 2019, pp. 69–70.
[60] Cabinet Office, Government of Japan, n.d.
[61] Cabinet Office, Government of Japan, 2015.
[62] Cabinet Office, Government of Japan, 2019, pp. 6–8.

as an important point of improvement[63], and the manual has been revised almost every year thereafter.

Moreover, the Nuclear Disaster Management Headquarters Secretariat Kantei Team is to have an operational response team (consisting of personnel seconded from the Self-Defense Forces, police, fire agency, etc.[64]) in charge of liaison with ministries with operational organizations.[65]

On the other hand, it was pointed out that the role of the Nuclear Safety Commission and Cabinet Secretariat advisors remained unclear in terms of science and technology assistance and advisory functions to top members of the Kantei in the accident at the Fukushima Nuclear Power Plant,[66] the Independent Accident Investigation recommending the establishment of a science and technology evaluation organization (function). On July 7, 2011, a proposal made by the NSC and Intelligence Subcommittee of the Democratic Party's Diplomacy and National Security Investigation Committee, which was the ruling party at the time, also posited the establishment of a "science and technology advisory group" in the NSC.[67]

Regarding this, the Nuclear Regulatory Agency currently plays this role in nuclear disaster management.[68] According to Shunichi Tanaka, who chaired the Nuclear Regulation Authority from 2012 to 2017, the assistance and advisory functions in terms of science and technology related to nuclear disasters have been improved through the development of monitoring posts.[69]

4. Public relations and communication

Regarding crisis communication by the officials at the Kantei, Chief Cabinet Secretary Edano held a daily press conference in the Fukushima nuclear accident, as described above, and on Twitter, the hash tag "#edano_nero" [Edano, get some sleep] was added generating quite a response.[70] However, the expression "have no immediate effect" that Edano and others used repeatedly in explaining the effects of radiation on the human body at press conferences was controversial among listeners because of its ambiguity.[71] Regarding the expression "event like an explosion" that was used by Edano at the press conference following the hydrogen explosion in the Unit 1 reactor building on March 12, Edano was forced to come up with this himself and not a nuclear expert.[72]

Acknowledging the difficulty of crisis communication, which uses many technical terms that are not familiar to the general public, the Independent Accident Investigation called for the coordination of public relations systems between departments and the timely and appropriate dissemination of necessary information in order for the government to win trust as an information provider responding to public anxiety about a nuclear accident.[73]

Even today, especially after the establishment of the Nuclear Disaster Management Headquarters, since the government is responsible for responding to nuclear disasters, it is a general rule that the

[63] Interview with Kiyotaka Takahashi, November 15, 2019.
[64] Interview with Tetsuya Yamamoto, November 22, 2019.
[65] Cabinet Office, Government of Japan, 2019, p. 176.
[66] Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, p. 310, 312; Funabashi, 2013, p. 193, 357; Cabinet Office, Government of Japan, 2012, p. 62.
[67] Democratic Party of Japan, Diplomacy and National Security Investigation Committee, NSC and Intelligence Subcommittee, 2011.
[68] Interview with Kiyotaka Takahashi, November 15, 2019.
[69] Interview with Shunichi Tanaka, November 20, 2019.
[70] Funabashi, 2013, pp. 154-157.
[71] Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, p. 126.
[72] Fukuyama, 2012, p. 79.
[73] Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, pp. 144–145.

Chief Cabinet Secretary holds press conferences as the government spokesman (however, in the event of a nuclear emergency, it is expected that the prime minister will issue the declaration in the form of a press conference, which has also been carried out in the Nuclear Emergency Management Drill).[74]

In this regard, during the term of Kiyotaka Takahashi as Deputy Chief Cabinet Secretary for Crisis Management (2016-2019) and in the context of reducing the burden on the Chief Cabinet Secretary, a proposal was considered where the Chief Cabinet Secretary was in charge of public relations to some extent, but the Cabinet Public Relations Secretary or Assistant Deputy Chief Cabinet Secretary (Situation Response/Crisis Management) assisted him and the relevant ministries and agencies would handle their own individual cases. Takahashi said the intention here was to avoid a situation where "things would be delayed if the Chief Cabinet Secretary wasn't there for decisions he was involved in, or the PR timing would be drawn out and delayed." However, he said, "there are stories that a PR Secretary can handle, and stories that require the Chief Cabinet Secretary as a politician," so it remained unresolved.[75] At present, after a press conference by the Chief Cabinet Secretary, the Nuclear Regulatory Agency will explain the technical and specialized contents by setting up a public relations officer in a conference room at the Agency.[76]

Additionally, in the Fukushima nuclear accident, the Kantei reported discomfort about the fact that Councillor Koichiro Nakamura said "There is a possibility of core meltdown" at a NISA press conference on March 12, the officer in charge being replaced in what was rumored to essentially be a dismissal and it also being pointed out that this led to widespread skepticism among the public regarding the government's PR.[77]

Regarding this point, from the standpoint of carrying out government crisis communication using "one voice", after April 25, joint press conferences started being held at the government and TEPCO Integrated Management Headquarters by NISA, the Nuclear Safety Commission, the Ministry of Education, Culture, Sports, Science and Technology and TEPCO.[78] In addition, following the Great East Japan Earthquake, the off-site center became less important from the perspective of creating one-voice in crisis communication.[79]

5. NSC: Safety and Security

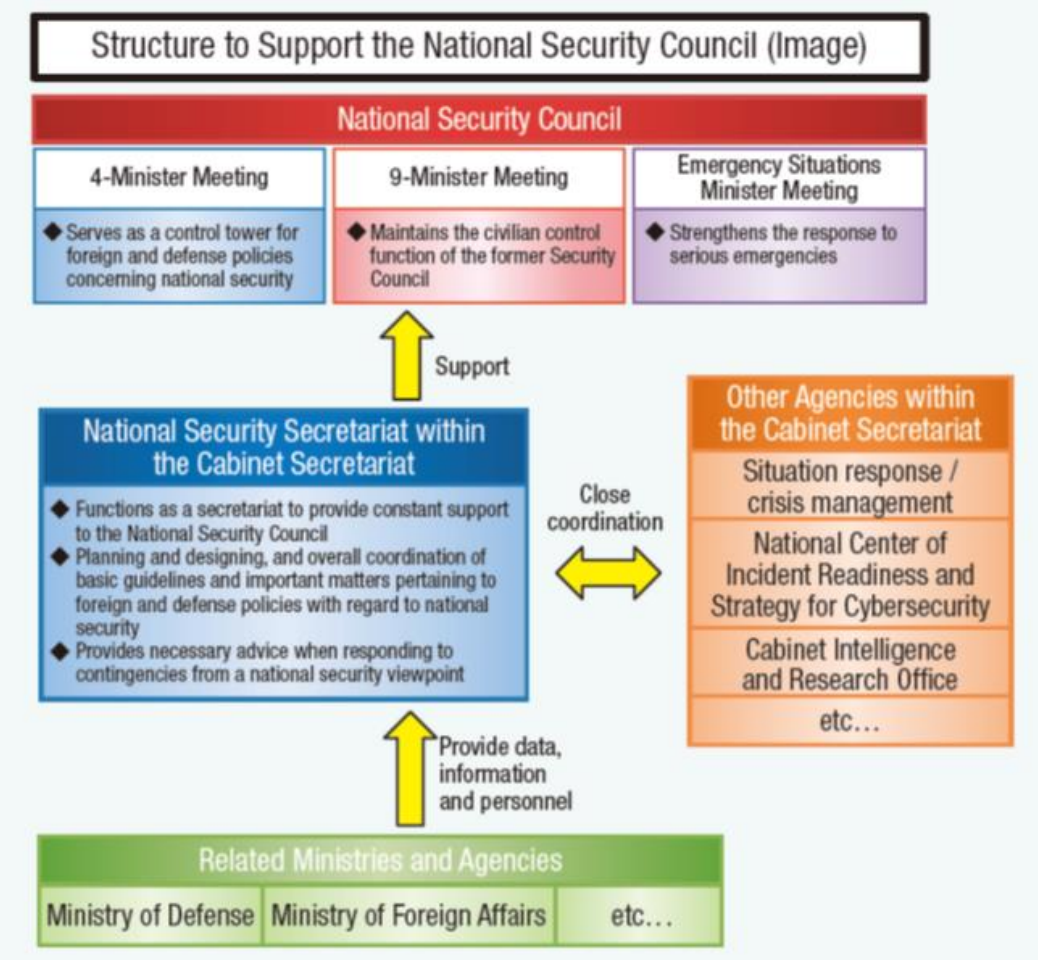
The NSC's predecessor, the Security Council, was not convened in the Great East Japan Earthquake. This is because it was said that the Security Council was not in charge of natural disasters[80] (based on the Basic Act on Disaster Countermeasures response to natural disasters comes under the jurisdiction of the Central Disaster Management Council). However, there was criticism from the opposition parties and others on not convening the Security Council following the Great East Japan Earthquake.[81] Thinking existed, for example, that with 100,000 Self-Defense Forces mobilized, the Security Council should have been held as an opportunity for the Chief of the Joint Staff, who is the highest-ranking Self-Defense Forces officer and who assists the Defense Minister in the operation of the Ground, Maritime, and Air Self-Defense Forces to express his opinions before the relevant

[74] Email interview with Tetsuya Yamamoto, January 16, 2020.
[75] Interview with Kiyotaka Takahashi, November 15, 2019.
[76] Interview with Tetsuya Yamamoto, November 22, 2019.
[77] Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, pp. 123–126.
[78] Hosono et al., 2012, p. 136
[79] Naoya Sekiya, an associate professor at the University of Tokyo, informed me of this point.
[80] House of Representatives, 1986.
[81] Question asked by Hiroyuki Arai at the 177th House of Councilors Special Committee proceedings no. 3 on Government Development Assistance, 2011, March 24; Question asked by Takashi Uto at the 177th House of Councilors Special Committee proceedings no.3, 2011, March 31.

ministers as a “related person” prescribed under the Security Council Establishment Act. The convening/non-convening of the Security Council itself is the subject of political debate here.

The establishment of the NSC in December 2013 was mainly due to national security demands such as China's military strengthening and marine advancement, as well as a response to North Korea's foreign policy brinkmanship. The hostage incident in Algeria on January 16, 2013, where an Islamic armed force killed nine Japanese nationals at a natural gas refining plant, also accelerated the momentum for its establishment.[82] When the NSC was established, disasters in the order of the Great East Japan Earthquake were to be deliberated at the NSC's Emergency Situations Minister Meeting (comprising the Prime Minister, the Chief Cabinet Secretary, and ministers designated in advance according to the type of situation). In addition to the Prime Minister and Chief Cabinet Secretary, for example, it is believed that in addition to the Minister of State for Disaster Management, others who may also attend the emergency situation minister meeting include the Minister of State for Nuclear Emergency Preparedness, the Minister of Environment, the Minister of Defense, the Chairman of the National Public Safety Commission, and the Minister of Internal Affairs and Communications, other interested parties starting with the Joint Chief of Staff, the Deputy Chief Cabinet Secretary for Crisis Management, and the Chair of the Nuclear Regulation Authority (NSS will serve as the secretariat). And discussions will be held at this venue, including “whether there is a vacuum”, that is, “whether there is a problem in terms of national security”.[83] In fact, when the Hokkaido Eastern Iburi Earthquake occurred on September 6, 2018, reconnaissance aircraft from a neighboring country flew in, and the Air Self-Defense Force are said to have taken anti-air space invasion measures[84], reminding us once again of the importance of securing response capabilities for compound disasters comprising a natural disaster and national defense.

[82] Yomiuri Shimbun, 2013.
[83] Interview with Kiyotaka Takahashi, November 15, 2019.
[84] Sankei Shimbun, 2018.



[Figure 4] Organization of National Security Council
(Source) *Defense White Paper*, 2019
https://www.mod.go.jp/e/publ/w_paper/wp2019/pdf/DOJ2019_2-1-3.pdf

Regarding the relationship between the NSC/NSS and the Cabinet's crisis management and Situation Response Room, coordination between the NSS Secretary General and the Deputy Chief Cabinet Secretary for Crisis Management, the concurrent assignment of the Assistant Chief Cabinet Secretary (Situation Response/Crisis Management) as a Deputy Secretary General of the NSS, and coordination between the NSS No. 3 Policy Group and the Situation Response Office all contribute to unified operations.[85]

The Cabinet Secretariat, which includes the NSS and the Cabinet's crisis management department, also acts as a contact point with the U.S., which is an ally in times of crisis. In the Guidelines for Japan-U.S. Defense Cooperation (2015 Guidelines) formulated on April 27, 2015, Japan-U.S. cooperation in dealing with large-scale disasters in Japan is called for, and it is assumed that activities at the time will be coordinated through an Alliance Coordination Mechanism (ACM), and as part of this, representatives on the Japanese side from the Ministry of Foreign Affairs, the Ministry of Defense and the Cabinet Secretariat will participate in the Alliance Coordination Group (ACG) of directors, section managers, and officers in charge (representatives from the NSC will participate on the U.S. side).[86] In fact, as a backdrop to the formation of the Japan-U.S. Joint Coordination Meeting at the time of the Fukushima nuclear accident, questions were raised by surrounding persons of the Prime Minister and the Chief Cabinet Secretary and the U.S. Ambassador to Japan, John Roos about the multidimensional nature of relations between Japan and the U.S. side, and it was proposed that

[85] Cabinet Office, Government of Japan, 2013.
[86] Ministry of Foreign Affairs, n.d.

the Kantei take the leadership in bringing them all together.[87]

6. Subsequent crisis management: major earthquakes, floods, infectious diseases

Next, let us consider the Kumamoto Earthquake, heavy rainfalls in western Japan, and COVID-19 as case studies for the crisis management system at the Kantei following the Fukushima nuclear accident. Certainly, these cases have different attributes to a nuclear disaster, but some suggestions may be obtained.

1) Kumamoto Earthquake

In the Kumamoto Earthquake that occurred at 1:25 on April 16, 2016 (the foreshock was 21:26 on the 14th) and caused 50 deaths, the Kantei Response Office was set up at 21:31 on the 14th, and the Emergency Assembly Team was convened and the Major Disaster Management Headquarters was set up at 22:10. Also, in contrast to the Security Council not being convened after the Great East Japan Earthquake, a NSC 4-Minister Meeting (Prime Minister, Chief Cabinet Secretary, Foreign Minister, Defense Minister) was held on April 21 regarding the response of the Self-Defense Forces in the case of Kumamoto Earthquake.[88] Then on April 23, a site visit by Prime Minister Abe was conducted.

In the Kumamoto Earthquake, a Cabinet Office Information Advance Team including councillors from the relevant ministries was dispatched to the Kumamoto Prefectural Office from April 14. They were also known as the "K9", and they said they had results like, "when someone at the director-general level goes to the ministry to inform them of local needs, the ministry will firmly accept the request and things will move very smoothly."[89] The former Minister of Economy, Trade and Industry executive involved in this said, "I came home totally convinced that unless we have actual onsite experience [at 3.11], we can't adjust or set up a system."[90] On April 16th, the Procurement and Transportation Team was set up at the Major Disaster Management Headquarters, and related ministries and agencies gathered to carry out centralized coordination as well as procure and transport materials without waiting for requests from the disaster area. So-called "push-type" material support was implemented. This push-type goods support is based on the amended Basic Act on Disaster Management, which was enacted on June 27, 2012, following the Great East Japan Earthquake.[91]

In addition, as the Major Disaster Management Headquarters unified their intentions regarding emergency measures by the whole government, a Victim Life Support Team headed by the Deputy Chief Cabinet Secretary was set up on April 17, consisting of administrative vice-ministers, as a practical command tower to implement the measures decided there. On the following 18th, the Liaison and Coordination Group was set up under the same team, which consisted of directors and section chiefs from related ministries and agencies, and was operated by the Cabinet Secretariat. Group meetings were held in the Deputy Chief Cabinet Secretary's office at the Cabinet Secretariat almost every day for about a month, the Minister of State for Disaster Management also joining halfway through. Confirmation of issues and response statuses at related ministries and agencies, identification of new issues and examination/instructions for additional countermeasures were carried out in real time with a sense of immediacy, and is said to have supported prompt information sharing, adjustment, and judgment by the government.[92] Actions by the related ministries and agencies were also quick, and some say that the system built by the government during the Great East Japan

[87] Isobe, 2019, pp. 95–97.
[88] Prime Minister Office, Government of Japan, n.d.
[89] Interview with Kiyotaka Takahashi, November 15, 2019.
[90] Interview with former executive of the Ministry of Economy, Trade and Industry, February 27, 2020.
[91] Cabinet Office, Government of Japan, 2016, pp. 8–9.
[92] Initial Response Inspection Team for the 2016 Kumamoto Earthquake, 2016, p. 3, pp. 20–21.

Earthquake worked.[93] Takahashi, who became the Deputy Chief Cabinet Secretary for Crisis Management after the Kumamoto Earthquake, said, "In the beginning of [the Heisei Era], the emphasis was on rescue activities in collaboration with operational ministries [sic] such as the police, the fire agency, the Self-Defense Forces, and the Japan Coast Guard. Since Kumamoto, efforts such as supplies and provision of information to the victims are starting to move including all ministries and agencies."[94]

Furthermore, in the Kumamoto Earthquake, the Japan-U.S. alliance coordination mechanism was utilized, and the first U.S. disaster relief support in line with the 2015 Guidelines was established. The integrated task force of the Self-Defense Forces, organized to respond to the earthquake, established a Japan-U.S. Joint Coordination Center in the field, and cooperated in transporting daily necessities by the MV-22 Osprey and Self-Defense Forces personnel by the transport aircraft C-130.[95]

On the other hand, it is said that since the Kumamoto Earthquake occurred immediately after the annual spring personnel change in the central government, the response from the Situation Response Office was inadequate. Therefore, a manual has subsequently been provided in advance to those moving to the Situation Response Office, with thorough training conducted immediately after the transfer.[96]

2) Heavy rains in West Japan

263 people were killed by the heavy rains that hit Western Japan from June 28th to July 8th, 2018. The government had held disaster warning meetings for the related ministries and agencies on an intermittent basis from July 2, the Kantei Liaison Office being set up at 13:58 on the 6th, and a meeting of ministers from the related ministries and agencies held on the 7th. At the relevant ministerial meeting, the Kantei Liaison Office was upgraded to the Kantei Response Office at 10:20 on the same day. Furthermore, at 8 o'clock on July 8, the Major Disaster Management Headquarters was set up. After July 11, a site visit by Prime Minister Abe took place.

As in the case of the Kumamoto Earthquake, even in the case of heavy rains in Western Japan, a Cabinet Office Information Advance Team was dispatched to the field (Hiroshima Prefectural Office, Okayama Prefectural Office, Ehime Prefectural Office) (after July 7), and a Victims Life Support Team was set up (July 9). Push-type goods support was implemented (on July 10, an Emergency Supplies Procurement and Transportation Team was established under the Disaster Victims Life Support Team).[97]

In terms of crisis communication, the Meteorological Agency held an extraordinary press conference on July 2. It is unusual for the Japan Meteorological Agency to hold a press conference other than for disasters such as an earthquake or typhoon, but there were also scenes where the forecaster called directly on residents to evacuate.[98]

3) COVID-19

COVID-19, which was confirmed to have occurred in Wuhan, China at the end of 2019, spread to all parts of the world including Japan in 2020.

On January 16th, the Japanese government established an Information Liaison Office at the Kantei Crisis Management Center (upgraded to the Kantei Response Office on the 26th) and dispatched the

[93] Kojima, 2018, p. 72.
[94] Nihon Keizai Shimbun, 2018.
[95] Nihon Keizai Shimbun, 2016; Ministry of Defense, 2016.
[96] Interview with Kiyotaka Takahashi, November 15, 2019.
[97] Cabinet Office, Government of Japan, 2019.
[98] Asahi Shimbun, 2019.

first charter flight to return Japanese residents in Wuhan to Japan on the 28th. On the 30th, the COVID-19Management Headquarters headed by the Prime Minister and the COVID-19ManagementHeadquarters Secretary Meeting chaired by the Deputy Chief Cabinet Secretary for Crisis Management were set up to respond.[99] Furthermore, on the 31st, the first NSC Emergency Situations Minister Meeting was held.[100] At the Headquarters, which was convened on February 12, NSS proposed a flexible entry refusal system that could promptly take port call and landing measures if target areas and passenger ships, etc. were reported to the Management Headquarters and made public without having to go through cabinet deliberations each time, which was approved.[101]

However, according to reports, the Prime Minister changed to a top-down decision-making method because of criticism of a cruise ship that suffered mass infection and an insufficiently aggressive basic government policy announced on February 25.[102]

On February 27, the Prime Minister requested all primary, junior and senior high schools as well as special needs schools be closed at once without prior consultation with the Ministry of Education, Culture, Sports, Science and Technology. The Prime Minister also announced on March 5 that he would strengthen immigration restrictions from China and South Korea, and on the 10th, based on the application of Item 14, Paragraph 1, Article 5 of the Immigration Control and Refugee Recognition Act it was decided by the NSC and Cabinet to expand the target area of the restricted entry scheme to include parts of South Korea, Iran and Italy, and all areas of San Marino.[103] On the 13th, the Revised Act on Special Measures for Pandemic Influenza and Other Infectious Diseases Preparedness and Response was enacted, and the Prime Minister was able to issue an Emergency Declaration with restrictions on private rights. The Prime Minister himself attended press conferences on February 29 and March 14. Top-down responses continued including the decision to postpone the Tokyo Olympic Games, scheduled for 2020, via a telephone conference between Prime Minister Abe and Thomas Bach, President of the International Olympic Committee on March 24. The Government Management Headquarters was set up on the 26th.

Then, at the COVID-19 Management Headquarters Meeting held on April the 7th, the Prime Minister announced a state of emergency and the situation entered a new phase. The distinctive point here is the fact that both preventing the spread of infection and maintaining economic activity were important issues as symbolized by the appointment of Yasutoshi Nishimura, the Minister of State for Economic Revitalization, along with Katsunobu Kato, the Minister of Health, Labor and Welfare, to be in charge of countermeasures for COVID-19. Concerning the above dilemma, coordination had to take place between decisions made at the Kantei level and each of the 47 prefectural governors, each with their own circumstances. Furthermore, compared to other countries, unlike the lockdowns seen in the U.S. and Europe or the management of personal information by the state using a tracking alert application as in China, the Act on Special Measures for Pandemic Influenza and Other Infectious Diseases Preparedness and Response scheme's approach insisted on "self-restraint" and respect for the protection of privacy.

On April 1st, the Economic Group was established in the NSS, the Secretariat being required to become actively involved in COVID-19 countermeasures.[104] Originally, the NSS was supposed to work closely with the Situation Response Office, and was to respond to a wide range of national

[99] Prime Minister Office, Government of Japan, 2020a; Prime Minister Office, Government of Japan, 2020b. Regarding the Japanese Government's response to COVID-19 see: Independent Investigation Commission on the Japanese Government's response to COVID-19, 2020.
[100] Prime Minister Office, Government of Japan, 2020b.
[101] Prime Minister Office, Government of Japan, 2020c.
[102] Yomiuri Shimbun, 2020.
[103] Prime Minister Office, Government of Japan, 2020c, pp. 1–2.
[104] Nihon Keizai Shimbun, 2020.

security issues not limited to diplomacy and defense, but if the NSS is involved in the details of COVID-19 countermeasures, this will create certain issues including manpower issues and questions of how to align this with the NSS's original mission, such as the formulation of national security strategies from a medium- to long-term perspective spanning the purvey of multiple ministries, as well as how to demarcate with the Situation Response Office that is originally responsible for crisis management operations.

7. Improving the crisis management system at the Kantei: Ten implications

While "lessons" from the Fukushima Nuclear Power Plant accident led to various advances in "preparedness" in the crisis management system at the Kantei as we have seen, several issues suggested by case studies conducted after the accident remain.

First is the nature of the prime minister's leadership. Looking at ideal leadership by the prime minister in a crisis, which is said to be largely dependent on the individual, it is most likely required that not only should the prime minister acquire crisis management skills under normal circumstances by participating himself in drills,[105] but there should also be agreement amongst his followers beforehand on the basics of what actions and decisions are going to be required of the leader during a crisis. Especially now that manuals for dealing with nuclear disasters have become quite thorough, it should probably be kept in mind that political decisions will be required from the heads of government, especially the prime minister, when a situation not covered by the manual occurs.

Second, concentration of work on a small number of managers can be considered an issue. In particular, since in the event of an emergency, the Chief Cabinet Secretary plays a central role in a system where the heads of the Kantei involved in crisis management deal with it in a unified manner, tasks can be expected to converge on him. It cannot be said that no doubts remain as to whether the Chief Cabinet Secretary, who is extremely busy, will be further overwhelmed by crisis communication such as press conferences. For example, it may be possible to narrow down or clarify the division of duties by examining whether the press conferences could have been done by someone other than the Chief Cabinet Secretary in past cases.[106]

Connected to this is the issue of how to delineate the roles of political affairs and administrative affairs for government officials involved in crisis management. At the time of the Fukushima nuclear accident, when top government officials gathered over the TEPCO withdrawal issue, it was not the government leaders who said, "This is where TEPCO must hold out," but Deputy Chief Cabinet Secretary for Crisis Management Ito.[107]

Koichi Isobe (Chapter 6 author), who was the director of the Defense Plans and Policy Department (J-5) of the Joint Staff at the time of the Fukushima nuclear accident, said, "I think it needs to be clarified what we are going to do when we reach the stage where political decisions cannot be made with the authority given to the Deputy Chief Cabinet Secretary for Crisis Management."[108] Isobe also noted the need to prescribe in advance the participation in the ACG of top Kantei political brains, witness the case of Goshi Hosono, Special Advisor to the Prime Minister, who for all intents and purposes headed the Japan-U.S. Joint Coordination Meeting at the time of the Fukushima nuclear accident.[109]

[105] Isobe, 2019, p. 255.
[106] Interview with Nobushige Takamizawa, February 4, 2020.
[107] Funabashi, 2013, pp. 316–317.
[108] Isobe, 2019, p. 192.
[109] Ibid., pp. 192–193.

Third is cooperation between the Kantei and the nuclear operators. Regarding this point, the final report of the Government Accident Investigation states "it is not appropriate for the government and the Kantei to intervene in field responses in the form of spearheading from the outset."[110] However, it is also true that given the recognition of the risk of a steam explosion, decisions like the water drop into the Unit 3 fuel pool by Self-Defense Forces helicopter on March 17 could not be made by the nuclear operator, but had to be the government or the Kantei.[111] The postponement of the planned power outage by TEPCO, which was scheduled for the morning of March 14, also reflects the intent of the Kantei in consideration of patients receiving medical treatment at home using artificial respirators.[112] Regarding cooperation between the Kantei and the nuclear power companies, the Independent Accident Investigation viewed the establishment of the Integrated Management Headquarters by the government and TEPCO on March 15 as having greatly shortened the information transmission route and promoted rapid collection and sharing of information.[113] However, the Independent Accident Investigation also points out that it is not necessarily clear whether the legal grounds for establishing the Integrated Management Headquarters were covered by the right of instruction of the prime minister' (as head of the Nuclear Disaster Management Headquarters) in Paragraph 2, Article 20 of the Act on Special Measures Concerning Nuclear Emergency Preparedness.[114]

While on the one hand there is a tendency to regard the Integrated Management Headquarters as a special case at the time, the point should not be forgotten, as Dr. Charles Casto, who was dispatched to Japan by the U.S. Nuclear Regulatory Commission (NRC) at the time and cooperated with the accident response, points out, "dialogue within the government alone was not enough".[115] Regarding the way information is shared between the Kantei and the nuclear operators, it is necessary to assume that political leadership will be required beyond the technical and specialist capabilities of the Nuclear Regulation Authority.

Further regarding the relationship between the Kantei and the nuclear operators, the Prime Minister is to issue instructions based on the Act on Special Measures Concerning Nuclear Emergency Preparedness in the "exceptional situation of an emergency",[116] but according to Tetsuya Yamamoto, former Cabinet Office Director General for Nuclear Disaster Management, the prime minister's instructions are "the last resort", and the government's on-site response should in principle be "not too much intervention by politicians", but the Nuclear Regulation Authority should do this from a purely technical perspective, and the primary responsibility for dealing with a nuclear accident lies solely with the nuclear operators, establishing something along the lines of an integrated management headquarters not being considered.[117] The Nuclear Regulation Authority's standpoint shows a similar awareness.[118] As regards TEPCO's perception, on the other hand, a company executive remarks, "In the end, we can only focus our advance [preventative] efforts so that such difficult things never happen again." "Of course, even if we're taking action after the fact, we have to put in place a route within the scope of accident response that will allow us to put an end to the accident without placing the lives of our workers at risk."[119] Prime Minister Kan, who understood that TEPCO was about to withdraw at the time of the Fukushima nuclear accident, rode roughshod into the TEPCO

[110] Cabinet Office, Government of Japan, 2012, p. 374.
[111] Funabashi, 2013, p. 409, 415.
[112] Fukuyama, 2012, pp. 96–101, 185.
[113] Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, p. 106.
[114] Ibid., p. 107.
[115] Interview with Charles Casto, August 26, 2019.
[116] Cabinet Office, Government of Japan, n.d.
[117] Interview with Tetsuya Yamamoto, November 22, 2019.
[118] Interview with Shunichi Tanaka, November 20, 2019.
[119] Interview with executive of TEPCO, November 27, 2019.

headquarters early in the morning of March 15, saying, "You're all involved. Please put your lives on the line."[120] Who will ultimately order to put the operators' life on the line is still undetermined ten years on.

Fourth is the Kantei "situation room function". Whereas the Kantei Crisis Management Center is a working room where staff from each ministry talk with each other, the function of the situation room is to allows political leaders to make quiet decisions based on selected information and options together with the staff in charge and other specialist staff.[121] A section of the Kantei Crisis Management Center has already been prepared in advance for staff of the Nuclear Regulatory Agency and the Cabinet Office (for Nuclear Disaster Management), but regardless of what the administration or situation, it is necessary to continuously study how to build a good hardware system that is easy to use in crisis management including the connection between the Center and the fifth floor of the Kantei.

Fifth, there is a difference in capability and experience between the center (Kantei) and local governments. This makes it difficult for the center (Kantei) and local governments to cooperate smoothly. Local government does not have the same structure as the central Emergency Assembly Team.[122] In this regard, it is expected that local governments' crisis management capabilities can be improved through training, meetings, staff secondment etc., all of which have been implemented following the Fukushima nuclear accident.

Sixth is the smooth transition from an initial response system led by the Kantei to a permanent response system by the departments in charge. In order to prepare for emergency situations where the crisis management system of the Kantei may go into force at any time, operations are to be gradually transferred to the Cabinet Office etc. as the situation calms down. Yamamoto points out that the issue of "how to pass the baton" from the Emergency Assembly Team to the relevant directors at the Nuclear Disaster Management Headquarters is a problem. Regarding this point, tests were also conducted at the Nuclear Power Disaster Management Drill for Kyushu Electric Power Genkai Nuclear Power Plant and the Chugoku Electric Power Shimane Nuclear Power Plant on November 8-10, 2019, but Yamamoto remarked, they haven't "been able to train to the point where the chips are down, so they need to improve training under severe conditions," adding, "what should be given priority in the case of a compound disaster?"[123]

Seventh is preparation for "a yet to be experienced crisis". Former Deputy Chief Cabinet Secretary for Crisis Management Takahashi noted, "[...] Despite being prepared for various situations including a catastrophic disaster in the capital, a large-scale cyber attack, and a pandemic of new influenza, they'll be difficult to deal with."[124] "How to deal with a situation we haven't dealt with before? I think it'll be up to the whole department, not just the crisis manager and staff, but the prime minister too," says Takahashi.[125] In crisis management, the use of imagination, as well as the preparation of manuals is necessary.

Eighth is the personnel policy for crisis management staff. In addition to extending the term of office of staff in the Situation Response Office recommended after the Kumamoto Earthquake, as well as the creation of a database, preparing incoming officers, and the expansion of a registration system for staff seconded to the Cabinet Office (Disaster Management) as proposed in the final report of *The State of the Government's Crisis Management Organization* in March 2015, it will be necessary for relevant ministries and agencies to consider how to secure personnel, carry out post rotation

[120] Kan, 2012, p. 115.
[121] Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, p. 394.
[122] Interview with Kiyotaka Takahashi, November 15, 2019.
[123] Interview with Tetsuya Yamamoto, November 22, 2019.
[124] Nihon Keizai Shimbun, 2018.
[125] Interview with Kiyotaka Takahashi, November 15, 2019.

simulations, and rotate personnel differently from normal times.

Ninth is the enhancement of science and technology assistance and advisory functions for the Kantei. Yasuhisa Shiozaki, a member of the Lower House, who led the establishment of the National Diet Accident Investigation and was involved in the establishment of the Nuclear Regulation Authority, points out the problem of "politics that don't believe science is in control".[126] Top members of the Kantei have pointed out with regard to crisis management that there are issues regarding usability, such as the fact that specialists do not have a coherent view, even when it comes to assistance and advisory functions in terms of science and technology.[127] On the other hand, in the case of the U.S., for example, there are posts with assistance and advisory functions such as the Assistant to the President for science and technology, and since a highly qualified scientist with academic networks is appointed to serve as the director of the Science and Technology Policy Bureau, they can explain the scientific and technological awareness of the crisis and proposals for countermeasures to the President independently of the cabinet based on the various opinions of experts (it is well known that this contributed to the White House's decision-making on pandemic measures as well as the Fukushima nuclear accident).[128] This type of science and technology assistance and advisory function on crisis management for the Kantei would be convenient for leaders at the Kantei and serve as a hub for expert networks,[129] and at the same time, in terms of crisis communication, it is hoped that this key post would be filled by an expert authority who would gain the trust of the public. In addition, science and technology assistance and advisory functions on crisis management for the Kantei should not be limited to nuclear power, but also include AI (artificial intelligence) and so-called "new domains" such as space, cybernetics, and electromagnetic waves, it being preferable to have human resources who support the National Security Strategy from a science and technology perspective.[130] Long-term human resource development in the field of science and technology bearing these things in mind will be an issue for the future.

The tenth task is to improve crisis communication, that is, smooth communication between the government and the people in a national crisis, backed by a high degree of expertise. For example, the Nuclear Regulation Authority has a scientific and technical assistance function for leaders at the Kantei in the event of a nuclear disaster, but to date there has been no clear decision about the Chairman of the Nuclear Regulation Authority holding a press conference during a nuclear disaster. However, nuclear disaster response is an extremely specialized field, and although it is natural that the Nuclear Regulatory Authority will play a role in crisis communication, there is also the view that it would be better to clarify that role publicly.[131] However, just as the Japan Meteorological Agency exerted its crisis communication function during the heavy rains in Western Japan, there is room for consideration as to whether the Nuclear Regulation Authority should also have an advanced crisis communication function. At such a time, although a joint press conference with the Chief Cabinet Secretary and the Chairman of the Nuclear Regulation Authority has not so far been envisaged,[132] whether this is possible (it is not legally prohibited[133]) should be looked into from the point of view of the government speaking with one voice while paying attention all the while to the independence of the Nuclear Regulation Authority as an Article 3 Committee under the National Government Organization Act. In addition, physical relocation from office spaces to press conference venues is considered to be a time loss in times of crisis, so it will be necessary to devise measures such as

[126] Interview with Yasuhisa Shiozaki, March 17, 2020.
[127] Interview with Kiyotaka Takahashi, November 15, 2019.
[128] Interview with Shunsuke Kondô, March 10, 2020.
[129] Interview with Nobushige Takamizawa, February 4, 2020.
[130] Ibid.
[131] Interview with Shunichi Tanaka, November 20, 2019.
[132] Email interview with Tetsuya Yamamoto, January 16, 2020.
[133] Ibid.

introducing online meeting tools to prevent this loss of time.[134]

In a national crisis, not only crisis management but national governance is also essential

If a severe accident such as the Fukushima nuclear accident occurs again in the future, the Kantei crisis management system will respond as follows. First, at the Kantei Crisis Management Center, under the supervision of the Deputy Chief Cabinet Secretary for Crisis Management, the Emergency Assembly Team and the Situation Response Office will deal with the initial response (after that, as the situation transits, it will be transferred to the Cabinet Office (Nuclear Disaster Management)). If it is found that the accident is difficult to deal with in the Kantei Response Office set up in the Kantei's Crisis Management Center, the NSC Emergency Situation Minister Meeting will be held in the Kantei, and a Nuclear Disaster Management Headquarters will be established. The Prime Minister will decide on important matters regarding the response to the situation, and leaders at the Kantei involved in crisis management will respond in a unified manner centered on the Chief Cabinet Secretary. If cooperation with the U.S. is required, the Cabinet Secretariat will send a representative to the ACG.

The Cabinet Office (Nuclear Disaster Management) and the Nuclear Regulatory Agency will serve as the secretariat for the task force, and the relevant directors' meetings etc. will assist as necessary. If other management headquarters have been set up in a compound crisis such as the Fukushima nuclear accident, response will be centralized at the headquarters and secretariat level (the Situation Response Office and the Cabinet Office (Nuclear Disaster Management) perform the secretariat functions). Through the Management Headquarters Secretariat, cooperation with local operational organizations will be supported and cooperation with local governments and nuclear operators will be achieved via the local management headquarters.

As mentioned at the outset, Japan has adopted the principle of shared management based on Article 66, Paragraph 3 of the Constitution as the basic principle for its governing mechanism. For example, debate on establishing a Japanese version of FEMA saw a negative conclusion drawn in the final report of *The State of the Government's Crisis Management Organization* in March 2015, but the report states, "Depending on the content of disasters and accidents, etc., each ministry and agency with operational units (the Police Agency, Fire and Disaster Management Agency, Ministry of Land, Infrastructure, Transport and Tourism, Japan Coast Guard, Ministry of Defense), the Nuclear Regulation Authority, and each ministry with disaster management related departments, *are to share the response in each of their respective jurisdictions*…" (author's emphasis).[135] On the other hand, as the report states here, "Regarding crisis management response in the government, (..) [Under the control of the Deputy Chief Cabinet Secretary for Crisis Management], the Cabinet Secretariat (Situation Response/Crisis Management) and the Cabinet Office (Disaster Management) are to carry out overall coordination from the perspective of the entire government," so by the Kantei taking the lead in dealing with the initial response to crisis in a cross-ministerial manner, the Kantei's crisis management system can be said to be a device that mitigates the crisis management risk of the late 19th to the early 20th Century Meiji legacy of the shared management principle in government. It can be said that this seeks to do the best possible within the framework of the current constitution and its lack of emergency clauses.

Be that as it may, in the event of a national crisis, governance and leadership are required that differ greatly from those in normal times. Following the Great East Japan Earthquake, Prime Minister Kan sounded out on March the 18th the then leader of the opposition LDP, Sadakazu Tanigaki, about forming a coalition government. This attempt failed,[136] but in a national crisis, with of course comprehensive coordination between the related ministries and agencies centering on the NSC, it

[134] Interview with Nobushige Takamizawa, February 4, 2020.
[135] Related Deputy Ministers' Meeting on the State of Government Crisis Management Organization, 2015, p. 1.
[136] Kan, 2012, pp. 135–137.

may be necessary to go beyond and temporarily shelve political parties' conflicts of interest to form a national unity cabinet along the lines of the distinguished British leader Winston Churchill during World War II, especially in the political circumstances of a "divided diet," that opposition parties control the House of Councillors.

In the Fukushima nuclear accident, Japanese "civil-military" leaders such as Prime Minister Kan and Ryoichi Oriki, Chief of the Joint Staff, were frightened that Japanese sovereignty might be threatened by foreign powers if Japan itself was unable to overcome this national crisis.[137] I mentioned earlier that, even after ten years, the answer as to who should order to put the operators' lives on the line in the extreme situation of a nuclear disaster still eludes us, but leaving it all up "to the throw of a dice" as at the end of World War II should never be repeated, not only in terms of national crisis management but also in terms of national governance.

Summary

The Kantei's crisis management system, in which the Kantei mainly takes charge of the initial response to the crisis across ministries and agencies, has only been in place since the mid-1990s. The Fukushima nuclear disaster provided many lessons for the Kantei's crisis management system, which only had such a short history and grew from the actual experience of dealing with the situation.

From the "lessons" advances in the "preparedness" at the level of the Kantei's crisis management system via the legal system, organization, human resources, assistant and advisory functions, public relations and communication, and NSC review are to be commended.

On the other hand, as can be seen from the case studies after the Fukushima nuclear accident, issues remain that harbor "risk" including the prime minister's leadership style, the concentration of work on a small number of officers, the demarcation of roles between senior Kantei political officers and administrative officers, coordination between the Kantei and the nuclear power operators, the Kantei's "situation room function", the gap in capabilities between the Kantei and local government, transition from the initial response system, preparedness for "yet to be experienced crises", personnel policies for crisis management staff, enhancement of the scientific and technical advisory support function at the Kantei for crisis management, and the nature of crisis communication by the Kantei.

In Japan, the principle of sharing management based on Article 66, Paragraph 3 of the Constitution has been adopted as the basic principle of the governing mechanism. However, in the event of a national crisis, governance and leadership that are very different from those in normal times are required. It can be said that the crisis management system in the Kantei is a device that mitigates the risk of the shared management principle in crisis management by taking a system in which the Kantei plays a central role in initial actions in a crisis across ministries. As a way of governance and leadership in a national crisis, it is still a challenge to fulfill the integrated coordination function of the Cabinet for crisis management at the lead of the Kantei, thereby overcoming the so-called "vertical division of administration" which is also a risk of the shared management principle.

[Appendix]
The contents of this article are the views of the author alone and do not represent the views of the institution to which the author currently belongs or has previously belonged to.

[137] Ibid., pp. 112–113, Isobe, 2018, p.126.

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Chapter 5: The Logistics of Responding to a Nuclear Emergency

Yuki Kobayashi

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Introduction: The Fukushima nuclear accident was a defeat of logistics
1. To make or break the site: logistics is the key
2. Onagawa Nuclear Power Plant and Fukushima Daini: a victory for information sharing and logistics
3. Review of logistics systems
4. "Worst Scenario": safety and security
5. France FARN and the Mihama Emergency Support Center
6. Issues involved with a "Japanese version of FEMA"

Summary
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Introduction: The Fukushima nuclear accident was a defeat of logistics

The Fukushima Daiichi Nuclear Power Plant accident that occurred on March 11, 2011 revealed a flaw in both the hardware and software provisions of the electric power company, which is expected to be "primarily responsible for responding to an accident"[1]. Not only were all the AC power supplies lost due to flooding by the tsunami and the three reactor cores go into meltdown, it also became dysfunctional in terms of what should be the results of daily training, such as who was responsible for commanding the accident response and sharing information. Furthermore, because the nuclear power plant where the accident occurred (on-site) and the response base (off-site) were not well coordinated, the supply of necessary materials and equipment for accident response was delayed, and even after equipment arrived at the site, the nuclear power station staff were unable to operate it, the spread of the accident unable to be curbed. In other words, logistics did not work effectively in response to the Fukushima Daiichi nuclear accident. In this chapter, we analyse the factors that caused logistics to malfunction, and examine how Japanese and other overseas nuclear power plant operators perceived the problem after the accident and implemented improvement measures.

Logistics is a military term that refers to general operations related to the procurement, supply, maintenance, and repair of military equipment and the transportation, deployment, and management of personnel and equipment. It consists of three elements: supply, transportation, and management. Soldier capabilities are classified into self-sufficient, locally procured, and supply base types.[2] As mechanization has progressed, however, the self-sufficient and locally procured types are no longer effective means of combat. In the Fukushima Daiichi Nuclear Power Plant accident, in addition to being incapable of self-sufficiency or local procurement both in terms of equipment and personnel deployment, the power company's head office as well as the government's backup systems were undeveloped.

Not only in terms of remorse for the Fukushima Daiichi Nuclear Power Plant accident, but also in many historical cases, a lack of understanding about the importance of logistics has influenced the fate of Japan. One typical example is the former Japanese Army in the Pacific War, which took logistics lightly and suffered one defeat after another[3]. It is no exaggeration to say that logistics in

[1] Investigation Committee on the Accident at the Fukushima Nuclear Power Stations of Tokyo Electric Power Company, 2012, p.5.
[2] Heitan [Military Logistics] in *Encyclopedia Britannica Japan*. Accessed May 13, 2020.
[3] Funabashi, 2014.

preparation for emergencies is the most important issue in Japan's national crisis management.

In the wake of the accident and following its investigation by various committees, the Nuclear Regulation Authority was established in Japan in September 2012, separate from and independent to the Nuclear Power Utilization and Promotion Department[4]. Overseas countries that use nuclear energy also reviewed their regulatory standards and strengthened safety. Reading the new regulatory standards in Japan and abroad, you will not find any substantial difference from the perspective of "lessons learnt" from the accident: "businesses must strengthen their prior preparations in order to stop a nuclear power plant runaway."[5] However, regarding how "learning" is linked to actual "lessons", interesting differences can be observed at home and abroad.

Looking mainly at the nuclear accident response team (Force d'Action Rapide Nucléaire: FARN) set up by French electric power companies as an overseas case and the Nuclear Emergency Support Center (Mihama, Fukui Prefecture) as a domestic case, we will examine the problems of information sharing at the time of an accident, and then focus on specific examples of efforts to improve logistics capabilities by electric power companies in Japan and the world. Finally, by highlighting the differences between Japan and overseas, especially differences in business and government preparedness for a "worst case", we will consider how Japan should improve its emergency and response capabilities.

1. To make or break the site: logistics is the key

Even if a supply network for goods and equipment from off-site to on-site is set up, it is impossible to supply the necessary materials at the required time if information cannot be shared between on- and off-site, and the on-site side does not have the ability to gather and appropriately convey information on the reactor situation and the predicted progress of an accident. In highly specialized science and technology facilities such as nuclear power plants, the work is often overly specialized and manualized, which leads to unexpected situations. What did the operator learn from the information gathering and logistics problems in the Fukushima Daiichi Nuclear Power Station emergency response headquarters at the time of the accident, and how has the emergency system been revised?

Difficulties in sharing information in an emergency

If equipment and personnel cannot be procured at the disaster site, the provision of a supply system is another component of logistics capabilities, and it is important that appropriate information is communicated and shared on-site and off-site. In the response to the Fukushima Daiichi Nuclear Power Plant accident, however, it was severely pointed out that information sharing did not work well and led to a delay in the response.

As described in detail in Chapter 2, at the time of the Fukushima Daiichi Nuclear Power Plant accident, there was not sufficient communication between the shift supervisor, who is the general manager of the central control room, and the main engine operator responsible for operating the nuclear reactor regarding whether the Unit 1 cooling system (Isolation Condenser: IC) was operating or not[6]. As a result, although the operators in the central control room were leaning towards a judgment that the "IC was not working", this perception was not conveyed to the emergency control headquarters (in the anti-seismic building) as the general consensus of the control room. The Fukushima Daiichi

[4] Nuclear Regulation Authority, 2016.
[5] Autorité de Sûreté Nucléaire (2017) Follow-up Seminar in Paris. November.
[6] The Technical Committee on Nuclear Power Safety Management in Niigata, 2015.

nuclear accident highlighted not only the difficulty of communicating between on-site and off-site, but also the difficulty of sharing information within the power plant. The reality was that information sharing did not work well among the 27 people, including the director, deputy director and emergency response team manager, seated around the round table in the anti-seismic building, or even among the operators in the central control room controlling the reactor.

About one and a half hours after the loss of all AC power due to the tsunami and the shutdown of the emergency diesel generator at 17:15 on March 11, 2011, an officer from the technical group (analysing the fuel situation in the reactor and the progress of the accident), which was one of twelve emergency countermeasure groups, presented some important information over the microphone at the round table.

"Accident progress prediction at Unit 1 from the technical team: Minus 150 cm at downscale. If the water injection is stopped, it will reach TAF (Top of Active Fuel) in an hour's time."[7]

As stated, immediately prior to this, information that the water level of Unit 1 was "TAF + 250 cm" had been sent from the main control room to the anti-seismic building. It meant that the water level had fallen 400 cm to TAF minus 150 cm in an hour. It was a crucial analysis and prediction that suggested the IC was not working.

However, according to the interview record of (then) Director Masao Yoshida conducted by the Government Accident Investigation, this important information was not shared at all at the round table. When an officer in charge of the accident investigation committee asked about this information, Director Yoshida replied "I didn't hear it", and when the officer showed him the technical team's statement in a chronology obtained from TEPCO, he was at a loss saying, "He must have said it, I suppose", finally hinting at regret that important information had not been shared, saying, "A team leader needs to speak more forcefully."[8]

The emergency response team leaders who were present at this scene recall that the round table of the anti-seismic building ceased to function as a base for gathering information and issuing commands for two reasons.

One was that each group moved vertically and disjointedly, and were unable to cooperate. "Each team was desperate to respond to their own top priority issues and couldn't grasp the overall situation", said an executive, who worked as team leader for the restoration team restoring power and opening the vent valve.[9] At around 17:00 on March 11, Director Yoshida gave top priority to confirming the safety of staff and reporting to regulatory agencies and local governments, and held a meeting with the public relations group with his back to the round table. This recovery team leader said, "I had left the round table and was working on a power recovery plan in the small meeting room next door." Another veteran restoration team leader, who had worked at Fukushima Daiichi Nuclear Power Plant for more than 30 years, called to the small meeting room, saying "let's listen to the information at the round table", but this same group leader revealed that he too "did not remember the remarks of the technical group".[10]

Why did they miss grasping important information even after returning to the round table? Another

[7] Investigation Committee on the Accident at the Fukushima Nuclear Power Stations of Tokyo Electric Power Company, 2011b, p.4.
[8] Ibid. pp.3–7.
[9] Interview with recovery team leader, November, 2016; Ibid., September, 2017; Ibid., April, 2018.
[10] Interview with recovery team leader, September, 2017; Ibid., April, 2018.

reason was that even when an unexpected situation occurred, the group leaders of each group reported according to the manual and could not prioritize information. Immediately after the disaster, the leaders of each group obediently kept to the manual and continued to pass along information unrelated to the accident response over the microphone. The aforementioned recovery team leader explains, "Each team was competing for the microphone, and they were waiting for the microphone to be available." Before and after the remarks of the technical team, non-urgent information such as "buses are being arranged" was constantly being released, and the most important information at that time, which was the prediction of water level change, was buried.

The round table method, in which the director and all the countermeasure group leaders meet together, was considered an indispensable system for sharing information under a premise that work was excessively subdivided, each group having its own technology and work procedures unfamiliar to other groups. In fact, even at the Fukushima Daiichi nuclear accident, a total of 27 directors, deputy directors, and group leaders surrounded the round table, but as the information flood continued, no one could identify the important information. In other words, the noise and the signal were indistinguishable.

In an emergency situation in which unexpected events occur in quick succession, it is not easy even for people in the same group to share information by reporting and confirming their understanding.

The evils of logistics manuals

One of the characteristics of a nuclear power plant where the system is manualized in great detail is that, by repeating training, it becomes possible to fully implement the manual and improve work efficiency. However, the flexibility that allows the organization to respond to unexpected situations tends to be lost in such a system. Not only in information sharing but also in logistics, such characteristics delayed the response to the unexpected. Director Yoshida testified in detail on this during an interview with the Government Accident Investigation. Although somewhat lengthy, it is quoted in full.

"As to whether people in the materials team understood the specifications, they didn't. Since it's the job of the materials team to gather things and they don't know the detailed technical specifications, the recovery team has to provide the specifications. For example, they have to specify how many batteries of what voltage, and how many kW the power supply car has, which makes it pretty difficult. You tell the materials team you want a power supply car or batteries, which the materials team acknowledges, and they then tell the recovery team to hand over the specifications, so the recovery team gives our materials team the specifications, and then, the response is a matter-of-fact one with our materials team telling the materials team at head office to send us such-and-such."[11]

Going by Yoshida's statement, it would be impossible to expect the necessary equipment and materials to arrive at the necessary timing if this kind of exchange was conducted in an emergency. It is easy to understand the reason why the French nuclear accident response force (FARN), which will be described later, emphasizes the importance of standardizing equipment and training so that the necessary gear can be brought in no matter where an accident occurs.

While the countermeasures headquarters in the anti-seismic building was ordering materials in keeping with the manual, the central control room, which was the front line of the accident response, was plunged into complete darkness with the loss of all power, and their dissatisfaction with and

[11] Investigation Committee on the Accident at the Fukushima Nuclear Power Stations of Tokyo Electric Power Company, 2011a, pp.26–27.

distrust of the anti-seismic building grew as basic materials such as batteries ordered many hours ago failed to turn up. The main engine operator of Unit 2 at the time of the accident commented on the atmosphere in the central control room during this time, especially the agitation of the younger operators, "they were whispering to each other, headquarters over at the anti-seismic building is going to abandon us."[12]

The ice drop strategy that completely melted

On the other hand, some cases can be observed in the crisis response to the Fukushima Daiichi Nuclear Power Plant where materials themselves and transportation work were wasted due to material arrangements that did not sufficiently consider the feasibility.

On March 13, 2011, the cooling function of Unit 3 ceased before dawn, making water injection and reactor cooling urgent issues. After many parties including Fukushima Daiichi, the offsite center and Tokyo head office spoke via video conference concerning water sources, water injection measures by fire engines, and what to do about outdoor tasks when the dose increased, at around 8:28 the idea of dumping ice in was proposed by an executive of the Fukushima Daiichi Nuclear Power Station, who was at the local countermeasure's headquarters at the offsite center. The following exchange subsequently took place between head office executives, Director Yoshida, and (then) Managing Director Akio Komori.

Headquarters Government Office Liaison Group: "Anyway, you have to think in parallel, you know, dropping in ice or something."
Director Yoshida: "OK, well then, aaah, get ice. Ice, get it."
Managing Director Komori: "Would that be the materials group? A large amount. Perhaps even head office?"
Director Yoshida: "Materials team, excuse me for a Fmoment. How much would we need, for Unit 1, the more the better, but it'll be difficult to get it in, so I'd be grateful if you could work out the amount and coordinate with the materials team."
Managing Director Komori: "Head office materials team, it may be necessary to procure ice, regardless of whether or not it can be shipped to the power station immediately."[13]

On the same day, a total of 2 tons of ice were ordered from a supplier in Saitama Prefecture, and were transported to the Fukushima Daini Nuclear Power Plant by a helicopter company that was a TEPCO affiliate. As far as the videoconference proceedings are concerned, discussions about the use of ice for the cooling of the spent fuel pool can be seen, but no evidence showed that the details were sufficiently agreed upon. As a result of prioritizing the ice shipment before solidifying concrete measures, everything melted before it could be put into practice. This example of ordering materials without fully considering the feasibility, with every employee sharing the goal of cooling the reactor all the while, tells almost tragically the story of a lack of preparedness for countering an unexpected event in the reactor.

What actions did electric power companies and the government actually take after the Fukushima Daiichi nuclear power plant accident to overcome the many problems witnessed in information sharing and logistics as well as dealing with the unexpected?

Breaking away from fake training

The lack of preparedness for the unexpected was patently clear when looking at the sham made of emergency drills and accident management training before the Fukushima Daiichi nuclear accident.

[12] Interview with main operator, March, 2016.
[13] NHK TV Conference, March 13, 2011 p.75.

Two former recovery team leaders said, “To put it extremely, staff were like scripted actors. In that sense, there is a lot to regret in terms of pre-accident preparation.” “Sometimes the director would adlib something not in the script like ‘Actually, isn’t this kind of phenomenon happening?’ He may have thought the training was too stylized.”[14]

Given the limitations of being unable to respond to the unexpected using their conventional method of predicting damage based on a given assumption and enhancing advance preparations, TEPCO did introduce the Incident Command System (ICS) used in the United States as a standardized emergency response organizational system. Under the ICS, the field commander is at the top, and the number of people reporting directly is three to seven people. Operations in the United States show that the number of people one person can directly issue directives to in an emergency is seven people, and TEPCO has abolished its round table method where a total of 27 group leaders, the nuclear power station director and the deputy director met together.

In the new emergency organization, the power station director is still in charge of the accident response, but he actually issues commands to the reactor recovery supervisors (two per unit), and five other people from information, materials, and general affairs. In addition, the mission of each person in charge is clarified, as are the skills and requirements of people in those positions, education/training to fulfil these requirements being mandated.[15]

After the Fukushima Daiichi accident, TEPCO established an in-house accident investigation committee and published a final report in the summer of 2012. However, as noted in Chapter 2, after its release, engineers unconvinced because it “was just an excuse about the accident response from start to finish”, newly launched a Nuclear Reform Task Force. In March 2013, they put together the so-called Anegawa Plan analyzing the failure of communication concerning Unit 1’s IC and proposing the introduction of ICS. This was based on the idea that, “After the Three Mile Island accident in 1979 in the United States, the personnel system was modified to add experience as a shift supervisor responsible for operating the nuclear reactor as a prerequisite for becoming the director of a nuclear power plant. This should also be considered in Japan.”

However, introducing this into Japan requires an even greater reform of the personnel system that in the United States. The shift supervisor is considered to be a major managerial, non-career (high school graduate) position, while the director is considered to be a post for people who have studied nuclear engineering at university engineering faculties. In the case of the United States and France, if the post becomes vacant due to personnel changes, operators of Navy nuclear submarines can be brought in, but this is not possible in Japan.

The current situation is one where in order to create an organization permeated to the very bottom by the right people fulfilling their duties, and sharing information and responding quickly in an emergency, “blind training with no scenarios has to be repeated continually, and each person has to master how to respond” (recovery team leader[16]). Although creating a flexible organization is endorsed, this is not to say laying down detailed responses in the manual is completely denied. The ability to fully implement the manual through repeated training is the first step of crisis management. How can flexibility also be embedded in the organization to realize responses to the unexpected? This remains an issue in system safety and resilience engineering ten years after the accident.

Yotaro Hatamura, who served as the chairman of the Government Accident Investigation, said,

[14] Interview with recovery team leader, September, 2017; Ibid., April, 2018.
[15] TEPCO, 2013, p.84.
[16] Interview with recovery team leader, April, 2018.

"There is still a lack of awareness in Japan that things that don't come to mind can happen. Training staff is important, but it's more necessary for the director class to be made aware of the unexpected through training so they can respond to unexpected events."[17] Overseas experts also warn that not only the power operators but also the regulatory agencies that supervise the power operators are still too unaware. Charles Casto, head of the U.S. team dispatched to Japan from the U.S. Nuclear Regulatory Commission (NRC) at the time of the Fukushima Daiichi Nuclear Power Plant accident, said, "I would like you to note in writing the seriousness of the fact that the Japanese regulators only assume their role is for normal times. In the event of an emergency, I think the essence of the problem is that regulators have not well thought out what they are to do. They will never leave their bureaucratic mentality behind. As for training, I don't think there is thorough training and expectations on what role the regulatory authorities should play."[18]

2. Onagawa Nuclear Power Plant and Fukushima Daini: a victory for information sharing and logistics

Fukushima Daini: the tactics of experienced reactor operators

At the Fukushima Daiichi Nuclear Power Station, information sharing and logistics did not function in the event of an unexpected accident. In comparison, both Fukushima Daini and Onagawa responded to the unexpected situation with quick action at the accident site. Can we not learn lessons about rapid information sharing and logistics from that response?

Although the Fukushima Daini Nuclear Power Plant escaped a meltdown, the water temperature in the pressure suppression pool increased in Units 1, 2, and 4, forcing them to report an Article 15 event under the Nuclear Emergency Special Measures Act that triggers the declaration of a nuclear emergency by the Prime Minister. In particular, as Unit 1 developed into a situation where venting would be required in another two hours, they had to go so far as to implementing cooling the containment vessel (dry well spray), "a first for world nuclear reactors" (then Superintendent Naohiro Masuda[19]). Although the situation was better than at the Fukushima Daiichi Nuclear Power Plant, it was still an extremely serious accident that would have rocked the world even if the event on March 11, 2011 involved only a single accident at the Fukushima Daini Nuclear Power Plant.

Like the Fukushima Daiichi Nuclear Power Plant, the Fukushima Daini Nuclear Power Plant faced an unexpected emergency. But in terms of crisis management, there was a huge difference between the two nuclear power plants. At Daini, communication was smooth between the emergency countermeasures room in the anti-seismic building and the central control room that controlled the reactor.

A staff member with experience in nuclear reactor operations was dispatched from the countermeasures room to the control room to serve as a liaison. If you are an experienced operator, you can accurately understand what kind of operation is being performed in the control room, and convey the situation and response of the reactor to the countermeasures room without disturbing the crisis response by the control room's shift manager and operators. According to Masuda, the idea was that of the power generation team chief in the countermeasures room (the power generation team is mainly in charge of communication with the main control room), who had experience as an operator in the control room. Masuda said, "The power generation team manager was a professional at operating the nuclear reactor, so I approved it. According to him, there was no way the operators

[17] Interview with Yotaro Hatamura, September 18, 2019.
[18] Interview with Charles Casto, August 26, 2019.
[19] Interview with Naohiro Masuda, December, 2016.

could concentrate on the task at hand if we (the anti-seismic building) kept asking them this and that. So, if that was the case, I thought it would be better to stick someone into the central control room who could report back in a timely fashion to our questions."[20]

Masuda said, "There were things we didn't do well in responding to the crisis, but dispatching a worker who knew how to operate the reactor made interaction with the control room a success. I'd like to see this adopted at all nuclear power plants in the future."[21]

Even in logistics, the Fukushima Daini Nuclear Power Plant took its own measures, not heeding the manual-like exchange between the emergency response teams at the power plant and Tokyo head office. For example, there was a mistake when head office was asked for 4,000 tons of water for cooling the reactor, but 4,000 liters of drinking water were delivered. The drinking water could only be transported to Miharu Town in Fukushima Prefecture, far from the nuclear power plant site. At the time, the Fukushima Daini Nuclear Emergency Response Team remembered that it used to draw water from the Kido River flowing next to the nuclear power plant, and started to restore the pipeline there. When restoring the line by a power supply car, there was a possibility that external refueling activities for the power supply car would not be possible due to the impact of the building explosion at Fukushima Daiichi Nuclear Power Plant, and there was a risk that the water supply would be delayed. As a result, Daini used the prohibited strategy of borrowing electricity from Tohoku Electric Power's power lines. Masuda remembers, "I know Tokyo head office was working hard, but the situation at Daiichi was getting worse, and the situation at Daini was not getting across accurately. So, it was up to us to do it. Using Tohoku Electric Power's electricity was an idea tantamount to stealing, but the person in charge of distribution arranged it for me in just two days. I only have gratitude for Tohoku Electric Power for letting us use their electricity in those circumstances."[22]

Onagawa Nuclear Power Plant: doing away with the videoconference

The Onagawa Nuclear Power Plant was also just a hair's breadth away from a serious accident. Located in Miyagi Prefecture, where a tsunami caused severe damage in the Meiji Sanriku Earthquake (1896) and the Chilean Earthquake (1960), tsunami awareness was higher than at both the nuclear power plants in Fukushima. The distance from the sea's surface became far, and the altitude of the reactor building at the Onagawa Nuclear Power plant was as high as 14.8m (about 10m at the Fukushima Daiichi Nuclear Power Plant), barely avoiding a huge volume of seawater pouring into the site. However, the tsunami damage around the nuclear power plant was serious, and the group that was supposed to take over the shift at the main control room on the day of the earthquake could not get to work, and it took 20 hours until Unit 1 was put into a cold shutdown at 1 am on the 12th. The operators dealt with the crisis unrelieved. During this time, a fire broke out in the Unit 1 turbine building, but the local fire brigade could not be dispatched, so the in-house fire brigade extinguished the fire. After the tsunami hit, neighboring residents who had lost their places of refuge had to be evacuated, so the plant decided to accept residents by opening the gymnasium as an evacuation center during the crisis.

Tohoku Electric Power Co., Inc. also ordered a helicopter stationed at Sendai Airport and owned by an affiliate to take off just before the tsunami hit, preventing it from flooding. This helicopter was used to transport people and materials, including a pregnant women from the Onagawa Plant. Their high level of tsunami preparedness was only highlighted by the fact that a SDF helicopter stationed at Sendai Airport that was meant to be a so-called "first responder" in the event of an emergency was flooded at the airport and could no longer be used.

[20] Ibid.
[21] Ibid.
[22] Ibid.

What should be noted in the response by Onagawa Nuclear Power Plant is its raising doubts about the nature of videoconferencing, which had been considered effective for information sharing.

At the discretion of the emergency response team within the nuclear power plant, the video conferencing system was not turned on. Since communicating with counterparts on a daily basis is the most important aspect of communication in response to an accident, they gave priority to communicating via telephone over a security line. They also note that they refrained from connecting to head office because they were aware that, as a harmful attribute of video conferencing, having senior executives participating in crisis response communication might confuse discussion and debate, which, in turn, might lead to the wrong response priorities.[23]

According to the interview record conducted by the Government Accident Investigation Committee, Director Yoshida often complained about the constant inquiries and directives from the Tokyo head office, who were unable to accurately grasp the situation via the video conference system. Until the situation exceeded the capacity of the site, the Onagawa Nuclear Power Plant's crisis response involving the conservative use of communication via a security line helped to prevent confusion.

3. A review of logistics systems

The Fukushima Daiichi Nuclear Power Plant accident, which amounted to a logistical defeat, forced a revision not only of on-site but off-site support systems. After the accident, a regulatory shakeup took place with the Nuclear Safety and Safety Agency and the Nuclear Safety Commission being dismantled, and a highly independent Nuclear Regulation Authority established as an external agency of the Ministry of the Environment. The government's crisis management system was also revamped.

In the new post-accident crisis response system, the Nuclear Regulation Authority, together with the Nuclear Regulation Authority Secretariat, will concentrate on response support (on-site response) at the power plant where an accident occurs. On the other hand, because the Cabinet Office will coordinate with government as a whole including the relevant ministries and agencies, and carry out disaster response outside the nuclear power plant sites (offsite response) such as the evacuation of residents, a new secretariat heading by a minister for nuclear disaster prevention and a full-time policy director was established comprising some 50 full-time staff.

Up until the Fukushima Daiichi Nuclear Power Plant accident, an approach was emphasized of setting the target area for an Emergency Planning Zone (EPZ) at a radius of 8 to 10 km from a nuclear power plant. Following the accident, the need arose to draw up evacuation plans for considerably more municipalities and resident populations as the Urgent Protective Action Planning Zone (UPZ) was changed to a radius of 30 km from the nuclear power plant. Consequently, the policy director of the Cabinet Office, who is in charge of nuclear disaster preparedness, provides support for disaster prevention planning through discussions with each local government taking into account the characteristics of the nuclear power plants in their respective regions (number of reactor locations, geographical features, population distribution, years of operation, etc.).[24]

Additionally, mimicking the days of the Nuclear Safety and Security Agency, the secretary general of the Nuclear Emergency Response Headquarters, which is set up when an accident actually occurs,

[23] Visit to Onagawa Nuclear Power Plant (by author), November, 2015.
[24] Regarding the nuclear disaster prevention system after the Fukushima Daiichi Nuclear Power Plant, see chapter 1 on "Safety Regulations" written by Akihide Kugo.

was initially to be the secretary general of the Nuclear Regulation Authority, but was changed to the policy director of the Cabinet Office. Regarding this process, Tetsuya Yamamoto, who served as the policy director of the Cabinet Office (in charge of nuclear disaster management) at the time of the Fukushima Daiichi Nuclear Power Plant accident response, pointed out, "It's difficult for the Nuclear Regulation Authority and the Nuclear Regulatory Agency Secretariat to handle all the disaster prevention measures. There are various tasks that have to be performed not only on-site but also off-site. Even taking into consideration the power relationships in Kasumigaseki, it won't be easy for a single regulator like the Nuclear Regulation Authority and the Nuclear Regulatory Agency to coordinate comprehensively."[25] On-site response is a specialized field that requires knowledge of reactor characteristics and nuclear engineering at each power plant, while off-site response such as resident evacuation requires coordination with many ministries. Establishing a policy director in the Cabinet Office to newly assume the task of secretary general of the Nuclear Disaster Headquarters was aimed at speeding up coordination between ministries and agencies as well as strengthening the government's crisis response system so that it can be put into action immediately.

Support for the formulation of regional disaster management plans by the policy director has also shown some progress after the Fukushima Daiichi nuclear power plant accident. Yamamoto commented, "Before the accident, most local government disaster prevention plans were just copies of a template distributed by the government as reference material.[26] Regarding Fukushima Prefecture, the disaster prevention plans for the towns of Okuma and Futaba (where Fukushima Daiichi Nuclear Power Plant is located) were mere shams." Currently, based on the lessons learned from the Fukushima Daiichi Nuclear Power Plant accident, the scope of the evacuation plan has been expanded to a 30km area. Evacuation plans for relevant local governments, including securing evacuation destinations and preparing evacuation means for residents within 30 km, have been formulated for each region with a nuclear power plant. Specifically, the number of residents living within 30 km, especially the number of people needing special attention, is attained, securing transportation means such as welfare vehicles according to the condition of people requiring attention. For the general public, the basic plan is to evacuate via private vehicles, but the required number of evacuation vehicles such as buses is prepared in advance for those who do not have their own vehicle. As for evacuation destinations, facilities suitable for people requiring special attention and facilities for the general public are prepared outside the 30km area.[27] Regarding the evacuation of residents and the supply of goods, he explained, "the local bus association, truck association, and other local governments surrounding the nuclear power plant have individually signed agreements and are preparing a system of cooperation in an emergency."[28] In order to improve the future effectiveness of the agreement, he noted enthusiastically that "they will continue to ensure that the contents of the agreement are understood and constantly revised by having each of these industry groups participate in the comprehensive nuclear disaster preparedness drill conducted by the government to deepen their understanding of emergency response and to identify issues."[29]

There is no doubt that moves to improve information sharing and logistics systems in an emergency are active both within business and the government. However, looking at overseas efforts and trends following the Fukushima Daiichi nuclear accident may provide new suggestions on the actions Japan should take.

[25] Interview with Tetsuya Yamamoto, November 22, 2019.
[26] Ibid.
[27] Ibid.
[28] Ibid.
[29] Ibid.

4. "Worst Scenario": safety and security

Another issue to be considered is that the division of roles between the operators' voluntary emergency response units and relevant ministries, security authorities and the military (SDF) is not yet clearly defined in Japan. It is quite possible that in a nuclear accident, the condition will progress to a level beyond the control of the operator. When such a situation occurs, it is essential to determine in advance who will stop the accident from advancing. A "worst scenario" was, in fact, secretly created within the government over the Fukushima Daiichi Nuclear Power Plant accident. With the acquisition of this confidential material and the inclusion of its full text in the report, the Private Accident investigation became widely known.

The worst scenario was commissioned by Dr. Shunsuke Kondo, (then) chairman of the Atomic Energy Commission, while Naoto Kan's Cabinet was responding to the accident. Saying, "this expression [worst case] is not desirable since anticipating the worst case in a nuclear accident leads to another kind of worst case. Contingency scenario is more suitable"[30], Chairman Kondo made the title "Drawing up a contingency scenario for Fukushima Nuclear Power Plant". It consisted of fifteen PowerPoint slides, the date of submission to Cabinet being "March 25, 2011", two weeks after the accident took place.

The scenario was composed of six chapters including "assumed new event" and "emergency countermeasure range", and it is assumed that there was a possibility of a steam explosion due to core damage and that the concrete floor of the spent fuel pool would drop out. It warned that a chain of accidents would be triggered once a serious event occurred at a given unit, and pointed out if the spent fuel concrete dropped off and a large amount of radiation was emitted, all workers would have to be evacuated and regarding the range of evacuation range, "there was the possibility of requesting compulsory displacement in a radius of 170 km or more (from the Fukushima Daiichi Nuclear Power Plant) and voluntary relocation would have to be recognised in a radius of 250 km if the annual dose greatly exceeded the natural radiation level." In other words, it assumed that people would hardly be able to live in eastern Japan.

How should we deal with such a serious accident? In contrast to Japan, which at present has no provision for when the operators' capabilities are exceeded, other countries have two-stage provisions for cases of unexpected situations.

Bearing in mind the speed of development and the difficulty of convergence for nuclear accidents, FARN, which consists of nuclear power workers, is in charge of responding within 72 hours after the disaster, and if there is no prospect of accident convergence by that time, it is clearly decided that the response is to be taken over by Groupe INTRA, a company specializing in operating unmanned equipment, and the French Defense Forces.

Groupe INTRA is a special organization set up following the 1986 Chernobyl nuclear accident by the French nuclear power industry, Cogema, a company whose main business is uranium mining, and the then Commission for Atomic Energy (Commissariat à l'énergie atomique: CEA), which was involved in developing nuclear power for both military or commercial purposes, (now the French Alternative Energies and Atomic Energy Commission). It is a unit consisting mainly of remotely operated heavy machinery (excavators, bulldozers, etc.), disaster support robots, and drones, and it has striven for more than 30 years since its establishment to train operating staff, improve equipment performance, and develop new equipment. Originally, this unit was also supposed to be deployed on-site within 24 hours, and although since 2015 a division in roles has been created with FARN, should the scale of

[30] Interview with Shunsuke Kondô, November, 2016.

the accident be judged to be extensive, it is capable of being deployed immediately. Koichi Shiraishi, director of the Nuclear Emergency Situation Support Center in Mihama-cho, Fukui Prefecture, acknowledges their sophisticated disaster response, saying, "We have a lot to learn, having just started, and we have visited Groupe INTRA many times for training."[31]

There is also a large difference between Japan and other countries in preparations regarding the dose limit for workers handling accidents. Regarding the radiation exposure of workers involved in emergency work in the event of an accident, the International Commission on Radiological Protection (ICRP) gave countries 500mSv (millisievert) or 1000mSv as a "reference level" in 2007. It was recommended that these figures be used as dose limitation values, and in the case of lifesaving activities, "no dose limitation" was recommended. Based on these ICRP recommendations of 2007, Haruki Madarame, (then) chairman of the Nuclear Safety Commission, advised the Cabinet to "raise the worker exposure limit from 100 mSv to 500 mSv" during the Fukushima Daiichi Nuclear Power Plant accident[32]. However, government officials commented that raising the value to 500mSv might lower worker morale, eventually halving it to 250mSv. This number, which did not comply directly with the recommendations of international organizations and had ambiguous grounds, has been carried over as the dose limit for workers even after the Fukushima Daiichi Nuclear Power Plant accident. There has been little discussion in Japan about raising the dose or removing the dose limit for volunteers.

Prefacing his remarks with "the United States has stipulated that there is no dose limitation for volunteers", Goshi Hosono, former special advisor to the Prime Minister at the time of the accident, says "If we don't institutionalize as a preliminary preparation that there's no limit in the case of volunteers, we'll be in trouble if a serious accident happens again."[33] He is pointing to the fact that government, businesses, and the people are less resolved to using nuclear power than other countries. Alternatively, Japan may be becoming infused with a new safety myth that "there will be no more nuclear accidents that require the abolition of dose restrictions".

In fact, the specially raised dose limit of 250 mSv for accident response was abruptly abolished in December 2011 when the government deemed that the reactor had reached a stable cold shutdown. Part of the Ionizing Radiation Hazard Prevention Regulations was revised in preparation for a nuclear emergency making 250 mSv the upper limit, which was only enforced in April 2016, five years after the accident. Although the Ministry of the Environment's Unified Basic Data on Health Effects Due to Radiation (2015 Edition), which explains the revision of the regulation, shows the difference between the ICRP recommendation and Japan's upper limit in a table, the reason why Japan does not directly introduce the ICRP recommendation is not provided.

It is not just the government that secretly created a "worst scenario". One was also drawn up by the Self-Defense Forces. Within TEPCO, just as with the aforementioned "contingency scenario" drawn up by Chairman Kondo, it is said that they considered Fukushima Daichi personnel filling and shielding the spent fuel with slurry as it was possible that the spent fuel pool might break and water drain out, exposing the fuel and scattering a large amount of radiation. The fact that these scenarios and the process of drawing them up were not shared is also one factor in the lack of debate in Japan regarding how the SDF should be involved in a worst case scenario and the division of roles with electric power companies.

In the current Japanese situation, joint training between the SDF and electric power companies was

[31] Interview with Koichi Shiraishi, November, 2019.
[32] Interview with Haruki Madarame, March, 2016.
[33] Interview with Goshi Hosono, December 19, 2019.

finally implemented eight years after the Fukushima accident. Since cooperation with the Self-Defense Forces is indispensable for transporting relief supplies to a nuclear power plant by air or sea routes, the Nuclear Emergency Assistance Center proposed to the Cabinet Office the "implementation of nuclear disaster prevention drills including cooperation with the Self-Defense Forces". In the nuclear disaster preparedness training held by the government in November 2019, transportation of equipment and heavy equipment to the nuclear power plant was carried out by the SDF-owned transport helicopter Chinook CH47 and the transport ship *Shimokita*. Japanese nuclear power plants use seawater for cooling reactors, so they are all along the seaboard, and several places, such as the Onagawa Nuclear Power Plant (Miyagi Prefecture) located on the cliffs, assert "we should be looking seriously into transporting equipment and materials by sea" (Director Shiraishi).

By conducting joint training with the Self-Defense Forces, it is possible to learn small details. For example, when loading big heavy equipment into a large truck at the support center, the weight of the heavy equipment lowered the bumper, which caught on the slope leading to *Shimokita*, wasting time[34]. Accumulating such small lessons allows us to avoid situation where the standard of power supply cars was incompatible, complicating power recovery at the time of the Fukushima Daiichi Nuclear Power Plant accident.

Given these circumstances, government, business and support centers are proactive in clarifying the division of roles between the Self-Defense Forces, the fire department, and the police regarding accident response, Director Shiraishi saying, "we at the emergency support center have requested the Cabinet Office that disaster prevention drills include cooperation with the SDF in the menu every year."[35]

However, since training takes place once a year, it is difficult to improve crisis response capabilities through that alone. Yamato noted, "One way would be incorporating the simulation exercises the Self-Defense Forces routinely carry out and nuclear disaster prevention." If cooperation was deepened between each organization through training and simulated exercises, and frank discussion on preparations for the worst were held between operators, who respond to the accident, the related ministries, security authorities, the Self-Defense Forces, and even the U.S. Forces stationed in Japan, safety (safe operation of facilities) and security (security of facilities against external attack), which Japan is poor at, could be linked, thereby strengthening the safety of facilities. Casto claims that security awareness must be constantly updated in order to prepare for new threats such as cyber attacks. "[The loss of power, the loss of emergency diesel generators] that covers the last war, which was Fukushima, but what's the next war? And that's the imagination thing. I think the failure of imagination is one of your lessons learnt. So, what's the next big thing? Our judgement is black sky. Because of hacking and all that."[36]

5. Emergency response capabilities and logistics capabilities: France FARN and the Mihama Emergency Support Center

FRAN: the French approach

In order to improve accident response capabilities at a disaster site and ensure the supply of materials and equipment to the site, it is essential that electric power companies first take an overview of the Fukushima Daiichi Nuclear Power Plant accident and in the process of learning the lessons, continue self-help efforts. This section introduces the efforts started by France, a nuclear power country where

[34] Interview with Koichi Shiraishi, November, 2019.
[35] Interview with Koichi Shiraishi, November, 2019.
[36] Interview with Charles Casto, August 26, 2019.

the ratio of nuclear power in the power source mix exceeds 70%, from the lessons learned from the Fukushima Daiichi nuclear accident and the post-accident efforts of Japan at the time of the accident. It covers FARN and the Mihama Nuclear Emergency Support Center that have already been partially covered.

France established FARN as part of strengthening the initial response of electric power companies and it has been active since December 2015. Originally, the creation of a unit was proposed by France Electricity (Électricité de France: EDF) in 2011 as part of self-help efforts on the part of operators. Subsequently, three-way discussions were frequently held with the French Nuclear Safety Agency (Autorité de Sûreté Nucléaire: ASN), the regulatory body for nuclear power, and the French Institute for Radiation Protection and Nuclear Safety (Institut de Radioprotection et de Sûreté Nucléaire: IRSN), made up of nuclear experts, the decision being taken to make it a regulatory requirement in the newly revised safety standards following the Fukushima accident. ASN has a policy of developing new regulatory standards in three stages, and has set the following schedule to strengthen the safety of nuclear facilities.

- Phase 1 (Strengthening safety standards in nuclear facilities, 2011-2015): Reinforce facilities in accordance with their respective characteristics (years of operation, geographical factors, population distribution in the vicinity, etc.), put in place power supply vehicles, fire engines, maintenance of reservoir, etc.
- Phase 2 (Reinforcement of backup system, 2015-2020): In the event of an emergency at a nuclear facility, provide the necessary equipment within 24 hours and establish a system that can quickly bring the accident to a conclusion.
- Phase 3 (Residual risk measures unresolved in the previous phases, from 2020): Response to new threats to nuclear facilities such as cyber attacks and terrorism.

As one of the highlights of beginning Phase 2, FARN was established in December 2015 with headquarters in Paris, four local branch offices and a staff of 270[37].

With the exception of staff members with licenses for helicopters and large heavy equipment as well as a few branch managers who applied from the army, FARN is mainly comprised of engineers who previously worked for a long time at EDF and normally work at nuclear power plants while taking part in training. ASN's Dominique Martineau emphasizes, “We set up a Paris headquarters and four regional headquarters given the geography of the French territory and the distribution of nuclear facilities. We can put equipment and materials into any power station within 12 hours of an accident and be operational within 24 hours. The organization is under the operator’s control, and there aren’t any collisions between the organizations like the problem of command authority between the police and the fire department that you sometimes see in a normal disaster.”[38] As will be described later, there is, however, a mechanism for collaborating with the French Defense Forces in a nuclear emergency.

[37] Follow-up seminar at the Autorité de Sûreté Nucléaire, November, 2017. Paris.
[38] Ibid.

Photo 1: Large FARN vehicle (French Electric Power: EDF)

What kind of facilities does FARN have and what is the scale of its bases? Let us look at an overview of FARN's Paluel Regional Headquarters (Northern France) as an example.

The headquarters are on a site the area of 62,354 m2, with a building of 997 m2. The building alone cost more than 4 million euros (about 480 million yen). Main equipment includes a generator, a bulldozer/lifter attachment, a cooling water pump, a helicopter-landing pad as well as 10 generators of 100kW class as well as an emergency diesel generator. Transportation is not only by deploying large vehicles and helicopters but also by ships for flood damage[39]. A total of 70 people are divided into five 14-man teams, members coming from the five nuclear power plants located in northern France, and they are provided trained in areas such as debris removal in the event of a disaster and strive to improve capabilities in operating heavy equipment and large vehicles.

At the time of actual deploy, members gather at this FARN regional headquarters within one hour and don protective equipment such as Tyvek suits. The necessary equipment and materials are dispatched to the site within 2 hours and all equipment is brought to the power station within 12 hours. It is the job of the military police to provide an escort to the accident site at the power plant. If helicopter dispatch is required in order to be operational within the time limit specified above, helicopters from EDF subsidiaries or military helicopters will be used, but they will be under the control of the French Defense Forces.

Grégory Buzogany served as head of the Paluel Regional Headquarters for three years until 2018. After serving as a captain of a French Navy nuclear submarine for 15 years, he learned of FARN's founding concept, raised his hand for recruitment, and was involved in the organization from the start. "The important thing in crisis management is that, in the absence of a scenario, decisions are made by preparing multiple answers and conducting a case-by-case response. In particular, there can be many scenarios for how nuclear disaster progresses. I thought it was indispensable for French Armed Forces graduates, who are trained based on such multiple scenarios, to participate in FARN." Furthermore, standardization and equalization of equipment and training at the Paris headquarters and the four regional headquarters are essential for a swift response to an accident. For this reason, the general managers of the five bases meet every Wednesday at the Paris headquarters to promote

[39] Japan Atomic Industrial Forum, 2014.

standardization of equipment at each FARN base according to the two types of plants EDF has (900 MW class and 1300 MW)[40]. This standardization of equipment and training is based on experiences at the Fukushima Daiichi Nuclear Power Plant accident when it took time to restore the power supply because the specifications of the power supply vehicles that arrived at the scene were not compatible.

Logistics tend to be interpreted as a backup system, but as we defined in this chapter's introduction, self-sufficiency and local procurement are also important factors for improving logistics capabilities. Not only EDF, but also those involved in the regulatory body are aware of the importance of training the nuclear power plant personnel and improving their ability to operate the equipment and materials necessary for accident response. French nuclear power parties take the fact very seriously that because subcontractors were in charge of operating fire engines and heavy equipment during the Fukushima Daiichi nuclear accident, TEPCO could not demand work under a high dose that was not covered by their contracts[41].

The Nuclear Emergency Support Center (Mihama, Fukui Prefecture) approach

There is also an organization in Japan established as part of the self-help efforts of the electric power companies. This is the Nuclear Emergency Support Center based in the town of Mihama in Fukui Prefecture, where Kansai Electric Power has a nuclear power plant. It consists of 21 members mostly seconded from the Japan Nuclear Power Company, a nuclear power company specializing in nuclear power plants funded by Japan's nine Japanese electric power companies, excluding Okinawa Electric Power, which does not have nuclear power generation. It has a total of 2 tons of equipment necessary for a disaster including a total of 8 small and medium-sized robots, 3 large and small shovel cars, 2 drones for dose measurement and on-site filming, protective clothing, masks, dosimeters and batteries, and emergency food. It has a total of 10 trucks, including large trucks for transporting heavy equipment, and electric power company staff who do not have a large-vehicle license cannot be seconded as staff to the Emergency Support Center even if they so wish.

Photo 2: Unmanned heavy equipment training at the Nuclear Emergency Support Center (photographed by the author, November 2019)

Even although the necessary equipment and materials were delivered close to the site of the power plant at the time of the Fukushima Daiichi Nuclear Power Plant accident, there were many incidences where drivers refused to transport it because the high radiation dose and debris made it physically

[40] Ibid.
[41] Interview with Philippe Jamet, May, 2019.

impossible to move it from there to the power plant. Based on regret about this, electric power company staff now obtain large-vehicle driver's licenses to prepare for an emergency. Furthermore, in order to ensure the transportation of materials and equipment to the disaster site, the Center said, "We only employ staff who have pledged to perform their duties up to the dose limit of 250 mSv applicable in emergencies, and have that written into their contracts." (Director Shiraishi)[42]. In addition, in order to secure three or more transportation routes for each nuclear power plant by simulating transportation routes to the site, they are working to secure access in an emergency by visiting multiple nuclear power plants with a large truck owned by the Center. Compared to before the Fukushima Daiichi Nuclear Power Plant accident, it seems that the awareness and system of delivering materials and equipment to the nuclear power plant no matter what has been strengthened, but compared to the case overseas, there are still issues that need to be itemized further as later described.

There is no point in conducting training for just the small number of Center staff, and unless there is an increase at each nuclear power plant in staff familiarity with the operation of robots and heavy equipment, it will not serve any use in the event of an accident. Accordingly, some 100 employees from each company's nuclear power plant visit for training each year. In the two days of initial training, they learn the basic operation of equipment such as heavy equipment and robots, and in a further two days of consolidation training, they perform highly difficult operations such as working in total darkness assuming the loss of all power. This is still not enough, however, so the Center prepares applied training such as operations on a debris-filled site. Nevertheless, Director Shiraishi confesses that there is a difference in intensity between the electric power companies when participating in applied training. Chubu Electric Power's Hamaoka Nuclear Power Plant, which is located in an area where Tokai and Nankai Trough earthquakes are predicted, is enthusiastic, proposing its own menu for applied training, and regularly dispatching staff to the Emergency Support Center.[43]

Points to learn from overseas efforts

Comparing France's FARN and Japan's Nuclear Emergency Support Center, which were given as examples of strengthening emergency response capabilities and practical logistics capabilities in the event of an accident, differences can be seen in the views of the regulatory body and its relationship with the electric power companies, which provide important suggestions when thinking about crisis management.

As you can see at a glance, FARN in France has a five-headquarters system, whereas Japan has only one nuclear emergency support center in Mihama, Fukui Prefecture. The Hokkaido Tomari Nuclear Power Plant, which is the farthest location from Fukui Prefecture, would take 31 hours at the quickest to replenish supplies. In the Fukushima Daiichi Nuclear Power Plant accident, a hydrogen explosion occurred in the Unit 1 building about 24 hours after the tsunami hit. Once a reactor is out of control, the accident progresses faster than you can imagine. Director Shiraishi admits to this weak point, "At the time of establishment, it was planned to have three sites in Japan, but we are initially working to improve the effectiveness of Mihama's Support Center and then increase the number of bases." FARN assigns a nuclear facility to the jurisdiction of each of the five bases under the ironclad rule of "arrival on site within 12 hours".

This difference comes from the outlook of the regulatory bodies in the two countries. Out of regret for the Fukushima Daiichi Nuclear Power Plant accident, Japan obliges each nuclear power plant to "prepare equipment that can withstand seven days during an accident, including emergency power supplies and heavy machinery", making this one of its regulatory requirements. The Nuclear

[42] Inspection of the Nuclear Emergency Support Center. Japan, November, 2019.
[43] Interview with Koichi Shiraishi, November, 2019.

Regulation Authority clearly stated in an official document that "the primary responsibility for an accident should be the operator's responsibility", and it can be said that this idea has been thoroughly implemented. France and the United States are concerned about terrorism and are wary of different natural disasters (mainly tornadoes) than Japan, and they fear that if heavy equipment and equipment were concentrated at a nuclear power plant, they could be misused by terrorists or wiped out by tornadoes, so the tendency is to distribute deployment bases outside nuclear power plants.

Since the types of natural disasters that need to be guarded for and the possibility of terrorism differ from country to country, it is not possible to unambiguously determine which country's regulatory body has the right mindset. However, the Japanese-style risk of concentrating disaster prevention equipment at nuclear power plants should be taken into consideration. Based on this point, Director Shiraishi suggests they should consider methods like, "In the event of an emergency at Tomari Nuclear Power Plant, for example, in addition to the equipment that the nuclear power plant itself has, it could be dealt with through an inter-operator agreement with Tohoku Electric Power Co., which is geographically closer."

Many business operator agreements have been concluded among other electric power companies as part of strengthening disaster prevention systems. For example, four electric power companies including Kansai Electric Power signed a mutual cooperation agreement in the event of a disaster in August 2018 with the Maizuru District Headquarters of the Maritime Self-Defense Force. According to the press release distributed by KEPCO, it assumes mainly sharing of personnel, goods and transportation means during crisis response, citing that effectiveness will be improved through training.[44] Similar to the Nuclear Emergency Support Center, agreements between operators limit the "completion of duties up to the dose limit of 250 mSv applicable in emergencies", and assume that nuclear power plant staff acting as disaster prevention personnel will respond. However, questions still remain as to whether this standard can really be applied in supporting facilities at another operator, and might not disaster prevention staff refuse to transport goods or work on-site because "I don't want to put my life on the line dealing with another operator's nuclear accident". Issues such as whether workers can be dispatched to a different nuclear power plant to the one they belong to and what to do if a business order is rejected are being discussed overseas, but they are not easily overcome. For example, the FARN headquarters are based on a system of five 14-man teams for each nuclear power plant because they fully understand the difficulty of accommodating personnel in the event of a nuclear disaster, and it will be difficult to establish a backup system for the supply of goods even in Japan unless the above issues are faced.

Self-help efforts and regulatory requirements

The second difference is that FARN is a regulatory requirement, while the Emergency Support Center is not. In other words, it is not obligatory for NRA staff to monitor and check the effectiveness of training and centers. In France, FARN training is also a regulatory requirement, and ASN checks the training and, if it deemed that there is no capability of reaching each nuclear power plant within 12 hours, it instructs EDF to improve. If the improvement measures are deemed to be insufficient, the nuclear power plant under the jurisdiction of the local office may be suspended.

In 2006, France separated its regulatory body from the Nuclear Energy Agency (Ministry of Economy) in accordance with the Act on Ensuring Independence and Transparency Regarding Nuclear Safety Regulations. As for current regulations, ASN, which is in charge of inspection work, is advised by IRSN, which comprises a group of experts, and gives priority to "discussing better regulation through public dialogue between the three organizations including EDF" (ASN). In fact, FARN itself was initially part of the self-help efforts of businesses, but became a regulatory

[44] KEPCO Press release, 2018.

requirement through discussion by the three parties.

Regarding the voluntary training of nuclear power companies, the importance of "rigorously checking and discussing with business operators" is being recognized by Japan's regulatory bodies. Yamamoto emphasizes, "In the disaster prevention drills conducted by operators, the training results are reported by all of the operators and discussed with each electric power company on points for improvement."[45] Today, ten years on from the earthquake, it is becoming increasingly important for operators and regulatory bodies to hold public discussions in order to further strengthen nuclear safety.

6. Issues involved with a "Japanese version of FEMA"

Following the Fukushima Daiichi nuclear accident, it has often been suggested regarding the clarification of the division of roles for each organization that is indispensable in dealing with contingencies and strengthening on-site and off-site cooperation, that the U.S. Federal Emergency Management Agency (FEMA) approach be introduced to Japan. The Private Accident Investigation proposes, "In the case of a severe nuclear accident, the responsibility of the state and the role of the corresponding execution unit should be clearly defined in the legal system. We should aim to create in the future a full-fledged execution unit for severe disasters and accidents comparable to the U.S. Federal Emergency Management Agency (FEMA)."[46]

The Fukushima nuclear accident was a compound disaster comprising natural disaster and nuclear accident, which greatly exceeded the response capabilities of the operator and local government. In addition, the national response also spanned many ministries and agencies, so coordination was time-consuming and prompt measures could not be implemented. Contriteness from this saw the opinion put forward that "a ministry specialized in disaster response should be established using the U.S. FEMA as a model" not only by disaster experts but also by the Diet[47].

Yasuo Sato, a former Tokyo Fire Department Police Department chief, asserted, "I think we should probably create an organization along the lines of FEMA under the prime minster that can establish a quick response task force that can be deployed nationwide, train for large-scale disasters, bring disaster related information together in an emergency and coordinate all the first responders. Currently, each municipality is supposed to collect disaster information, but the more an area is hit by a disaster, the greater the damage. We need to ready some other forces for the Prime Minister, not just the SDF. There's no central government agency with proper staff at present that can support disaster prevention measures, and no government agency that can comprehensively plan disaster countermeasures and control production units". [48] In addition to the Self-Defense Forces, he emphasized the need to maintain at the government level the creation of disaster response units that can be directly commanded by the Prime Minister.

However, not a few of the "build a Japanese FEMA" arguments are based on inaccurate understanding of FEMA's organizational structure and the nature of U.S. and Japanese government administration. Not only is it a misconception that FEMA is in charge of all ministries and agencies involved in disaster response, but the command of disaster response in the United States is legally authorized by local government, FEMA's main institutional duty being coordination and advise. On the other hand, FEMA sceptics often voice the opinion that "it doesn't fit the vertically

[45] Interview with Tetsuya Yamamoto, November 22, 2019.
[46] Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012.)
[47] House of Representatives, Japan, 2014.
[48] Interview with Yasuo Satô, October 8, 2019.

compartmentalized organization of Japan's government", but this counterargument is also not convincing. The adverse effects of a vertically divided administration are not unique to Japan, but are also common in the United States and Europe. In particular, any organization whose mission is survival and the preservation of life, such as national defense, security, and emergency response, tends to become a vertically divided administration if only because of its "familial" organizational culture. Discussions and organizational reforms have been undertaken by all countries in order to overcome this and achieve prompt response.

Therefore, even if an organization such as FEMA was established without giving due consideration to Japan's governance system, it is unlikely that disaster response would be dramatically improved. Rather, highlighting how FEMA clarifies the jurisdiction of disaster response work, and knowing exactly how the federal government, the states, and local governments strengthen cooperation would be a first step in extracting lessons for Japan.

FEMA outline

FEMA is a disaster response organization founded in 1979, coming under the jurisdiction of the Department of Homeland Security, which was established in November of the year following the terrorist attacks of September 2001. In order to deal with ever-changing threats, emphasis is placed on natural disasters, attempts to improve response capabilities for terrorist attacks, and changes have been made in its authority and personnel.

One of FEMA's characteristics is that the law stipulates that the FEMA Commissioner shall act as the president's representative in all emergency situations. In addition, for disaster response across multiple departments, emergency support functions (ESF) are classified into 15 categories that are carried out by principal departments (P), support ministries (S), and coordinating bodies (C) (see Figure 1)[49].

	USDA	Forestry	DOD	Military Engineers	DOE	DHSS	DHS	Cybersecurity Communications Agency	FEMA	Coast Guard	FEMA Fire Dept	DOI	National Park Service	Office of Alcohol, Tobacco, Firearms & Explosives Control	DOT	EPA	GPA	Red Cross
Transportation	S		S		S		S					S			CP		S	
Telecommunications	S		S				S	CP	P			S					S	
Civil engineering	S		S	CP	S	S	S					S			S	S	S	
Fire fighting		CP	S							S	CS	S				S		
Information/Planning									CP									
Victim response	S		S	S		S	S		CP			S			S		S	PS
Logistics	S		S	S	S	S			CP			S			S		CP	S
Health & hygiene	S		S		S	CP	S					S			S	S	S	S
Search & rescue	S		PS			S	S		CP	P		S	P		S			
Oil & poisons	S		S		S	S	S			P		S			S	CP	S	
Agriculture & nature	CP		S		S	S	S					P			S	S	S	S
Energy	S		S		CP		S					S			S	S		
Public safety			S				S					S		CP				
Shift to NDFR																		
External							C		P									

Figure 1: The main areas of ESF & division of governmental roles in the U.S. (compiled by the author with reference to *The possibilities and the Points for the Construction of the 'Japanese FEMA': Recommendations on Disaster Response for the National Government and Local Governments*)

At first glance, it is clear that it is unrealistic to consolidate all of the work into one organization as there are many major areas of emergency response alone.

FEMA specializes in six of the 15 major tasks: communications, information/planning, disaster victim response, logistics, search and rescue, and public relations, which are especially important in the initial stage. The remaining nine tasks are carried out after coordination with departments and agencies. If coordination between departments and agencies proves difficult for these nine tasks, the FEMA Administrator directs the final coordination.

[49] Sashida et al., 2014, pp. 9–12.

However, even if the FEMA Administrator directs all disasters, departments with specialized knowledge take the lead in responding to highly specialized cases such as nuclear/radioactive accidents, cyber accidents, terrorism and pandemics, FEMA being responsible for the evacuation of residents and logistics.[50]

There are two points to keep in mind when studying U.S. crisis management and FEMA functions. One is that the top (mayor) of the basic municipality affected by the disaster centrally manages the disaster response. State government employees and federal FEMA support units are under the command of the mayor, so the initial response will be greatly affected if government offices or disaster response bases in the basic municipality sustain damage as was the case in the Great East Japan Earthquake. The United States is aware of this, and in fact, there was fierce debate among experts concerning the fact that in the 2005 Hurricane Katrina disaster, both the New Orleans City Hall and the alternative base were destroyed by storm surges making an initial response impossible.[51]

The other point is that FEMA is a competent organization with working units for the aforementioned six specialized tasks. It is a huge government office with more than 7,600 full-time employees, having personnel with qualifications and licenses required for communications, civil engineering, and emergency response. The number of part-time staff mobilized during a disaster exceeds 10,000. It has ten regional bases in the United States, and has a system in place to immediately support an affected local government. A common practice in the United States, the delegation of task authority in the event of a disaster has been decided in advance by law or regulation, and the person in charge of local bases can make a prompt decision on the spot without permission over loading the equipment necessary for initial operations and the number of people to mobilize, for example. During normal times, employees are dispatched from local bases to state and basic municipalities for education and training. Employment in the United States takes the form of hiring by job type, and since experts with specialized knowledge are assigned to disaster response departments at the basic municipalities, the effectiveness of training is likely to increase. It conducts training and concludes disaster agreements in cooperation with local companies and NPOs.[52]

Possibility of a 'Japanese FEMA'

What should Japan learn from understanding the current status of FEMA and the clarification of jurisdictions over disaster response in the United States?

Measures have been implemented in Japan also to improve the effectiveness of crisis management following the Great East Japan Earthquake of 2011. Regarding nuclear accidents, the Nuclear Regulation Authority has jurisdiction over the on-site response, and the Cabinet Office is responsible for off-site response such as resident evacuation. The Cabinet Office, which reports directly to the Cabinet and is independent of other ministries and agencies in charge of specific fields and industries, is characterized by its ability to exert power as a coordinating body when cooperation between ministries and agencies is required. In addition, the Cabinet Office discusses the allocation of tasks under each jurisdiction, and stipulates the division of tasks under the jurisdiction of each ministry in the event of a nuclear disaster, as in the United States.[53]

However, the Cabinet Office does not specialize in matters of initial response that are particularly important in disaster response, nor does it have a working unit. In Japan, each ministry and prefecture

[50] FEMA Website: http://www.fema.gov/
[51] Comfort et al., 2010, pp.42–51.
[52] Mutai et al., 2013.
[53] Cabinet Office, Government of Japan, 2014.

has jurisdiction over actual working units, and they are dispatched at the instruction and request of the Prime Minister, the minister in charge, and the prefectural governor. The Ministry of Defense has jurisdiction over the Self-Defense Force, and each municipality and prefecture is in charge of fire fighting and police. Examples of actual work units specialized in more specialist fields are the Ministry of Land, Infrastructure, Transport and Tourism's TEC-FORCE (Emergency Disaster Response Dispatch Unit), which handles the restoration of national roads, and the Ministry of Health, Labor and Welfare's DMAT (Disaster Medical Assistance Team), which provides emergency and medical care.

TEC-FORCE was founded in April 2008. It comprises 12,654 members nationwide, mainly technical staff at the Ministry of Land, Infrastructure, Transport and Tourism and its regional development bureaus, which are the Ministry's regional outposts. In addition to damage investigation and restoration of national roads in the event of a disaster, ten regional development bureaus throughout the country dispatch members to the emergency response headquarters of disaster-affected local governments to provide advice. Since its establishment, it has dispatched a total of more than 100,000 members in response to 106 disasters including the 2011 Great East Japan Earthquake and the heavy rains of July 2018.[54]

DMAT is defined as a "a medical team trained in mobility capable of working in the event of a disaster" and consists of 9,000 doctors, nurses and work coordinators (medical and non-nurse medical staff and clerical staff) nationwide. "Having mobility" means having the ability to operate within approximately 48 hours at the scene of a large-scale disaster or accident involving multiple injured persons. It was launched in April 2005 after it was pointed out that there were 500 cases where lives could have been saved if emergency medical services had been available at the time of the Great Hanshin-Awaji Earthquake in 1995.[55]

Following the Great Hanshin-Awaji Earthquake, there were many cases where organizations were reorganized with the aim of strengthening response in the event of a widespread disaster. The fire department, dubbed a "first responder" for disaster response along with the Self-Defense Force, newly established an Emergency Fire Support Corps, and the police established a Wide Area Emergency Relief Corps.[56]

As far as nuclear disaster prevention is concerned, it is rare at present for all task forces including the police, fire department and the Self-Defense Force to participate in the comprehensive disaster prevention drill organized by the government once a year. As pointed out earlier, the SDF officially began to participate in nuclear disaster preparedness training only from 2019. Irrespective of whether working units excluding security organizations and the SDF such as TEC-FORCE and DMAT are to be integrated in FEMA-like fashion or not, it is clear that training should be enhanced to improve cooperation.

It is also necessary to examine FEMA's efforts in analyzing disaster response and revising important items in tune with the times, both in terms of success and failure.

It is difficult to discriminate between on-site and off-site responses regarding the topic broached by this chapter of "supplying materials to a nuclear power plant that has had an accident". In fact, if

[54] Ministry of Land, Infrastructure, Transport and Tourism Homepage: http://www.mlit.go.jp/river/bousai/pch-tec/index.html (In Japanese.)
[55] Japan Disaster Medical Assistance Team Homepage: http://www.dmat.jp/ (In Japanese.)
[56] For organizational reforms of the police and fire department, see chapter 4 on first responders written by Kôichi Isobe.

cooperation agreements between operators are not adequate, the SDF, police, and fire fighters will have to be responsible for supplying materials. Even in the case of the Fukushima Daiichi Nuclear Power Plant accident, power supply vehicles and fire engines could not be supplied just by exchanging information between operators, and the SDF and fire department brought them in. Self-Defense Force personnel, police, and fire department personnel all participated also in the task of on-site water discharge. Following the accident, progress has been made in clarifying the division of roles with the Nuclear Regulation Authority being assigned on-site and the Cabinet Office off-site, but who is responsible for tasks that fall somewhere in between on-site and off-site such as providing materials to nuclear facilities? This is a point that can be learned from the U.S. case, which has identified issues from experience and disaster training, and has clarified the division of roles of each department centering around FEMA.

On the other hand, it should be noted that there are cases where the lessons learned from disasters have been oversimplified, and are thought to have had an impact on later emergency response. In 2005, when the failure in the initial response to Hurricane Katrina wreaked terrible damage in New Orleans, it was pointed out that after the 2001 terrorist attacks, personnel at the Department of Homeland Security, which is in charge of FEMA, had an over tendency to assign experts on terrorism and had become unfamiliar with natural disaster responses[57]. What should be gleaned as a lesson from disasters is always a difficult task not just for Japan. In 2020, a lack of infectious disease control became clear as the new corona virus spread around the world. The lessons from this are also a difficult issue.

Comparing Japan's present situation with that in other countries, a more serious issue than the compartmentalization of administrative tasks in the central ministries is that, except for some local governments, the number of staff with specialized knowledge who have learned resilience and crisis management at graduate school, is small and the ability to prepare and respond to disasters is inadequate. If this point is overlooked, it is doubtful how effective disaster response will be even if central government administrative tasks are clarified. In the United States, the local government has the authority to control disasters, and the FEMA support team is under the command of the mayor. As with the United States, Germany has also transferred control of emergency response except for war to basic municipalities[58]. In France, which is said to be more strongly centralistic among the democracies, basic action is conducted by the basic municipality, and depending on the level of disaster, it has adopted a mechanism in which commanding power ascends to the prefecture, the region (France divides the whole country into 13 regions), or the state.[59]

In Japan's legal system for crisis management, it is customary for the national government to have overall command with "directive authority" and "total regulatory authority" when responding to disasters even though under the Basic Act on Disaster Management authority is distributed among both national and local governments. Even when dealing with the novel coronavirus, there was a scene in which the governor and the mayor, who were both trying to respond to the local situation, conflicted with the national government regarding the interpretation of the law (the Act on Special Measures for Pandemic Influenza and New Infectious Diseases Preparedness and Response). The national government also provides guidance to prefectures and local governments in preparing disaster prevention plans, and the nuclear disaster prevention plans have been drawn up in a process where the state, which has command of disaster prevention but no knowledge of the actual situation in local areas, sends a template to local governments that know the local areas well but have little expertise in disaster prevention. It has been pointed out that this composition has not changed

[57] Sashida et al., 2014.
[58] Ministry of Land, Infrastructure, Transport and Tourism, 2012.
[59] Cabinet Office, Government of Japan, 2014.

significantly since the Fukushima Daiichi nuclear accident. Regarding the regional disaster prevention plan (nuclear disaster prevention measures) newly formulated after the accident, Muneyuki Shindo, Professor Emeritus of Chiba University, commented ironically, "The composition is almost identical regardless of which municipal plan you look at."[60]

This difference with the U.S. and Europe can be attributed to the fact that the U.S. and Europe basically hire professionals, whereas Japan practices general hiring, which derives from the tendency to transfer employees regularly every two to three years to handle a broad range of jobs and build up a certain amount of expertise[61]. This will be difficult to change overnight because human resource systems are deeply connected not only to workstyles but also to the very nature of society.

Against such a backdrop, the government has concluded after due deliberation that there is no need to review the establishment of an organization along the lines of FEMA. Under the current administration's stance, immediately after a disaster, members of the emergency assembly team from the relevant ministries and agencies will immediately gather under the supervision of the Cabinet's crisis management to take initial action, and with the establishment of a Government Response Headquarters, the Cabinet Office Disaster Prevention (in the case of nuclear disaster, the Cabinet Office Nuclear Disaster Prevention) will take the initiative. Their view is that it is realistic to accumulate training and make steady improvements under the current system.

Idealizing overseas cases should be avoided whether for a corporate organization or a ministerial organization.

When preparing for the worst, differences in the environment surrounding nuclear energy between Europe and Japan must be considered, especially the difference in the impact of the 1986 Chernobyl accident. The countries of Continental Europe, which were directly affected by the accident through the arrival of radioactive material, improved their emergency response systems considerably after the accident, witness the creation of the French Groupe INTRA. What Japan has to learn from Groupe INTRA is not so much improving the domestic production and operation capabilities of disaster support robots, but more clarifying roles concerning how to prevent the spread of an accident and who will prevent the spread of an accident if a reactor goes out of control. It should not be forgotten that in the Fukushima Daiichi Nuclear Power Plant accident, if just one more piece of bad luck had occurred, a catastrophe where Metropolitan Tokyo was no longer be liveable would have taken place.

Additionally, the Fukushima Daiichi Nuclear Power Plant accident was a complex disaster in which earthquakes, tsunami and reactor abnormalities overlapped, and in the process of responding to the nuclear disaster, which required specialist knowledge, and the natural disaster, which required mobility, the division of roles among the ministries and agencies became confused. As a lesson to be learned from this, the Private Accident Investigation recommended that "we should aim at establishing a full-scale execution unit for severe disasters and accidents comparable to FEMA", but without improving the disaster response capabilities of local governments and redefining the division of roles between central government agencies, businesses and local governments, it is unlikely that disaster response capabilities can be expected to improve.

7. Summary

In this chapter, we compared efforts in Japan and overseas following the Fukushima Daiichi Nuclear

[60] Shindô, 2017, p.153.
[61] Sashida et al., 2014.

Power Plant accident in terms of logistics, that is, how to quickly supply the necessary materials and equipment to the disaster site in order to respond to a nuclear accident. Each country has reviewed its nuclear safety regulations, and electric power companies have also established voluntary emergency response units. FARN in France and the Nuclear Emergency Assistance Center in Japan are part of this, and compared to the time of the Fukushima accident, preparedness for emergencies, especially logistics capabilities, has been strengthened.

However, in order for such voluntary response units to improve their effectiveness, excessive subdivision and manualization of tasks in the nuclear industry must be avoided. In the Fukushima Daiichi Nuclear Power Plant accident, such excessive manualization hindered the response to "a situation that exceeded expectations", and due to a failure in information sharing, it was not possible to transport materials and equipment efficiently. Electric power companies are confident that they have improved their ability to respond to emergencies by reorganizing and revamping training methods, but there are still many points that Japan should learn in comparison with overseas efforts.

First, regulatory bodies and electric power companies need to discuss in a transparent setting with a view to strengthening safety regulations. FARN was initially part of the self-help efforts of electric power companies, but it became a regulatory requirement as a result of public discussions with regulatory agencies and experts.

Furthermore, in order to improve response capabilities in emergencies, it is also necessary to envision "unexpected scenarios" and clarify the division of roles for the business operator and related ministries. After the Fukushima Daiichi nuclear power plant accident, the Nuclear Regulatory Agency was placed in charge of on-site response, and the Cabinet Office in charge of off-site response, but this is not enough. In the case of a compound accident, since the response will cover many ministries and agencies, the division of roles must constantly be discussed through training and simulation exercises.

Lastly, it was revealed during our examination of "Building a Japanese FEMA" that, except for some local governments, there are few staff who have gained disaster prevention knowledge at graduate school. Even if the state directs the disaster response, the presence or absence of expertise in the local government at the disaster site has a great effect on the response.

Ten years have passed since the Fukushima Daiichi Nuclear Power Plant accident, but there are still matters to be weighed in improving emergency response and logistics.

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Chapter 6: First Responders and U.S. Military Support Responders

Koichi Isobe

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Why first responders?
1. Aerial and ground water discharge: First responders in the field
2. What was questioned? What has changed?
3. The truth about “directives” “centering on the Self-Defense Forces”: Proposal by the National Governors’ Association
4. Japan-U.S. Alliance as support responder
5. The operators and first responders (The Mariners’ Act Model)
6. “The ultimate question”
7. Civil-military relations: 10 years after the Fukushima accident－the relationship between politics and the Self-Defense Forces

Summary
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Why first responders?

The Fukushima nuclear accident was Japan’s largest post-war national crisis, in which, in the worst case, the radioactive materials it scattered could have polluted the Tokyo metropolitan area and made part of eastern Japan into dead land.

The Japanese government mobilized the so-called first responders[1] of the fire department, police, Japan Coast Guard, and Self-Defense Forces in order to overcome the crisis. It also used the Japan-U.S. alliance as a national resource. How well did those operations function? Or did they not function? What was the lesson to be drawn from that? What kind of "learning" was subsequently acquired?

At the time of the Fukushima nuclear accident, in addition to pre-planned off-site roles, the first responders of the fire department, police, and the Self-Defense Forces carried out on-site water discharges under high radiation, which was not included in disaster prevention work plans. First responders tend to think that their roles, organizations, and activities are similar, but since the background to formation, legal basis, and organizations all differ for each first responder, it is appropriate to discuss them after understanding their attributes.

The following is a brief description of the rules governing the mission of each responder.

Fire fighters’ mission: “In addition to using equipment and personnel to protect the life, limb and property of the people from fire, to prevent and control disasters such as floods, fires and earthquakes, reduce the damage caused by these disasters, and appropriately transport the victims of disasters, etc.”[2]

[1] First responders here refer to the fire department, the police, the Japan Coast Guard, and the Self-Defense Forces, who rush to the scene in the event of a disaster and are engaged in search and rescue, lifesaving, localization of damage, and emergency recovery. Looking at these first responders, they are divided into municipal fire departments, prefectural police, and the national Japan Coast Guard and Self-Defense Forces. They usually conduct their activities under their respective laws. When a disaster occurs, they cooperate with disaster relief in the disaster area.
[2] Fire and Disaster Management Organization Act (Law No. 226, 1948), Article 1.

Duty of the police: “In the duty of protecting life, limb and property of the people, to prevent crimes, suppress and investigate, arrest suspects, control traffic and maintain public safety and order.”[3]

Japan Coast Guard mission: “Securing maritime safety and public safety by carrying out the enforcement of laws and regulations at sea, salvage, prevention of marine pollution, maintenance of order in the navigation of ships at sea, prevention and suppression of crime at sea, investigation and arrest of criminals at sea, regulation of shipping traffic, affairs related to waterways and navigation signs, and other affairs related to ensuring maritime safety, and related matters.”[4]

The SDF's mission: “In order to protect Japan's peace and independence and to maintain national security, our main task is to defend Japan and, if necessary, to maintain public order.”[5]

In this way, based on the rules governing their duties, the fire department, the police, and the Japan Coast Guard, always have the task of going to a disaster site immediately and helping the people affected. The Self-Defense Forces can be dispatched to carry out disaster relief, etc., if necessary, but their main task is to defend the country. Therefore, unlike the other three organizations, when going to disaster relief, it has a mechanism for deploying troops basically at the request of the prefectural governor.

The following five points summarize what has become clear through the task of verification regarding the first responders.

First, the first responders have coordinated and cooperated when responding at the disaster site. However, because their organizations and legal foundations differ, they respond differently, and it is hard to say that sideways cooperation and communication systems between the first responders are necessarily adequate. Although mutual cooperation among responders has deepened through disaster drills, etc. based on the lessons learned from the Fukushima nuclear accident, there are still issues to be resolved.

The second point is that it seems that the measures taken for a nuclear disaster by the first responders after the Fukushima Nuclear Accident were somewhat negative and un-first-responder-like.

The third is the existence of support responders, the U.S. Armed Forces, who extended their support as an ally. In the process of cooperation between the U.S.-Japan alliance, issues became apparent at the policy and unit operation levels.

Fourth is the fact that the “ultimate question”, that is, what will be done by the state and first responders when a nuclear operator alone cannot take adequate measures in the event of a severe accident at a nuclear facility, has not fully been answered.

Finally, there is the relationship between politics and the SDF. The Self-Defense Forces are a first responder, but it is also the last bastion, the last responder expected to play the ultimate role as a nation. It appears that the distance between politics and the Self-Defense Forces has decreased in the last ten years, but it seems that the people, politicians, and the Self-Defense Forces should build an even more trusting relationship.

[3] Police Act (Law No.162, 1964), Article 2.
[4] Japan Coast Guard Act (Law No.28, 1948), Article 2.
[5] Self-Defence Forces Act (Law No.165, 1945), Article 3.

1. Aerial and ground water discharge: First responders in the field

The trajectory of the actions of the first responders who worked at the Fukushima Daiichi Nuclear Power Station from the eventuality of the accident to around March 20 is clear as shown in the chronology below. The process leading up to their action presents many issues for us.

March 12, 15:36:	Unit 1 building hydrogen explosion
March 14, 11:01:	Hydrogen explosion of Unit 3 building, SDF personnel and TEPCO staff responding at the site injured
March 15, early morning:	Government/TEPCO integrated headquarters established
March 16, 6:10:	Unit 4 building hydrogen explosion
Sometime after 14:00 on March 16th:	Although the company plans to discharge water from a large GSDF helicopter, it gives up due to high radiation.
March 17, 9:48:	Start of water discharge to Unit 3 from the large GSDF helicopter
March 17, 19:05:	Start of water discharge to Unit 3 by the high-pressure water discharge vehicle of the Metropolitan Police Department riot police
March 17, 19:35:	Self-Defense Forces fire engine water discharge commenced
March 18:	"On the policy of water discharge activities on March 18" issued by Special Advisor Hosono
Before dawn on March 19:	Tokyo Fire Department's hyper rescue team start watering
March 20:	Issue of "directives" from the head of the Nuclear Disaster Headquarters (Prime Minister Kan)

Water discharge operation from helicopter

Approximately three days after the accident on the 14th, how to pour water into the spent nuclear fuel pool became a pressing issue for the government and TEPCO. During their discussions, a plan to discharge water by helicopter emerged as an option. It took time to coordinate the relevant ministries and agencies about implementing surface water discharge, and as a result, water from the helicopter was ready the earliest.[6] Under these circumstances, Prime Minister Kan gave the go ahead for an aerial water discharge, which was implemented on the 17th.

Around the same time, the frustration of the U.S. government was reaching its peak. U.S. Ambassador to Japan John Roos asked Chief Cabinet Secretary Yukio Edano to have a U.S. expert resident in the Kantei's Crisis Management Center both on the afternoon of the 13th and the night of the 14th, but was refused by the secretary, finally being successful with a third call on the night of the 15th. The nuance from the U.S. government for the Japanese government to act swiftly and in a visible manner was conveyed through all its channels including the Japanese embassy in the U.S., the U.S. embassy in Tokyo, and the U.S. military.

According to the chronology, the plan was to use a helicopter to spray water from the air on the afternoon of 16th, but it was decided to give up because the radiation dose above the reactor building was high. The disappointment of government leaders at this time was great. At midnight on that day,

[6] Please refer to the following to confirm the process of water discharge. Isobe, 2019, p. 47-49.

top officers of the Self-Defense Forces gathered in the commander's office, and made up their minds that on the next day, they would stay unaffected and carry out the aerial water release.

Next morning, two of the Ground Self-Defense Forces' largest helicopters, the CH-47 Chinook, dropped a total of 30 tons of seawater in two runs. From that night onwards, surface water was ready to be discharged, so the aerial water mission was completed.

Evaluation of the water discharge by helicopter is divided. At the time, Cabinet Crisis Director, Tetsuro Ito, judged that spraying water from a helicopter had little effect because of the small amount of water. Ichiro Fujisaki, the Japanese ambassador to the United States, also felt that the watering did not seem to change the attitude of the U.S. side. On the other hand, Defense Minister Toshimi Kitazawa notes that this was not the case, given his impression from senior US government officials.[7] What can be clearly said is that by broadcasting to the world via NHK, CNN and so on, the aerial operation was effective both at home and overseas in demonstrating that the Japanese government was making a serious effort to tackle the crisis and had brought in the Self-Defense Forces.

Groundwater discharge by first responders

The ground water discharge followed a more complicated adjustment process than the aerial water discharge, with the addition of the police, the Self-Defense Forces, the fire department and TEPCO.[8]

After the aerial water discharge, it was the high-pressure water discharge unit of the Metropolitan Police Department riot police that led the ground water discharge. It is said that this was made possible at the strong insistence of Kansei Nakano, Chairperson of the National Public Safety Commission, and Cabinet Crisis Director Ito.[9] The riot police's high-pressure water discharge vehicle, the Ground Self-Defense Force's chemical protective vehicle, along with TEPCO's vehicles all headed to the side, where the riot police released some 44 tons of water in one go on the night of the 17th. .

Next, 30 minutes after water was released by the riot police, the SDF fire trucks started surface watering. Ground-based water discharge by the Self-Defense Forces continued until March 21, and a total of 338 tons was discharged.

On the night of the 18th, TEPCO staff members also started using a high-pressure water truck to discharge water. Water operations by the fire fighters, professionals at discharging water to extinguish fires, was achieved in the early morning on the 19th.

The Tokyo Fire Department at the time responded to the Fukushima nuclear accident applying Article 1 Causes of Special Disasters in the Ordinance on Emergency Fire Assistance Corps under the Fire and Disaster Management Organization Act, which mentions "accidents with a fear of abnormal levels of radioactive substances or radiation, or the diffusion or release of these.[10] In response to a request from the Prime Minister, head of the Nuclear Emergency Response Headquarters, to deploy to the Fukushima Daiichi Nuclear Power Plant, the hyper-rescue team of the Tokyo Fire Department was dispatched by an order from the then Governor of Tokyo to go because the Great East Japan Earthquake was a national disaster. With the fire departments of Osaka City and Kawasaki City, the

[7] Ibid., p. 92.
[8] Funabashi, 2013, pp. 433–441.
[9] Ibid., pp. 427–432.
[10] Interview with Yasuo Satô, October 8, 2019.

group performed a total of five water discharges until March 25 for a total of 23 hours and 39 minutes, releasing 4227 tons into the Unit 3 building.[11]

Special Advisor Hosono and the "Directive" in the name of the Prime Minister

Around March 17, at the local government headquarters, which had been relocated to the annex of the Fukushima Prefectural Office, the members of the headquarters were at a loss because they had run into a situation that was not covered by the manual. When asked by Tadahiro Matsushita, head of the headquarters if there was something they could do, Lieutenant General Masato Taura, then deputy commander of the Central Response Group, who was working at the headquarters as a representative of the Self-Defense Forces, replied, "the police, fire department, Self-Defense Forces, and TEPCO are coordinating [watering] activities at the site, but it's not going well. It's no wonder since everyone wants to work in the best position at the best time."[12] After that, Director Matsushita wrote something on a scrap of paper and faxed it. The result was a written directive, "On the policy of water discharge activities on March 18th," issued in the name of Goshi Hosono, Special Advisor to the Prime Minister. At the end of the directive, the astonishing sentence was inserted, "3) The SDF will assume overall command of future activities such as water discharge and decontamination including the above activities 1) and 2)."

At the disaster scenes so far, first responders were basically coordinating with each other and acting based on their respective command systems. It was unprecedented that both the fire department and TEPCO act under the command of the Self-Defense Forces. For the Self-Defense Forces, assuming command was equivalent to laying their lives on the line. No matter how you looked at it, it was impossible for the Self-Defense Forces to assume responsibility for the lives of police officers and fire fighters.

A "directive" was issued in place of these instructions on March 20, in the name of the Nuclear Emergency Response Headquarters (Prime Minister). Regarding the problematic point, it was decided that the SDF would play a central role in the specific implementation procedures, that were to be decided after consultation, and that the SDF dispatched to the field would "unify management" in the field coordination center.

For the first responders, this was the first case of a "directive" in the name of the Prime Minister. By the time the directive was issued, the fire department and TEPCO were continuing water discharge activities with the Self-Defense Forces.

Yasuo Sato, Tokyo Fire Department's Chief of Defense, who had command of the fire fighting on site, said, "the Prime Minister's directive did not cause a great deal of discomfort because, before the Prime Minister's directive was given, cooperation with the Self-Defense Forces had made progress in the field." He said of that time, "we made a shared declaration that 'our troops were under your command' to Lieutenant General Masato Taura on the Self-Defense Forces side."[13]

Despite all the twists and turns, both the aerial water discharge and the ground water discharge achieved their purpose of discharging water into the spent nuclear fuel pool. How, then, should they be evaluated and what should be passed on to future generations? This will be clarified in Section 3, The truth of "directives" "centering on the Self-Defense Forces": Proposal by the National Governors' Association.

[11] Sato, 2019, p. 258.
[12] Isobe, 2019, p. 54–57.
[13] Sato, 2019.

2. What was questioned? What has changed?

Since the earthquake, four accident investigation reports have been published by the Diet, the government, the private sector and the Japan Atomic Energy Society. Looking at those investigations, descriptions about first responders are surprisingly few. Almost no description is found in the Parliamentary and Government Accident Investigations.

Unfettered by any organization, the Independent Accident Investigation captures the accident from an independent standpoint and from multiple perspectives, investigating the causes and providing lessons and recommendations regarding first responders.

One of them is to recommend the need to examine organization and command systems at the time of a large-scale earthquake in order to establish a system rapid response for first responders.[14]

They next propose the following on-site support. "If this [on-site response of each organization] is also included, along with clarifying the division of roles between nuclear operators and each organization as well as organizational operation systems, there is a need to examine in detail the nature of safety measures for emergency response at nuclear power plants, training and advance preparedness, and methods of responding when a situation occurs."[15]

Thirdly, they argue the need for a nuclear disaster response unit as a last bastion along the lines of the U.S. Federal Emergency Management Agency (FEMA). Specifically, "The last bastion this time was the Self-Defense Forces. (…) The responsibility of the state in the event of a severe nuclear accident and the role of the executing unit responding in that case must be clarified in the legal system. In the future, we should aim to create a full-fledged execution unit for severe disasters and accidents comparable to the U.S. Federal Emergency Management Agency (FEMA)."[16]

As a recommendation regarding first responders in the accident report of the Japan Atomic Energy Society compiled in March 2014, three years after the Fukushima nuclear accident, it is proposed that "given the fact that the activities of the state, the police, fire departments and Self-Defense Forces, who are at the forefront of protecting residents, and the local public bodies responsible for the implementation of protective measures against nuclear disasters, are almost identical to other disaster prevention measures in general disaster prevention, they should be integrated on a common basis with reference to overseas cases as well."[17]

Yoichi Funabashi, who compiled a book based on what became the last testament of Masao Yoshida, Director of the Fukushima Daiichi Nuclear Power Station, concludes his commentary on first responders, "neither the Parliamentary or Government Accident Investigations evaluated the response of the first responders. The police, the fire department and the Self-Defense Forces continue to be a 'blank area of investigation' on the Fukushima nuclear crisis."[18]

What kind of efforts has each first responder subsequently made?
With regard to fire fighting, the Ministry of Internal Affairs and Communications' Fire Service Agency took measures such as reviewing its nuclear facility fire fighting activity manual, organizing

[14] Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, p. 169.
[15] Ibid., p. 168.
[16] Ibid., p. 388.
[17] Atomic Energy Society of Japan, 2014, p. 363.
[18] Rebuild Japan Initiative Foundation, 2015, p. 51.

terminology, and unifying views on the response to victims of nuclear disasters after the Fukushima nuclear accident.[19] Following the earthquake, the agency compiled *A Collection of Records on the Great East Japan Earthquake* in March 2013, holding a Study Group for Upgrading Fire and Rescue Technology (Fire Fighting Activity Subcommittee on Nuclear Disasters, etc.) in that process, measures being taken from the perspective of responding to the revision of the nuclear disaster prevention system of the entire government, reflecting examples of fire fighting activities such as the Fukushima nuclear accident, and recent technological progress.[20] Regarding the introduction of specific materials and equipment, utilizing the supplementary budget for JFY2011, equipment and materials for responding to radioactive material accidents such as personal alarm dosimeters are now deployed at the Emergency Fire Assistance Corps Registration Headquarters.[21]

The police investigated police activity in the Great East Japan Earthquake by the National Police Agency, which was announced in November 2011.[22] They looked at seven items in response to nuclear disasters: evacuation guidance, water discharge activities for reactor buildings, search activities around Fukushima Daiichi Nuclear Power Station, establishing warning zones, various police activities, ensuring the safety of nuclear facilities, and countermeasures for cyber attacks related to nuclear power plants. As matters to be examined in the future, it recommends promoting cooperation with related organizations in light of the loss of contact during the accident, implementing practical training that specifically assumes a nuclear disaster, thoroughly educating police officers about the characteristics of radiation, radiation protective clothing, and providing and enhancing equipment and materials necessary for dealing with nuclear disasters such as personal dosimeters.

In March 2012, the National Police Agency released *Future Crisis Management System related to Disasters* with the aim of expanding the operation of police forces and strengthening its system in anticipation of an earthquake directly under the Tokyo metropolitan area.[23]

Regarding the Japan Coast Guard, in the *Coast Guard Report 2012*, the status of equipment and facility damage for the Coast Guard, restoration of damaged route signs, surveying waterways in damaged ports and nautical charts, and strengthening the system based on lessons learned from the Great East Japan Earthquake are described. However, there is no description of a nuclear disaster.[24] According to an interview with the Environment and Disaster Prevention Division of the Coast Guard, after the Fukushima nuclear accident, training courses for nuclear disasters were conducted for staff members, and regarding protective equipment for nuclear disasters, patrol boats, etc. belonging to the Regional Coast Guard Headquarters where nuclear power generation facilities are located are gradually being increased.[25]

The current Japan Coast Guard has a variety of roles in a vast sea area with a force of 14,000. A commander of the Coast Guard commented that "considering the response to the Senkaku Islands, there's not enough room to devise countermeasures specializing in nuclear disasters."[26]

Regarding the Self-Defense Forces, even before the Fukushima nuclear accident, it was assumed that there might be an emergency under radiation contamination, so the Chemical Unit of the Ground

[19] Interview with Miura Hiroshi, December 9, 2019.
[20] Fire and Disaster Management Agency, 2013, p. 636.
[21] Ibid.
[22] National Police Agency, 2011.
[23] National Police Agency Security Planning Division, 2012.
[24] Japan Coast Guard, 2012.
[25] Interview with Japan Coast Guard Marine Environment Protection and Disaster Prevention Division, March 5, 2020.
[26] Interview with Hisayasu Suzuki (Commander of the Japan Coast Guard at the time of the accident), January 30, 2020.

Self-Defense Forces, which possesses equipment for radiation protection, is deployed nationwide. In addition, the largest specialist chemical unit, known as the Central Nuclear Biological Chemical Weapon Defense Unit, is stationed centrally in Saitama City in preparation for the threat of biological, chemical, and nuclear materials. This unit was also the one that rushed to the scene after the Fukushima nuclear accident.

In November 2012, the Ministry of Defense and the Self-Defense Forces compiled and published *Lessons related to the Great East Japan Earthquake*. The lessons related to the nuclear accident response are as follows: 1) a review of various response plans in the SDF and confirmation of cooperation points, active participation in nuclear disaster preparedness training drills, review of education and training system related to nuclear energy, and 2) a need to reconsider the procedure for information sharing and coordination immediately after a disaster occurs between the Kantei (Prime Minister's Office) and related ministries and agencies.[27]

In the 2012 budget, the year following the earthquake, measures were taken for "carrying out various drills and exercises to strengthen response to nuclear disasters in addition to responding to natural disasters. Also, to attend radiation related courses to strengthen capacity related to nuclear disasters."[28]

Generally speaking, after the accident and in response to a nuclear disaster, the first responders have enhanced equipment and education for responding to accidents involving radioactive material such as personal exposure dosimeters. As for some of the above, although various needs have been stated, actually putting them into practice has not made a great deal of progress.

3. The truth about "directives" "centering on the Self-Defense Forces": Proposal by the National Governors' Association

Examining the water discharge: Repeating the same mistakes?

First, let us examine the aerial water discharge. It was pointed out that the evaluation of the aerial water discharge was divided. On what grounds were these statements based? Were they based on some scientific evidence? Do not such verbal conjectures hinder working out the lessons that will link to the future in Japan?

Some say that water from the helicopter amounted to "the piss of a cicada". If so, there was no need for GSDF troops to risk their lives in releasing water from the air.

Probing the issue, you find that no verification on the effect of the helicopter water discharge has taken place. Neither the Government nor the Parliamentary Accident Investigations examined if it was possible to ascertain how much of the estimated 30-ton seawater aerial drop was injected into the fuel pool, and by what degree the pool was cooled. Nor did the Ministry of Defense or the Self-Defense Forces, the matter ending up in vagueness. I believe this kind of attitude poses a huge challenge. The action of resolutely heading into the skies over Unit 3 at the Fukushima Daiichi Nuclear Power Plant, and feeling one's life to be at the risk, ends up either being a heroic tale, or an irony-loaded cold epithet, the piss of a cicada.

Unless a scientific verification is conducted to examine how much water filled the spent nuclear fuel pool and helped in cooling it, their actions will be wasted. If the verification concludes that there was

[27] Ministry of Defense, 2012a.
[28] Ministry of Defense, 2012b.

little effect from aerial water discharge, then it would lead to the lesson of eliminating aerial water discharge from the options should a similar nuclear disaster occur.

Next, the process of surface water discharge was positively erratic. All things being equal, it should have been the fire fighters, who have the longest experience in discharging water, to rush to the front and implement it, but in reality, they were the last of the first responders to appear. On the other hand, although the police took the initiative, their high-pressure water discharge vehicles for suppressing riots were not suited to discharging water into high places.

What topped it all off was the monologue of Masao Yoshida, Director of the Fukushima Daiichi Nuclear Power Plant. “We got the riot police's one to come in first, but it wasn't very useful. They ended up only doing it once then pulling out. (...) This was especially true of the fire fighters’, but at first, it was going like this, then the tip of the hose gradually fell. And even though it was falling, nobody went to fix it.”[29] This bald monologue by Yoshida, which was not meant to be released, caused a sensation when it was.

Similar to the afore-mentioned verification of the aerial water discharge, unless there is an examination on the ground water discharge based on scientific grounds regarding how many tons of water the police, the Self-Defense Forces, the fire department, and TEPCO's water spray trucks discharged in total, and what percentage of that made it into the pool, it is probably impossible to know whether or not it contributed to the cooling.

Also, there was an opinion at the site that it would be faster to quickly restore the power supply than to discharge water. If so, then, what was the essence of the problem of injecting water into Unit 3’s spent nuclear fuel pool? Unless we examine this, there will be no development for the future.

Finally, from March 22, concrete pump cars started injecting seriously and continuously a large volume of water into Units 4, 3, and 1. Is not a verification by experts from various angles necessary on how effective the aerial and ground water discharges were up until then in maintaining the water levels in the spent nuclear fuel pools? Making the same mistakes should be avoided.

Following the Prime Minister's “Directive”

Next was the “directive” on March 20 from the head of the Nuclear Disaster Headquarters, which entrusted the SDF with centralizing the management of the first responders, subsequently put to use? Let us look back here at the response of the first responders stipulated in the Nuclear Disaster Countermeasures Manual and the response to the recommendations of the National Governors' Association in July 2015, and see how the “directive” was reflected.

Instructions in the Nuclear Disaster Countermeasures Manual

The Cabinet Secretariat of the Nuclear Emergency Preparedness Council established the Nuclear Disaster Countermeasures Manual on October 19, 2012, one year and seven months after the Fukushima nuclear accident, and it is constantly updated. Although the manual basically assumes that first responders conduct off-site activities, on-site measures specify the activities of operational organizations as follows.

The first paragraph states the basic recognition that on-site measures are the responsibility of the operator, and if the operator's response is not adequate, the Kantei's operational taskforce team will make adjustments with the relevant ministries and agencies, including the first responders. After

[29] Rebuild Japan Initiative Foundation, 2015, p. 8, 47.

taking safety measures, the relevant ministries and agencies are to adjust responses related to on-site measures within the range that the first responders recognize as possible.

The second paragraph stipulates that the head of the disaster headquarters (the prime minister), etc., obtains the approval for deployment from the heads of the first responders.

And, in the third paragraph, based on the lesson that a "directive" was issued by the head of the Nuclear Disaster Headquarters at the time of the Fukushima nuclear accident, when several different first responders are active on-site, the Kantei's operational taskforce team is to coordinate activities, it also being stipulated that the head of the Disaster Headquarters should instruct the relevant ministries and agencies of the first responders.[30]

In this way, a system has been defined based on the lessons learned from the Fukushima Nuclear Power Plant accident that allows first responders to direct on-site countermeasures even though the operator is responsible for on-site countermeasures.

Proposal by the Governor's Association: Cooperation among first responders

Following the earthquake, it was the 2015 Governor's Association that encouraged cooperation among first responders. In July of the same year, more than four years having passed since the accident, ensuring the safety of nuclear facilities was of the utmost importance. Recognizing the necessity for the national government to continue to enhance and strengthen nuclear disaster prevention measures, the National Governor's Association adopted its Proposal for Nuclear Power Plant Safety Measures and Disaster Prevention Measures.

As part of the proposal and with regard to first responders, it was recommended, "in preparation for a severe accident, the country's system should be clarified concerning support by operational organizations such as the Self-Defense Forces, maintenance of command, command systems and necessary materials."[31]

In response to this, the government decided at the Nuclear Energy Ministerial Meeting its Stance on Enhancing Nuclear Disaster Countermeasures as a national response policy to this recommendation.[32] The following is an outline of the cooperation policy for operational organizations.

1) The state handles it responsibly
2) Operational organizations cooperate in support activities for accident convergence activities and disaster victims support activities carried out by nuclear operators.
3) In normal times, information on site conditions, accident-convergence activities, evacuation plans for each entity, and local conditions are shared between operators, national/local governments, and private businesses.
4) In the event of an emergency, a predetermined person among the commanders of each operational organization adjusts flexibly according to the situation and the equipment of each unit, and takes necessary measures.

Furthermore, based on the above-mentioned response policy, the government adopted its Cooperation of Operational Organizations at the time of a Nuclear Disaster at the first subcommittee of the Ministry of Nuclear Emergency Response related ministries meeting in July 2017.

[30] Cabinet Office, Government of Japan, 2012, p. 102.
[31] National Governors' Association, 2015.
[32] Cabinet Secretariat, Government of Japan, 2016.

In the above-mentioned Stance on Enhancing Nuclear Disaster Countermeasures, important government policies that lead to a prime ministerial "directive" are specified. This is stipulated in Section 4, "a predetermined person among the commanders of each operational organization adjusts flexibly according to the situation and the equipment of each unit, and takes necessary measures". This means that the role played by the Self-Defense Forces in the Fukushima Daiichi Nuclear Power Plant based on a prime ministerial "directive" will be decided in advance among the commanders of the first responders. This displays the government's thinking based on the lessons learned from the Fukushima nuclear accident. However, in the current plan, it is not yet clear who will be the first responders.

Future issues: Recommendations

We propose that the following issues should be addressed in the future so that the first responders can deepen mutual cooperation and respond more quickly and effectively at nuclear disaster sites and other natural disaster sites.

** Acceleration of communication between first responders (improving communications)*

At present, communication between first responders at the disaster site takes place face-to-face with the local countermeasures headquarters.

Moreover, communication between first responders and the operator is crucial. The team from the Tokyo Fire Department dispatched to the site said, "It was very disappointing, but we [fire fighters]) had hardly any information on the operator's regulatory equipment under the Act on Special Measures Concerning Nuclear Emergency Preparedness, such as information on the anti-seismic building. Uncertainties during operations were extremely high, since the supply point, evacuation point, and replacement point for replacement units were inevitably the command post 40 kilometers away or J Village about 20 kilometers away."[33]

In 2014, the Vice Ministers' Meeting on a Crisis Management Organization pointed out issues such as the standardization of radio frequencies among first responders, but even today there is no change in the status of being unable to communicate unless face-to-face. This issue should be corrected immediately. Bearing in mind not only nuclear disasters, but also an earthquake directly under the Tokyo metropolitan area or a huge Nankai Trough earthquake, it is hoped that cooperation between the first responders will be improved as soon as possible.

It is desirable that shared communication equipment and tablet devices stored in advance at facilities such as offsite centers and local countermeasures offices be prepared, so that communication and emails can be made in real time. It is important to check telephone call status and practice cooperation procedures through joint drills, along with the maintenance of materials and equipment.

** Promoting practical hands-on joint training*

Disaster prevention drills for nuclear disasters include those conducted by the national government, by prefectures, and by nuclear operators.

A former staff member of the regulatory agency said "the current situation is that nuclear disaster preparedness drills are only conducted based on scenarios. The prime minister participates [in the government's nuclear disaster preparedness drills]. Since the governor is at the forefront of prefectural drills, no mistakes can afford to be made. There is a lot of pressure [not to fail] on disaster prevention drills," he said.[34] Since drills could not fail, there was resistance to introducing blind drills.

[33] Interview with Yasuo Satô, October 8, 2019.
[34] Interview with "Old Boy" from the Nuclear Emergency Preparedness Cabinet Office, November 29, 2019.

However, when all participants share the drill scenario in advance, you cannot expect participants to have the ability to judge, share information between complicated organizations, and communicate instructions. In order to deal with a special disaster site such as radiation from a nuclear disaster, it is desirable to use more practical training and further promote game-based training involving the head of the organization as well. It is essential to improve the judgment ability of managers and operators by more actively incorporating blind training, which is conducted by the Self-Defense Forces.

It will be necessary to concentrate personnel and authority in order to carry out blind training in government-level comprehensive nuclear disaster prevention drills. To that end, giving appropriate authority to appropriate departments such as the Cabinet Office Nuclear Emergency Preparedness or the regulatory agencies should be considered as well as creating a function to bring experts together to plan and control training. In addition, a function of continuously and cross-sectionally evaluating drills and the response of training participants is required. It is important that such a supervisory organization have skilled personnel from the participating organizations seconded to an evaluation department for the long-term and using a skilled eye to evaluate at fixed points.

In addition, not only exercises on nuclear disaster but also risk management should be conducted at the central government level as well as in the field. It is becoming increasingly important to provide this kind of exercise to political leaders and administrative bureaucrats given the security environment surrounding Japan in recent years and having to deal with sudden natural disasters and severe accidents.[35] Former Assistant Chief Cabinet Secretary Nobushige Takamizawa commented, "In order to train politicians [strong in crisis management], I think a 'crisis management school' would be effective. You might be able to mix multi-partisan young politicians, researchers and bureaucrats, and train them in decision-making by setting up various scenarios."[36]

As the most realistic way to practice without making large-scale preparations, one possible approach is to have the many related organizations train or participate in the integrated disaster prevention drills conducted by the Self-Defense Forces, exchange opinions, and regularly check points of cooperation.[37]

** Response to wide-area disaster areas that span prefectures*

So far, we have looked at the mission/organization of first responders, the response at the time of the Fukushima nuclear accident, and subsequent responses, it being made clear that when a disaster in a wide area where damage crosses prefectures occurs, fire fighters' and the police's area of activity have to be either municipalities or prefectures. On the other hand, the Japan Coast Guard and the Self-Defense Forces are organizations that operate on a nationwide scale, so even when a nuclear disaster affects multiple prefectures, it is possible to set the operation area and adjust the operational units of the organization according to the extent of the disaster area.

At the time of the Fukushima nuclear accident, the affected area was generally limited to one prefecture, but several nuclear power plants in the Reinan region of Fukui Prefecture are close to neighboring prefectures such as Kyoto and Shiga. In such an area, is it not possible to create a wide-area fire and police cooperation system that straddles prefectures?

[35] Isobe, 2019, p. 255.
[36] Interview with Nobushige Takamizawa, February 4, 2020.
[37] Isobe, 2019, p. 260.

The fire department has a system known as its emergency fire response team, and during the Great East Japan Earthquake, it carried out long-term activities for up to 88 days.[38] The original role of fire fighters is to extinguish fires as quickly as possible. It is not desirable for them to leave their area of jurisdiction for a long period of time. As pointed out by former Commissioner of the Fire and Disaster Management Agency Nobuyasu Kubo, it is necessary when dispatching an emergency fire brigade to not only provide logistical support, but also detailed arrangements including status compensation. Fire fighters deployed to other areas as an emergency fire brigade may need to be deployed as public servants of the national government.[39]

Regarding the police, in addition to prefectural police, there are six regional police bureaus nationwide. Based on the Police Act, the regional police bureaus are responsible for inspecting and instructing the prefectural police, making commendations, coordinating wide-area investigations, responding to large-scale disasters, and police communications, etc. It does not have the authority to centrally command.

Not only nuclear disasters but also natural disasters are expected to increase in scale, frequency, and severity, and the population is declining nationwide. Regarding the disaster response capabilities of the police operating in Japan, it is becoming an issue to respond flexibly and agilely across the boundaries of municipalities and prefectures.

4. Japan-U.S. Alliance as support responder

With the exception of the Independent Accident Investigation, no other investigation captured the Fukushima nuclear accident in the context of the U.S.-Japan alliance.

Chapter 12 of the report, U.S.-Japan Relations Regarding Nuclear Accident Response, clearly verifies how the U.S.-Japan coordination was carried out. Finally, in response to the question, "did the U.S.-Japan alliance function?" it said, "in a critical situation, until a cross-ministerial approach was established, it was the alliance function between the Self-Defense Forces and the U.S. Army that undertook the responsibility for coordinating between Japan and the United States."[40] It later concluded, "in an extremely important accident like this involving governmental and private organizations other than those traditionally involved in managing the alliance, such as the defense authorities, the military, and diplomatic authorities, the key is how to systematically build a multi-layered information sharing/coordination system that covers not only bilateral but also all functions inside and outside the government. What is required is precisely the creation of a "whole of state" or "whole of alliance" approach."[41]

Approximately at the same time, or slightly after, the verification work of the Independent Accident Investigation, interviews with the people involved were underway in the Government Accident Investigation. Of particular note is the fact that they were interviewing Japanese government officials about the state of coordination between the U.S. and Japan at the time of the accident. This covered politicians, Cabinet Secretariat, Ministry of Defense, Ministry of Foreign Affairs, NISA, the Atomic Energy Commission and others. In these interviews, many valuable opinions regarding coordination and cooperation in the U.S.-Japan alliance are presented. However, for some reason, the Government

[38] Kubo, 2015, p. 31.
[39] Interview with Nobuyasu Kubo, December 3, 2019.
[40] Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, p. 380.
[41] Ibid.

Accident Investigation does not include the results of its verification on the status of coordination between Japan and the United States.

What should be learned from the coordination between Japan and the United States, especially Operation Tomodachi?

Lessons learned from the Hosono Process

Cooperation between the Japanese and U.S. governments was a series of miscommunication at the beginning of the Fukushima nuclear accident. U.S. Ambassador to Japan John Roos telephoned Chief Cabinet Secretary Yukio Edano on Tuesday, March 13, and the night of March 14 to ask for an American expert to be dispatched to the Crisis Management Center. This was finally accepted on the third phone call in the afternoon on the 15th. The Hosono Process began in the midst of the growing communication gap between the two governments.

The Hosono Process was a conference body that aimed at sharing information and awareness about the Fukushima nuclear accident between the two governments of the United States and Japan, and to discuss cooperation between the two countries for an early end to the accident. This name was given by the U.S. participants based on the name of the Japanese representative, Special Advisor to the Prime Minister Goshi Hosono. Participants on the Japanese side were Special Advisor Hosono, the Cabinet Secretariat, Ministry of Economy, Trade and Industry, Ministry of Foreign Affairs, Ministry of Education, Culture, Sports, Science and Technology, Ministry of Defense and the Self-Defense Forces, NISA, TEPCO, and others. The U.S. side comprised U.S. counterparts, such as James Zumwalt, Deputy Chief of Mission at the U.S. Embassy in Tokyo, and Charles Casto from the U.S. Nuclear Regulatory Commission (NRC). At the beginning of the accident, communication between Japan and the U.S. was barely connected by an extremely thin pipe. Amidst the lack of information sharing between the Japanese and U.S. governments, officials from the Ministry of Defense, Ministry of Foreign Affairs, Ministry of Economy, Trade and Industry, NISA, and TEPCO met at the Ministry of Defense for the first time on March 16th, five days after the disaster. From the U.S. side, the U.S. Embassy in Tokyo and the U.S. Armed Forces in Japan participated in discussions, and this meeting was developed into the Hosono Process established on the 22nd.

The process was characterized by the following: the fact that a Japanese politician, Special Advisor to the Prime Minister Hosono headed the Japanese side; the fact that all related organizations, including the Self-Defense Forces, the U.S. forces, and TEPCO, all participated; and thirdly, the fact that a direction was set that with the participation of the director general class, decisions could be made on the spot.

Special Advisor Hosono said of the process, “the silo mentality that symbolizes Japan was resolved relatively smoothly. Each had a strong sense of all Japan pulling together in the face of the crisis at the nuclear power plant.”[42] Zumwalt recollects about the meetings, “The military were probably familiar with having this kind of meeting, but the civilians weren’t. So, with the participation of all the ministries concerned, this meeting was very meaningful.”[43]

Reflected in the Guidelines for Japan- U.S. Defense Cooperation

This achievement was to be reflected in the new Guidelines for Japan-U.S. Defense Cooperation formulated in April 2015, four years after the earthquake with the establishment of a new “alliance coordination mechanism”. Within that, a consortium was formed called the Alliance Coordination

[42] Isobe, 2019, p. 99.
[43] Ibid., p. 103.

Group, in which the Ministry of Defense, the Self-Defense Forces, the Ministry of Foreign Affairs and other related ministries and agencies participate.[44]

However, looking at the details of the Alliance Coordination Group, it must be said that it is still in the middle of reaching a cross-ministerial and unified government response. Participants in the group are described as "representatives from the Cabinet Secretariat (including the National Security Bureau), the Ministry of Foreign Affairs, the Ministry of Defense/Self-Defense Forces, and related ministries (NB: as required)." In other words, other than the Cabinet Secretariat, Foreign Affairs, and Defense, there is a reservation that rather than participate regularly, the others will participate as required. These are the Guidelines for Japan-US Defense Cooperation authorized by the Japan-U.S. Security Consultative Committee (a so-called "2+2" four-member committee consisting of the Foreign and Defense Ministers and the U.S. Secretary of State and Defense). Yes, it may reflect the opinion of other ministries that ministries other than foreign affairs and defense are not obligated. However, there were many related ministries and agencies that responded to the Fukushima nuclear accident. Will it not be indispensable for all ministries to participate if an even more intense situation than Fukushima arises in which the United States and Japan jointly deal with an armed attack? It would consequently be appropriate for relevant ministries and agencies to participate in the Alliance Coordination Group on a regular basis and, if possible, for politicians at the Kantei to also enter this scheme in the way that Special Advisor Hosono led the other initiative.

The essence and lessons of Operation Tomodachi

Operation Tomodachi[45] is the name of the disaster relief and humanitarian operations conducted by the U.S. military during the Great East Japan Earthquake. The SDF and the U.S. Armed Forces often conduct joint training and consultations to communicate with each other. Even during the Great East Japan Earthquake, immediately after the quake, cooperation began between the Joint Staff Division, the command center of the Ministry of Defense, and the U.S. Army in Japan.

The characteristics of this operation are that, firstly, the United States Armed Forces formed a joint task force for the first time in Japan and joined in Operation Tomodachi; secondly, the name of the operation was "Joint Support Force (JSF);" and finally, the mission of the U.S. Army extended not only to disaster relief and humanitarian assistance but also to a wide variety of tasks.

Immediately after the earthquake, the Self-Defense Forces and the U.S. Armed Forces in Japan dispatched liaison officers to each other and worked closely together to provide disaster relief and humanitarian assistance. However, information was received in a telephone conference between the Joint Chief of Staff and the Commander of the U.S. Army in Japan on the night of the 18th that a navy admiral and U.S. Navy Pacific Fleet Commander, located in Hawaii, was coming to Yokota Air Base on the 20th to assume command of the Joint Support Force.[46] This information was a bolt from the blue for the SDF. Both Japan and the United States had been accumulating command post training and operational training under normal conditions, but it was the first time in history that the U.S. Army formed an integrated unit in Japan and the Navy took command of it. This was proof that not only the U.S. military but also the U.S. government took the Fukushima nuclear accident very seriously. It is believed that they were worried that if the Fukushima Nuclear Power Plant was not properly controlled, the U.S. military Yokota Base, Yokosuka Base and Sagamihara Depot would not be able to operate in the Kanto area.

[44] Ibid., pp. 172–173.
[45] Ibid., pp. 110–111.
[46] Ibid., p. 122.

The next point regards the name Joint Support Force. Normally, when the U.S. military conducts operations, it forms a Joint Task Force (JTF) by combining units from land, sea, air, and marines that suit the purpose of the operation. And the name of this unit is usually JTF XYZ. However, in the Great East Japan Earthquake, although it was a joint task force, it was named the JSF (Joint Support Force). Admiral Robert F. Willard, Commander of the U.S. Pacific Command, who was head of the U.S. forces in the Asia-Pacific at the time, said, "The reason we used JSF and not JTF, was because we wanted to make it clear that it was the SDF side being supported and the United States on the side of supporting. As the situation worsened, we recognized the need to expand the scope of our support and strengthen our command, so eventually the role was given to the Pacific Fleet commander."[47] The important point here was the fact that the main force of this operation was the Self-Defense Forces, and that the U.S. Armed Forces were dedicated to providing support. Command relations between the U.S. and Japanese units in US-Japan joint training are arranged in parallel and follow their respective command systems. Operation Tomodachi was carried out according to each command system, but the U.S. military took a step back.

Finally, as I have touched on earlier, JSF's mission was to provide disaster relief and humanitarian assistance to Japan, which had been hit by an unprecedentedly compound disaster, and to help American citizens living in eastern Japan. At the time, it also had the task of evacuating abroad.[48] The U.S. Marine Corps commander in Okinawa was in charge of evacuation. When they heard the explanation from him, the command directors recalled the tense situation at the time, "at the same time as having an unfamiliar feeling of frustration going through our minds about the fact that American citizens from our U.S. ally might evacuate in this tough situation from Japan, we knew the Fukushima Daiichi Nuclear Power Plant accident had to be contained at all cost."[49]

When you view the alliance with a cold eye, it is only normal for the interests of both parties to intersect. Of these, it is the work of the alliance to find common interests that are the greatest common divisor for both parties. French President De Gaulle is said to have said that allies may come to your rescue, but they will never share your destiny. Operation Tomodachi in the Fukushima nuclear accident was precisely on that brink. At the time, if things became worse, the U.S. military would have, of course, evacuated U.S. citizens residing in the Kanto region. For them, the overriding task was to protect the citizens of the United States.

The U.S. military seriously tried to support Japan. This was because the White House and other political leaders at the Department of State and the Department of Defense as well as senior civilian officials believed in the importance of the U.S.-Japan alliance, but at the same time, the solid training between the U.S.-Japan military personnel cultivated through joint training under normal conditions was also a gift of trust and friendship. "When it comes to professionalism, the Self-Defense Forces are always in the top tier. I had no worries whatsoever about professionalism regarding the SDF,"[50] said Michael Mullen, Chairman of the Joint Chiefs of Staff and the top U.S. military man at the time. "The military-military relationship was extremely easy to have talks with, because we've always been training together since before the crisis. All I had to do was to pick up the phone to communicate with Oriki. That's how deep the relationship between the U.S. Army and the Self-Defense Forces is."[51] Although there were communication problems and conflicts of interests between the two countries, the strong bond between the Self-Defense Forces and the U.S. Army resulted in Operation Tomodachi, further strengthening the U.S.-Japan alliance.

[47] Ibid., p. 129; Interview with Robert Willard, September 25, 2017.
[48] Ibid., pp. 132–134.
[49] Ibid., p. 134; Interview with Masayuki Hironaka, August 1, 2018.
[50] Ibid., p. 203; Interview with Michael Mullen, August 1, 2017.
[51] Ibid., p. 225; Interview with Michael Mullen, August 1, 2017.

5. The operators and first responders (The Mariners' Act Model)

Let us revisit the Nuclear Disaster Countermeasures Manual. The manual still adheres to the expression that coordination with first responders, who are operational organizations, will commence when it comes to a full emergency.

What should be done when confronted by such an ultimate situation? Neither the government nor the operators have an answer yet about what concrete adjustments are to be made.

Is the operator then to leave everything to the first responders in the event of a nuclear disaster and be a complacent secondary responder? With brutal frankness, staff working for the Cabinet Nuclear Emergency Preparedness said the reason why first responders did not participate in the operators' disaster prevention drills was "because the operator is supposed to stay put until the very last. They're instructed to stay put until the last. We've had serious discussions with staff at the Regulatory Agency about whether they'll have to do the ultimate valve at the end. The Ministry of Defense says it won't do it and the operator that it can't. So, we wonder if it will be someone from the Regulatory Agency or someone involved with them."[52] However, from the perspective of the first responder, this is basically the responsibility of the operator, and if there is a role that the operator cannot fulfil, such as the transfer of materials and equipment to the site, then, under a division of labor, that role is expected of the first responders, and so it is true that until a specific need is identified, they cannot provide an answer.

When asked if there were specific requirements for first responders regarding support for the site, a TEPCO executive replied, "In the present situation, since we did what we could, there aren't any explicit requirements for this or that please. But when the unexpected happens, it's bad not being prepared, so I think we should be sharing on a daily basis a basic risk map about the structure and risks of the power plant and avoid a situation where both parties (the operator and the first responders) are seeing this for the first time."[53]

Although it is the operator who makes every effort to prevent the worst situation, there is no one but the first responders who can provide the ultimate help when all measures are exhausted.

<u>Is a legal approach conceivable?</u>
Although we believe first responders will ultimately respond alongside operators, a moral hazard for nuclear operators should not be created and the status and treatment of operators working at nuclear power plants should be guaranteed. In that regard, legal provisions may be desired.

At this time, the Mariners' Act might be helpful. According to the Mariners' Act, the regulation covering the duty of the captain to remain with the ship is "Article 11: With the exception of unavoidable cases, unless the captain delegates his duties to another person to direct the ship on his behalf, the captain must not leave the vessel under his control from the time of loading cargo and boarding passengers to the time of landing cargo and passengers."[54]

[52] Interview with multiple former staff of the Nuclear Emergency Preparedness Cabinet Office, November, 2019.
[53] Interview with TEPCO executive, November 27, 2019.
[54] From the homepage of the Ministry of Land, Infrastructure, Transport and Tourism Hokuriku-Shin'etsu District Transport Bureau: "From the perspective of protecting workers, (...) only sailors are subject to the seafarers' law. This law addresses the following particularities of maritime workers: Long-term absence from land; the inability to receive aid (repairs or medical) from outside the ship; doing dangerous work in a moving ship (including the danger of

There is no move to prepare a bill that imposes the obligation to remain at the facility until the end on the nuclear operator as in Article 11 of the Mariners' Act. A TEPCO executive said, "Not even the Prime Minister had the power to order TEPCO employees to put their lives on the line at the time of the Fukushima accident. At the time, TEPCO's onsite handling of the accident was on a voluntary basis. As long as we can't get employees to sign a contract like the SDF's Pledge of Service, all we can do is take preventive measures to prevent severe accidents."[55] Operators will remain in the reactor on an absolutely voluntary basis.

Shuya Nomura, who was involved in the Parliamentary Accident Investigation, explained the need for legal developments such as the Mariners' Act as follows. "I wouldn't object to making such a law, but it would be a legislative mistake to bind them by law because if things are left as is, they will take to their heels. On site at the Fukushima Nuclear Power Plant [the reactor operator] dealt with the accident without fleeing. To say they would run is an insult to them and is contrary to the facts. On the other hand, I think using the words compulsory for public compensation would be acceptable. For example, compulsory hospitalization as a measure to counter designated infectious diseases such as coronavirus uses the term compulsory as a basis for publicly funded benefits. It differs from the logic of if left to their own devices, they wouldn't be hospitalized."[56]

"Even if it is an irrational command, people will act if they have a sense of mission. The same applies to the Japanese members of university faculty who currently remain in Wuhan, but when it comes time, people are prepared to act. Isn't that why, when taking an oath for assuming a position, instead of clearly specifying the obligation of dealing with a crisis, compensation is guaranteed for that through mutually agreed coercion and financial compensation if the maximum allowance is promised as compensation?"[57] It is impossible to find a simple and clear answer for the ultimate question. However, at the end of the day we can say that we must contemplate the following.

6. "The ultimate question"

What should we do if a reactor falls into a situation where the vent has to be opened even at the risk of life?

Of course, the ironclad rule for preventing such a situation is to consider and prepare all the necessary measures, and train for them, so that a reactor can be kept in a prior state. Still, when the unanticipated happens, and you have to vent even at the risk of life, who exactly will be the person to say, do it, and to whom?

The Chernobyl nuclear accident

On April 26, 1986, the nuclear reactor explosion at the Chernobyl Nuclear Power Plant in the Ukraine in the former Soviet Union released radioactive material into the atmosphere surpassing that of the Fukushima nuclear accident. Immediately after the nuclear reactor's explosion, it was the power plant and the local fire brigade that rushed to the scene. They extinguished the fire in the presence of very high concentrations of radioactive material with poorly prepared protective clothing. Many were

capsizing); labour consisting of 24 hours of continuous overlap between 'work' and 'life.' In Ministry of Land, Infrastructure, Transport and Tourism, Hokuriku Shin'etsu Transport Bureau. (n.d.).
[55] Interview with TEPCO executive, November 27, 2019.
[56] Interview with Shūya Nomura, February 4, 2020.
[57] Ibid.

exposed to intense radiation and died.[58] A military helicopter unit was subsequently deployed. Sand and boron started to be dropped into the reactor that exploded 40 hours after the accident, 5,000 tons being dropped in about ten days.[59] Most of the pilots were heroes who had fought in Afghanistan and were highly skilled. The most rigorous tasks of removing radioactive debris and building the sarcophagus were carried out by service soldiers, reserves, engineering units, and private guards. Many young soldiers were from Central Asia who could not speak much Russian and had no knowledge of radiation protection. They were called biorobots. Nearly 600,000 people were mobilized for this intense work.[60] At the time, the Soviet Union had a one-party dictatorship system of the Communist Party, which had little consideration for basic human rights and radiation protection, and there was a backdrop that progress was to be made on the sarcophagus for the nuclear reactor no matter the human sacrifice. As such, it does not serve as a reference at all. The Chernobyl accident tells how harsh the task of sealing an exposed reactor is for humanity.

Role of first responders shown in Nuclear Disaster Countermeasures Manual

According to the Nuclear Disaster Countermeasures Manual mentioned above, the basic principle for on-site countermeasures is that they are the responsibility of the operator. Tetsuya Yamamoto, former policy director of the Cabinet Office (Nuclear Disaster Prevention) confirmed the principle of the manual saying, "the on-site response involves a system design that the operator is primarily responsible for acting. However, staff of the Regulatory Agency have technical knowledge about responding to a severe accident, and have made great progress compared to the days of NISA. Basically, it's the responsibility of the operator, but if there's a role that the operator can't fulfil, such as the transfer of materials and equipment to the site, then that role is expected of the Self-Defense Forces, and so on."[61]

Charles Casto, who was sent to Japan from the U.S. NRC at the time of the Fukushima nuclear accident, said to this ultimate question, "Well, you can't ask civilians. They didn't sign up for that. That would have to be SDF, police, fire etc. Just regular people didn't sign up to die. And that's why I commend the operators at both of these sites."[62] Meanwhile, George Apostolakis, Professor Emeritus at the Massachusetts Institute of Technology and Head of the CRIEPI Nuclear Risk Research Center, said, "the control room operators are the absolute masters. (…) the principle is that the control room operators are the masters."[63] The views of these two U.S. experts diverge.

First responders' Oath of Service

Public servants who serve the public take office by signing an oath of service to the appointed authority when they are appointed. The same applies to first responder staff.

The oath of SDF personnel is exemplary. "I will be cognizant of the Self-Defense Forces mission to protect the peace and the independence of Japan, to comply with the Japanese Constitution and the laws, and shall aim to maintain unity, to strictly and impartially observe rules, to constantly cultivate virtue, to respect people, to refresh mind and body, to polish skills, to execute duties with a deep sense of responsibility and dedication, to face events without regard for risk, to strive to the utmost of my abilities to complete the assigned tasks, and to respond to the will of the people."[64]

[58] Plohky, 2018, pp.87–100.
[59] Potter et al., 1991, pp.1034–1047.
[60] Plohky, 2018, p.218.
[61] Interview with Tetsuya Yamamoto, November 22, 2019.
[62] Interview with Charles Casto, August 26, 2019.
[63] Interview with George Apostolakis, January 29, 2020.
[64] Self-Defence Forces Act Enforcement Regulations (Prime Minister's Office Ordinance No. 40 of 1945).

Of civil servants, only Self-Defense Forces personnel swear "to face events without regard for risk, to strive to the utmost of my abilities to complete the assigned tasks, and to respond to the will of the people." Even if, then, the SDF were suddenly ordered to come and open the vent, it would probably be impossible to open a vent they had never before seen or touched. The SDF is a national organization that anticipates invasions such as armed invasion, and is usually prepared through rigorous training, refining its training and preparing for emergencies. However, their knowledge of reactors is almost non-existent, and reactor structures are an unknown. It would be well nigh impossible for them, even if asked, to suddenly become reactor operators and vent.

Ryoichi Oriki, Chief of Staff at the time of the earthquake, commented on the oath of SDF personnel as follows.

"They swear 'to face events without regard for risk' in order to be prepared for a national emergency, so it's not as if the SDF are prepared to lay down their lives for all the dangerous events in the world. That's not the case. Basically, they put their lives on the line when carrying out their duties against armed forces or members of armed forces. I think asking personnel without expertise to go in to open a vent can even increase the number of victims and worsen the situation. Only experts can ensure success with minimal damage."[65]

Looking back on the first responders' response to the Fukushima nuclear accident, it was not only the Self-Defense Forces, who swear to face events without regard for risk and to strive to the utmost of their abilities to complete the assigned tasks, who put their lives on the line at the Fukushima nuclear accident. It is true that the crew of the GSDF helicopter, who performed the seawater air drop into the reactor building under high radioactive contamination, put their lives at risk in an effort to complete their duty, but this was followed by the groundwater discharge by the police, the Self-Defense Forces, the fire department, and TEPCO's unit.

In this way, regardless of the content of their pledges, it can be said that the first responders were prepared to risk their lives and take on the task when a national crisis was imminent.

For that reason alone, it is more important than anything else that the government take various actions in advance in light of various situations, so that they can do their jobs without endangering themselves, rather than relying solely on their resolve.

7. Political and military relations: 10 years after the Fukushima accident– the relationship between politics and the Self-Defense Forces

Clarifying in this way the relationship between first responders and the operator is a reminder of the necessity for both the operator, who manages and operates the reactor, and the first responders, who support the operator, to face responding with a clear sense of mission and determination. And it is politicians and state leaders who in the end seek the ultimate measure. In the Fukushima nuclear accident, what was the relationship between the first responders, especially the SDF and politics, and what kind of civil-military relationship was it? What was the lesson there? What has changed in the last 10 years?

The relationship between politics and the Self-Defense Forces at the time of accident
In a press conference the day before the water drop on the reactor building at the Fukushima Daiichi Nuclear Power Plant, when asked if they would release water from a helicopter, Defense Minister

[65] Interview with Ryōichi Oriki, January, 21, 2020.

Toshimi Kitazawa replied, "it is the ultimate duty of the SDF to protect the people. And resolve to carry out this last-minute mission has been consolidated at the Ministry of Defense and the Self-Defense Forces,"[66] announcing they were prepared to risk the life of the troops.[67] It was the first time since the inauguration of the Self-Defense Forces that a minister himself announced in public that the SDF was determined to do an aerial water drop at risk of life and limb. At this point, there was no discrepancy between the politicians and the SDF engaged in the aerial drop.

On the other hand, in a post-drop press interview with Defense Minister Kitazawa, he stated, the order "was a decision made by the Chief of Staff himself upon his own judgement of the Prime Minister's and my weighty decision."[68] This statement caused some controversy. Some pointed out that the Defense Minister escaped his responsibility and had the Chief of Staff make a decision. Regarding this, Masayuki Hironaka, General Manager of the SDF Operations Division at the time, notes that there were SDF officers who were confused by this third-party like statement. Apparently, there was a sense of incongruity that wasn't it the politicians, who were the leaders of the state, not the commander-in-chief, who bore responsibility for the final decision? Hironaka said later, "Japan's political leaders, including Prime Minister Naoto Kan, the Supreme Commander of the Self-Defense Forces, have no understanding of the principles involved in using the Self-Defense Forces, which is a defense organization. (...) The commander of the Self-Defense Forces was also unable to grasp the nature of the relationship with the political leaders, and it was difficult to clearly present options from a military perspective to the political leaders,"[69] demonstrating the lack of a "common language"[70] between the politicians and the Self-Defense Forces.

Has the relationship changed over the last 10 years?

How, then, has the relationship between politics and the Self-Defense Forces changed ten years on from the disaster?

In December of the year following the earthquake, the DPJ government changed to the second Abe Administration. The Abe Cabinet launched the National Security Council in December 2013, and the Joint Chief of Staff now regularly attends meetings. The Joint Chief of Staff (formerly the Chairman of the Joint Staff) also attended the Security Council and the Defense Council, which were the predecessors of the National Security Council, but the frequency and content of the meetings have changed. Looking at the annual average frequency of meetings, the National Security Council met 32.7 times (the average for 2014-2019), a significant increased compared to the former Defense Council, which met 2.4 times, and the former Security Council, which met 8.1 times.[71] In addition, discussions cover North Korea and the Indo-Pacific region, and the opportunity for the Chief of Staff to explain and speak are increasing.

With the harsher security environment surrounding Japan, it seems that politicians and the public are deepening their interest and understanding regarding security and defense. In fact, Katsutoshi Kawano, a former Vice-Admiral and Chief of Staff for four years and five months under the Abe Administration (retired April 1st 2019), said, "We shared a common language and values with Prime Minister Abe. I think he is the first post-war prime minister interested in the SDF's actions and always bears them in mind."[72] Although there were exceptions such as Yasuhiro Nakasone, a post-war prime

[66] Ministry of Defense, 2011.
[67] Isobe, 2019, p. 50.
[68] Ministry of Defense, 2011.
[69] Hironaka, 2017, pp.28–29.
[70] "Common language" means a common understanding and recognition that forms a basis of mutual trust and communication among actors from different positions.
[71] Chijiwa, 2016, p. 8.
[72] Interview with Katsutoshi Kawano, May 21, 2020.

minister and experienced defense minister with a deep knowledge of defense issues, it is worth noting that the Abe Administration as a whole, not just Abe the man, has tried to share a "common language".

On the other hand, with the deployment of troops to disasters due to large-scale storms and floods in recent years, it has been heard that even when the SDF is deciding on its own unit operations, matters are sometimes decided in local task forces because they are the wishes of the Kantei. An example is the size of deployed troops. If the duties to be assigned are to be determined by political judgements, it would be more appropriate to let the SDF decide on optimal unit sizes and the necessary scale.

It is important that there always be a dialogue between politicians and SDF leaders on what politics should judge and decide, and what should be left up to the SDF, not only for deployment in disasters but also for coping with various situations.

The Self-Defense Forces: Conflict between the "last bastion" and an "all-rounder bastion"

The roots of the Self-Defense Forces are in the police reserve forces that were established to fill a void of power from the diversion of troops stationed in Japan to the Korean Peninsula at the outbreak of the Korean War broke in 1950. The Self-Defense Forces was established in 1954 without amending the constitution at a time when there was strong aversion to the army shortly after the defeat. In a hostile climate, the SDF has striven since its inception to become a beloved SDF accepted by the people, focusing its efforts on recruiting and public relations. It was in the Great East Japan Earthquake that this half-century long desire to be recognized by the people was fulfilled.

However, what was accepted was a SDF that was active in disaster relief and humanitarian assistance rather than a SDF for national defense. According to a public opinion poll on the SDF/defense issues conducted in 2018, 79.2% of the total respondents cite disaster relief as the role expected of the SDF, followed by national security at 60.9%.[73]

The Self-Defense Forces have begun to move further forward in responding to frequent disasters following the Great East Japan Earthquake. It mobilized a total of 850,000 people in the 2016 Kumamoto earthquake, 100,000 people in the 2017 heavy rains in northern Kyushu, and a total of 1.19 million people in the July 2018 heavy rains and the Eastern Hokkaido Iburi Earthquake. Its modes of dispatch are becoming more diverse, including special deployment for swine cholera in JFY 2018 and responding to the novel coronavirus in 2020. Today, the Self-Defense Forces are no longer the "last bastion", but are becoming an "all-rounder bastion". As a national asset, it has come to be deployed under various circumstances. The SDF has become a handyman, which raises the issue that this new image may hinder its original training and prevent the SDF from showing its true potential at a critical moment. The SDF is a first responder, but it is also the final or ultimate responder as well. The final bastion of a nation is its army. When the SDF looks over its shoulder, no one is there. The task of a first responder is naturally important, and everything that can be done for victims should, of course, be done. However, we must not forget for a moment that the SDF is the ultimate responder.

Civil-military relations

The need for a "common language" between politicians and the Self-Defense Forces may be placed in the broader context of the need for a "common language" between society and the SDF. One manifestation of this is the difference in enthusiasm between society and the SDF regarding its mission and role. Among the people, the expected role of the Self-Defense Forces is disaster deployment rather than defense. It is difficult to say that defense, the original task of the Self-Defense Forces, is widely acknowledged by the people. As mentioned above, the SDF is "the last bastion", but it is becoming an "all-rounder bastion" in light of recent disaster deployment.

[73] Cabinet Office, Government of Japan, 2018.

An “all-rounder bastion” and “last bastion” are also themes for coordinating the relationship between the military value of the army and its professional and functional roles.

Samuel Huntington, who pioneered a new academic field called civil-military relations by theorizing the relationship between politics and the military in modern nations, wrote in his book *The Soldier and the State* about the relationship between the military and society. He said.

“The military institutions of any society are shaped by two forces: a functional imperative stemming from the threats to the society’s security, and a societal imperative arising from the social forces, ideologies, and institutions dominant within the society. Military institutions that reflect only social values may be incapable of performing effectively their military function. On the other hand, it may be impossible to contain within society military institutions shaped purely by functional imperatives. The interaction of these two forces is the nub of the problem of civilian-military relations.”[74]

The army cannot exist without society, and society cannot exist without the army. In the words of Huntington, pre-war Japan could be said to have failed as a result of pursuing too many “military institutions shaped purely by functional imperatives” beyond society’s tolerance. And the Self-Defense Forces that were born after the war “reflect only social values [and are therefore] incapable of performing effectively their military function].”[75]

It seems that both pre-war Japan and post-war Japan have come along without managing to find a harmony and balance for these two imperatives of “social values” and “military function”. And even today, it seems unlikely that the people, political leaders, and the Self-Defense Forces are seriously addressing this issue in search of a solution. Huntington argued, “some societies may be inherently incapable of providing effectively for their own military security. Such societies lack survival value in an era of continuing threats.”[76] The time has come for the people, politicians, and the SDF to find a balance point between “functional imperatives based on threats” and “social imperatives”.

Yuichi Hosoya, a professor at Keio University, said, "In post-war Japan, discussions have concentrated on controlling the SDF as a ‘competent organization’ and there have been limited opportunities to envision desirable and harmonious relationships.”[77] He went on to state, “Only when the people and government understand the difficulties, empathize, respect, and even provide compensation for military personnel, who will ultimately be compelled to sacrifice their lives, will military personnel also be subject to such controls. It is a reciprocal relationship, which requires trust on all three sides of the triangle,”[78] emphasizing that interaction of the people and politicians with the SDF is the cornerstone of a healthy relationship of trust.

Issues within the Self-Defense Forces: establishment of a new integrated commander

Next, the Fukushima nuclear accident left lessons on political assistance and troop operations. Political assistance is the role of the Self-Defense Forces in assisting political decisions on behalf of the Self-Defense Force on the side of being controlled. Troop operations refer to the role of bundling the three Self-Defense Forces, establishing operations under one policy, and executing that policy. In democratic countries, the political assistants and the troop operators are usually separated.

[74] Huntington, 1957, p.5.
[75] Ibid.
[76] Ibid.
[77] Hosoya, 2019, p. 24.
[78] Ibid., p. 23.

In March 2006, the Self-Defense Forces' Joint Staff Council and its secretariat were abolished, and the Joint Staff Office was established. Along with this, a system has been established in which the Chief of the Joint Staff will assist the Defense Minister in an integrated fashion in the operation of the Self-Defense Forces. However, there still remains no integrated command center that binds the operation of the three Self-Defense Forces under one commander. For the sake of convenience, the Joint Staff Office assumes this role. Despite not having command authority, the Joint Staff Office also played a commanding role during the Great East Japan Earthquake.

At the time, Joint Chief of Staff Ryoichi Oriki, who was the top uniform and was in both positions of assisting politics and managing the operations of the Self-Defense Forces, said, "I had to use about 40% of my time on Japan-U.S. coordination, ministerial assistance, and liaison with the Kantei, so I could only devote 60% to the operation of the troops."[79] Furthermore, he recalls, "because of the lack of personnel in normal times, we start off with the expectation of 'one person, two roles', but once there is a disaster or a battle begins, that becomes 'two people, one role'."[80] He is saying, in an emergency or crisis response, it is impossible for one person to play the two roles of bundling political affairs and operating troops, and in normal times, one or two roles may be manageable, but it is impossible during an emergency, and if possible, you need to have four times the number, i.e. two people, one role.

After the earthquake, momentum for a division of labor increased in the form of a new integrated command established to centrally control the three Self-Defense Forces from within the SDF and politics, the chief of the integrated staff to be dedicated to assisting politics, and the integrated commander to be dedicated to operating and managing the units of the SDF. In March 2018, a joint meeting of the Liberal Democratic Party's Security Investigation Committee and the Defense Committee proposed that a unified commander should be permanently installed.[81] However, the establishment of an integrated headquarters was postponed in the new General Defense Plan decided by the Cabinet in December of the same year.

If the Chief of Staff puts a great deal of emphasis on political assistance, unit operations will be neglected. The reverse is also true. Former U.S. Secretary of State Colin Powell, a military officer, said in his autobiography, "In my days as an intermediate-level officer, I was sometimes afraid of the obedience of the Joint Chiefs of Staff. They engaged in the Vietnam War without asking the politicians for a clear goal."[82] The Chief of Staff should be devoted to political assistance, and the Joint Commander should be in charge of managing unit operations in a centralized manner and clarifying what the SDF can and cannot do. It is inevitable that there will be disagreement between the Chief of Staff and the Joint Commander. This is because each position is different. But in that tension, it is their role to find a point of equilibrium under the direction and supervision of the Defense Minister. The military cannot be regulated only by political needs, and conversely, it is not possible to carry out operations pursuing only military rationality and disregarding the actual situation of society.

Although the current relationship between politics and the Self-Defense Forces is heading in the right direction, two-way communication is still insufficient. This means that in Huntington's words, in Japan, the pre-war military forces pursued too much"a functional imperative stemming from the threats to the society's security" leading to the country's destruction, but the post-war Self-Defense Forces are nothing but still hesitant about asserting this imperative. In order to bring about

[79] Funabashi, 2014, p. 225.
[80] Ibid., p. 219.
[81] Mainichi Shimbun, 2018.
[82] Powell, 1995, p. 548.

coordination and balance, an integrated commander should be swiftly created to unite the three Self-Defense Forces.

Summary

We have analyzed how the first responders responded to the Fukushima nuclear accident and what they subsequently learned, as well as further explored the essence of support responders from the U.S. military.

Firstly let us recap on the first responders. In the event of a nuclear disaster such as the Fukushima nuclear accident, it goes without saying that closer coordination and cooperation between the first responders will be needed, but even more so is the fact that a more detailed discussion is needed on how the operators and first responders should share roles in a nuclear disaster. At the same time, constant efforts and reforms are needed to permit the government to respond promptly in the event of not only a nuclear disaster but also other major disasters.

Next, the support responders, the U.S. Army, the only allied army Japan has. Considering the growing preference for domestic politics in the United States, it is necessary for Japan itself to lead the way in multi-layered ties in various fields such as politics, diplomacy, military, and human exchange. With the U.S. Army, which provides support in the event of an emergency, the Ministry of Defense and the Self-Defense Forces must continue to enhance strategic dialogue, joint training and operations. At this time, it is hoped that Japanese participants will not only include the Self-Defense Forces, but also related organizations to practice joint policy as a more integrated government.

Finally, about politics and the SDF. Since the Great East Japan Earthquake, Japan has been hit by many great disasters. In each case, the Self-Defense Forces have been acting as an all-round responder. In Japan, where the central government does not hold an operational organization such as FEMA in the United States, the SDF is expected to play that role. The ultimate task of the SDF is disaster rescue as well as the protection of Japan from foreign enemies. As a result, engaging in long-term and large-scale disaster deployment activities is becoming an obstacle to maintaining national defense and training. The Self-Defense Forces need to clearly communicate their duties, roles, what they can do, and what poses a hindrance, and to build a firm relationship of trust between the people, politicians and the Self-Defense Forces.

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Chapter 7: Disaster Recovery Frontier

Hiroshi Kainuma

Introduction - Aiming for “the ideal state of Japan in the mid-21st century”

The Basic Act on Reconstruction in Response to the Great East Japan Earthquake, which was promulgated and enacted on June 24, 2011, three months after the Great East Japan Earthquake and the accompanying Fukushima Daiichi Nuclear Power Plant accident, declares its basic principles (Article 2) in the General Rules (Chapter 1) as follows.

Reconstruction from 3.11 is “not just a revival, but a reconstruction aiming for the ideal state of Japan in the mid-21st century”, and in addition to “addressing cutting-edge measures to contribute to the resolution of issues common to all humankind such as responses to falling birth rates and demographic aging, population decline, progress in socioeconomic activities across borders, the food question, restrictions on the use of electricity and other energy, environmental load, and global warming and so on”, our aim is to “create a safe community where people can live in peace of mind” and “to revitalize a sustainable and vibrant socio-economy.”

In other words, there are urgent issues on the one hand that exist in the affected areas, and structural issues on the other hand in Japan's economy and society such as the declining birth rate and demographic aging that predate the disaster. Through a twin strategy of overcoming them, it intends to achieve reconstruction underpinned by a “will for universal reversal”. A firm intent can be felt here that Fukushima’s reconstruction in the face of a triple compound disaster of earthquake, tsunami, and nuclear accident should not only naturally deal with individual issues, but also universal issues that go beyond. The backdrop created by such a context no doubt included a desire to make this national crisis that occurred at the very bottom of Japan's “lost twenty years” into a catalyst for revitalization and rebirth. The phrase “the ideal state of Japan in the mid-21st century” is nothing if not a statement of intent.

This intent to revive may well be the same as the words of Governor Andrew Cuomo of New York, which was in the grip of the coronavirus crisis in the spring of 2020: “I don't want to simply restart. Let your imagination work again, be smart, and let’s use this crisis to grow,” in the sense that it is a declaration on projects for the future, not only for reopening, which is revitalizing, but also for reimagining, which is rebuilding.

This intent arose during the parliamentary debate between the ruling and opposition parties seeking ideas on reconstruction. On May 13, 2011, the then Democratic Party of Japan Administration

submitted a Bill on Basic Policy and Organization for the Great East Japan Earthquake Recovery (177th Ordinary Diet, Law No. 70). On the other hand, the opposition party and the LDP submitted a counter-proposal, Bill on Basic Policy and Organization for the Great East Japan Earthquake Recovery (177th Ordinary Diet, Law No. 70). At the plenary session of the House of Representatives on the 19th when the two parties met, the Democratic Party's government proposal was subjected to criticism.

“I am forced to say that the content is extremely inadequate for a bill submitted more than two months after the Great East Japan Earthquake. Many headquarters have been set up haphazardly and a mass of Cabinet advisors have been appointed and yet, there is still ongoing confusion in the command system, and now when a bill is finally presented, it is almost just a reprinted version of the system put in place at the time of the Great Hanshin-Awaji Earthquake [1995].”

So speaking, Shigeru Ishiba, then Chairman of the LDP, remarked, it is “essential that we try to revitalize the region, and eventually Japan, by anticipating what Japan should be in the future,” asserting that “reconstruction and revival after the Great East Japan Earthquake must be carried out with the purport of aiming for an ideal state for the mid-21st century, not just restoration to the original state.”

Prime Minister Naoto Kan proposed an amendment on May 31 in the form of incorporating the LDP opposition party's proposal. The next day, the bill was enacted under the agreement of the three parties: Democratic, Liberal, and Komei.

How did the subsequent reconstruction project in Fukushima proceed?

The total reconstruction budget for the intensive reconstruction period from 2011 to 2015 and the reconstruction/reconstitution period from 2016 to 2020 amounted to 32 trillion yen. This 32 trillion yen included reconstruction in other disaster areas such as Iwate and Miyagi. Apart from this, the costs (assumed) involved in cleaning up after a nuclear disaster, decommissioning, compensation, decontamination/intermediate storage have reached 21.5 trillion yen. A huge amount of unprecedented costs has been poured into this region, people working to shift it, and vast amounts of knowledge having been accumulated.

But how has this been connected to the realization of the “will for universal reversal”?

Certainly, at least as a matter of form, the “will for universal reversal” can be said to be currently reflected to some extent in various initiatives aimed at ensuring food safety and improving brand value in the primary industry, new town development aimed at compact towns in disaster-affected municipalities, and the Fukushima International Research and Industrial City (Innovation Coast) Plan put forward as a national policy and which will be later looked at in detail. However, on the other hand, many projects are not making adequate progress due to constraining factors that must be called the negative legacy of radioactive material from the disaster, prolonged evacuation, difficulty in lifting evacuation orders, and deep-seated, persistent reputational damage.

In fact, it is not easy to sweepingly say that the current state of reconstruction is “like such and such”. In terms of the extent of the widespread damage that occurred at the time, there are substantial variations depending on the region, location, and attributes. In addition, there are discrepancies between psychological reconstruction at the individual level and social ones at the group/organizational level.

There is a tendency for those on the outside to facilely repeat the pressing set phrase “the recovery is lagging”. However, it is also important to reconsider the fact that reconstruction should be promoted from a longer-term perspective, that is, “that adverse effects have come about due to rushing reconstruction”.

In this way, it can be said that the concept of “reconstruction” itself, especially the concept of “rebuilding Fukushima”, has remained unclarified for the past 10 years. Furthermore, the state is far from one where everyone shares the feeling of finding the “will for universal reversal”.

Again, we must recapture the meaning of reconstruction. To that end, I would like to look back at what kind of trajectory the reconstruction of Fukushima has taken during this period.

1. Fixed and isolated by the disaster

After 3.11, more than 160,000 people in Fukushima were forced to evacuate at the peak. Ten years on, the number of evacuees still outside the prefecture is some 30,000. On the other hand, many residents have returned to their original home bases, and even if they are not in their original homes, they have moved, relocated, and settled down in Fukushima Prefecture. Immediately after the disaster, there was a flow of evacuation a long way from existing home bases as well as a return to home bases within the prefecture from evacuation destinations. However, that coming-and-going has long been lost. In other words, the number of people who continue to live far away from Fukushima - now less than 2% of the total population of Fukushima- has fallen and is becoming fixed as “evacuees who will not return to Fukushima in the long run”. This does not indicate the end of the evacuation problem. Rather, the amount of support, whether it be public or community, for evacuees scattered all over the country is decreasing. Of the people involved in wide-area evacuation, who lost their jobs and social networks to avoid radiation from the nuclear accident, there are those who are confused about what their ten years were like and who feel a sense of isolation every time they look askance at most of their former friends and acquaintances continuing to live in Fukushima where they once lived, eating local food, raising children and living a healthy life.

In that respect, the issue of disaster-related death is also serious. Earthquake-related deaths (2,306 as of April 2020), which refer to cases of physical and mental illness and death due to prolonged evacuation, show a unique situation in Fukushima. It now greatly exceeds the number of people who died directly from the earthquake and tsunami (1,605 ditto)[1] and is still climbing. The fact that immediately after the disaster, the government was forced to carry out large-scale evacuation, and the necessary medical care for patients who were hospitalized or had chronic diseases was not available, and since the evacuation became prolonged, evacuees continued to have greater mental, physical, and social burdens than initially anticipated form the backdrop to these numbers.

At the bottom of this lies the background of a declining birth rate and aging population. The fact that this disaster occurred in 2011 when Japan’s birth rate was low and its population was aging, and in an area where these trends were relatively widespread, has amplified the issue of earthquake-related death. The disaster has also accelerated the drop in the birth rate and demographic aging.

Had the falling birth rate and demographic aging not been so strong, human resilience would have undoubtedly been more effective in supporting reconstruction. Even if you suddenly lose your daily life or job, you will need to rebuild your home and human relationships, relearn what you need, find a new job, and jump into it. For example, young people tend to possess higher abilities for this than

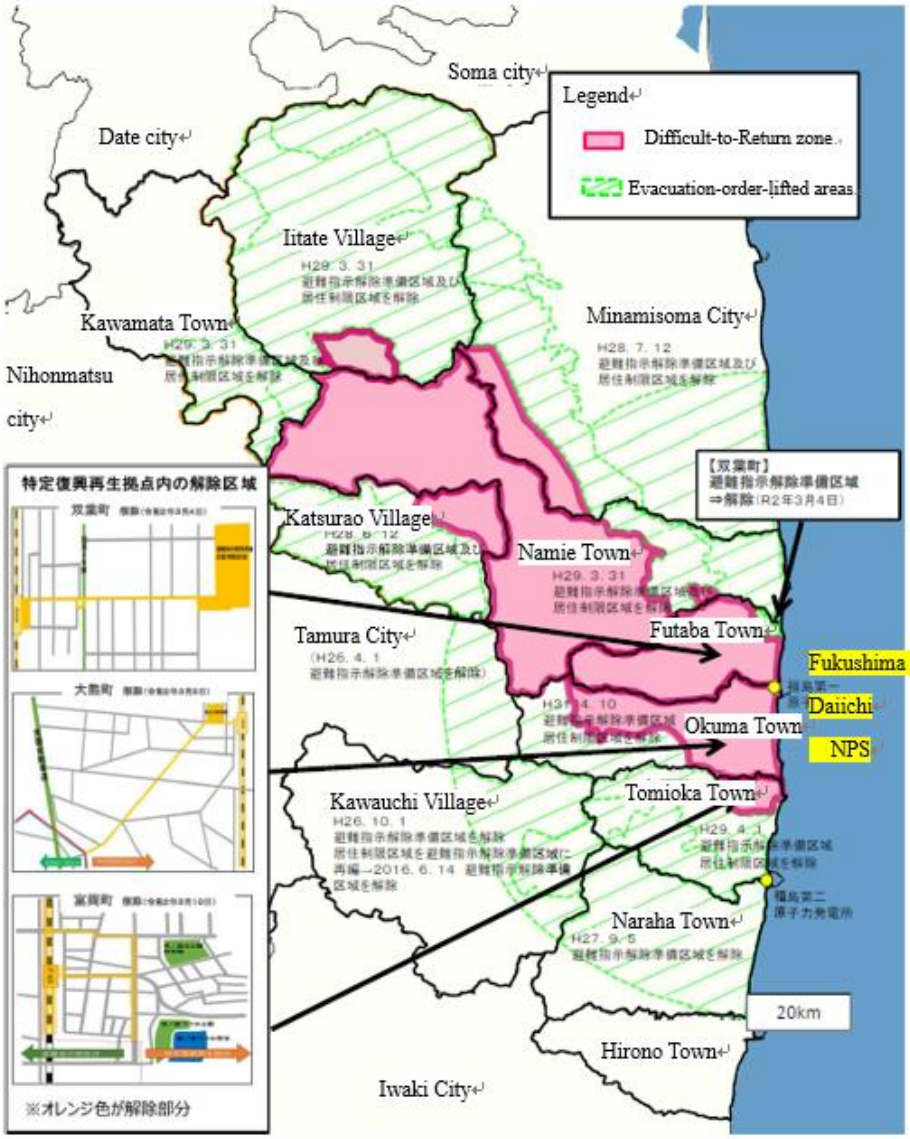
[1] Fukushima prefectual government, 2020b.

older people. The same applies to the ability to recover from temporary damage to one's health. Initiatives to overcome various disasters by harnessing the powers of the individual are difficult to achieve in an aging society. It is very hard for the elderly to return to their original state once they have lost their home bases. Here, too, we see a structure in which people in a disaster-affected situation lose the opportunity to overcome, become fixed/isolated, and the burden is concentrated there. For example, in an ongoing Awareness Survey on Residents in Nuclear-Affected Municipalities conducted by the Reconstruction Agency, Fukushima Prefecture and each municipality since 2012, and when comparing the present time with the earthquake, the number of households with two or less people has consistently risen and households with five or more people has consistently dropped. The dismantlement of the family, which is one of the foundations of work and life for the elderly, can be seen. The biggest difference between the Great Hanshin Awaji Earthquake in 1995 and the Great East Japan Earthquake in 2011 is the aging of Japan's population during this period. That is behind the extraordinary increase in earthquake-related deaths.

The disaster also confronted this region with the issue of declining birth rates and an aging population in a condensed form. Fukushima Prefecture is one of the prefectures with the most advanced demographic aging in a greying Japan. Most symbolic is the trend of insurance premiums in the long-term care insurance system. Nursing-care insurance premiums for residents over the age of 65 are reviewed once every three years, depending on whether there is a high or low demand for nursing-care services by each municipality or regional association. Fukushima's Katsurao Village had the highest long-term care insurance premium for residents aged 65 and over among nationwide municipalities for JFY 2018-2020. The village was the most depopulated and aging population of the local governments instructed to evacuate their residents during the Fukushima nuclear accident. Furthermore, Futaba, Okuma, Namie, Iitate and Kawauchi are in the Japanese top ten for long-term care insurance premiums for residents over the age of 65, and were also municipalities that received evacuation orders after the accident. Along with the evacuation process and the loss of employment, these local governments saw a rapid loss of connections between families and local communities with residents moving to work and life bases in urban areas proceeding apace. This move has led to the collapse of the mutual aid safety net that existed in these areas up until now, and has forced people, including the elderly and the socially vulnerable, to depend on public medical, welfare and nursing care services. The result has been an unprecedented surge in long-term care insurance premiums.

The triple set of problems of a declining birth rate and aging population, a falling population, and a decline in industry that has supported the region can be seen not only in Fukushima but throughout Japan. However, in Fukushima, which experienced the disaster, it has struck the area in a shorter period of time, more seriously, and more directly, and still continues to do so.

In short, the damage is becoming more fixed and isolated. It is progressing not only at the level of individual residents in wide-area evacuation and earthquake-related deaths, but also at the regional level. Initially, evacuation orders were issued to residents of 12 municipalities around the Fukushima Daiichi Nuclear Power Station. Futaba Town, the last municipality still subject to evacuation orders, started lifting them in March 2020.



Conceptual Map of Evacuation Instruction areas[2]

In the parts of Futaba Town where the evacuation order has been lifted, there is an industrial base and industry exchange center that will be used as a platform for attracting companies, as well as a Great East Japan Earthquake and Nuclear Disaster Museum that will serve as a platform for those visiting the area during school excursions and vocational training. The fact that people are free to come and go as the tenth anniversary of the accident approaches in the coastal area of Futaba Town, which is close to the Fukushima Daiichi Nuclear Power Plant, can be said to be a significant result of reconstruction.

On the other hand, however, there are still some areas where the evacuation order has not yet been lifted even after the tenth year. In particular, “difficult-to-return zones”, which have the highest dose of all areas receiving evacuation orders, have been systematically left behind in reconstruction. Unlike other evacuated areas (“preparatory evacuation order rescindment zone” and “restricted residence zone”), the difficult-to-return zone is premised on restricting residence in the future and is not subject to decontamination. Access by residents has also been strictly restricted.

[2] Fukushima prefectual government, 2020c.

Nevertheless, from 2017, some of the difficult-to-return zones with low doses and highly convenient areas with transportation infrastructure have been designated as “special reconstruction and regeneration zones”, and intensive land preparations have begun with decontamination and house demolition. However, the future of most other difficult-to-return zones remains unclear. There are fixed and isolated disasters here as well. Some of the disaster difficulties are concentrated at both the inhabitant and regional level, which deepens fixing of the status quo and isolation.

Persistent economic loss

Economic losses from 3.11 continue to occur.

Among the economic losses, some were caused by the earthquake and tsunami, which made it impossible to physically use farmland, factories, stores, etc., thereby making it difficult to continue business. In addition, people in charge of businesses were forced to evacuate. As a result, the living environment has changed and future prospects are uncertain, so there is a loss in terms of human resources, such as the inability of a business owner to restart his or her business and prospective successors leaving the job. Additionally, even if a business can be resumed, there are losses in the form of an inability to cover the costs required for maintaining the business resulting in the reduction or withdrawal of the business amongst various changes in the environment.

Of these economic losses, it is reputational damage that afflicts residents the most. Reputational damage is mainly concentrated in primary industry and tourism. The resulting economic losses, although improving, still cause serious problems in the local economy. Refer to Chapter 3 for details of reputational damage.

Economic losses are ongoing with the interaction of a falling birth rate and aging population, the decline of the industrial base, and persistent reputational damage. While the causes and places affected by these losses vary widely, taking for example the amount of compensation for corporations and sole proprietors suffering damage due to the TEPCO disaster, some 5,802.9 billion yen has been incurred as of April 2020 in approximately 438,000 payments, indicating an enormous scale.

Of course, the economic loss from the Great East Japan Earthquake was enormous even in affected areas other than Fukushima, but Fukushima, which still has areas suffering reputational damage or under evacuation orders, is one of the most left behind areas for reconstruction.

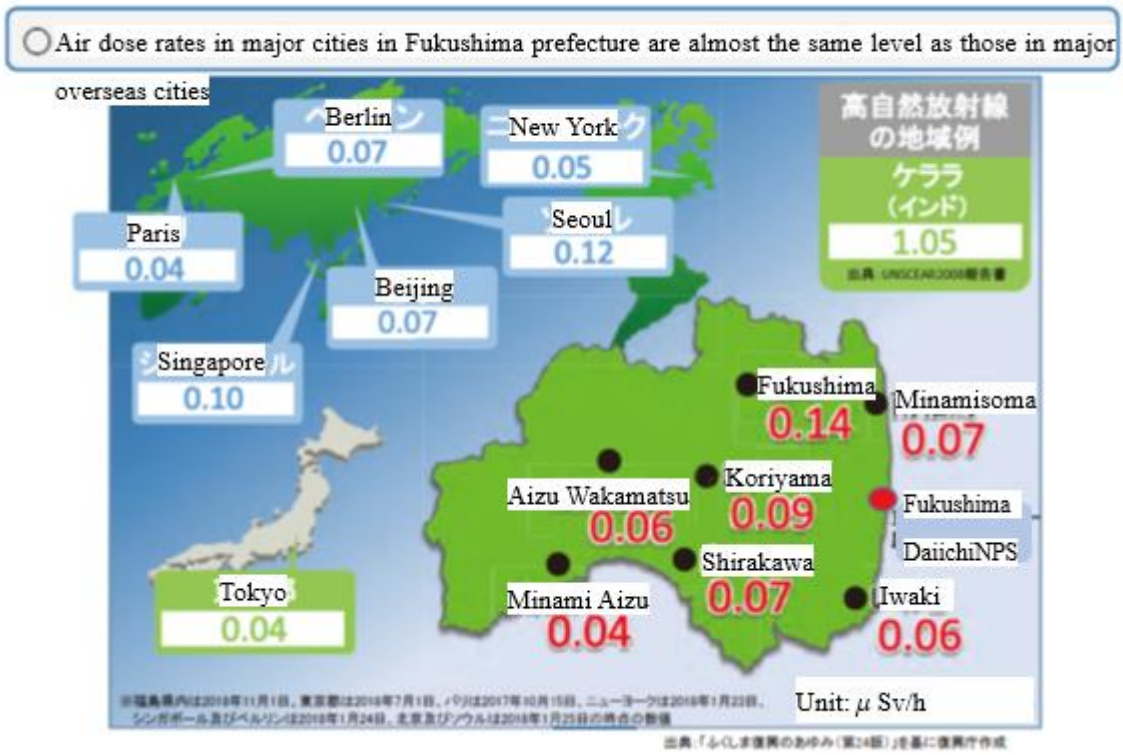
Following the disaster, extremely strict inspections have been carried out on agricultural products produced in Fukushima Prefecture. It is still ongoing, but no outliers above the legal standard have been detected.

Regarding the risk of radiation exposure in the environment, environmental air doses in various areas in Fukushima Prefecture, including areas where evacuation orders have been lifted, are consistently measured and disclosed, and their values are dropping.

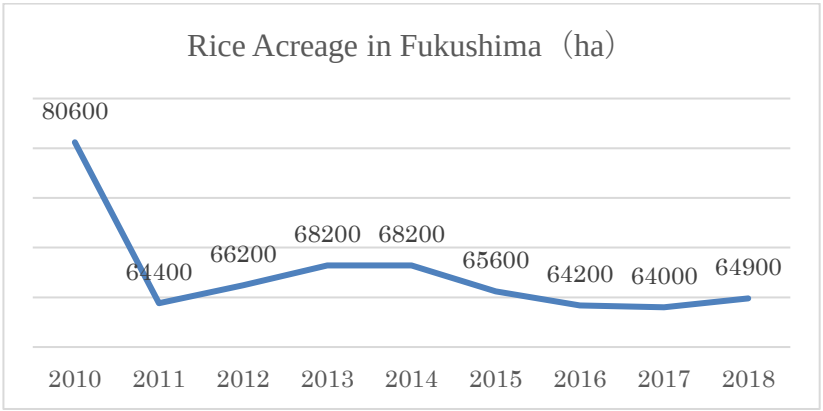
For example, the average air dose rate at a height of one meter from the ground surface within 80 km of TEPCO's Fukushima Daiichi Nuclear Power Plant fell by about 77% compared to November 2011, and the air dose rates for major cities in the prefecture are shown in the figure. As you can see, it is almost at the same level as major overseas cities.[3]

[3] The Reconstruction Agency, 2019.

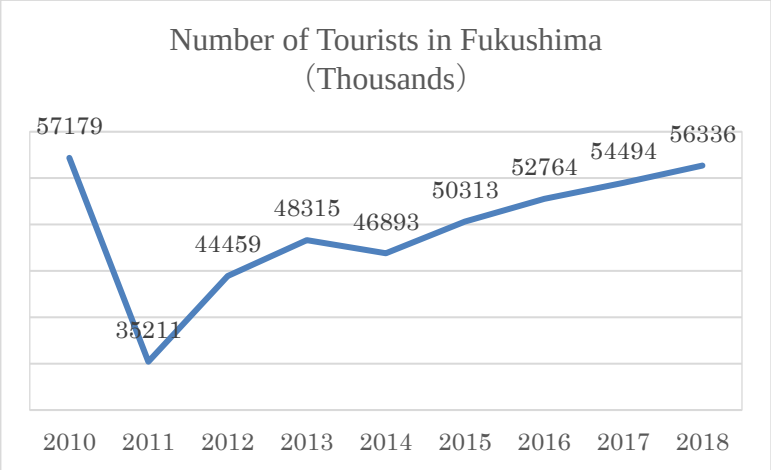
Current Air Dose Rates in Fukushima Prefecture



However, this situation is still not well known in Japan and abroad, as evidenced by persistent reputational damage for primary products and tourism.[4] Awareness of Fukushima's actual status is constantly being updated inside Fukushima, but that is not the case outside Fukushima. Some people still see Fukushima as it was in March 2011. Speaking only of Fukushima, time has passed in the absence of any updates about the current situation. Radiation monitoring is the most important data that forms the basis for understanding the current situation.



[4] For example, the rice acreage and number of tourists have shown some recovery but have not recovered to 2010 levels.



2. Radiation monitoring

After the Fukushima nuclear accident, the four investigation reports later released had set the accident itself and the circumstances leading up to it as the central theme of the investigation, and there were not so many proposals related to "the reconstruction of Fukushima". At the time, we were still trying to find out how the area should be restored and rebuilt, and in a process of trial and error for the reactor decommissioning that was to follow. However, even in that situation, a number of recommendations regarding radiation monitoring and decontamination were made.

The Independent Accident Investigation[5] states that the effects of radiation exposure on residents should be managed over the medium- to long-term, and recommends the need for a more accurate, faster, and longer-term specialized survey by the government in addition to the "prefectural health management survey".

The Parliamentary Accident Investigation[6] proposed the need for proceeding with inspections of external and internal radiation exposure and disclosing information, and monitoring forests and rivers, stating the government should take responsibility for managing the effects of radiation exposure in residents in the medium- to long-term.

Furthermore, the Atomic Energy Society of Japan[7] has proposed the establishment of a system for centralized data collection and storage from the early stages of an emergency, and the development of a new method for ongoing and long-term individual dose monitoring for residents.

It is commendable that these recommendations for radiation monitoring have subsequently largely been achieved.

The target of radiation monitoring is broadly divided into three categories: environment, food, and the human body.

For radiation monitoring of the environment, the Nuclear Regulation Authority has a system in place to measure the dose in Fukushima Prefecture in detail and disclose it to the public.[8] This radiation

[5] Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, p. 67.
[6] The National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission, 2012, p.2.
[7] Atomic Energy Society of Japan, 2014, p. 370.
[8] Nuclear Regulation Authority. *Hōshasen monitaringu jōhō* [Monitoring information of environmental radioactivity level]. Retrieved from https://radioactivity.nsr.go.jp/ja/ (In Japanese.)

monitoring information has been regularly conveyed by newspapers, television and radio in Fukushima Prefecture along with weather forecasts.

On the other hand, radiation monitoring of food has been mainly promoted by the Fukushima Association for Securing Safety of Agricultural Products consisting of producer groups, distributors, retailers, consumer groups and Fukushima Prefecture. Extensive inspections have been conducted on the amount of radioactive substances contained in primary products, including an inspection of all bags of rice produced in Fukushima, and results can be checked through the continuous disclosure of the latest information on the web.[9]

Furthermore, regarding the status of radioactive substances inside individual human bodies, Fukushima Prefecture has established a system where people can voluntarily undergo "internal exposure inspection by a whole body counter" in Fukushima Prefecture. At the same time as notifying the individual person himself/herself of the test results, overall results are also disclosed.[10] The government/administration have not only conducted these large-scale, comprehensive, and continuous surveys, but have also tried to highlight various dose information with individual surveys on the soil, sandy beaches, and waters in the sea off Fukushima Prefecture, as well as the status of radioactive materials in and around the Fukushima Daiichi Nuclear Power Plant premises.

Along with this, investigations by governments and NGOs are being conducted. For example, the Survey on Radioactive Substances Intake from Meals at Home[11] conducted by the Japan Consumers' Co-operative Federation since 2011 covers meals actually provided to ordinary households using the duplicate method and is an effort to collect nationwide the amount of radioactive substances, accumulate and disclose the data. Alternatively, the Super Science Club, which is a club activity at Fukushima High School, has shown that external exposure in the living space of high school students in Fukushima Prefecture does not show a unique value compared to that of high school students outside Fukushima Prefecture and overseas. A part of these results was put together in a paper, which was published in the peer-reviewed *Journal of Radiological Protection*,[12] and featured in many media.

These independent activities by civil society are not limited to simply investigating the actual state of radiation in more detail, but have great significance in acting as a kind of second opinion to the effect that "the conclusion is the same even if measured by a third party or using different methods". As a result, it has acted to mitigate distrust of the government/administration, experts and media. In that respect, it can be commended that actions beyond the recommendations for radiation monitoring in each accident investigation are taking place in the field.

However, radiation monitoring is now at a turning point. Despite being safe, an answer is still to be found for the question of how long should the monitoring continue.

Why can it not be stopped? It is because the acknowledgement that safety has already been achieved is insufficient, especially outside Fukushima Prefecture and overseas.

For example, regarding rice, which is the main crop of Fukushima and had the fourth largest

[9] Fukushima Association for Securing Safety of Agricultural Products. *Kore made no hōshaseibusshitsu kensa jōhō* [Information about radioactive substance inspections to date]. Retrieved from https://fukumegu.org/ok/contentsV2/index.html (In Japanese.)
[10] Fukushima Prefectual Government, 2020d.
[11] Japanese Consumers' Co-operative Union. Retrieved from https://jccu.coop/products/safety/radiation/method.html (in Japanese.)
[12] Adachi et al., 2015.

nationwide production in 2010, an annual budget of 5 billion yen has been spent conducting an all-bag inspection of an annual production reaching 10 million bags. No bag exceeding the legal standard value has been found in inspections since 2015. However, inspections are maintained under the premise that the fact that rice from Fukushima Prefecture is "safe" has not been sufficiently shared at home and abroad. There is no problem with Fukushima's rice itself, but there is a problem with the perception outside Fukushima, but it is not easy to change external perceptions. At the production and inspection sites, the ritual verification of safety is still carried out "even though it is known that the inspections will continually confirm the safety and yet time and effort is spent to prove it."

However, the fact that radiation monitoring has been excessively promoted in each of the three fields of environment, food, and the human body has provided important assessment material in formulating a regional reconstruction vision.

The special reconstruction and regeneration zones, which are designated only in those relatively high-dose difficult-to-return zones whose dose is low, were precisely possible because of the trust of the residents engendered by the accumulation of this kind of honest-to-a-fault radiation monitoring.

Difficult-to-return zones have a more difficult outlook for future recovery than any other area. In the first place, the very name "difficult-to-return zone" carries political overtones. In the 2017 Diet session, Goshi Hosono, a member of the House of Representatives, said:

"At the time, there was a huge debate among the ministers about using the strict name of 'difficult-to-return zone'. I am sorry for those forced out of their hometowns, but by intentionally using such a strict expression, we wanted people to choose a new life. By making it clear that returning home was difficult, TEPCO had to pay compensation to the more than 20,000 evacuees living in the area on the assumption that they couldn't return."[13]

As once was the case with some overseas regions that underwent nuclear tests and nuclear accidents, it could have been possible to have a policy of semi-permanently designating areas with high doses as uninhabitable zones. However, it became clear while carefully measuring radiation doses that there were places where the dose dropped more than expected even if decontamination was not actually carried out. This has led to the creation of "special reconstruction and regeneration zones," and provided the prospect for revitalizing difficult-to-return zones.

In the towns of Okuma and Futaba, where the Fukushima Daiichi Nuclear Power Plant is located, there happened to be an area with a low dose that was suitable for redevelopment as a highly convenient town, so it was first decontaminated as a "special reconstruction and regeneration zone", and the decision taken to relocate the functions of the government office there. Redevelopment of "special reconstruction and regeneration zones" has begun even in neighboring local governments that have difficult-to-return zones. Various trials and errors will be pursued over the next five to ten years to see whether residents and industries can be rebuilt.

3. "1mSv/Year Golden Line": Decontamination and intermediate storage facilities

Along with radiation monitoring, decontamination is a large-scale project offsite from the Fukushima Daiichi Nuclear Power Plant.

After the disaster, the national government uniformly targeted decontamination for areas where the

[13] House of Representatives, 2017.

additional exposure dose was 1 mSv/year or more.

The need for decontamination to reduce the adverse effects of radioactive substances on the human body and environment was recognized immediately after the disaster. However, widespread decontamination of radioactive materials in a residential area was unprecedented worldwide, there being little technical knowledge, and existing laws were unable to even determine the responsible ministries in terms of administrative procedures. They literally had to start from scratch.

Meanwhile, the Ministry of the Environment raised its hand. The then Administrative Vice-Minister of the Environment Secretary, Hideki Minamikawa decided, “Seeing the turmoil in Fukushima Prefecture caused by this accident and the local bewilderment, let's raise our hands here even if it’s excruciating.” He was “almost overwhelmingly opposed within the Ministry of the Environment”, but he pushed it through.[14]

In August 2011, the Act on Special Measures Countering Radioactive Material Pollution (a special measure act on the pollution of the environment by radioactive materials released by the nuclear power plant accident following the Tohoku-Pacific Ocean Earthquake on March 11, 2013) was stipulated and concrete work began.

Regarding decontamination, the Atomic Energy Society of Japan[15] made specific proposals regarding the following three points: setting decontamination targets/areas; decontamination and implementation system; and safekeeping/storage of decontamination waste.

1) Setting decontamination targets/areas: “While positioning 1mSv/year as a long-term target and based on the optimization principle of ICPR, given the decontamination effect, time and cost required, as well as individual annual effective residual dose, realistic decontamination targets and decontamination areas should be set. In decontaminating, the “average individual” should not be used for exposure control, but should be reviewed based on the exposure dose measurement results for each individual.”

It must be concluded that this has not been achieved even after ten years.

Initially, the radiation dose of people living in each region had to rely on estimates from the air dose, which acted as the premise for decontamination. There were some areas where the effects of decontamination (benefits) could not be expected, and the balance between them and the costs and risks was unclear. When decontamination actually started, it was found that speculation did not always match the “actual individual dose of exposure”. Actual doses were lower than conservatively calculated estimates, and doses were completely different, for example, for people working outdoors in difficult-to-return zones and for indoor deskwork in other areas. It has become clear that there are individual differences.

Although this recommendation was made based on this reality, the decontamination project has almost reached completion with no improvements being made here to date. The standard of 1 mSv/year was recognized by residents as something that should be immediately achieved irrespective of cost, and local governments and other local communities made decisions based on this assumption and went ahead with decontamination.

2) Decontamination and implementation system: “In decontamination performed by municipalities,

[14] Ministry of the Environment, 2018, p.15.
[15] Atomic Energy Society of Japan, 2014, pp. 370–371.

steps should be taken to make prompt decision-making near the site possible so that decontamination can be carried out flexibly according to the local situation. In carrying out decontamination, all parties should make every effort to ensure the cooperation and participation of local residents. Decontamination technology needs to be selected and individually assessed on the basis of the attributes of the location and target."

Regarding this recommendation, the importance of the part "all parties should make every effort to ensure the cooperation and participation of local residents", which does not necessarily seem to be given special weight in this context, has emerged in the course of practical work, and is assessed as having has been achieved to a certain degree.

Initially, the main issue for decontamination was to overcome technical and engineering problems such as choosing the decontamination technology, but as the actual decontamination went forward, the need for a perspective on how to communicate closely with residents and promote consensus building was recognized as a major issue.

For example, before implementing decontamination, the Ministry of the Environment had a conflict with target sites over the question of the wide-area treatment of disaster waste. Some people lay in front of the trucks carrying waste in trying to block their way, which spread via net-based media, the same thing happening elsewhere. There were almost no examples of consistent and accurate information sharing from the mass media and the Ministry of the Environment.

In these circumstances, everyone started talking about the importance of "risk communication", but it was shown to be just an armchair theory even when it did materialize, and ineffective as a means of securing interaction with residents. Even all the various methods amassed by advertising agencies that are launched every time there is a scandal to be dealt with proved to be not very useful.

Even so, through repeated trial and error, communication and cooperation between the government and residents has made headway.

For example, the decontamination promotion team from the Ministry of the Environment, which was created in the first year and consists of 31 people from Fukushima, frequently goes around each municipality deepening dialogue with local residents and the heads and other officers from government offices.[16] In the process, temporary storage areas have gradually been opened with the agreement of local government and residents, and decontaminated soil in flexible container bags has been brought into the temporary storage areas.

In January 2013, when the Asahi Shimbun reported suspected improper dumping of decontaminated soil into rivers near the decontamination work site[17], Shinji Inoue, then Vice-Minister for the Environment, other politicians and top officers from the Ministry of the Environment frequently visited the local area to try and restore trust.

The decontamination work methods and progress are constantly available on information bases and homepages that are always open to residents, such as Fukushima City's Environmental Regeneration Plaza (Decontamination Information Plaza until 2017).[18] They created a system for answering questions from the general public, and according to the need, have started holding workshop-type and

[16] Ministry of the Environment, 2018b.
[17] Aoki and Kihara, 2013.
[18] Ministry of the Environment. Kankyō-saisei-plaza. [Environmental Regeneration plaza]. Retrieved from http://josen.env.go.jp/plaza/ (In Japanese.)

tour-type events that involve sending experts to residents' groups and schools as well as workshops and the involvement of local residents.

Perhaps there was no detailed image involved in the recommendations from the Academic Accident Investigation for "decontamination and the implementation system", but they can be said to have been realized to a certain extent.

Of course, not everything was smooth sailing. There were problems such as the improper dumping mentioned earlier, the lengthy time it took to form a consensus delaying plans, and although in hindsight it looks like it proceeded smoothly, matters moved forward always in the midst of conflict with local governments and residents. However, the root of the problem was the same kind of difficulty as with "setting decontamination targets/areas". In other words, no matter how long, communication and agreement with residents to optimize the balance between decontamination effects (benefit), costs and risk could never be achieved. The nub of the problem was that various untenable aspects emerged such as the initial standard of 1 mSv/year being taken as gospel, and ignoring actual exposure dose and the existence of individual differences, the premise that it should be achieved regardless of cost as well as the reality that it ended up being shared as if it was a new "safety myth", all this was allowed to go unchallenged as matters moved ahead.

3) Safekeeping/storage of decontamination waste: "Since the provision of a temporary storage site will immediately affect the progress of decontamination, the parties concerned need to actively engage in dialogue with residents and secure the participation of residents in selecting sites. This involves management from temporary storage sites to intermediate storage facilities, and further to final disposal sites. Minimizing the amount of material to be moved in this flow greatly contributes to rapid transferral. To this end, reducing volumes and recycling waste pollutants is essential. The parties concerned should take the necessary steps to ensure that measures are taken promptly."

As is pointed out here, decontamination cannot proceed unless a temporary storage site is set up. Of course, everyone wants to decontaminate and remove contaminants, but allowing a temporary storage site means contaminants will be gathered and stuck close at hand, even if only temporarily. A dilemma exists between promoting decontamination and setting up temporary storage sites. Therefore, the need for dialogue with and the participation of local residents is emphasized more when setting up temporary storage areas than for decontamination. However, if you try to proceed with building such a consensus, this means placing importance on the residents' feeling that the 1 mSv/year standard is gospel and should be achieved regardless of cost. As decontamination progresses, further temporary storage areas will need to be installed, and when intermediate storage facilities come into view, parties are forced to be even more sensitive to such feelings.

In that respect, it is commendable that the first half of this third recommendation was realized to some extent. On the other hand, it is the latter section that has stalled, "reducing volumes and recycling waste pollutants". In 2020, although it is possible to a certain extent both technically and in terms of equipment to reduce the amount of waste transported to intermediate storage facilities, in short **operations to reduce the amount of highly radioactive contaminated soil through incineration, technology known as sorting that classifies based on soil and sand particle sizes, and heat treatment technology**, prospects for recycling decontaminated soil of 8,000 Bq/kg or less stipulated by the **Act on Special Measures Against Radioactive Material Pollution** are non-existent. Recycling before transportation to an intermediate storage facility has started to be practiced in farmland in the Nagadoro area of Iitate village, but plans have foundered in the cities of Minamisoma and Nihonmatsu, where a relationship of trust with residents broke down in the midst of a consensus-building exchange. The difficulty of building a consensus with residents will continue to have a major

impact on the future of decontamination projects.

Goshi Hosono, who was in charge of responding to the disaster during the accident at the Fukushima Nuclear Power Plant, was appointed Minister of Environment in the Yoshihiko Noda Cabinet in September 2011. At the time, the problem was how much decontamination should be done. If the decontamination standard was strictly set to “1 mSv/year”, nobody would be able to return in the atmosphere of the debate at the time when it was assumed that decontamination would be completed for the return of evacuees. Former Special Advisor Hosono recalls those days.

“On the Fukushima Prefecture side, there was a strong demand for things to be returned to how they were, and it turned out that unless we said that goal exactly down to the millimetre, the decontamination project itself wouldn’t start.
I then decided to decide it like this while doing a lot of behind-the-scenes talking for about two months, I think.”

It was decided that “1 mSv/year” was a standard for safety but not a standard for evacuee return, but in view of TEPCO's responsibility, that should be the target when decontaminating.

“But in reality, it was kind of taken as a safety standard, and dragged along for a long time,” says Hosono.

The decontamination gospel of “1mSv/year” has become a new form of “safety myth" that still remains. Both politicians and administrative officials hesitate to challenge it head-on, and residents set it aside, avoiding revisiting the issue. Discussions never reach the stage of pursuing a “global optimal solution” with a balance between benefits, costs and risks.

Nevertheless, decontamination and intermediate storage have achieved certain results and have a good future outlook. Currently, the main issue is shifting to “reducing and recycling waste pollutants”.

Radioactive material released from the Fukushima Daiichi Nuclear Power Plant has extensively contaminated land and soil in Fukushima Prefecture. The amount of decontaminated soil is equivalent to 11 million Tokyo Domes = 14 million cubic meters. Where is it to be amassed? In October 2011, the government formulated and published its basic concept (road map) for intermediate storage facilities, explaining it to mayors in the Prefecture. This showed that final disposal would be completed outside Fukushima Prefecture within 30 years from the commencement of intermediate storage. Until then, it would be stored in intermediate storage facilities to be constructed in Futaba and Okuma, the most polluted areas from the Fukushima Daiichi Nuclear Power Plant.

This final disposal policy continues to be the most burdensome political and psychological theme for Fukushima citizens even after the passage of ten years.

The deep involvement of local people is essential for this discussion. However, whether the locals have a venue for such discussion, what is their will, and whether they are interested in the first place, the reality today is that these considerations remain vague.

Behind this is a situation where “local residents” are not monolithic, or where they have no other choice but to do so.

The local residents mentioned here are the residents of Futaba and Okuma towns, as well as future residents, residents who have decided to build roads, embankments, and farmland reusing

decontaminated soil, residents in the area who accept final disposal, and those involved in the process of determining all this. Almost no detailed explanations or discussions have started yet for each of these local resident groups. In the first place, although it has been decided to remove waste from the intermediate storage facilities to outside the prefecture within thirty years, it does not look like there will be any decision soon on who will actually accept it. The promise of ten years ago may not be fulfilled after all. That is what is generally thought to be the current situation.

However, according to the Ministry of the Environment, about 80% of this decontaminated soil is below the reference value of 8,000 Bq/kg specified by the Act on Special Measures Against Radioactive Pollution. 8,000 Bq/kg is a value that keeps the annual additional exposure dose within "1 mSv" even if a person works a year along side it. Moreover, a group of experts[19] has pointed out that waiting for natural decay over time to reduce volume further will lower the volume of highly radioactive decontaminated soil, ultimately making about 99.2% of the total decontaminated soil 8,000 Bq/kg or less.

Reusing decontaminated soil of 8,000 Bq/kg or less will lead to a significant reduction in the amount transported to the final disposal sites to be set up outside Fukushima Prefecture. Therefore, promoting volume reduction and recycling would increase the feasibility of final disposal outside the prefecture within thirty years, and even if it was delayed, it would reduce the amount of highly radioactive decontaminated soil that carries the risk of radiation exposure stored in intermediate storage facilities and lessen the physical and mental burden on residents living in the towns of Futaba and Okuma.

There are places in Futaba and Okuma where there has been a lot of traffic with the start of evacuation orders being lifted even on land adjacent to intermediate storage facilities. In the future, it will be necessary to proceed with discussions on how to use the land in the intermediate storage facilities. In this way, the process of moving intermediate storage facilities to final disposal sites is no simplistic thing as imagined by many people, witness statements like "if only someone would decide to accept a final disposal site, it could be shifted out of the intermediate storage facilities. But that's totally impossible, so it's a dead end, and that place is bound to end up as a final disposal site."

The transfer of decontaminated soil to intermediate storage facilities that started in 2015 is planned to end by 2021.

Looking back over the past 10 years, although the decontamination/interim storage project did not go as planned in the middle stages, it can be said that the Ministry of the Environment has made good progress by flexibly changing its stance on building relations with residents/municipalities, as recommended by the Academic Accident Investigation, and cooperation with the Ministry of Land, Infrastructure, Transport and Tourism in the practice of securing land.

However, the greatest issue for these decontamination/intermediate storage facilities is final disposal outside the prefecture within thirty years. No doubt, it will continue to be so in the future. How can taking decontaminated soil, etc. out of the prefecture and finally disposing of it within thirty years from starting to place it in intermediate storage facilities, a policy set out under the Democratic Party Administration, be achieved? There is no specific solution or prospect at this time for this quintessential NIMBY issue. While the countdown to the final deadline = 2045 has already begun, there will be limits to how long this issue can be shelved. The discussion needs to shift from decontamination/intermediate storage facilities to the realization of final disposal, and to be promoted throughout Japan.

[19] Ministry of the Environment, 2018a, p. 7.

4. Over-diagnosis

On February 19, 2020, in an Upper House study group on resources and energy, Member Otokita (Japan Restoration Party) called the government to task on the thyroid cancer screening that was underway in Fukushima Prefecture.

The content was roughly as follows.

1) Have multiple occurrences of thyroid cancer from the nuclear accident been noted in Fukushima Prefecture, or if not, is thyroid cancer that would normally have gone undetected throughout a lifetime being discovered and an over-diagnosis of treatment targets happening?
2) Although with the quasi-compulsory tests conducted at schools, it is extremely rare for thyroid cancer detected in a minute stage to lead to death, what should we think about the risk of detecting at any cost?

Member Otokita persisted as follows.

"If, for example, you're a teenager and you have cancer, you are more likely to be treated with discrimination at every stage of your life, such as going on to higher education, getting a job, getting married, or having a baby. As one example, there's a chance that you may not be able to get major life insurance, you may not be able to get a loan, or you may not be able to buy a house. In addition, there are cases where patients continue to be ill due to surgery and have to take medication."

Katsushi Tahara, Director-General of the Environmental Health & Safety Division at the Ministry of the Environment, stood to reply.

"The over-diagnosis that you have just pointed out, in other words, the high likelihood of a cancer being diagnosed that the patient already had, but that did not cause life-threatening symptoms has been pointed out in scientific knowledge to date."

"In response to this kind of over-diagnosis, we follow the guidelines of the Japan Association of Breast and Thyroid Sonology and take measures to prevent the diagnosis of lesions which do not require treatment as much as possible. Additionally, in Fukushima, from April this year, we are sending a guide on thyroid examination that explains the advantages and disadvantages of examination more carefully to the examinees, and we are aware that measures will be taken so that applicants can receive a medical examination."

These tests were initially started to seek the benefit of eliminating the anxiety of prefectural residents, but as it has progressed, the risk of over-diagnosis and the most likely unnecessary costs that examinees will incur have been exposed. However, for the time being, this discussion is based on an inner circle of "the administration plus alpha (experts etc.)", including Fukushima Prefecture, which is in charge of administering the tests, Fukushima Medical University, and experts from the Prefectural Health Survey Exploratory Committee/Subcommittee, the issue not being widely known amongst the public, and discussions based on a dialogue with residents have not been developed. Victims of exposure are purportedly informed of the risks and costs of the test in writing, but it remains unclear how this is to be conveyed to the public or how politicians are to be involved in the matter.

What was the situation immediately after the disaster? Lower House Member Hosono, who was

involved as Special Advisor to the Prime Minister in launching the prefectural health survey including thyroid tests, explains the circumstances at the time as follows.

"The government tried at the time to conduct a health survey for the residents of Fukushima Prefecture, but because Fukushima Prefecture wanted to do it on its own, it was decided to do a prefectural health survey. One of the main items was the thyroid test. It started tracking children from zero age up to the age of 18."

"I thought it'd be better not to test everyone but only those who wanted it, so I told them they should introduce a system that didn't have to be taken by people who didn't want to... Responses right after an accident tend to be excessive, but after that, the thyroid test is a typical example of how do you phase it out? At the time, the question was whether to take iodine or not, to drink or not to drink, so the thyroid test was the most requested. So all we could do was to run them to prove it was safe."

Despite changes in the situation from the start of 3.11, the countermeasures there remain in place, and the issues and adverse effects we have learnt more about during that period have been shelved. The benefits, costs, and risks for not only "the administration plus alpha" but residents and politics as well need to be scrutinized, and discussions started in order to pursue overall optimal solutions.

5. The ambiguous concept of reputation: Countermeasures against reputational damage

When considering rebuilding Fukushima after the nuclear disaster, the cruellest discrimination and severest trial for residents would have to be so-called reputational damage. As mentioned earlier, **even if safety can be scientifically proved, the tendency for a question mark to hover over Fukushima Prefecture and to avoid Fukushima products and Fukushima as a tourist destination persists**.

The government has made various efforts to dispel reputational damage. In Fukushima Prefecture, prefectural government departments in charge of primary industry, tourism, the Paralympics, education, etc. are all trying to dispel reputational damage in their respective areas. Additionally, central government ministries like the Reconstruction Agency, the Ministry of Economy, Trade and Industry, and the Ministry of Agriculture produce and distribute pamphlets and videos, and hold events outside Fukushima Prefecture to invite Fukushima farmers and others to introduce Fukushima produce and products. In 2017, the government announced its Reputational Damage and Risk Communication Strengthening Strategy, and started disseminating information across ministries. In addition, there are many efforts to dispel reputational damage at the private level. For example, grassroots efforts include a major company in Tokyo creating an opportunity for employees to buy and support Fukushima products directly, and university students in urban areas working voluntarily to have rice and vegetables from Fukushima at university cafeterias and school festivals.

In this way, countermeasures for reputational damages have spread to a certain degree through the offices of various bodies, but conversely speaking, it has remained from start to finish a passive structure in which no one is responsible for the problem and no one takes responsibility for the results.

Looking back on these ten years, what is missing from the countermeasures for reputational damage is an objective analysis of how successful they have been and how sustainable they are.

At the root of the problem lies the ambiguous nature of the concept of "reputation".

Roughly speaking, what manner of things comprise "reputational damage countermeasures"? What

do people think of when they hear the word?

PR for agricultural products and tourist spots in Fukushima carried out by the pop group, TOKIO, has been going on in various forms, including TV commercials. Produce exhibitions dealing with Fukushima products have also been held in various places.

However, how effective are they as measures against reputational damage? For example, even areas unaffected by the disaster promote agricultural products and tourist spots, run TV commercials and hold produce exhibitions in remote locations. If it is not possible to clearly distinguish Fukushima's promotional activities from those of other places, it cannot be deemed a countermeasure for reputational damage even though it is sales promotion. Measures, therefore, need to be to separately evaluated to see how effective they are in eliminating reputational damage.

This does not mean that the various measures implemented as countermeasures for reputational damage have been meaningless. There is no doubt that it is important to do what you can in order to first recover consumption that has dropped due to reputational damage.

However, when advancing conventional countermeasures for reputational damage, it is tempting to come up with countermeasures by advocating some vague concept of reputation. There may be a shared problem here associated with the equivocality of the concept of risk communication.

A person from the Ministry of the Environment, who has been involved in the reconstruction of Fukushima for ten years, points out that the concept of so-called "risk communication" has changed after a lapse of time from that immediately after the disaster.[20]

Initially, the concept was for policymakers and TEPCO to "close" the distance with residents through transparency and information disclosure. That was the ideal that risk communication experts spoke of. However, from some time or another, the aim became to "persuade". This is because the risk communication ideal theoretically envisioned before 3.11, and the experts who promulgated it, were shown to be ineffective and powerless before the overwhelming reality of 3.11. With risk communication required within the budget range of the administration, advertising agencies commissioned to do the work had to produce "results". They leant towards a narrative-oriented risk communication that aimed to "persuade". However, even if this has a certain effect in knowledge transfer, it does not spread beyond a certain level. After all, the purpose itself is to hold an event and create a pamphlet, WEB, video, etc. on the assumption that the budget will be exhausted. The structure is one in which the key question of how well the original purpose of risk communication was achieved is not asked.

There is survey data that suggests that the effectiveness of the reputational damage prevention measures has so far been limited.

With the Tokyo Paralympics 2020 advocated as the Reconstruction Olympics in mind, the Mitsubishi Research Institute conducted two polls in 2017 and 2019 on the awareness, interest and understanding of Tokyo residents regarding the reconstruction situation in Fukushima Prefecture and the health effects of radiation.[21]

The two surveys revealed that:
・About half of the people in Tokyo think that people in Fukushima will later have health problems

[20] Interview with Ministry of Environment official, February 16, 2020.
[21] Mitsubishi Research Institute, 2019.

such as cancer, contrary to scientific knowledge, and about 40% said that “I am concerned that children and grandchildren born will have health effects.”
・About 30% of people answered that they would hesitate because of radiation to ask their families, children, friends, and acquaintances to eat foods from Fukushima Prefecture or to travel to Fukushima.

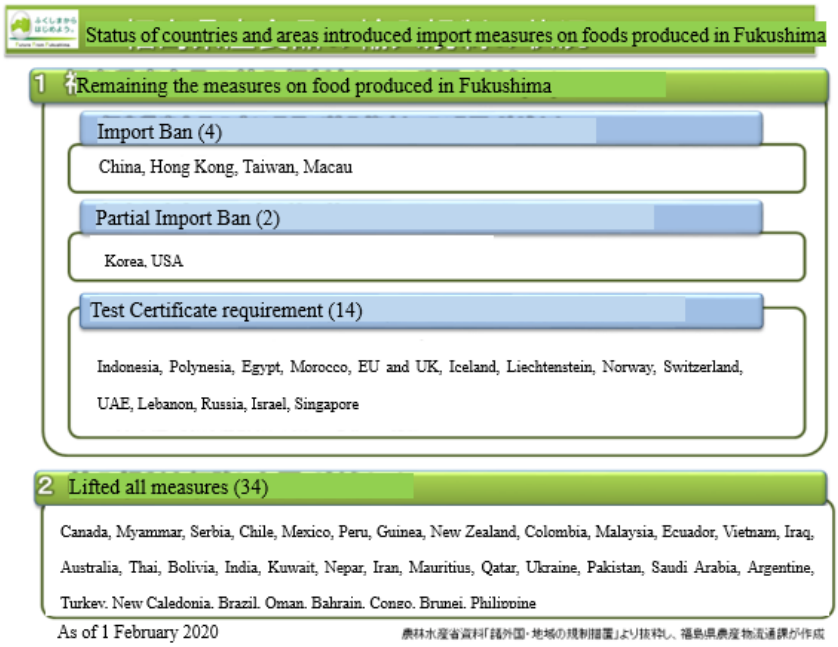
Although these reactions have improved slightly over the past ten years, they do not seem to have improved significantly. Discrimination and prejudice against Fukushima is still widespread.

In response to this situation, the administrative authorities have consistently taken the position of “continuing to convey accurate information”. Although it seems to be a decent attitude to respond calmly and patiently, in reality, it can be said to be risk avoidance that fears coming face-to-face with reputational damage and confronting radical people who discriminate and are prejudiced. It is nothing less than a “head-in-the-sand” policy that wants to avoid arousing criticism of politics and the bureaucracy from people with radical views.

Preventing reputational damage does not just amount to a sales promotion event, nor can it be entrusted to risk communication experts. It is a major strategic theme related to the essence of Fukushima's rebuilding, which is a multidisciplinary issue spanning decommissioning, decontamination, health surveys, return of evacuees, economic revitalization, town development, and the rehabilitation of nuclear disaster areas. It is a theme related to the Fukushima identity and the establishment of the brand itself, a “will for universal reversal”.

Nevertheless, measures on reputational damage to date are only a patchwork of individual and decentralized measures by each manager. There has been no thorough verification of the results, and no strategy for a fundamental solution to the problem. As a result, reputational damage continues today not only in Japan but also overseas. There are many countries that continue to regulate the import of Fukushima products even after ten years.[22] For example, in Taiwan, a referendum held in November 2018 proposing opposing the lifting of the import ban on Fukushima and other foods produced by five prefectures of Japan passed. Also, with South Korea, Japan has sued as unjustified the ongoing South Korea prohibition of the import of marine products from eight prefectures including Fukushima at the World Trade Organization (WTO), a final decision that the action was justified being handed down in April, 2019. The price is being paid for shelving the idea of taking the initiative to formulate a consistent strategy that pays attention to domestic and international public opinion and situations. An entity and command tower that comprehensively responds to reputational damage needs to be established.

[22] Fukushima Prefectural Government, 2020a.



6. Hamadori and the Innovation Coast

The experience of disaster and rebuilding is to be a world experience. Fukushima Prefecture is attempting projects carried out with such a concept and aspiration. One of them is the Fukushima/International Research and Industrial City (Innovation Coast) Framework.

As the name suggests, this concept takes an international perspective in turning the Pacific coastline of Fukushima Prefecture into a seedbed for innovation in fields such as robots, energy, decommissioning, agriculture, and the space industry. It aims to be an area of intensive research and industry.

The concept was originally compiled in June 2014 by the then Vice-Minister of Economy, Trade and Industry, but in May 2017 with the enactment of the Revised Act on Special Measures for Fukushima Reconstruction and Regeneration, it was upgraded to a national project.

Research facilities related to decommissioning by JAEA (the Japan Atomic Energy Agency) have already been established in the towns of Naraha, Tomioka and Okuma. In July 2017, the Fukushima Innovation Coast Framework Promotion Organization opened the Fukushima Robot Test Field in Minamisoma City as a core legal body promoting the framework. In Futaba Town, the Great East Japan Earthquake/Nuclear Disaster Museum has been established as a base for disseminating information.

However, looking back from the start of the framework to the present, no results have been achieved. The Innovation Coast concept is still relatively unknown, and the only visible results are the creation of buildings.

For example, according to the Fiscal 2019 Report on Prefectural Government Opinion Poll Results[23] regarding the status of recognition for the Fukushima Innovation Coast Framework, 83.3% said they did not know of it: “I don’t know the name or anything about it” (46.3%), “I’ve heard the name, but I don't know very well what it is about” (37.1%). On the other hand, only 15.7% said “I have heard

[23] Fukushima Prefectural Government, 2019.

the name and know something about it" (13.1%) and "I have heard the name and know a lot about it" (2.6%).

What is the issue here? Former Special Advisor Hosono commented, "There is still a huge gap between the Innovation Coast concept and how much local residents are involved in it."[24] He was pointing out that the framework mainly focuses on companies coming in from outside, and that it would not function unless the gap in terms of local human resources, technology, management, and capital was filled.

Of course, there are some efforts with a strong presence. For example, the Fukushima Soso Reconstruction Team (commonly known as the "Joint Public-Private Team")[25] is a public-private support platform for disaster-affected businesses in the Soso district of Fukushima. This organization was established in August 2015, and supports rebuilding Fukushima in terms of industry by bringing together "public" human resources from the Ministry of Economy, Trade and Industry, Fukushima Prefecture, and the Ministry of Agriculture and Fisheries, and "private" human resources from TEPCO, local banks, and consulting companies. Specifically, they have conducted door-to-door visits to businesses in the prefecture providing expert consulting if there is a need. They have been supporting business restarts, increasing sales, and human resources.

By March 2020, they had conducted individual visits to 5,400 businesses based in 12 disaster-affected cities, towns and villages. Since April 2017, they started visits to individual farmers, visiting some 1,800 farmers in an effort to support restarting farming and improving profitability and competitiveness.

Many people may not really understand what 5,400 door-to-door visits mean. If it was achieved in Tokyo, it would probably not be a big deal because the number of businesses is huge. However, more than 9,000 disaster-affected businesses are scattered around Fukushima Prefecture. They include some organizations where managers, including elderly owners are missing. Before a visit can take place, preparatory work to grasp the current situation has to be conducted via mail or telephone. At first, there were many businesses that regarded them with distrust. However, a steady approach has been successful and produced results. General Secretary of the Fukushima Headquarters for Fukushima Reconstruction and Revitalization Directorate, Masakatsu Okamoto said, "Now, when you ask the local municipalities, the most trusted among organizations working on recovery is the Joint Public-Private Team. They've seen all the ledgers of small and medium-sized enterprises and helped people who don't know how to do bookkeeping. Some of them have even intervened in fights between parent and child..."[26] and laughed.

There is even some infrastructure for restarting, maintaining or expanding business activities that appears to be more robust than prior to 3.11

For example, after the disaster, the Joban Expressway, which connects Tokyo to Sendai and runs through the Futaba district, was fully opened. Roads connecting the Joban Expressway and the regional main roads were also constructed partly in order to transport decontaminated soil to intermediate storage facilities. The JR Joban Line was also reopened in March 2020, directly connecting them to Tokyo and Sendai. A number of industrial parks in the area that can serve as production bases for companies have also been readied.

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[24] Interview with Goshi Hosono, December 19, 2019.
[25] Fukushima Reconstruction Promotion Group homepage: https://www.fsrt.jp/
[26] Interview with Masakatsu Okamoto, January 17, 2020.

In the process of lifting evacuation orders in 12 municipalities over the past 10 years, there was initial pessimism that “no one will return and no businesses will be viable in a place with such high radiation”. However, when the dose fell more than expected and the number of people coming and going increased due to the resumption of housing and business, customers gathered at convenience stores and hotels. In order to then attract employees, there was for a time an exceptional jump in wages to an hourly rate of 1,500 yen, when the minimum wage in Fukushima was in the 700-yen range. Although this temporary “reconstruction bubble” has settled down to some extent now, economic activity seems to be strong due to the flow of funds for compensation, decontamination, and decommissioning.

However, compared to residents, it is much more difficult for a business operator who has evacuated at the time of the disaster and rebuilt production and sales bases elsewhere to return. Many businesses have also gone out of business due to aging and a lack of successors.

Former Special Advisor Hosono put it in this way.

“Fukushima’s reconstruction, I think they’ve done a great job coming this far in nine years, more than I expected. Okuma Town is a symbol. It was 2012 when Okuma’s Mayor Toshitsuna Watanabe told me he wanted to make Okuma a base for reconstruction, and to tell you the truth, that gave me a bit of a headache. But the mayor was adamant. I think it’s ground breaking that the Okawara district in Okuma has now become just such a base.”

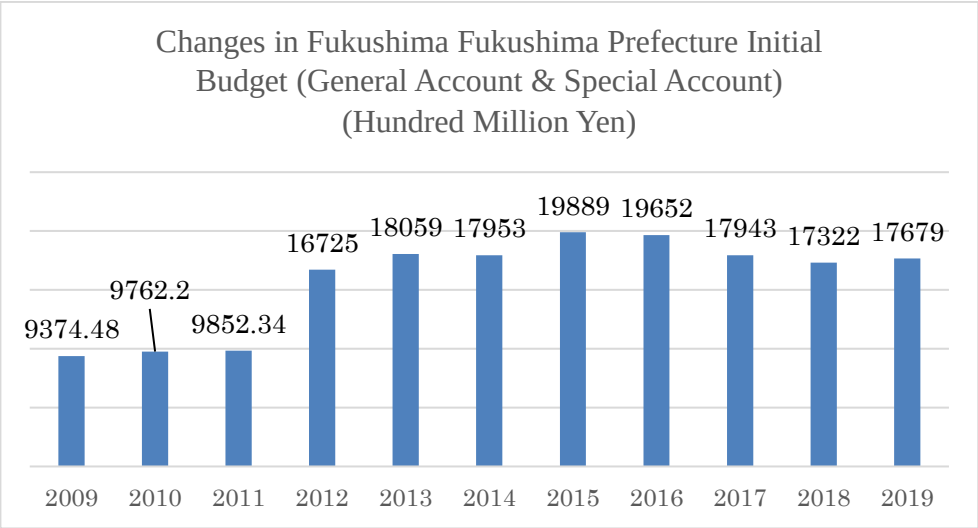
Fukushima's industrial recovery has yet to show any outstanding results. Nonetheless, the state, prefecture, and Hamadori municipality hope that the Innovation Coast framework and actions by the Joint Public-Private Team will serve as the basis for various future reconstruction efforts. It is strongly desired that the special reconstruction and regeneration zones mentioned above will also become a base for rebuilding industry and daily life in cooperation with these movements.

However, beyond that, there may be some areas where the problems of regional reconstruction and those of decommissioning and decontamination/interim storage, which have run on different rails up to this point, overlap. A concrete image remains unclear, however, in the present tenth year.

Even so, in areas where social issues are concentrated and multiply layered, an attractive and sustainable life base for both original residents and newly incoming residents must be built by re-understanding the issues and their potential, by turning decommissioning, that will take decades, into a local industry, and by establishing new industry in the region as promoted by the Innovation Coast framework. This is to be enhanced to a level where it can act as a regional model for a future Japan. Once seemingly dead, it must rise from such a crisis, reverse its fortunes, universalize the knowledge and lessons experienced there, and open up the future. This is the vision of reconstruction for Fukushima that should not be allowed to go out.

7. Zombies and the End State

As reconstruction-related projects proceed, the government's reconstruction budget has blown out. For example, in terms of the budget scale for Fukushima Prefecture, it has expanded during these ten years to approximately 1.7 to 2 times that of 2010, the year that predates 3.11.



As many of the reconstruction-related projects reach completion in the tenth year, it is evident that the peak occurred around 2015-16 and that it continues to shrink thereafter. Completing the intensive reconstruction period and the reconstruction and revitalization period, it is assumed that a post-reconstruction bubble period will be experienced in various aspects and that a fraying of the economic structure supported by reconstruction projects and their ripple effects will become apparent. There is a strong possibility that business sentiment, already deteriorating little by little due to the new coronavirus crisis, will suddenly worsen.

Adverse effects will not only affect the industrial side but also the living side. For example, the total fertility rate in Fukushima Prefecture fell immediately after 3.11, but then recovered in a V shape, reaching the highest level in eastern Japan at one point. The economic boom may have contributed to support this phenomenon. What will happen to it in the future will be another important theme in reconstruction.

Full-scale reconstruction of evacuation areas

While Fukushima as a whole has entered the post-reconstruction bubble period, the reconstruction of areas under evacuation orders has been forgotten. These areas have been described in the stereotyped image of “ghost towns with no human figures and where time has stopped”. This is not the case, however. From the beginning, there have at times been tens of thousands of people involved in decommissioning and decontamination projects coming and going.

On-site at the Fukushima Daiichi Nuclear Power Plant, there were more than 7,000 people working every day at its peak, and more than 3,000 people today. Even off-site, when the initially planned decontamination work was completed, work on intermediate storage facilities and the demolition of houses started, and people continued to come and go. As evacuation orders were lifted, the number of residents returning, albeit slow, gradually increased. Behind this was the fortuitous miscalculation of the dose falling much faster than initially expected.

However, there are disparities in regional development, within the region depending on the timing of when evacuation orders were rescinded. It is in the number of inhabitants who actually live in the municipality that the difference becomes apparent. Namie Town, where the evacuation order was finally lifted in spring 2017, six years after the nuclear accident, has a population of 17,114 (as of the end of February 2020), but the number of residents actually living in the town is 1,332 (as of the end of March of the same year). Similarly, in Tomioka Town, where the evacuation order started to be

lifted in the spring of 2017, only 1,205 residents out of a population of 12,673 live there (all as of February 2020). In other words, only about 10% of the total population actually lives in the town. On the other hand, Naraha Town, where the evacuation order was lifted in September 2015, has 3,937 inhabitants out of a population of 6,784, that is, 60% of the population. Elsewhere, in Hirono Town, where the evacuation order was lifted at the end of March 2012, from a population of 4,755 people 7,268 currently live in the town, the actual number of residents being larger than its population. In the case of Hirono, the fact that residence could be taken up from an early stage and it became a living base for decontamination and decommissioning workers, and that a new school, Futaba Mirai Gakuen, was established there to provide integrated education from elementary and junior high school with a school dormitory saw many new residents starting to live there. Even now, because residents who newly come to the area for decommissioning work and other reconstruction-related work and live in hotels and employee dormitories are not registered as official residents, the number of people actually living there is higher than the number of registered residents. In this way, there is a substantial difference between areas where efforts to rehabilitate were started as a base for early reconstruction and decommissioning and where they were not.

If there was a competition, the advantages and disadvantages would be blatant. Discrepancies would also emerge. This fact itself is the result of economic activity in a market economy, and must be accepted as a by-product. The issue is the sustainability of these economies. To put it somewhat cruelly, doubts exist as to whether the various “Fukushima's revival” phenomena we have seen so far are ventilators, artificial hearts, nutritional supplements, but not blood transfusions, and just how sustainable are they?

In the long run, the budget devoted to the reconstruction of Fukushima will shrink. Areas that have experienced evacuation orders are no exception, and demand and employment will gradually decline. After reconstruction projects are over, the facilities built during them will not create added value and may turn into “useless boxes” with high maintenance costs. At such a time, the state of reconstruction up to that juncture will once again be questioned. The cost performance of past reconstruction, which has been accepted because they’re disaster victims, they’re disaster victims, will come into question.

If venturing a comment, reconstruction projects in Fukushima seem to be resting on the laurels of an “unfounded sense of safety”. This also connects to a structure in which areas where nuclear power plants were located coexisted with the “safety myth”, which was examined in the Independent Accident Investigation. In the past, in the midst of forging an economic and social coexistence with nuclear power, nuclear power plant sites in Fukushima were incorporated into a governance that avoided facing the risks and economic sustainability of nuclear power. They supported the “safety myth” about nuclear power. The “unfounded sense of safety” that seems to be occurring in “Fukushima's revival” may now become a “new safety myth” that replaces the former safety myth.

For example, the financial sustainability of compensation, decommissioning, and decontamination/interim storage-related businesses that will continue in the future depends on TEPCO's management performance. How much do residents, local governments, people outside Fukushima and the government realize that TEPCO is in a situation of severe competition with the deregulation of electricity while fulfilling its responsibility for the accident?

A former Minister of Economy, Trade and Industry executive, who took the lead in reforming TEPCO reform, says:

“The balance between responsibility and competition was set out in the 2014 New Comprehensive Special Business Plan, but how long can this last, the motivation of the people onsite, which I

mentioned earlier, they've been inspired in bringing them along so far… I'm personally worried that just dragging this all the way will turn both responsibility and competition into a zombie."[27]

Shimada is afraid that TEPCO will not be able to maintain both responsibility for Fukushima as a disaster-inflicting company and competition in the market as a private company without continuing to motivate its onsite workers.

Another person, Masakatsu Okamoto, who has been in charge of the post-earthquake, post-tsunami, and post-disaster reconstruction of the Tohoku region during this time, testifies as follows.

"I think it can be said that the tsunami has ended to some extent, but when will Fukushima end... I think it will probably not be finished until the debris is taken out and the decommissioning is over."[28]

Decommissioning, intermediate storage facilities, and other reconstruction in Fukushima is endless. That is why discussions with an end in sight have been shelved to date. In the meantime, many appear to be trapped in a "new safety myth". No real recovery will come from that.

What is needed now for decommissioning, decontamination/intermediate storage, and regeneration of industries and livelihoods in the 12 municipalities is nothing but an extensive discussion of the end state.

The end state is a concept originally used in engineering discussions on decommissioning, and refers to the final circumstances.

What should the end state for the Fukushima Daiichi Nuclear Power Plant be? For example, how can we accept that it takes a long time and a huge amount of money to dispose of the waste generated even if we completely remove waste and pollution and return it to a greenfield site? Is it alright, for example, to accept that this time and cost should be spent on other things, and that rather than bringing it back to a greenfield state, couldn't we stop at dismantling the buildings and so on and reducing the risk to a state that does not affect the lives of the residents in the surrounding area, a state where it can be safely managed? Or, will we create a power generation facility for thermal power and renewable energy in the vacant place on the site to make use of the existing power transmission facilities and make it into a new industry in the region? The Fukushima Daini Nuclear Power Plants situated in Tomioka and Naraha towns will also enter a 40-year long decommissioning process. Is it possible to add value by treating them both in an integrated manner?

The debate about various possible end states for decommissioning the Fukushima Daiichi reactors has still not begun even after ten years. Are they running a 100-meter sprint or a marathon? It is equivalent to running without knowing the answer. You will run out of breath on the way.

There is almost no open discussion about the end-state theory for intermediate storage facilities. The work of loading, sorting and storing decontaminated soil at the intermediate storage facilities will be completed in about 5 years. After that, the actual area used to store soil will be less than half the total area of the intermediate storage facilities. However, what needs to be considered is the fact that the area covered by intermediate storage facilities is about 1600 ha, which is almost the same size as Haneda Airport (1522 ha). And 70% of the landowners who provided the land for the intermediate storage facilities have responded to the purchase of land by the state (not by setting land lease rights). In other words, in the future, a vast stretch of government-owned land will lay idle there, and by

[27] Interview with former Ministry of Economy, Trade and Industry executive, February 27, 2020.
[28] Interview with Masakatsu Okamoto, January 17, 2020.

rights, discussions on what to do with this should be considered in tandem with the issue of securing a final disposal site outside the prefecture and transporting waste there. Such discussions have hardly begun, however.

What should be the end state for issues such as radiation monitoring, thyroid cancer inspection, and recompense/restitution? What will the 12 municipalities look like in the end, and what kind of treatment of the difficult-to-return zones would please old and new residents alike?

The difficulty of defining an end state for Fukushima's revival lies in the twin difficulties of “what to define as the end” and “who can argue this”.

Initially, it was clear what to overcome and where to aim for “reconstruction”, but even as time progresses and certain conditions improve it has paradoxically become more ambiguous.

The various remaining reconstruction challenges that have been left untouched in the last ten years are not simply a question of getting the budget, or perfecting the technology, or involving residents in discussions. All of them can only be resolved by taking the time to make efforts based on these complex issues. Shelving will only continue without clarifying who is to aim for what as “certain situations improve”, and what resources are to be used to solve difficult problems and rebuild.

Thorny problems that remain unsolved even after ten years include ensuring safety and security through detailed radiation monitoring, confronting reputational damage, starting up decontamination and intermediate storage facilities, lifting evacuation orders and rebuilding local life and industry.

Reconstruction after a nuclear disaster: this contains many questions where the answers cannot easily be found even if you think of it as an applied problem of “learning” from the reconstruction carried out after the many wars and disasters that humankind has experienced to date.

Summary

In the history of Japan's recoveries, has there ever been one where the end point beyond the restart is so hard to determine?

The shape of Tokyo laid out in the Teito Reconstruction Plan after the Great Kanto Earthquake in 1923, the main functions of the state, the industry and education formed by World War II and the subsequent rebuilding, the nature of democracy, or the changes that have been wrought since the Great Hanshin-Awaji Earthquake in presence of civil society, police, fire departments, and the Self-Defense Forces. These things created during this reconstruction assuredly exist at our feet. Will something similar to this be created after the disaster recovery?

If there is to be, it must be found beyond the tackling of globally shared issues such as declining birth rates and aging populations, the decline of established industries, the relationship between huge science and technology, political interests and the formation of democratic consensus, that is, universal issues through reconstruction.

Ten years since the nuclear accident. The disaster recovery is at a turning point. Memories of 3.11 are fading, but domestic and overseas reputational damage has become even more persistent, frustrating Fukushima residents. Neither politics nor the administration have been able to take any effective measures during this period. And, after the post-revival bubble, a great depression from the new

coronavirus is on the attack. In a structure of entrusting decision-making to the “administration plus alpha”, the disaster is becoming more fixed and isolated, political and administrative voices relying on scientific and accurate information are weak, and a “new safety myth” is unconsciously being constructed. And the shelving of issues continues. As it stands, Fukushima's problems will be preserved as issues peculiar to Fukushima.

Once again, we should return to that horizon keeping in mind the “will for universal reversal” that does not stop at restoration but aims at resurgence, and imagine an end state for recovery. And then, should we not look ahead to “the ideal shape of Japan in the mid-21st century”?

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Conclusion: Creating the "shape of this country"

Kazuto Suzuki

This report is not a continuation of the inquiry conducted by the Independent Accident Investigation examining the current status of the accident. Rather, it discusses how the lessons and recommendations drawn by the many accident investigations, including the Independent Accident Investigation, were understood, learned, and changed government and society. Above all, it focuses on points such as whether safety regulations have overcome the "safety myth", whether TEPCO has changed its management and its culture, whether government offices are well prepared for crisis response, and who, when a worst situation is reached, will or has come to handle the situation with what authority and responsibility. It also deals with the issue of rebuilding that was not touched upon by respective reports released in the first or second year after the accident, showing that "preparedness" for and "learning" about nuclear accidents must also cover rebuilding.

Based on these analyses, this chapter reconsiders what the Fukushima Daiichi Nuclear Power Plant accident was, reconsidering the nature of corporate and government governance in that context, and reappraising the state of Japan's legal system and other systems during the extraordinary times of a national crisis, concluding the report with a synthesis of the implications for "the shape of this country", so to speak.

The birth of a new "safety myth"

The Independent Accident Investigation pointed out "the trap of the absolute safety myth" as one of the factors in the Fukushima Daiichi nuclear power plant accident, and concluded that it made the nuclear power plant's preparedness for the accident insufficient. The absolute safety myth is "a belief system in which social psychology takes a taboo view of nuclear disaster risk as the upper structure, and the interests and concerns of the nuclear power village that promotes nuclear power generation is the lower structure".[1] As a result of pursuing the "small peace of mind" of the people, it led to a loss of the "great safety" of the people and the nation.

This "safety myth" is often presented as a belief of those promoting nuclear power generation, and is described as an alchemy of safety regulations enabling nuclear power generation by providing a "small peace of mind" to the people. It is argued by media and scholars that the safety myth was destroyed by the Fukushima Daiichi nuclear accident[2]. This discourse has become popular, and has led to a belief in many places throughout society that we won't make the same mistakes again because the safety myth has collapsed; the new nuclear safety regulations are strict and aren't hoodwinked by the old safety myth; it will make things tough for the pro-nuclear power group. Is this true, however?

The harm of "homework" regulation

Tsuyoshi Shiina, a member of the Parliamentary Accident Investigation's secretariat, dubbed the new regulatory standards set by the Nuclear Regulation Authority "homework style" regulations, and the 10CFR safety regulations announced by the US Nuclear Regulatory Commission (NRC) as an "objective-driven", explaining the difference between the two ideas[3]. "Homework style" regulation refers to the regulatory authority setting "homework", the operator completing the "homework" and achieving a pass grade, which is guaranteed to be "safe". The "objective-driven" idea refers to a method of regulation in which an objective is set "to prevent damage to residents in the event of an accident," and the method of achieving that objective is left up to the operator.

[1] Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, pp.385–386.
[2] Kuroda, et al. (Eds.), 2012.
[3] Interview with Tsuyoshi Shīna, October 9, 2019.

This difference in "homework style" and "objective-driven" regulatory mindsets is crucial when considering the "safety myth". The "homework style" regulations may be the "most stringent in the world", but their basic assumption is events "anticipated as much as possible" and setting regulatory requirements to respond as best as possible to such events. Meeting regulatory requirements becomes the goal of operators, and by meeting this goal, they believe that "safety" has been achieved and they provide people with "peace of mind".

However, there are a number of problems involved in this "homework" regulation. First, when using homework style regulation to aim for "absolute safety", it is necessary to set extremely unrealistic regulatory requirements, which not only imposes a heavy burden on the operator but also severely restricts the operator's management. George Apostolakis, a former commissioner of the US Nuclear Regulatory Commission (NRC) from 2010 to 2014 at the time of the Fukushima Daiichi Nuclear Power Plant accident, noted, "[the Regulation Authority] they're really killing the industry. Extremely expensive to respond,"[4] and further pointed out that strict regulations make nuclear power plants inoperable. If the task of the Regulation Authority is to ultimately stop nuclear power generation and achieve the so-called denuclearization of power generation, such regulations can be said to be rational, but its role is "to ensure safety in the use of nuclear energy in order to contribute to the protection of life and property, the conservation of the environment and the security of Japan"[5]. As long as the use of nuclear power is a prerequisite, it should be thinking of how operators can continue their businesses as well as enabling the sustainable use of nuclear power.

Secondly, homework regulations restrict dialogue between regulators and operators, confronting operators with one-sided regulatory demands from the regulators. Apostolakis also commented, "the NRA had to show that they were truly independent, so they isolated themselves. So, that explains why these regulations are so strict"[6], having the view that the Authority refuses to engage in dialogue with the operators. Regarding this point, Shunichi Tanaka, the inaugural chairman of the Nuclear Regulation Authority, said that it was feared that the public would become suspicious if dialogue with operators was held behind closed doors, and that all dialogue should be "fully open" in a public place. He was confident that holding discussions in an open venue and in public sight meant the operators "couldn't say anything peculiar"[7], and if discussions descended into just going through the motions, "the public will see that and they'll just lose credibility".[8]

However, it is extremely difficult in a fully open environment for an operator to ask for a revision of regulations or a more efficient change to regulations for their own management reasons. It is inconceivable that the regulatory authorities and operators could exchange opinions on an equal footing in the circumstances that operators can hardly be said to have the trust of the people following the Fukushima Daiichi nuclear power plant accident. In this case, "homework" regulation means accepting unilateral demands from the regulators, operators whittling down their management resources in order to meet the standards, and any incentive to further improve safety is lost. A fixed hierarchical relationship is created between the teacher issuing the "homework" and the student submitting the "homework"," one in which the student does not have the authority to speak out about the "homework".

[4] Interview with George Apostolakis, January 29, 2020.
[5] Japan Act for Establishment of the Nuclear Regulation Authority of 2012, Article 2.
[6] Interview with George Apostolakis, January 29, 2020.
[7] Interview with Shunichi Tanaka, November 20, 2019.
[8] Interview with Shunichi Tanaka, November 20, 2019.

Furthermore, it was reported by the press that members of the Nuclear Regulation Authority had met with regulatory officers behind closed doors to hammer out a decision on policy over volcanic ash countermeasures at KEPCO before the Authority conducted its public committee session. If this is true, it means the Regulation Authority, which has been taken the position of being independent from the government and having "fully open" debate, is actually making de facto decisions secretly in cahoots with the government. It can only be criticized for not changing from the old regulatory system. If the Regulation Authority, which should act as the "teacher", has been adjusting its "homework" in private, it would undermine its principles of independence and openness.[9]

As Kugo argued in Chapter 1, the reason why the Regulation Authority needs independence is because of the marked reality in Japan of the "regulatory capture" highlighted by the National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission. "Regulatory capture" refers to a state where the operators being regulated have a technical advantage over the regulatory authority that is regulating it, and with the on-site having more information, they are able to control regulators, water down regulations, or incorporate profit inducements into regulatory practices. The concept was originally advocated by Nobel laureate George Stigler,[10] who also cites the U.S. Nuclear Regulatory Commission (NRC) as an example of "regulatory capture". The National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission explains as follows, however.

> The Commission's examination of the way safety regulations are deliberated and amended reveals a cozy relationship between the operators, the regulators and academic scholars that can only be described as totally inappropriate. In essence, the regulators and the operators prioritized the interests of their organizations over the public's safety, and decided that Japanese nuclear power plant reactor operations "will not be stopped." Because the regulators and operators have consistently and loudly maintained that "the safety of nuclear power is guaranteed," they had a mutual interest in averting the risk of existing reactors being shut down due to safety issues, or of lawsuits filed by anti-nuclear activists. They repeatedly avoided, compromised or postponed any course of action, and any regulation or finding that threatened the continued operation of nuclear reactors. The FEPC has been the main organization through which this intransigent position was maintained among the regulatory agencies and in the academic world.
> Our investigation focused on the significant lobbying role taken by FEPC on behalf of the operators, and scrutinized the relationship between the operators and regulators. The Commission found that the actual relationship lacked independence and transparency, and was far from being a "safety culture." In fact, it was a typical example of "regulatory capture," in which the oversight of the industry by regulators effectively ceases. We found examples of this in the neutering of revisions in the Guideline for Anti-seismic Design, and the improper discussions that took place on regulating severe accident countermeasures..[11]

The conclusion that this "significant lobbying" via the Federation of Electric Power Companies of Japan and "cozy relations with METI" "deliberated and amended" regulations in support of operators, and the "the oversight of the industry by regulators effectively ceases" changed the direction of regulations after the Fukushima Daiichi nuclear accident towards eliminating pressure from the industry and breaking up the relationship with relevant government agencies. The independence of the Regulation Authority took on the characteristics of a rigid autonomy that brooked no dialogue or engagement with other stakeholders. Its independence tended to "isolation".

In financial regulation, which also faces the issue of "regulatory capture" as discussed later, the Financial Services Agency (FSA) escapes "captivity" by supplementing "passive regulation" with dialogue with the business operators known as "dynamic supervision", and alongside financial institutions and their customers, aims at the kind of regulation that achieves both the goals of financial system stability and economic growth[12]. However, the Nuclear Regulation Authority only engages in

[9] See, Mainichi Shimbun, 2020a; Mainichi Shimbun 2020b; Mainichi Shimbun, 2020c.
[10] Stigler, 1971, pp.3–18.
[11] The National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission, 2012, p.43.
[12] Mori, 2016.

homework regulation, a typical example of passive regulation, not dynamic supervision through such dialogues, and in the name of independence, is holed up in "isolation".

Thirdly, and perhaps most importantly, homework regulation inevitably brings about risk management of the "unexpected". As Okuyama analysed incisively in Chapter 2, the point noticed in the debate over the Fukushima Daiichi nuclear accident was that despite the fact that TEPCO reported research on tsunami by the Japan Society of Civil Engineers (JSCE), they did not deal with it properly. The court ruled that the lack of tsunami countermeasures did not amount to criminal liability on the part of management, saying, "It was not recognized that the possibility of a huge tsunami could have been predicted."[13] The ruling means that since there was no legal obligation to anticipate and deal with the tsunami, even if tsunami countermeasures were lacking, it does not mean that they forgot their "homework" and is, therefore, not illegal. In short, homework-based regulation is premised on the fact that the Regulatory Authority issuing the homework achieves "safety" by paying attention to every event and knowing all possible hazards. It is assumed that all accident scenarios are considered by Regulatory Authority and by incorporating them into the "homework", and this, in turn, is to provide "peace of mind" to the people. In other words, if a problem overlooked by the Regulatory Authority issuing the homework, safety cannot be achieved and the people cannot have peace of mind. The fact that regulation by homework still prevails, however, is creating a myth that somewhere the Regulation Authority has covered all the issues and achieved "safety", which is nothing but the creation of a "new 'safety myth' " that the people are getting some "peace of mind".

Of course, the new regulatory standards imposed on operators by the Regulation Authority certainly incorporate the idea of "defense in depth" advocated by the International Atomic Energy Agency (IAEA), and consider an accident to be possible, taking into consideration that measures including the evacuation of residents will eventually have to be taken if the situation gets out of control. Regarding this resident evacuation, however, local governments where nuclear power plants are located are given the "homework" of mainly drawing up a manual and submitting an evacuation plan. If their answer for the homework is correct, they get a passing grade. In other words, if a situation that the manual does not anticipate occurs, that is, if you face an "unexpected" situation, you will be forced to deal with it as if you were at the Fukushima Daiichi Nuclear Power Plant accident.

When faced with an "unexpected" situation, "the NRC take their regulator hat off, we're no longer the regulator. We are a representative of the federal government to give that utility resources, we're their conduit for resources," but Charles Casto, formerly a regional deputy director with the NRC and the NRC's team leader dispatched to Japan, severely castigates that "[the Japanese regulators] one thing that NISA and NRA can't get over is to take off their regulator hat and give power over when they need to".[14] The Regulation Authority says their job is to provide "homework" as a teacher and not to help their students in times of crisis.

Prior to the Fukushima Daiichi Nuclear Power Plant accident, the problem was that being subject to "regulatory capture" and setting "homework" in their relationship with the operators, the regulatory authorities created greater room for the "unexpected". Under the new safety regulation system, however, regulators have increased their independence (isolation), and channels of communication with operators have narrowed, so that all the "homework" is prepared by the regulators. The fact that it is "the world's most stringent homework" not only disregards the profitability and sustainability of businesses, but also leaves no room for accepting proposals for safety improvements from the operators. And regulators are now required to keep an eye on all the issues and make assumptions on everything "unexpected". However, as long as humans are involved, there will always be the

[13] Japan Broadcasting Corporation (NHK), n.d.
[14] Interview with Charles Casto, August 26, 2019.

possibility of the "unexpected". Despite this, the structure of providing "peace of mind" to the people by continuing "homework-based" regulation and creating a "new 'safety myth' " has not changed.

"Objective-driven" regulation should be pursued

Interviews with executives of operators raised the following points.[15]

- Even with results obtained through discussions in a public forum with the Regulation Authority, it is possible that actual implementation of the regulations and achieving regulatory requirements may not work or be rational.
- Regulatory requirements have the effect of enhancing safety to some extent, but if certain regulatory requirements are met, the need to make further efforts to improve safety is not recognized not only among businesses but also in their relations with the Regulation Authority.

The problem this implies is deep-rooted. In other words, homework style regulations can be turned into issues of compliance by businesses, that is, responses that aim at doing what you're told to do and trying not to cause problems. Safety regulations are not meant to help businesses escape punishment or to satisfy regulators. There is no end to improving safety in the nuclear power business, which is a vital industry that puts many lives at risk in the event of an accident. Both businesses and regulators have no choice but to aim for "greater safety", to "prepare" for it and to "learn" from it. Both the regulatory side and the business side should strive for safety, generate safety, and mutually share their wisdom. The introduction of "dynamic supervision" conducted by the Financial Services Agency (FSA) is the key to breaking away from regulation by homework and a "new 'myth of safety' ". The dynamic supervision at the FSA refers to a method of seeking better response by "forecasting the future environment and dynamic development of financial institutions, evaluating the probability that financial institutions may diverge from minimum standards in the future, and sharing the awareness of problems with financial institutions."[16] If "financial institution" here is replaced with "business operator" in nuclear safety administration, "dynamic supervision" means projecting future energy problems and environmental problems as well as the development of the power supply business of operators, and regulatory authorities sharing their awareness of problems and seeking action for improvement. Regulators should not be placing maximum value on preventing accidents, and imposing monolithic prescriptions based on changes in technology and new knowledge, but rather engaging in constructive dialogue to seek solutions in line with operators' individual circumstances.

This approach of homework style regulation fails to break away from the thinking that has underpinned the safety myth to date. In the wake of the accident, the safety regulations prior to the Fukushima Daiichi Nuclear Power Plant accident were simply replaced with "homework" under "the world's most stringent" regulations.

"Object-driven" regulations should be introduced into Japan's nuclear safety regulations.

The Regulation Authority lays down the regulatory goals. The business operator devises how to achieve those goals and implements it. The Regulation Authority confirms and licenses them. This is dynamic regulation where instead of giving a drill for homework and grading it against model answers, students are free to write and evaluate their own strengths and weaknesses, the better to share with other students.

Nuclear power remains caught in the "national policy/privatize operation trap"

[15] Interview with TEPCO executive, November 27, 2019.
[16] Financial Services Agency, 2017.

The Independent Accident Investigation pointed out the problem that nuclear power policy prior to the Fukushima Daiichi Nuclear Power Plant accident was promoted by an operational system known as "national policy/privatize operation", a system where private-sector companies carry out "privately" the business of nuclear power generation, which is a "national policy" of the government promoting the peaceful use of nuclear power.

Nuclear policy has been pursued, however, leaving the question ambiguous of whether the government that promoted the policy will take responsibility or whether the operator, which is a private company, will have unlimited liability in the event of a nuclear accident.

This ambiguity became a problem once more because of the question of compensation and decommissioning after the Fukushima Daiichi nuclear accident. Under the Nuclear Damage Compensation Act, which stipulates compensation in the event of an accident, the liability limit for private companies is set at 120 billion yen, the government to support compensation by private businesses if it exceeds that amount "within the authority of the government by the resolution of the Diet".

One issue at the time was the question known as the "Article 3 proviso" in the Nuclear Damage Compensation Act. Article 3 of the Act states that "when nuclear damage is caused by the operation etc. of a nuclear reactor, the nuclear operator involved in the operation of the reactor shall be liable for the damage. However, this does not apply if the damage is caused by an abnormally large natural disaster or social upheaval." On this basis, the Great East Japan Earthquake was recognized as an "abnormally large natural disaster", and methods of solving the compensation question without considering TEPCO liable were considered. In the final analysis, however, the operator, TEPCO, ended up taking responsibility for the accident, and the Nuclear Damage Compensation and Decommissioning Support Organization (NDF) was established by the Nuclear Damage Compensation Support Organization Installation Act in August 2011, the government supporting the compensation by private business.[17] Based on the so-called "New and Comprehensive Special Business Plan" currently applied, TEPCO adds some 200 billion yen to NDF every year, with TEPCO to pay 16 trillion yen of the total amount of 21.5 trillion yen (2016 estimates) in compensation. To this end, TEPCO aims at securing approximately 500 billion yen annually.[18] Additionally, decontamination costs will be covered by a gain from the sale of TEPCO stock held by the government, but in order to achieve this, a stock price of around 1,500 yen has to be maintained (approximately 400 yen as of the end of March, 2020).

If it was still a regional monopoly using the former general cost method, it would have been trivial to raise such profits. This is because customers who use electricity within TEPCO's jurisdiction had no choice but to purchase electricity from TEPCO and it could raise electricity prices to compensate for the compensation and decommissioning costs. However, electricity tariffs were completely deregulated in 2016, and TEPCO found itself facing a situation where so-called new power companies and power utilities active in other regions such as Chubu Electric Power, were breaking the regional monopoly and entering the market, robbing them of their customers. TEPCO was forced to divide itself into a so-called competitive section (electricity retailing and power generation) and a public interest section (power transmission and distribution), each section being divided into a

[17] According to Article 16 of the Act on Compensation for Nuclear Damage: "Where nuclear damage occurs, the Government shall give a nuclear operator (except the nuclear operator of a foreign nuclear ship) such aid as is required for him to compensate the damage, when the actual amount which he should pay for the nuclear damage pursuant to Section 3 exceeds the financial security amount and when the Government deems it necessary in order to attain the objectives of this act."

[18] The Nuclear Damage Compensation and Decommissioning Facilitation Corporation, TEPCO Holdings, 2017, pp.2–9.

different company that had to be run in a different business environment. Under this kind a new business environment, TEPCO was in a situation where it was essential to restart existing reactors, specifically Units 6 and 7 at the Kashiwazaki-Kariwa Nuclear Power Station. Mr. Yamana, a former director of the Japan Nuclear Damage Compensation and Decommissioning Support Organization, said that TEPCO "lost about 20% of its customers" as a result of deregulation, and was of the opinion that "if Units 6 and 7 were running at Kashiwazaki-Kariwa on the premise of safety, it would generate about 100 billion, but they're not. It's really tough."[19]

In this way, TEPCO, on the one hand, has "invisible (not listed on the balance sheet)" liabilities related to compensation and decommissioning, and has no choice but to aim at generating more than 400 billion yen annually. With the deregulation of electricity, it has to raise profits in a competitive environment. Moreover, as to restarting its nuclear power plants, this is not a decision for its own management alone, and although it is a huge management resource, it requires negotiations with the national government and local governments. Kazuhiko Tomiyama, who was involved in the management of TEPCO and promoted the deregulation of electricity, said, "Of course, in terms of nuclear power there are a lot of negotiations with the national government, so TEPCO had no choice but to deal with national politicians. At the same time, you have to look towards local politics for restarting nuclear power plants with local governments and prefectures. So about half of the business mindshare geared towards purely competitive markets"[20] still maintains the old management style of the "privately administered national policy" era. While deregulation of electricity is expected to help deregulate management and foster a management and corporate culture along more like a "normal" private company, circumstances where it faces the problems of compensation and decommissioning, and management is dictated by the political decisions of regulatory authorities and local governments, is the fate of TEPCO, unable to escape from the framework of the "national policy/private operation" era.

The situation in which management as a "normal company" under pressure from deregulation of the industry and management that further strengthens "national policy/private operation" as a legacy from the Fukushima nuclear accident must be pursued simultaneously, has increased the risk of delay in TEPCO's reforms and the obstruction of improved safety innovations. All things being equal, they should be building an "effective" regulatory relationship based on creating relationships of trust with the regulatory authorities, but in their rush to restart the Kashiwazaki-Kariwa Nuclear Power Plant, there is no denying the possibility that they will appeal to political forces that could lead once more to "regulatory capture".

As discussed by Okuyama in Chapter 2, the Anekawa Plan[21], which promoted reforms in TEPCO's nuclear power division and advocated reforms based on TEPCO's corporate structure, was released, but it failed to dig deeply into issues linked to the cause of the Fukushima accident, and changes from inside cannot be expected. Who is responsible for the nuclear power plants with this unresolved internal paradox of being a "normal company" and a "national policy/privatize operation" as well as insufficient internal reform? Who is ultimately responsible in the event of an accident? With these questions unanswered, one is forced to evaluate the situation as remaining unchanged from before the Fukushima Daiichi Nuclear Power Plant accident.

Selfish Galapagosization

In the Independent Accident Investigation, the international aspects of the Fukushima Daiichi nuclear accident were taken up in Part 4, The Global Context. It argued that of the "3S" of nuclear power,

[19] Interview with Hajimu Yamana, December 11, 2019.
[20] Interview with Kazuhiko Toyama, March 18, 2020.
[21] Tokyo Electric Power Company, 2013.

Safety, Security and Safeguards, the emphasis was on safety and safeguards, and there was a low awareness of nuclear security issues. What became a problem there was the so-called "B.5.b problem", which was a regulation established by the 2002 Nuclear Regulatory Commission (NRC) order (currently Federal Regulation 10CFR50.44 (hh) (2)[22]) as a countermeasure to nuclear terrorism that stated "Guidance and strategies must be developed and implemented for maintaining/recovering core cooling, containment vessel function, and spent fuel pool cooling function even in the event of a large-scale loss of plant function due to an explosion or fire." This B.5.b was reported to the Japanese side as an issue of "nuclear security", but the government did not instruct operators appropriately to take similar measures, nor was it communicated to the Atomic Energy Commission or the Nuclear Safety Commission's subcommittee, which are the emergency technical advisory organizations for countermeasures against armed attacks and nuclear disasters.

Part 4 of the Independent Accident Investigation also pointed out that Japan did not fully learn the lessons of the Three Mile Island nuclear accident in the United States and the Chernobyl nuclear accident in the former Soviet Union, and that despite both direct and indirect warnings from international activities to improve the reliability of nuclear power use including the IAEA peer review system and the International Commission on Radiation Protection (ICRP) regarding radiation protection, Japan failed to correct these problems and proceeded apace with a form of "Galapagosization", which deviated from global standards.

Based on the lessons learned from the Fukushima Daiichi Nuclear Power Plant Accident, it has certainly been clearly stipulated that the Nuclear Regulation Authority handles nuclear security issues, and measures for maintaining and recovering nuclear power plants based on Article B.5.b are now also included in the regulations. However, as already mentioned, the new regulations still maintain the framework of regulation by "homework style", and are not "objective-driven" regulations that take into account the regulatory thoughts and best practices of other countries. For example, in the event of an emergency, when a Precautionary Action Zone (PAZ), in which preliminary evacuation starts, and an Urgent Protective Action Planning Zone (UPZ), in which measures such as indoor evacuation are taken, are established under regulations claimed to be "the world's most stringent", the truth is that these are only "homework style" regulations that have been approved by the IAEA. It is hard to say that the experience of evacuating residents at the Fukushima Daiichi Nuclear Power Plant Accident has been utilized here.

Of course, the lessons from the Fukushima Daiichi Nuclear Power Plant Accident have not gone completely unlearned, such as regulations on off-site centers that take into account protection from tsunami and radioactive materials. However, as Isobe argued in Chapter 6, there is still no solid mechanism for cooperation between first responders such as the SDF, police, and fire fighters off-site. As Kobayashi argued in Chapter 5, there is no evidence that the need for an independent organization similar to the French Nuclear Accident Response Force (FARN) has been discussed sufficiently in the event of being unable to use onsite equipment in an emergency.

Also regarding the issue of rebuilding, the experience in Fukushima is completely different to that experienced in Three Mile Island and Chernobyl in that there has only been very limited international communication regarding decontamination and decommissioning directed mainly at experts. The world has learned from past nuclear accidents and has absorbed the lesson of accident preparedness, but it is difficult to say that the experiences of the Fukushima Daiichi nuclear accident have been shared by many countries or the lessons learned at the level of residents as well as experts.

[22] Nuclear Regulatory Commission, 2011.

In particular, as discussed by Kainuma in Chapter 7, international dissemination on decontamination and thyroid cancer tests to eliminate various social concerns associated with the nuclear accident is extremely limited, and one often witnesses the phenomenon of political movements based on specific values such as anti-nuclear and pro-nuclear power plant movements as well as the international distribution of advocacy-based information. In some cases, this has resulted in harmful rumors or misinformation that affect Japan's agricultural exports, including those from Fukushima Prefecture.

A typical example would be the problem of contaminated water. Water contaminated with radioactive substances generated from the Fukushima Daiichi Nuclear Power Plant is filtered using purification devices such as ALPS to remove most of the radioactive substances, leaving only tritium, which is accumulated in tanks after filtering. However, Goshi Hosono, who worked on the problem of contaminated water as the Minister of the Environment in the then DPJ (Democratic Party of Japan) Administration of Naoto Kan, said that "it is the government that caused the concern, so the root of the concern lies with the government." He responded politely, but did not have too much to say on excessive claims about the contaminated water risk, which he described as "a fake news thing". Subsequently, however, false information started circulating in Korea and other countries, and he considered the reason was "we didn't fight properly over that in Japan", trying hard to disseminate information.[23] Dissemination of information was poor in the immediate aftermath of the accident, and since they were unable to distribute accurate information overseas, a distorted image of the accident circulated internationally and became entrenched. As pointed out by Sekiya in Chapter 3, this point can be interpreted as a failed case of transition from emergency crisis communication to normal risk communication.

Also from the viewpoint of information dissemination, there were problems in the Fukushima Daiichi Nuclear Power Plant accident concerning the role of the Chief Cabinet Secretary as a government spokesperson, and the issue of information dissemination by ministers and experts. In regard to the new coronavirus that broke out in the beginning of 2020 and the infection on a cruise ship entering the port of Yokohama, Katsunobu Kato, Minister of Health, Labor and Welfare, took the role of government spokesperson. However, his handling of information was neither sufficient for Japanese public nor international community, especially dissemination in foreign languages was extremely poor (in fact, the pitiful English used on the MHWL website became a significant problem[24]). In spite of the fact that the issue of poor information dissemination in the Fukushima Daiichi Nuclear Power Plant accident remained, bringing about various suspicions and speculations in other countries that subsequently lead to rumors and misunderstandings, there is no evidence that the issues of crisis communication and risk communication have been given serious consideration, and mechanisms for providing information remain unchanged. Many foreign journalists are stationed in Japan, and the content they send plays a major role in shaping international perceptions. However, no innovation has been made in the reporter club system, other information channels or access for foreign journalists. From the point of view of information dissemination, Japan is still in the "Galapagos", and there is no evidence of any improvement from the lessons learned from the Fukushima Daiichi Nuclear Power Plant accident.

In other words, these issues were treated by the government, regulators, businesses, and the media as domestic problems without thinking of international audiences, which means the lessons from Fukushima Daiichi Nuclear Power Plant accident on public communication has not been learned. The "Galapagosization" of the nuclear power safety system pointed out in the Independent Accident Investigation has remained essentially unchanged since then.

[23] Interview with Goshi Hosono, December 19, 2019.
[24] Wada, 2020.

Governance and immaturity in "the shape of this country"

In the Independent Accident Investigation, safety regulation governance and historical/social structure were analyzed as structural causes leading to the Fukushima Daiichi Nuclear Power Plant accident, and the Kantei's handling of the accident was analysed as a proximate cause. With regard to safety regulation governance, it considered problematic the fact that the fundamental system was a dual one where the government agencies in charge of nuclear power were divided between MITI/METI and the Science and Technology Agency/MEXT, and experts were also split into two groups between the Nuclear Safety Commission and NISA, security regulations being performed in tandem under an ambiguous relationship between the Commission and NISA, pointing out that this complicated and divided system of responsibility created a situation of irresponsibility. In addition to this ambiguity in nuclear governance, it also pointed out that with the anti-nuclear movement adopting judicial tactics, safety regulations took on the nature of regulation for fighting in court and of written safety regulations that focussing on the safety of nuclear power plant hardware.

It also analyzed in detail the actions of the Kantei in its crisis management: the lack of information coming into the Kantei and its leadership in an emergency; how Prime Minister Naoto Kan directly went to the Fukushima Daiichi Nuclear Power Plant and requested they vent; how he bulldozed his way into TEPCO's head office and castigated its executives, examining the difficulty of leadership in a crisis and organizational response in complex disasters. It commended the expansion of the resident evacuation area and the extraordinary establishment of the Fukushima Nuclear Power Plant Accident Countermeasures Integrated Liaison Headquarters by the government and TEPCO, pointing out the importance of conveying information and integrating command systems. Furthermore, it severely criticized the fact that the Nuclear Emergency Response Headquarters (Nuclear Disaster Headquarters) based on the Act on Special Measures against Nuclear Emergency Response, NISA and the off-site center, that should have acted as its secretariat, did not function at all. It also analyzed the role not only of the SDF but that of other first responders such as the fire department and the police, examining the overall governance capabilities of the government in crisis.

Through these examinations and analyses, the Independent Accident Investigation argued that "the key to government crisis management is how quickly a bureaucracy operating according to routine values can be switched to emergency response", concluding that "decision making in times of crisis must give priority to flexibility, adaptability, clarification of priorities, redundancy, and top-down decisions. You must get rid of vertical divisions and organizational compartmentalism, integrate resources and authority, and boost capabilities at once".[25] It argued that "the heart of this crisis was that the government lost the people's trust in the government during the crisis"[26], pointing to poor communication throughout.

Have these problems really been solved? Certainly, the Nuclear Regulatory Agency was created as an external agency of the Ministry of the Environment, and the Nuclear Regulation Authority was established as a highly independent "Article 3 Committee", eliminating the prior duality in nuclear administration and clarifying responsibilities. However, as has been repeatedly pointed out, the ideological background of that governance has failed to escape the framework of "homework style" regulation, leading to the recreation of a "new 'safety myth' ". Changing the institutional framework does not mean governance has changed. Moreover, by trying too hard to avoid "regulatory capture" in the relations between the regulatory authorities and the business operators, independence for independence's sake has been strengthened at the Nuclear Regulation Authority, and has failed to lead to governance aimed at bettering safety with the business operators. For judgment on the safety of nuclear power plants, the tendency to rely on the courts has not changed with the Otsu District

[25] Independent Investigation Commission on the Fukushima Daiichi Nuclear Accident, 2012, p.394.
[26] Ibid., p.395.

Court issuing a suspension order for KEPCO's Takahama Nuclear Power Plant in 2016, which stopped an operating nuclear power plant for the first time. Apostolakis, mentioned above, states, "the only job the court has is to review the process which led to a decision and make sure the process is according to the law. Just to give you an example, supposing the NRC issues a regulation without sufficient interaction with the public. They know you've violated the law because you're supposed to do that. But the court would never say 'oh, the structural analysis of this pipe is not right.' Because the court doesn't know. Okay? The judge will never say 'I'm not convinced it's safe.' "[27]

Lack of balance between experts and political leadership

Various changes can be seen in the decision-making system centered on the Kantei. As Chijiwa mentions in Chapter 4, improvement can be seen in the information sharing framework and training of the emergency muster team that was a problem in the Fukushima Daiichi Nuclear Power Plant accident. There is no doubt that the establishment of the National Security Secretariat has improved coordination with each security system and crisis management system. Moreover, since the LDP government has been in power since 2012 and the long-standing administration has continued to gain experience in responding to emergencies associated with natural disasters such as the Kumamoto earthquake and heavy rains in Western Japan, the level of crisis management has undoubtedly improved. However, the accumulation of such experience and the concentration of work on certain positions places a heavy load on, for example, posts like the Prime Minister, Cabinet Crisis Control Officer and in particular the Chief Cabinet Secretary, who also plays the role of spokeperson in disseminating information. Although this was raised as a crisis communication issue in the Fukushima Daiichi Nuclear Power Plant accident, far from being improved, authority has become even more concentrated on certain positions. Moreover, under this kind of a decision-making framework that focusses on certain positions, crisis response tends to be influenced by personal leadership, and as such, the Prime Minister should probably participate in crisis management drills during normal times in order to prevent such swings. After the Great East Japan Earthquake, Nobushige Takamizawa, who was in charge of crisis management as Assistant Deputy Secretary-General of the Cabinet Secretariat, expressed concern about the personal nature of leadership saying, "Whether the existing well-trained leadership can be carried over when there is a change of government is an issue. I doubt whether sharing experiences or training a successor can be done smoothly even in the case of a change of administration within the Liberal Democratic Party when they are not usually aware."[28]

Comparison with response to COVID-19

In the spring of 2020, the COVID-19 crisis broke out. As was the case with the Fukushima Daiichi Nuclear Power Plant accident, this time the phrase "the greatest crisis since the war" is also being used. In fact, Prime Minister Shinzo Abe has stated that this is the "greatest crisis since the war" and its impact on the economy will be "greater than during the pre-war depression".

Moreover, the two share a common fear of an invisible enemy this time as well, invisible radioactivity and an invisible virus, as well as the government seeking behavioral changes from people such as evacuation and planned blackouts/staying home.

Dealing with the new virus crisis has also become a touchstone for seeing whether Japan has really learned the lessons of Fukushima.

The crisis is still underway and judgments at this point need to be made carefully, but as far as the government's response to the crisis so far, some points have been learned and others not sufficiently.

[27] Interview with George Apostolakis, January 29, 2020.
[28] Interview with Nobushige Takamizawa, February 4, 2020.

One is the establishment of a control tower for determining quick response measures for a "comprehensive optimum solution". Here, false starts were made – with an upcoming "political agenda" including an April visit to Japan by Xi Jinping and the Tokyo Olympic and Paralympic Games in July, it is conceivable that it was difficult to switch to emergency mode - but the Kantei adjusted immediately appointing the Minister of State for Finance and Economic Policy, Yasutoshi Nishimura, as the minister in charge, and set up a new Coronavirus Infectious Diseases Control Headquarters in the Kantei to embark on a crisis response. The direction of the government was clarified with the establishment of a "experts council" centering on infectious disease experts and a strategy for infectious disease control.

There was a problem on legal authority exists in this context for effectively carrying out crisis governance. The powers given to the Prime Minister differ between the Nuclear Emergency Preparedness Act and the Novel Influenza Special Measures Act. The former is given strong authority and incorporates various policy measures such as the forced evacuation of residents and use of the Self-Defense Forces, but the latter does not have the authority to implement compulsory lockdowns. It grants a limited authority to the government for requesting stay-at-home.

Another challenge was how, in responding to the crisis, to utilize the scientific advice that is indispensable in dealing with the uncertainty of the unknown infectious COVID-19 disease. Here, scientific knowledge and political leadership must work hand in hand. In the Fukushima Daiichi Nuclear Power Plant accident, confusion reigned in the field due to the so-called "Naoto Kan risk", that is the self-recognition of the Prime Minister as being "familiar with nuclear power" and his impatience over the lack of information, distrust of TEPCO and NISA, the importance placed on input from non-experts and micro management. It was Haruki Madarame, Chairman of the Nuclear Safety Commission, who mainly acted as the Prime Minister's advisor, but he was given only a limited role of responding only when asked by the Prime Minister. What became an especial problem was communication with the Prime Minister, Kan immediately panicking after he asked "Is there re-criticality?" and Madarame responded "The possibility is not zero" but re-critical situation never happened. This created a distrust of the experts that is sometimes referred to as the "Haruki Madarame Risk". In COVID-19 case, Prime Minister Abe was initially criticized for his attitude of emphasizing political leadership, such as deciding to close all elementary, junior and senior high schools without consulting with the experts, subsequently attempting to "tie up" with experts. Regarding partnerships with scientists, people's behavioural changes are actively being urged with not only Shigeru Omi, President of Japan Community Health Care Organization, at the forefront of communicating with politicians and the people, but both Hitoshi Oshitani, a professor at Tohoku University, formerly in charge of SARS countermeasures for Asia at the World Health Organization, and Professor Hiroshi Nishiura of Hokkaido University, representing the cluster tracing team, frequently appearing in the media and disseminating information via SNS and so on.

At the time of the Fukushima Nuclear Power Plant accident, and still today concerning rumors and the issue of contaminated water, the fact that we cannot accurately, rapidly and effectively convey the risk situation to the world remains the same. A typical example is how to deal with the cluster outbreak on the Diamond Princess, a cruise ship anchored in Yokohama Port. Although the Ministry of Health, Labor and Welfare took the lead in dealing with this case, the timing of embarking on action was delayed because it was a foreign vessel, which contributed to the explosive infection on board. In addition, information dissemination at the time was not consistent, and because very little information was conveyed overseas, it was dubbed the "Petri Dish" and treated as an international scandal.

The COVID-19 crisis has not gone away. It is still too early to make a judgement about the government response to the crisis. However, one thing is certain: there is much that can be learned from the response to the Fukushima nuclear crisis regarding how to deal with this crisis.

First responder and the "ultimate question"

Lastly, the issue of first responders discussed by Isobe in Chapter 6 was the subject of investigation and verification in the Independent Accident Investigation, but was not taken up in the Government Accident Investigation or the National Diet Accident Investigation, etc. Regarding this point, no noticeable organizational change or alteration to the activity manual have been seen following the Fukushima Daiichi nuclear accident.

Certainly, the police will be in charge of off-site activities during the evacuation of residents, a new regulatory requirement, and participate in the training, but this amounts only to the police responding to activities required by law rather than proactively learning lessons and addressing them. The Self-Defense Forces are also repentant about the Fukushima Daiichi nuclear accident and have learned lessons from it, but this does not mean that the SDF has redefined its role or mission as a first responder in a nuclear accident. On the contrary, according to the former Nuclear Emergency Preparedness Officer of the Cabinet Office, this issue was discussed with the Ministry of Defense and the Self-Defense Forces, but it was almost taboo to place the "onsite" role of the Self-Defense Forces on the agenda, no deep discussions taking place.[29]

Needless to say, in the event of a nuclear accident, the operator who runs the plant is primarily responsible for dealing with the accident. Without daily operational experience, it is impossible to understand what is happening where. On-site plumbing and valve locations cannot be known if the SDF or police suddenly enter the site. In that sense, it is natural for the operator to bear primary responsibility for the response.

However, the problem is the "worst case", when the operator loses control and lives must be put at stake to halt the progress of the nuclear accident to protect the people and the nation. At that time, the ultimate question is who will be responsible for ending the worst case incident and who will do the job? This has not been addressed in discussions or in the debate over restarting nuclear reactors, and there is no public consensus or decision by regulatory regimes, political leadership or public.

It is assumed that the operator, which runs the plant, is a private company under the "national policy/privatize operation" framework. It is difficult to oblige employees who work for and are contracted to private companies to put their lives in the balance to stop the nuclear power plant and protect the nation and the people. In Chapter 6, Isobe examined the establishment of a legal system similar to the Mariners' Act, but concluded that it would be difficult to enact such a law on the assumption that nuclear power plant operators would run away.

The aforementioned Casto noted that while it was difficult to request civilian operators to put their lives on the line and do the job, in the United States, NRC inspectors lived near the nuclear power plant sites with their families, and being local residents, they couldn't leave; there job was to stay in an emergency and work to stop the accident[30]. Apostolakis also said that even if the President showed an interest in dealing with the accident and would like to intervene directly, he would not be able to gives orders to the operator, that the principle is that the utility has authority, the control room operators are the absolute masters.[31]

[29] Interview with Hashimoto and Yuzawa, November 29, 2019.
[30] Interview with Charles Casto, August 26, 2019.
[31] Interview with George Apostolakis, January 29, 2020.

There is no ready-made answer to this "ultimate question". However, if a severe accident develops and both the safety of the state and the people will be lost if it is not stopped, and if someone has to place their life on the line to do the job, one supposes the operators, who know the site inside out, and the SDF, whose members pledge "to face events without regard to risk, to strive to the utmost of my abilities to complete the assigned tasks, and to respond to the will of the people", would cooperate in some form or other. While it is the role of politics to make the final decision, at least assuming that such a situation may occur, if the operators and the SDF do not plan and prepare for such a time, they will have to perform extremely dangerous tasks in the absence of any "preparedness" when and if the government makes the call.

And as a state, it must decide what compensation, rewards and penalties, commendations as well as damages should be put in place for those who will be in the forefront of these duties, and how they will be rewarded. In this way, it is time for us to determine the "shape of this country".

No one wants the worst to happen. Nevertheless, preparing for the worst situation was the greatest lesson of the Fukushima Daiichi nuclear accident. And it continues to be its greatest lesson.

Summary Achieving both "great safety" and "small peace of mind"

Viewed this way, it can be said that "learning" from the last ten years has been ardent about eliminating "proximate causes" of the accident, but diffident about overcoming "remote causes".

To repeat, the remote causes are the "homework style" regulation that created the "safety myth"; the "village and governance of osmosis" of the electric power industry, which still wields strong political power; the practice of "national policy/privatize operation" that causes ambiguous responsibility and the inertia of TEPCO's corporate culture; the lack of risk communication; the "Galapagosization" psychology that is devoid of a sense of participation in building safety regulations in tandem with the world; and the immaturity of a "national security state"[32] that avoids facing front on the "ultimate question".

Why haven't these "remote cause" been removed?

Casto commented, "so we did FLEX [storing equipment for emergency] that covers the last war, which was Fukushima, but what's the next war? And that's the imagination thing. I think the failure of imagination is one of your lessons learnt. So, what's the next big thing? Our judgement is black sky. Because of hacking and all that."[33] His point is that the visible "proximate causes" of hardware-related accidents are dealt with, but there is a lack of imagination when contemplating invisible, software-related "remote causes".

However, perhaps an even greater reason behind this impossibility of overcoming "remote causes" is the distinctive and essential nature of Japan's socio-political psychology probed in the Independent Accident Investigation that places the same value on and integrates "small peace of mind" and "great safety".

Here, "peace of mind" is sought rather than "safety". It is easy to take actions that are unnecessary for "safety" but necessary for "peace of mind". It may at times be inconsistent, and it may undermine

[32] Hosoya, 2019, pp.16–29.
[33] Interview with Charles Casto, August 26, 2019.

what is necessary for “safety”. In the Independent Accident Investigation, these socio-psychological dynamics were described as “prioritizing small peace of mind and sacrificing great safety”. To press the point, what remains the most unchanged in the last ten years is the failure to create the best shape of risk, governance, and leadership to preserve the security of society as a whole.

In this regard, Yotaro Hatamura, professor emeritus at the University of Tokyo and who served as chairman of the Government Accident Investigation, stressed during his interview, “They talk about safety and peace of mind in one breath, and confabulate them in everything they do. It's good to strive for safety, but striving for peace of mind is no good. Striving for peace of mind will lead you to ignore risk.”[34]

After the Fukushima Daiichi nuclear accident, Japan announced far and wide that it would enforce “the most stringent regulations” in the world, which seems to have resulted in providing “peace of mind” to the people and recreating a “new ‘safe myth’ ”.

In order to escape this “homework style” society and continue to endlessly pursue “safety”, “objective-driven” regulations must be introduced, regulators and operators engaging in dialogue to create common goals, thinking by themselves how to achieve those goals, and making nuclear safety regulation seek ever better arrangements. In order to achieve that “safety”, operators must switch to a business that provides their customers with “peace of mind” by enhancing “safety” through the creation of a new corporate culture out of the old mentality of regional monopoly and general cost methods that fits the deregulation of the electricity industry. And that dialogue must also include the Japanese people and the world. It is by breaking away from “Galapogos” and becoming a state and operators that can speak of nuclear safety in their own words that will regain the trust lost in the Fukushima Daiichi Nuclear Power Plant accident and heal the scars that remain in the international community. To support of this, nuclear safety governance and a system of governance that can cope in an emergency with accidents without running away from the “ultimate question” have to be established

Only then will “great safety” and “small peace of mind” be compatible and harmonious.

[34] Interview with Yotaro Hatamura, September 18, 2019.

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Interview with Hashimoto and Yuzawa, November 29, 2019.

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Interview with Nobushige Takamizawa, February 4, 2020.

Interview with Shunichi Tanaka, November 20, 2019.

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Acknowledgments

The 10-year Investigation Commission on the Fukushima Nuclear Accident met a total of 20 times from August 2019 to March 2020, holdings interviews with the following parties and experts in addition to committee member study groups. (Some people wish to remain anonymous. Some are noted only by their institution.)

Charles A. Casto (President, The Casto Group Consulting LLC, former Nuclear Regulatory Commission (NRC) Regional Administrator), August 26, 2019
Yotaro Hatamura (CEO, Hatamura Institute of Creative Technology, former chairman of the Government Accident Committee), September 18, 2019
Tsuyoshi Shiina (former TEPCO Fukushima Nuclear Power Station Accident Investigation Committee Secretariat), October 9, 2019
Nuclear Regulation Authority Executives, October 10, 2019
Shunichi Tanaka (currently Iitate Village Reconstruction Advisor, Futabacho Chairman of Dose Verification Committee, inaugural chairman of the Nuclear Regulation Authority), November 20, 2019
TEPCO Executive, November 27, 2019
Nuclear Damage Compensation and Decommissioning Support Organization Executives, December 11, 2019
Goshi Hosono (Member of the House of Representatives, former Special Advisor to the Prime Minister, former Minister of the Environment), December 19, 2019
Former Executive Officer of the Reconstruction Agency, January 17, 2020
George Apostolakis (Head of Nuclear Risk Research Center, former commissioner of the U.S. Nuclear Regulatory Commission), January 29, 2020
Shuya Nomura (Professor, Graduate School of Law, Chuo University, former member of the Parliamentary Accident Investigation), February 4, 2020
Takashi Shimada (Special Advisor to the Ministry of Economy, Trade and Industry (METI), Special Advisor to the Nuclear Damage Compensation and Decommissioning Facilitation Corporation), February 27, 2020
Shunsuke Kondo (President of Nuclear Waste Management Organization of Japan, former chairman, Japan Atomic Energy Commission), March 10, 2020
Yasuhisa Shiozaki (current Chairperson of Headquarters for Promoting Administrative Reform, Liberal Democratic Party of Japan), March 17, 2020
Kazuhiko Toyama (Managing Partner of Industrial Growth Platform, Inc., member of TEPCO Reform/1F Problem Committee), March 18, 2020

In addition, the following people were asked to participate in individual interviews with the committee members. (Titles are as of the time of the interview).

Kota Juraku (Associate Professor, Tokyo Denki University), September 24, 2019
Former Diet Investigation Secretariat Researcher, October 1, 2019
Yasuo Sato (participant, Fire and Disaster Prevention Science Center), October 8, 2019
Kiyotaka Takahashi (former Deputy Chief Cabinet Secretary for Crisis Management), November 13, 2019
Eiji Hiraoka (former Vice Director-General, Nuclear and Industrial Safety Agency, former Deputy Director-General, Minister's Secretariat for the Ministry of the Environment), November 19, 2019
Ken Yamada (former Fukushima Prefectural Security Officer), November 22, 2019

Tetsuya Yamamoto (former Nuclear Emergency Preparedness Officer, Cabinet Office), November 22, 2019
Mihama Nuclear Emergency Situation Center Representative, November 26, 2019
Experienced officer, Cabinet Office, Nuclear Disaster Prevention, November 29, 2019
Hiroshi Miura (Director, Special Disaster Countermeasures Office, Fire Department, Ministry of Internal Affairs and Communications), December 3, 2019
Nobuyasu Kubo (former Commissioner of the Fire and Disaster Management Agency), December 3, 2019
Mid-career staff, National Police Agency, December 6, 2019
Hisayasu Suzuki (Former Commandant of the Japan Coast Guard), January 30, 2020
Nobushige Takamizawa (former Assistant Chief Cabinet Secretary), February 4, 2020
Decontamination Policy Officer, Ministry of the Environment, February 26, 2020
Ryoji Oi (Disaster Prevention Policy Officer, Ministry of the Environment, Japan Coast Guard), March 5, 2020
Former Self-Defense Force official, March 19, 2020
Masato Taura (Former Deputy Commander, Central Response Group), March 27, 2020
National Institute of Health Sciences, March 30, 2020
Tomoyuki Takahashi (Associate Professor, Kyoto University), March 30, 2020
Takami Morita (National Fisheries Research and Education Organization Group Leader), March 31, 2020
Ohtsura Niwa (Chairman of Radiation Effects Research Foundation), April 1, 2020

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