Radioactive Governance: The Politics of Expertise after Fukushima

Maxime Polleri

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Abstract

This dissertation focuses on Japanese public and state responses to the release of radioactive contamination after the 2011 Fukushima nuclear disaster. I argue that the Fukushima nuclear disaster has led to the emergence of new forms of expertise in governing radioactive risks. These include techniques of governance that attempt to normalize people's relationships with nuclear matter as an everyday concern. They also include decentralized strategies that empower victims of the disaster by providing access to technoscientifc practices of radiation monitoring and delegating radiation protection from the state to the citizens. My findings uncover a major shift in how societies have formerly organized responses to radioactive risks. In the aftermath of nuclear accidents, scholars have criticized central authoritarian decisions, in which state management of radioactive hazards was associated with politics of secrecy, victimhood, or public knowledge deficit. At stake in Fukushima is an increased normalization of citizens' relationship with residual radioactivity, which is transformed into an everyday concern, rather than being represented as something exceptional. This is not only done by state experts, but equally via the increased activity of citizen scientists that collectively monitor residual radioactivity. My research is a significant departure from traditional sociocultural works that predominantly focus on micro-scale studies, such as how prior sociocultural factors influence a group understanding of radioactive risks. By highlighting major shifts in the structure of expertise and the regulation of life amidst toxic exposure, my research highlights how the management of contamination risks is evolving in an era where the impacts of modernization represent permanent marks on the planet.

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List of Acronyms

ABCC: Atomic Bomb Casualty Commission

ALARA: As Low As Reasonably Achievable

Bq: Becquerel

FEPC: Federation of Electric Power Companies

FMU: Fukushima Medical University

FPHMS: Fukushima Prefecture Health Measurement Survey

IAEA: International Atomic Energy Agency

ICRP: International Commission on Radiological Protection

JAEA: Japan Atomic Energy Agency

LDP: Liberal Democratic Party

LNT: Linear non-threshold

μSv: Microsievert

mSv: Millisievert

METI: Ministry of Economy, Trade, and Industry

MEXT: Ministry of Education, Culture, Sports, Science and Technology

MITI: Ministry of International Trade and Industry

MOE: Ministry of the Environment

NIRS: National Institute of Radiological Science

NEPR: Network to Evacuate People from Radiation

Sv: Sievert

TEPCO: Tokyo Electric Power Company

UNSCEAR: United Nations Scientific Committee on the Effects of Atomic Radiation

WBC: Whole-Body Counter

WHO: World Health Organization

A Note on Names and Translation

This ethnography employs a mixture of real names and pseudonyms to maximizes historical evidences, while protecting the anonymity of its participants. I use real names when the information surrounding an individual was gathered through public records or public conferences. I resort to pseudonyms when my information was acquired during formal interviews or informal conversations. Real names include both given name and surname, while pseudonyms are composed of mock given names. In Japanese, surnames usually precede given names. This order was reversed so as to not confuse the English reader. All interviews conducted in Japanese have been translated by the author. In cases where the valence of a certain Japanese word does not have a clear equivalent for the English translation, I usually insert the word in question within parentheses.

Chapter 1: Introduction

The road sign highlighted the current level of radiation: 2 microsieverts (μSv) per hour. With a woman named Michiko, I was driving in Tomioka, a city situated in the prefecture of Fukushima, Japan. In 2016, Tomioka was a ghost town, with the most striking sight being the rust, as if the brittle skin of the city had crumbled apart. With phantom-like eeriness, the storefront windows were stuck in time, exhibiting the same household items from five years ago. These were the tell-tale signs of the city evacuation following the 2011 Fukushima Daiichi Nuclear Disaster.

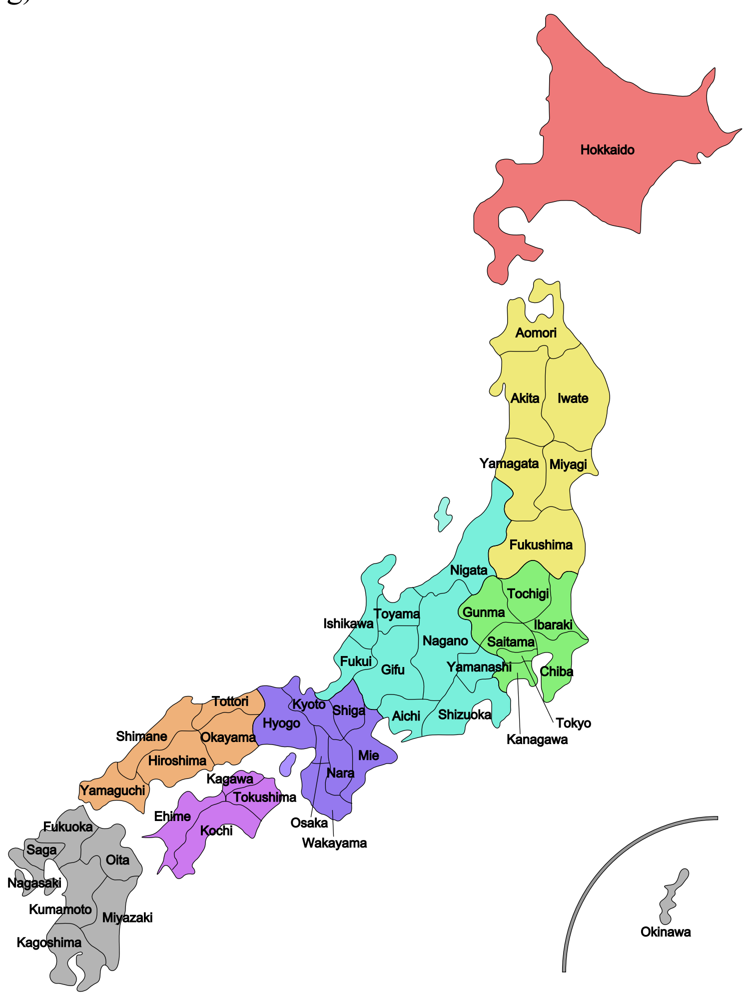
Prior to this catastrophe, Fukushima prefecture was an obscure region of northeastern Japan (*tōhoku-chihō*).[1] Yet, on March 11, 2011, Fukushima became an indelible part of Japanese history and materiality. On that day, the country experienced the most powerful earthquake ever recorded on the archipelago, only to be followed by a devastating tsunami. These two successive disasters damaged the Fukushima Daiichi Nuclear Power Plant, while human errors contributed to the nuclear meltdown of some of its reactors. This caused the discharge of dangerous radioactive materials called radionuclides forcing the evacuation of more than 160 000 people (Nuclear Emergency Response Headquarters 2011: 20).

On March 6, 2016, Michiko and I were driving to a temporary housing complex situated nearby Tomioka city. After the disaster, the Japanese state had created numerous apartment complexes in order to lodge evacuees from Fukushima, who were still displaced from their homes because of the harmful radioactive contamination. I met Michiko in

[1] A prefecture is the equivalent of a state in the United States or a province in Canada. Japan is divided into 47 prefectures.

February of 2016 at the Fukushima District Court (*fukushima chisai*), during a trial hearing that attempted to evacuate children from Fukushima. As the only white foreigner present in the court room I stood out amidst the crowd, prompting whispers of curiosity. Wondering what I was doing in such a place, Michiko came to see me after the hearing. I told her that I was doing fieldwork for an anthropological dissertation and that I was interested in studying Japanese public and state responses to the release of radioactive contamination after this nuclear disaster.

Illustration 1: *A map of Japan with its prefectures* (https://en.wikipedia.org/wiki/Prefectures_of_Japan#/media/File:Regions_and_Prefectures_of_Japan_2.svg)



She invited me to visit a temporary housing complex in Fukushima, where she maintained a long relationship with some of the evacuees living there. For three years, Michiko had slowly built a relationship of trust and confidence with residents of the temporary housing complex. Although Michiko was born in Fukushima prefecture, she had moved to Tokyo in her youth to get married. Nonetheless, she had a deep affective attachment for what she called her *furusato*, which can be translated as “home town” or “birth place.” Consequently, she followed the aftermath of the nuclear disaster with a mix of interest and sadness. When the disaster happened, Michiko was dissatisfied with the information on radioactive contamination coming from the Japanese state. She argued that data about contamination was sporadic, unclear, and hard to understand. Additionally, Michiko became worried about the possibility of radioactive contamination in Tokyo, where her grandchildren were living. These concerns prompted her to gather information on radiation hazards and she later joined a network of worried citizens that dealt with the risks of residual radioactivity by mobilizing practices and discourses of their own.

In the time span of merely five years Michiko had developed an impressive knowledge about radioactivity, while an array of new terms entered her vocabulary: Cesium-137, Becquerel, Sievert, alpha particles, and gamma rays. What was once reserved to nuclear experts had become a needed language for making sense of a post-Fukushima Japan.

Michiko’s story was far from unique – as I came to learn during my fieldwork in Japan, which lasted for 14 months between 2015 and 2017. Indeed, after 2011, radionuclides were not the only problems released into the Japanese atmosphere, as the nuclear disaster threw the archipelago into a flurry of controversies. One of the most important controversies emerged from the 2011 Japanese state decision to increase the minimum radiation threshold for evacuating the public from contaminated areas from 1 milliSievert per year (mSv) – the global standard – to 20 milliSieverts per year (Japan Cabinet Office 2016).[2] This increase of allowable radiation exposure, in which Japanese people were forced to accept a revised threshold for what is considered to be safe in regard to radiation exposure, caused members of the public to become wary of state experts, especially in their ability to manage and explain the risks of residual radioactivity (Dudden 2012; Hommerich 2012; Gill, Steger, and Slater 2013).

As a result, widespread grassroots action emerged and became epitomized by impressive anti-nuclear rallies (Ogawa 2013), as well as by the creation of non-governmental organizations (NGOs), where Japanese people collectively began to track and monitor radioactive contamination in an effort to make sense of the scope, character, and tangible effects of radiation dangers in their environment (Sternsdorff-Cisterna 2015; Kimura 2016). This increased activity of "citizen scientists" (*shimin kagakusha*) in radiation protection ultimately produced contradictory narratives of contamination, which heavily clashed with the official state discourse of radiation hazards.[3]

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[2] Technical terms surrounding radiation will be explained in details in Chapter 2.

[3] Throughout this dissertation, in talking about groups of "laypeople" that generated their own knowledge about radiation, I used the term citizen scientists, translated as *shimin kagakusha* in Japanese. I built my understanding of citizen scientists on Irwin's definition of "citizen science," which evokes a science that "assists the needs and concerns of citizens" and that is "developed and enacted by citizens themselves" (1995: xi). Indeed, as I examined in this work, many Japanese people have mobilized scientific practices to get a better understanding of radioactive contamination than the information provided by the state. In the context of U.S. toxicology, Fortun and Fortun have proposed the concept of "civic science," as something that "scientists think about and pursue through practical projects" (2005: 44). While they talk about toxicologists, their definition points to the importance of a science that is used to "serve the public good," rather than a science that "simply serves the state" (2005: 44-50). Much of this also echoes the rise of citizen science after Fukushima. Similarly, Wylie et al. make the call for a "civic technoscience," in which "new material technologies in combination with new social and literary technologies can sustain a civic research space external to the academy and where nonacademics can credibly question the state of things" (2014: 18). Based on this definition, I also examined how citizen scientists are invariably implicated in particular networks,

1.1 A Crisis of Expertise

In the Theater of Operations, anthropologist Joseph Masco (2014) examines the crisis of expertise that ensued from the 9/11 terrorist attacks against the World Trade Centers. He argues that U.S. security experts were "shocked and shamed by the ease with which the attacks were carried out" (2014: 10). By focusing on the different ways in which terror became an organizing principle of U.S. security policy, Masco highlights a fundamental shift in the expert process that produced security since the Cold-War. This led him to contend that an ever-expanding counterterrorism state now exaggerates specific imaginary threats over existing forms of everyday violence.

Similar to Masco, this dissertation also examines the crisis of expertise that ensued in a post-Fukushima Japan, where many citizens like Michiko became wary of state experts, especially toward the state capacities to govern the problems engendered by residual radioactivity. In particular, my research is concerned with how the nuclear crisis contributed to new formations of expertise and new means of governing environmental contamination. I examined how expertise on radiation hazards was enacted – both for the citizen scientists and the Japanese state – while highlighting the political transformations linked with this crisis. The relationship between expertise, politics, and governance is the main interest of this dissertation, as I explore how state and non-state actors compete, cooperate, and overlap in managing the reconstruction of what "normality" involved in post-Fukushima Japan.

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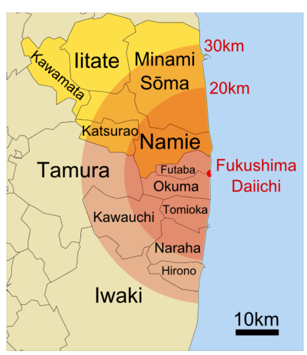
driven by community organizations and specific values. As such, I used the term "citizen science network" in order to refer to the physical and social infrastructure (e.g., laboratories, specific communities) through which Japanese people monitor and track residual radioactivity for their own purpose.

The crisis that ensued from the Fukushima nuclear disaster is complex and has evolved in different ways since 2011. Initially, the crisis was epitomized by a sense of urgency, in which state experts had to navigate the uncertainties brought by a triple disaster (*higashi nihon daishinsai*), namely an earthquake, a tsunami, and a nuclear disaster. In the chaos following March 11, 2011, scholars have already pointed out the challenges of responding to a nuclear disaster. For instance, some have argued that the emergency responses to the nuclear meltdown of Fukushima have "revealed a lack of preparedness, associated with inappropriate risk assessment, and a rather disorganized command and control mechanism for disaster response" (Akiyama 2016: 80). Others have highlighted the ineffective communication of information between the Prime Minister's office of Kan Naoto and Tokyo Electric Power Company (TEPCO), the owner of the Fukushima Dai'ichi power plants (Nakamura and Kikuchi 2011; Kushida 2016).

These problems were quickly amplified when a series of hydrogen-air explosions at the power plant released harmful radioactive pollutants between March 12 and 15. As a result, radionuclides such as iodine-131, cesium-134, cesium-137, strontium-90, and plutonium-238 spread predominantly throughout the Fukushima region. The amount of radioactive matter discharged was so critical that the incident was classified as a level 7 on the International Atomic Energy Agency's Nuclear Event Scale – the highest level possible. Following the reactors' meltdown, an emergency evacuation of the surrounding area was put into motion. At first, the Japanese state issued an in-house evacuation order only; people in the immediate vicinity of the power plant were advised to stay indoors and remain prepared to leave the area if so ordered. As the seriousness of the disaster became apparent, this evacuation order was expanded. By the following day (March 12, 2011) it encompassed a 20-kilometer radius around the power plant (Ministry of Economy, Trade, and Industry 2012: 3).[4]

In the weeks that followed the release of radioactive contamination, the boundaries of evacuation became highly contested. For instance, the U.S. military recommended a larger evacuation zone for the military and the members of its embassy staffs, ranging up to 80 km (Cleveland 2014). Internal worst-case scenarios in the Prime Minister's office of Kan Naoto suggested the possibility of an even larger evacuation zone that would have included the Tokyo metropolitan area (Kushida 2016: 20). The quick expansion of the evacuation zone, as well as the contradiction with U.S. recommendations, contributed to much public unrest about the extent and danger of radioactive contamination. Many individuals living beyond the officially restricted zone of 20 km fled through their own initiative, putting the number of evacuees at more than 160,000. These individuals later became known as "voluntary evacuees" (*jishu hinansha*).

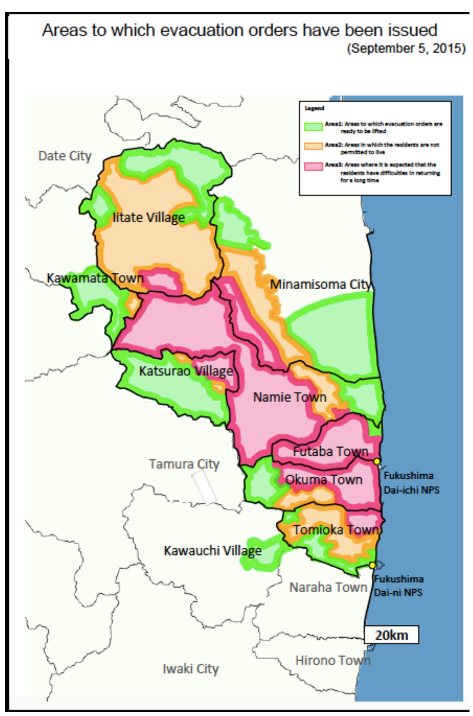
Illustration 2: *Initial evacuation map*
(https://en.wikipedia.org/wiki/Japanese_reaction_to_Fukushima_Daiichi_nuclear_disaster#/media/File:Towns_evacuated_around_Fukushima_on_April_11th,_2011.png)



[4] On March 15, 2011, the evacuation order encompassed a 20- to 30-kilometer radius, and all people living in this area were advised to prepare for an imminent evacuation. However, the decision was later lifted by the state.

Public skepticism toward Japanese experts was reinforced when it became apparent that the Ministry of Education, Culture, Sports, Science and Technology (MEXT), withheld crucial information on the prediction given by a computer model, designed to provide projections on the dispersion of radioactive fallout through weather patterns (see Cleveland 2014). After the hydrogen explosions, wind, rain, and snow transported radionuclides far beyond the vicinity of the initial evacuation zone of 20 km. This caused the government to relocate individuals to zones that had high level of contamination, a mistake that was not rectified for many weeks (Hasegawa 2012; Kingston 2014). With new information available, December 2011 saw the reorganization of the evacuation zone of Fukushima prefecture.

Illustration 3: *The three areas of evacuation*
(https://www.meti.go.jp/english/earthquake/nuclear/roadmap/pdf/150905MapOfAreas.pdf)



The 20-km radius that first defined the cartography of this disaster was rendered obsolete and the prefecture became a patchwork of three different areas, with well-defined boundaries based on the annual level of atmospheric radiation. Each area, represented by a different color (green, yellow, and red), corresponded to the annual dose of external radiation projected to be received by residents if they remained within the zones (Ministry of Economy, Trade, and Industry 2012). Area 1 (green) corresponded to areas in which evacuation orders were ready to be lifted (atmospheric radiation under 20 mSv/year). Area 2 (yellow) encompassed locations where residents were not permitted to reside (20 to 50 mSv/year). Area 3 (red) encompassed areas where it was expected that residents would be unable to return in the near future (exceeding 50 mSv/year).

In defining zones that were supposed to be safe, the Japanese state modified the level of acceptable radiological exposure. The accepted levels of public exposure to radiation should not exceed 1 mSv per year (World Nuclear Association 2015). However, partly based on the recommendations of the International Commission on Radiological Protection (ICRP), an organization that set internationally authoritative standards in radioprotection, the Japanese state increased the minimum radiation threshold for evacuating the public. Indeed, in the context of nuclear disasters a new reference level of annual dosage can be proposed. According to ICRP (2009), the introduction of a new baseline is usually intended to guide protection measures, aiming to keep the magnitude of exposure "as low as reasonably achievable," (ALARA), while taking into account economic and societal factors (Higuchi 2016). Due to socioeconomic considerations the best option is not necessarily the one resulting in the lowest residual dose level for affected individuals. For instance, ICRP (2009) argues that countries generally cannot afford to lose a part of their territory and that inhabitants generally prefer to stay in their homes, rather than to be relocated. For ICRP, these considerations suggest that reference levels should be chosen within the 1 to 20 mSv band of exposure and on the basis of this recommendation, the Japanese state opted for the higher part of the band: 20 mSv per year. As such, the governance of radiation hazards was initially done by changing the standards of radiological safety.

Pragmatically speaking, doing so allowed the Japanese state to reduce the areas of forced evacuation, while limiting the scope of areas that had to be managed. This decision, however, led to polarized viewpoints amongst affected citizens, with some arguing against the new policy (Higuchi 2016). The increase was criticized by Japanese people, scientists, and academics as representing a concession to economic and political imperatives over the well-being of children and women, who are more sensitive to radiation exposure (Citizen-Scientist International Symposium on Radiation Protection 2017: 4; see also Asanuma Brice 2014). State-sanctioned experts and members of ICRP defended the increased baseline, contending that a forced evacuation above 1 mSv per year would prove more harmful than the risks of radiation exposure, especially since vulnerable people might die during the evacuation process (see Jacobs 2016).

In the subsequent months that followed the disaster, members of the local and central government announced that the levels of radiation released during the disaster were too low to pose serious adverse health effects. In particular, state experts asserted that the most serious source of harm to the affected public would surely be a resultant psychological fear linked with radiation.[5] These arguments were supported and conveyed by the radiation

[5] As official documentation explains: "In the short term, it is believed that the most serious and significant health effects of the nuclear accident will be related to mental health and social problems. Additionally,

risk management adviser of the Fukushima Prefecture, Dr. Shun'ichi Yamashita, who was appointed by the central government. Dr. Yamashita made comments that were perceived by members of the population as downplaying radiation risks. These included: "The effects of radiation do not come to people who are happy and laughing, they come to people who are weak-spirited" and "The people are suffering, not only because of the earthquake and the tsunami, but also from severe radiation anxiety, real radiophobia." (Spiegel *online*). Because of such comments, Yamashita became a despised figure among some of the Japanese citizens that I interviewed. As one citizen argued to me: "He's a scientist for the government and he claimed that 'if one laughs, then radiation is not scary' (*warate ireba houshanou ha kowakunai*). And that's what the government calls an expert!? This man is not an expert he's a murderer (*satsujin*)!"

In order to further reassure the population, the Japanese state launched public relations campaigns in the name of scientific risk communication. In a clear model case of "knowledge deficit" (Wynne 1992), experts were brought in by the state to educate a scientifically illiterate population, by delivering basic knowledge on radiation hazards (Shirabe et. al 2015; Kimura 2016: 55-77). Much of these public relations campaigns have already been criticized as representing a state-sponsored approach that provided a highly optimistic view of radiation risks (Asanuma-Brice 2014; Hirakawa and Shirabe 2015; Slater et al. 2014; Kimura 2016). As Dudden (2012: 354) best summarizes:

> Throughout the early weeks of the crisis, television channels replayed images of the reactors exploding as announcers attempted to explain number-drenched

evacuation after the accident caused immediate problems for those in socially vulnerable situations (Japan Cabinet Office 2016: 16 *my translation*).

information in interchangeable millisieverts (mSv), microsieverts, and becquerels, all the while reassuring viewers with cartoon-charactered flip charts that there was no need to worry because all these numbers equaled "the same amount of radiation on a flight from Tokyo to New York" or "in a year's regular exposure to the sun."

To monitor the potential long-term health effects of radiation exposure, an epidemiological study called the Fukushima Prefecture Health Management Survey (FPHMS) was launched by the national government in 2011, with the help of the Fukushima Prefectural government (Abe N.D.; Ishikawa et al. 2015; Kumagai and Tanigawa 2018). Eventually, the survey led to the discovery of an apparent increase of thyroid cancers among children. By 2016, as many as 131 children were diagnosed with thyroid cancer, and 41 others were suspected of having it (Kyodo News 2016). In the aftermath of Chernobyl, an increase of thyroid cancers in children was linked with the intake of iodine 131 (Blackburn et al. 2001; Michel and Donckier 2002), a dangerous and short-lived radionuclide also released after Fukushima. Yet, according to the Japanese state experts, the increase of thyroid cancer in Fukushima was rather the result of a "screening effect," where intensive ultrasonography surveys detected large numbers of thyroid abnormalities, including a number of cancer cases that would not have been detected without such screening (Japan Cabinet Office 2016; IAEA 2015). In regard to health hazards, the Survey concluded that it was "hard to believe that radioactivity had affected the population health (*Hōshasen ni yoru kenkō higai ga aru to wa kangae nikui*)" (Japan Cabinet Office 2016: 2).[6] These assurances of safety

[6] International organizations echoed similar conclusions. The International Atomic Energy Agency (IAEA), for instance, contended that "No early radiation induced health effects were observed among workers or members of the public that could be attributed to the accident" (IAEA 2015: 131). A report from the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) stated that: "The doses to the

were not well received by an important part of the media and the population. Indeed, it became apparent that the state had "chosen and nominated their experts to be in charge of assessing radiological risks and then of communicating such risks to the population" (Shirabe et al. 2015: 3). In this context, experts that gave reassuring messages quickly became labeled with the derogative term of *goyō gakusha*, meaning "lapdog" or "government-patronized scholars" (Ikeda 2013).

Beyond fear of direct exposure to radiation, members of the population became wary of the possibility of radioactive contamination in the food of Fukushima. This fear created a consumer avoidance of food products from the affected areas, resulting in a decline of sales. In an effort to revive the food economy of the region, the government took on the task of testing the food produced in Fukushima, implementing a strict limit of allowable amount of radioactivity in food products.[7] The safety of food present in the market was assured by the government, which encouraged people to consume it through public fairs and other public relation activities. Yet, trust in the testing procedures heavily crumbled when different food products on the markets were found to be contaminated above government standards (Sternsdorff-Cisterna 2015: 457).

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general public, both those incurred during the first year and estimated for their lifetimes, are generally low or very low" and that consequently, "no discernible increased incidence of radiation-related health effects are expected among exposed members of the public or their descendants" (UNSCEAR 2013: 11-12). Lastly, a health risk assessment produced by the World Health Organization (WHO) contended that: "Outside the geographical areas most affected by radiation, even in locations within Fukushima Prefecture, the predicted risks remain low and no observable increases in cancer above natural variation in baseline rates are anticipated" (WHO 2013: 9). In the end, the most important health effect would be estimated to be on the "mental and social well-being, related to the enormous impact of the earthquake, tsunami and nuclear accident, and the fear and stigma related to the perceived risk of exposure to ionizing radiation" (UNSCEAR 2013: 11-12). Scholars have, however, criticized these statements and challenged the accuracy, nature of knowledge, limitations, and over-extrapolation of the probabilistic models that were used to estimate human exposure to radiation (Morris-Suzuki 2014; Yagasaki 2016).

[7] The limit is currently set at 100 Becquerel per kilo.

Before 2011, most people had never considered the possibility of a nuclear disaster, nor of its ensuing problem of radioactive contamination. After all, few had reason to doubt state experts who repeatedly assured the population of the safety of nuclear power. As an evacuee from Fukushima explained to me in 2016: "We were always told that nuclear power was safe. [The possibility of a catastrophe] never crossed my mind." But by now, the series of aforementioned controversies and scandals had eroded the trust that Japanese people put in their experts.

Much of the distrust toward state management of the disaster coalesced in the emergence of citizen science networks, where Japanese people began to collectively track and monitor radioactive contamination (Sternsdorff-Cisterna 2015). While people of various backgrounds and political affiliations have joined citizen science, they have shared the common goal of legitimizing different views to an official assessment of the radioactive contamination. Yet, the alternative created by citizen scientists have not been without difficulties, even though they produced helpful data on radioactive contamination.

Indeed, Kimura (2016) describes how mothers who tested food for radioactive contamination were seen as impediments to the social and economic recovery of Fukushima, both by the state, as well as by a part of the population. Rather than being praised for their efforts of testing food, they were accused of having an "irrational 'radiation brain,' being anti-science, and overreacting" (Kimura 2016: 24). The emergence of non-state actors in radiological protection were met with disregard from the Japanese state. This contrasts other participatory engagements of civil society in scientific matters, such as in the U.S. case of the Cornell Lab of Ornithology, where members of the public willfully partnered with professional scientists to work toward a common goal, or to collectively analyze large quantities of data (Bonney et al. 2016).

As the historical background of the Fukushima nuclear disaster highlights, the initial governance of radiation hazards was epitomized by a series of important controversies that often pitched citizen scientists against state experts. In brief, the initial response to radioactive hazards was that of a "state that seeks to manage the crisis according to its own agenda" (Slater et al. 2014: 486).

Yet, when I arrived in Japan in September 2015, the sense of urgency and crisis had withered away – or so it seemed to me. Indeed, monitoring boards that displayed the atmospheric level of radiation had been installed all over the prefecture of Fukushima, with people passing right by them as if they were mere lampposts. Citizen science networks in which people could test foods for radioactive contamination were no longer novelties and had sprung up like mushrooms. Many had beautifully designed websites that provided information about contamination and radiation dangers in easily comprehensible ways. Devices formerly associated with nuclear experts were now mobilized by members of the population. Even children in Fukushima possessed small Geiger counters to measure radiation, enabling them to make sense of a hardly perceptible harm. In parallel, the state had launched a massive program of radioactive decontamination in the urban and rural areas of Fukushima (Ministry of the Environment 2012). In this context, an official policy of repatriation to former irradiated areas was launched and evacuees were invited to come back to their beloved regions, albeit amidst a new benchmark of raised exposure for what is considered to be safe in Fukushima (20 mSv per year).

As such, my research happened in a different time frame, when it was no longer the sense of chaos or urgency that needed to be governed, but rather something else. This post-disaster period was epitomized by what one of my informants – a retired nuclear scientist – called the "era of emergency" (*kinkyū jidai*). As this individual argued to me on January 29, 2016:

> After 2011, we have been in a state of emergency [20 mSv per year]. More than 5 years have passed and we are still in an official state of emergency, [20 mSv per year is still the acceptable baseline of safety]. How many years will we be staying in this state! Japan has entered a continual era of emergency…

It is precisely the attempts to govern this so-called "era of emergency" that interested me the most and that the rest of this dissertation will examine. In talking about the effects of the atomic bombs, Masco focuses on "radioactive nation-building," which he describes as the "long-term effects of participating in national-cultural logics that mobilize resources in the name of security and community, but that do so in ways that are unsustainable and that create both social and material toxicity" (2006: 212). This dissertation does not focus on radioactive nation-building, but on what I call "radioactive governance." For the purpose of this dissertation, I use this term in a broad way, so as to explore and describe the different ways in which the socio-material aspects of radiation hazards are governed by state and non-state actors in post-Fukushima Japan. I was particularly interested in analyzing the evolution, transitions, and contradictions that surrounded the governance of radiation hazards since 2011. Inspired by Masco's focus on the logic that enables certain narratives of the atomic bomb to thrive or not in the U.S., what I seek to understand is why radiation hazards are governed in particular ways and not others.

To examine this, I asked a set of interrelated questions: First, how did the Japanese state attempt to overcome concerns over the legitimacy of its expertise in managing radiation hazards; second, how did the implication of citizens in radiological protection intersect with the politics of governance of a nuclear disaster in Fukushima? Third, how were the uncertainties of radiation hazards managed by this new assemblage of state and non-state actors?

I argue that the Fukushima nuclear disaster led to the emergence of new forms of governing radioactive risks. More specifically, I argue that radioactive governance was epitomized through a two-fold process. These included techniques of governance that attempted to normalize people's relationships with residual radioactivity as an everyday concern. They also included decentralized strategies that increasingly empowered victims of the disaster with technoscientifc practices of radiation monitoring, delegating radiation protection from the state to the citizens. These changes point toward an important reorganization of state expertise, which increasingly move beyond traditional forms of risk communication and institutional experts, often in an attempt to downplay the controversy of a raised threshold of exposure after Fukushima. Importantly, the aftermath of 3/11 has forced the Japanese state to enact and acknowledge different forms of expertise in their attempt to manage the dangers of radioactive contamination. Averting the crisis of expertise and managing the reconstruction of normality include important reorganizations of power and authority, which no longer rest on the dissemination of radiation risk information in mere quantitative manners, nor on a clear dichotomy between experts and lay people. These shifts in the management of radioactive hazards, as I show below, can tell us much about how the governance of contamination is evolving amidst irreversible ecological change.

1.2 Radioactive Governance and the Politics of Expertise

In the previous section, I have described how a state-sponsored increase of allowable radiation exposure, the emergence of non-state actors in the realm of radiological protection, and the disregard of nuclear scientists have contributed to an important crisis of expertise after Fukushima. To examine the implications of this crisis, my dissertation engages with the politics of expertise that surround the governance of radioactive hazards. In other words, I examine how scientific expertise and politics intersect with regimes of governance around radiation dangers. Based on literature inspired by anthropology, science and technology studies, and feminist studies, I first turn my attention to the politics of expertise as a way to understand how expertise on radiation hazards is inseparable from political relations. In the anthropological context, politics have long been theorized as a set of situated power relations that are disciplinary, hierarchical, or productive (Taussig 1984; Li 2007; Mathews 2011; Petryna 2013; Harvey and Knox 2015; Victoria 2016).[8] Claims of expertise are, in that regard, inherently political, since they always represent a "claim to power" (Li 2007: 5; see also Latour and Woolgar 1986; Knorr Cetina 1999; Rabinow 1999; Fortun 2001; Mathews 2011). As Carr (2010: 18) further explains, expertise manifests

[8] Rather than focusing only on reified normative political institutions, anthropologists have particularly examined the wider and contradictory realm of power through mundane aspects, in other words, the "daily practice of politics within and outside state institutions" (Mathews 2011: 14).

itself in “power relations that are both repressive and productive, and it reproduces these relations when expressed by disciplined social actors (i.e., experts and laypeople).”

Why do particular forms of knowledge get legitimized as “expertise,” while others are regarded as “lay knowledge” or “irrational belief” is a question that fascinated anthropologists. Consequently, an aspect of expertise that received considerable attention was the establishment of asymmetries between different actors. By seeing expertise through the exercise of a power, scholars have notably examined the power plays that work in cementing asymmetry, questioning who or what gets empowered by the articulation of hegemonic knowledge (Willems-Braun 1997; Escobar 1999; Kosek 2006, 2010; Blaser 2013; Hetherington 2013).[9] Hierarchical relations surrounding “proper” knowledge of radiation hazards were prominent after Fukushima, as women implicated in the realm of citizen science were depicted as “having an irrational ‘radiation brain,’ being anti-science, and overreacting” (Kimura 2016: 24).

In studying a range of different state and non-state actors, I am, therefore, careful not to reproduce a hierarchy that would legitimatize particular ways of defining “experts” versus “non-experts” (Carr 2010). Thus, I turn my attention to the importance of “considering citizen scientists and resident peoples as experts who are particularly suited

[9] This process usually downplays specific worldviews (often indigenous), as well as particular materialities of nature. For instance, by focusing on Afro-Colombian activists of the Pacific region, Arturo Escobar (2008) highlighted how particular domains of life, such as nature and territory, have been transformed – or “governmentalized,” to use Foucault’s term – by expert knowledge, administrative institutions, and state apparatuses. His lens takes a critical stance at the processes that determine which kinds of statements count as true, as well as which kinds of speakers count as truthful. Many of such ethnographies have discovered their essential force through the association between, as Foucault would put it, the “buried knowledges of erudition and those disqualified from the hierarchy of knowledges and sciences” (1980: 82). This notably echoes what Foucault has called “subjugated knowledge” – that is, “a whole set of knowledges that have been disqualified as inadequate to their task or insufficiently elaborated: naïve knowledges, located low down on the hierarchy, beneath the required level of cognition or scientificity” (1980: 82).

to managing the ecologies in which they live" (Gururani and Vandergeest 2014: 345; see also Fairhead and Leach 2003).

This was made evident during my fieldwork, especially when I visited former farm lands afflicted by radioactive contamination in the village of Iitate. In order to decontaminate these farms, the government applied a cookie-cutter approach to decontamination procedures. Blue Prussian, a chemical used for radioactive decontamination in Chernobyl, was sprayed throughout the soil in an attempt to dislodge radioactive cesium, one of the main pollutants in Fukushima. Yet, in the region of Iitate, cesium present in the soil does not move as it did in Chernobyl and Blue Prussian was rendered inefficient. As a farmer explained to me, this was the result of the specific soil composition, which is rich in vermiculite, a hydrous phyllosilicate mineral. Because of this, radioactive cesium accumulates in the soil without dispersing.

A local farmer complained that the so-called state experts were unaware of the specificity of the local ecology in Iitate. Indeed, state experts decided to use Blue Prussian without first asking farmers about the mineral composition of their soil. As one farmer explained to me: "The cesium gets trapped in a sandwich kind of way, between minerals. That's a specific problem linked with our soil." What appeared to be a very homogeneous and unproblematic element – soil – constituted a more complex issue that had, as revealed by the farmers, crucial consequences for managing radioactive contamination.

In May of 2016, the executive director of a citizen science network situated near this farm, angrily told me the following: "For us, state experts are people who have 90% of knowledge, but no wisdom!" In Japanese, two words – *shiru* and *wakaru* – can be used for the verb "knowing." *Shiru* means "to find out" or "to learn." It implies a process of acquisition of knowledge and information. *Wakaru*, on the other hand, is closer to "understanding this knowledge." *Shiru* comes before *wakaru* and in a way, one can know, but not necessarily understand. *Wakaru* consequently shows a greater and more personal level of comprehension often based on a given context. For this citizen scientist, state institutional experts did not possess *wakaru*, but only *shiru*. From this viewpoint, being an expert is someone who "knows things by virtue of being experienced in the relevant ways of the world" (Dear 2004: 206). Having been directly affected by radioactive contamination, this citizen scientist strongly believed that the inhabitant of a place, the *jūmin* (literally: the people who resided) were best suited to manage their life in a post-Fukushima Japan. Therefore, I am careful of not considering "lay" actors as non-experts.

Still, in giving a voice to different categories of experts, I do not claim that the knowledge held by citizen scientists was necessarily better than other particular claims, nor that they were equally valid. All forms of expertise have strengths and limitations (Jasanoff and Martello 2004: 348). In examining such limitations, I turn my attention to the fact that expertise is always embedded in situated contexts and logic.[10] The partiality of any expertise was highlighted by feminist STS scholars who examined the contingencies of how experts get to know about the world, while parting with the sterile dualism between universalism and relativism. For instance, through her concept of "situated knowledge," which consists of embodied and locatable forms of knowledge, Donna Haraway has called into question the situated nature of objectivity in expertise (Haraway 1990; 1991; see also

[10] Indeed, the authority through which experts assert their objective knowledge – one could think of Traweek's "cultures of no culture" (1988), Mitchell's "locationless logics" (2002), Haraway's "God-trick" (1991) – has been shown to rest on situated modes of knowledge production and circulation.

Barad 1996; Schrader 2010; Myers 2015).[11] With her material-discursive framework of "agential realism," Karen Barad equally contributed to these issues, arguing for a framework that ties together epistemological and ontological issues. She notes that objectivity and realism is "not about representations of an independent reality, but about the real consequences, interventions, creative possibilities, and responsibilities of intra-acting within the world" (1996: 188). Avoiding the word "interacting," as it presupposes that two pre-existing entities interact, Barad instead uses the word "intra-action" to refer to the 'be-in' where the matter and meaning meet (1996: 179). In this understanding, subjects and objects are no longer determined prior to their interaction. Accordingly, I do not view radioactive contamination as a fixed entity defined by a single body of experts who hold the yardstick of truth about its nature. Rather, as per feminist studies' findings, I ground expert claims in local experiences. State experts or citizen scientists' understandings of radiation hazards are then closely related to particular experiences, especially as complex sociocultural agents.

In bridging the gap between citizens and experts, and in conceptualizing the partiality of expertise, this research focuses on two particular dimensions that have so far received limited attention within the study of expertise: embodiment and affect. For the purpose of this thesis, embodiment is defined as a mode of "perceptual experience" regarding one presence and engagement within the world (Csordas 1994: 12; see also Martin 1987; Scheper-Hughes and Lock 1987; Turner 1995; Murray and Sixsmith 1999). Importantly, embodiments are always "partial and tentative," since they evoke "ongoing and never ending processes" (Myers and Dumit 2011: 249; Myers 2015). By affect, I refer

[11] In particular, these authors highlight how the practices of knowledge producers are inextricably embedded into politics of race, class, gender, and technologies.

to feelings and emotions that are culturally specific (Csordas 2011), but also to indeterminate energies, intensities, or moments of confusion (Anderson 2009; Stewart 2011; Little 2012, 2014) that exist in the difference between two states of being, such as when a housewife stands at the forefront of a judicial fight to get her children evacuated from Fukushima, or when a 65 years old farmer traded his plowing tool for a radiation monitoring device. It is during such gaps, when things are actualizing (Little 2012), that the sense of something happening becomes tactile (Stewart 2011: 445), proving new spaces for imagining one's life amidst an irradiated environment. Focusing on affects before they "are completely narrativized as cultural representations or as political forces" (Little 2014: 224), helps the researcher attune to the emergent politics of a crisis of expertise. It does so by highlighting the spaces of possibilities that can contribute to radical change or fail to produce meaningful events after a nuclear disaster. As it will be shown later on, this is a good antidote to the teleological overtones that automatically link the endeavor of citizen science with a politics of resistance against the state or corporate polluters.

A focus on embodiment and affect, which examines the specific, the unique, and the emergent, adds a powerful dimension to the study of expertise. It does so by highlighting how local systems of knowledge are lively, contextualized, and politically relevant in dealing with environmental problems. By linking expertise to corporeal and emotional experience, anthropologists have explored a deeper conceptualization of expertise, drifting away from the normative figures of technocrats and scientists as rational beings (see Masco 2006).[12] Such an approach has led anthropologist Dominic Boyer to define an expert as "an actor who has developed skills in, semiotic-epistemic competence

[12] The word "expert" is a derivative of the Latin *expertuse*, which meant "I have experienced" (Dear 2004: 206).

for, and attentional concern with, some sphere of practical activity" (2008: 39). Consequently, a focus on citizen scientists as *jūmin*, the inhabitant of a post-Fukushima Japan, allows for a deeper theorization of expertise through ethnographic and cultural specificities, with the aim of speaking "meaningfully to and across the dominant phenomenological, praxiological and semiological encampments of our discipline" (ibid).

Moving beyond broad generalizations of hazards understood through the concept of "risk society," which is defined as a "systematic way of dealing with hazards and insecurities induced and introduced by modernization itself" (Beck 1992: 21), recent STS literature has highlighted how toxic exposure, contamination, and pollution are rooted within modalities of power relations and sociocultural relations. These works highlight the importance of gendered, technological, economical, and temporal factors in embodying and feeling certain hazards (Murphy 2006; Schrader 2010; Hecht 2012; Liboiron 2015; Shapiro 2015; Ureta 2017). In particular, I draw on two concepts: the "regimes of perceptibility," describes as an assemblage of social and technical things where chemical exposures are "granted or not granted existence" (Murphy 2006: 7), as well as on "nuclearity" (Hecht 2012), the process through which things like uranium are made symbolically nuclear or not. In the context of my research, I engage with these concepts to first historicize the practices through which radiation hazards were defined in specific ways, both before and after Fukushima. Throughout my fieldwork, these concepts allowed me to examine which bodies and things were perceived as being affected by radioactive contamination or not.

The aforementioned analytical supply led me to understand that the acceptance or rejection of baseline of exposure is invariably intertwined from a way of somatically inhabiting and affectively engaging with an irradiated landscape (Mascia-Lees 2011). Through participant observation and interviews with how people experience radiation hazards, this research highlights the range of embodied and affective experiences of a radiation event and how such differences produce conflictual rationalizations of harm, where the very notion of a safe baseline of radiation exposure becomes highly politicized. Since citizen scientists constitute a highly heterogeneous group, many do not experience radiation hazards in the same way. These factors tremendously influence how different groups enact their expertise and for which purpose. Not only does the peculiar experience of individuals clash with the expertise of state experts, but it also creates tension *amongst* citizen scientists, such as a when a group of farmers mobilized radiation monitoring to revitalize the sociocultural life of Fukushima, while a group of mothers came forward to highlight the danger of living in Fukushima.

Beyond focusing on the experiences of citizen scientists, the notion of embodiment and affect are useful to study undertheorized facets of state expertise, particularly those associated with performance. As Masco exemplifies, this is made relevant when embodiment and affect are linked with issues of performance as being integral to modern state power and its expertise, often with the effect of managing the national community at the level of emotion, so as to install "structures of emergency into a deep future" (Masco 2014: 43).[13] Similarly, I found out that the Japanese state increasingly organized public fairs, food festivals, recovery symposia, and state-sponsored scientific hubs that affectively explained the phenomenon of radioactivity to nuclear victims. These theatrical renderings were not just performed by the state. They were also performative (Myers 2015: 18),

[13] In that regard, Masco argues that a post 9/11 national security state is increasingly structured around theatrical performance of secrecy as a means to power (2014: 124).

meaning that they attempted to condition people to "see, feel, know, and be affected" by radioactivity in very specific ways (Myers and Dumit 2011: 250). In her study of protein modelers, Natasha Myers, working with the analytics of Karen Barad and Judith Butler, shows how certain kinds of "phenomena come to matter, while others are rendered invisible" (2015: 130). This serves as a reminder of the importance of examining the different aspects of nuclear matter that are promoted or hidden in state performance. During my fieldwork, I noticed that specific embodiments and affects with nuclear safety management were promoted over other ones by state experts. Often, these relationships with nuclear matter reflected asymmetrical power relations and inherent social, economic, and gendered inequalities.

The crisis of expertise also happened in a specific locality: broadly Japan, and more precisely Fukushima prefecture. In order to understand the historical context and spatiality that surround this crisis, I turn my attention to the precarious context in which the nuclear disaster has emerged and evolved. To do this, I draw on Anne Allison's work (2013), which focuses on the precaritization of labor and life in the last two decades of Japanese society. Notably, Allison (2013) demonstrates that the disintegration of ideal life models (the family-corporate system of Japan) brought down the Japanese normative order for social belonging and citizenship, highlighting a precarity that goes beyond material deprivation, leading to an affective decay of cultural ties and a loss of belonging about one's place in Japanese society. In what she calls "social precarity," Allison follows the social sensibilities of survival, "how relations with others – of care, belonging, recognition – are showing strain but also, in a few instances, getting reimagined and restitched in innovative way" (2013: 124). I draw on her work to highlight the fact that the prefecture of Fukushima, a peripheral area far from the center of power that is Tokyo, had, long before the disaster, always been caught in multiple forms of precarity, such as poor economy, aging population, and rural exodus (Kainuma 2011). For many, radioactive contamination was another burden deposited on top of a huge pile of problems. Consequently, I also pay attention to sociocultural contexts of rurality, urbanism, employment, and class, as well as the affects that surround them in Fukushima. This material and social precarity shapes how expertise around radiation hazards is enacted, as explored in Chapters 3, 4, and 7.

Throughout my fieldwork with citizen scientists I was initially surprised by the efforts that many deployed to distinguish their work from political activism (*sekkyoku kōdō shugi*). Countless times, I was told things such as: “Our organization is not political! We are only trying to change the current state of order!” Part of such sayings are not to be taken literally and can be explained by the important taboo associated with the word “politics” in Japan. In understanding this “allergy” to the political in Japan, I am indebted to a series of scholars who explored the category of the political in Japan. For instance, Kimura argues that a distancing from the political (*seijiteki*) needs to be situated within the broader political context of Japanese society. She contends that Japanese citizens have historically associated politics with rigid hierarchical organizations, like political parties or labor union (Kimura 2016), which are perceived as occurring in a closed sphere from daily life (see also Leblanc 1999). Additionally, the political space of citizens in contemporary Japan is more limited than elsewhere (Schnell 2008) and a good citizen is constructed as not being involved in confrontational politics (Kimura 2016). This sentiment of taboo is understandable in Japanese society, where normative models emphasized harmony (*wa*) and groupism (*shūdan shugi*) as ideal cultural values (Befu 2009; Goodman 2008; Kondo

1990). These socio-historical factors, among others that will be explored later on, often result in an important self-censorship on expressing political opinions in the community or in the public sphere (Leblanc 1999).[14]

By focusing on Japanese citizen scientists questioning the picture of normalcy imposed by the Japanese authorities after Fukushima, Kimura examined the techno scientific enterprise of mothers who tested food for radioactive contamination, while pointing to the stiff social sanctions that they faced in doing so. Ultimately, she argues that citizen science was an endeavor diverted from real politics; as citizen scientists were unable to tackle head on the structural inequality among the state, residents, and corporate polluters (2016: 4). While my own fieldwork highlights the fact that citizen scientists were rarely successful in challenging the governing political order, I believe in theorizing expertise as a powerful tool through which political disagreement can be expressed.[15] To understand such politics, I engage with Li's concept of "practice of politics," which refers to the expression of a critical challenge, as a refusal of the way things are, and as practices that challenge issues of governance (Li 2007).[16] In post-Fukushima Japan, scientific expertise on radiation hazards can then be seen as the "expression, in word or deed, of a critical challenge" (Li 2007: 11). In Chapter 3 and 4, I notably examine how the expertise of citizen scientists was used to disregard the state narrative of safety toward radioactive

[14] The political performances constitutive of a "good democracy" in North America (demonstration, activisms, criticisms, political affiliations) are frowned upon in Japanese public. The actors who enact such replies can face harsh social pressures and criticisms from their own communities.

[15] This is something that Kimura acknowledged but does not fully explore. Her book principally focuses on the forces that have restricted the political potential of women implicated in citizen science.

[16] This is a concept that Tania Li (2007) develop against Foucauldian studies, which she perceived as limiting the "possibilities for engaging with the targets of improving schemes as political actors, fully capable of contestation and debate" (2007: 281).

contamination and how Japanese actors attempted to legitimize their voices as authoritative narratives in the process.

What can be referred to as "politics through science" (Graeter 2017: 128) is not something merely used by citizen scientists, but also by the state. This was particularly examined by the STS literature of co-production, which put forward the "centrality of knowledge making as a site of political engagement" (Martello and Jasanoff 2004: 14). As STS scholar Sheila Jasanoff argues, the concept of co-production explores "how knowledge-making is incorporated into practices of state-making, […] and, in reverse, how practices of governance influence the making and use of knowledge. States, we may say, are made of knowledge, just as knowledge is constituted by states" (2004: 3).[17] The analytic of co-production is particularly useful to examine how expertise about radiation hazards and political order have co-evolved together in Japanese society, while excluding certain forms of hazards, insecurities, and knowledge.

The fact that scientific expertise is inseparable from political action is also an important facet of the literature of development studies. Expertise, as a claim of power by the state, is made particularly evident when used to depoliticize problems. For instance, by focusing on the development apparatus, James Ferguson (1994) argues that experts can repose political questions by framing problems in technical terms. The development project and its experts take the form of an "anti-politics machine," that converts social issues into

[17] In the literature of "co-production" it no longer makes sense to assume that "scientific knowledge comes into being independent of political thought and action" (Jasanoff 2004b: 15). As Jasanoff (2004) explains: "Briefly stated, co-production is shorthand for the proposition that the ways in which we know and represent the world (both nature and society) are inseparable from the ways in which we choose to live in it. Knowledge and its material embodiments are at once products of social work and constitutive of forms of social life; society cannot function without knowledge any more than knowledge can exist without appropriate social supports." (2004: 2-3)

technical ones. This rendering of things technical parallels the work of Timothy Mitchell (2002) who argues that expertise gains its authority from objectifying political problems as natural as possible. Throughout my fieldwork, this was apparent in state laboratories that monitored radioactive contamination, as well as in decontamination processes, which both attempted to render radioactive contamination as a technical matter.

Yet, recent anthropological works also argue that the rendering of the technical is never fully successful, since it faces challenges from human and non-human actors (Li 2007; Mathews 2011).[18] Thus, I also attend to the aspects of radiation hazards that challenge the narrative of human control. What happens when radioactive hazards didn't fall within the frame of technical expertise? What happens to radioactive contamination beyond the laboratory? These problems are further examined in Chapter 5.

To conceptualize the extremely broad range of political thoughts and actions that surround specific expertise on radiation hazards I found it useful to engage with the work of French philosopher Jacques Rancière (2013), especially with his concept of the "regime of the sensible." Rancière first makes a clear distinction between the concept of "policing" and the concept of "politics." For Rancière, policing is what naturalizes and reinforces the given boundaries for institutions and citizens. The police (not to be confused with a policeman) is "[…] an order of bodies that defines the allocation of ways of doing, ways of being, and ways of saying, and sees that those bodies are assigned by name to a particular

[18] Additionally, by opening the "black box" (Latour 1993) of specific episteme, anthropologists have explored the processes through which expertise become stabilized. Sociologists of science and proponents of the Actor-Network Theory (ANT) have explored the division that surrounds the scientific representation of nature and the political representation of society, depicting technical expertise as a precarious political network of human and non-human alliances that are vulnerable to destabilization (Callon 1984; Latour 1993, 2003; Law 1999). To remain "apolitical," scientific expertise passes through "trials of strength," where actors form associations, which transformed themselves into stronger alliances, eventually becoming networks. In such an understanding, expertise is a fragile achievement, produced by building networks of alliances.

place and task; it is an order of the visible and the sayable that sees that a particular activity is visible and another is not, that this speech is understood as discourse and another as noise" (Rancière 1998: 29 cf. Swyngedouw 2009: 606).

Politics, on the other hand, is understood as a process of dissensus that confronts an established framework of perception, thought, or action. It is a political process that creates a fissure in what Rancière (2013) calls the "regime of the sensible." The regime of the sensible is a system of coordinates that defines modes of being, doing, making, and communicating. It establishes a consensus around the borders, horizons, and modalities between the visible and the invisible, the audible and the inaudible, the sayable and the unsayable (Rancière 2013). In the context of Fukushima, I use this concept to explore how state and non-state actors mobilize particular ways of speaking, feeling, talking, and perceiving radiation hazards. Focusing on the regimes of the sensible allows me to highlight whom and what has to be hurt for radioactive contamination to matter. As such, I pay close attention to how different actors and institutions attempt to stabilize a given regime of the sensible around radiation hazards. How did state and non-state actors' regime of the sensible differ or resemble each other? Which experts were associated with particular ways of knowing and talking about radiation hazards? How was post-disaster normality understood in different regimes of the sensible? These questions are explored throughout this work and the concept of the regime of the sensible provides a useful lens to highlight the numerous political stakes behind the governance of radiation hazards.

Lastly, in talking about radioactive governance, I use the term governance to refer to the assemblage of state actors, rules and regulation, as well as non-state actors and non-human actors that participated in the management of specific regimes of the sensible around radiation hazards. While governance is often associated with state power and control, I draw from recent anthropological works that see governance as far from being consistent, unified, or applied towards over-arching goals (Li 2007; Mathews 2011; Cabot 2012; Hathaway 2014). In that regard, recent ethnographies have embraced a different approach to Foucault's understanding of governance, with its heavy focus on the techniques designed to govern the conduct of both individuals and populations at every level of life.[19] For instance, Andrew Mathews argues that the production and circulation of official knowledge in Foucault's inquiry do "not do justice to the internal conflicts within the state" (2011: 16). He contends that the state must be conceptualized as "a shifting group of loosely connected institutions that are unstable and often in conflict with one another" (2011: 10).[20] Similarly to Mathew, turning my attention to the internal conflicts of the state enables me to explore different techniques of governance that operate on different aspects of radioactive materiality and symbolism. This is something that I explore in further details in Chapter 5. Moreover, in studying governance, anthropologists have begun to track the nexus of actors, practices, and things that surround environmental issues. In the context of the international market of Matsutake mushrooms, Michael Hathaway (2014: 398) highlights how "governance comes from a number of sources and exhibits a range of forms, which at times overlap and contradict each other." Acknowledging this understanding of

[19] Foucault's concept of governmentality focuses on the rationalization and systematization of particular ways of exercising political sovereignty through the government of people's conduct (Foucault 1991). As Forsyth and Walker (2014: 409) summarized, governmentality refers to "the indirect, often unseen, means of influencing 'the conduct of conduct'—or the shaping of political decision-making or social behaviour by influencing the generation of expert knowledge, regulatory practices, and social expectations."

[20] In that line of thought, seeing authoritative knowledge as narratives that are power-laden bypass attention to issues of materiality, practice, and resistance, while assuming that official state discourses are seamlessly internalized by citizens (ibid).

governance allows me to account for a plurality of actors and institutions that cooperate, compete, and overlap in managing radiation hazards.

Focusing on the development apparatus of Indonesia and on the limits of governmentality, Tania Li has argued that "power that are multiple cannot be totalizing and seamless" (2007: 25). While I agreed with the partiality of totalizing power and governance, my own fieldwork in Fukushima led me to acknowledge that different ways of managing radiation hazards do not impede certain regimes of the sensible to gain predominance over other ones. The radioactive governance that I describe throughout this dissertation is managed by very different actors, but nonetheless coalesced toward certain politics. Such politics attempted to repatriate the population to Fukushima, to revitalize irradiated areas, to promote a resilient mindset in the face of adversity, and to normalize a raised threshold of radiation exposure. A politics of victimization has no place in such regime of the sensible or has failed to gather strong political momentum. The radioactive governance that I describe throughout this work ultimately aim to reinvigorate the public's trust regarding living in Fukushima, while increasingly resorting to the work done by citizen scientists, which provided the state an opportunity to bypass traditional forms of governance so that citizens themselves would engineer the normalization of Japan's radioactive thresholds. Throughout this work, I introduce this radioactive governance via the two concepts that I identify as "nuclear embodiment" and "conflictual collaboration."

First, as opposed to the initial months that followed this disaster, I aim to show that the governance of radiation hazards is not merely enacted through traditional forms of risk communication. In particular, by presenting an ethnography of state sponsored scientific hubs that taught about radiation (Chapter 6), I highlight how a state expertise was increasingly disseminated to the public via precise feelings about radioactive matter that were embodied through sensory interactions. I contend that a normalization of radioactive contamination is promoted through a process that I called "nuclear embodiment," in which radiation was made visible, palpable, enjoyable, and affective. This process of nuclear embodiment aimed to make radiation both tangible and somatically affective (Masco 2006; Myers 2015), while at the same time carefully concealing and disembodying certain aspects of the phenomenon. My study of nuclear embodiment takes a cue from Myers' ethnographic study of protein crystallography, where protein modelers rely on corporeal knowledge and interactive computer graphics technology to build their models. Myers' sensory ethnography of protein crystallography pays close attention to how protein modelers get entangled with their molecules, models, and computers in the course of scientific experiments. In similar ways, I explore the promotion of an embodied and affective knowledge of radioactive matter through specific sensory interactions, as made apparent by the creation of state-sponsored infrastructure like scientific hubs, public fairs, laboratory open days, or educational centers that explain the risks of radiation. Through participant observation in these places, I looked at how radiation exposure was a phenomenon that was taught and experienced in specific ways. My research highlights the visitors' embodied interactions with the technologies, models and displays that explain radiation, as well as the predominant emotions that propagate through sensory interactive experiences.

Myers contends that rendering transforms "how the stuff of life is made visible, tangible, imaginable, and workable" (2015: 161). Likewise, I found that while information on radiation is easy to understand, many aspects of its hazards are carefully concealed. The point of importance is that these sensory performances embody a specific of politics, which in the case of Fukushima makes only certain regimes of the sensible visible around radiation hazards. Nuclear embodiments are performative, meaning that they attempt to sediment particular ways of seeing and knowing (Myers 2015), often in the interest of a particular politics of recovery. Consequently, what is being governed through these nuclear embodiments is never simply the attempt to merely explain radiation phenomena, but also an indirect attempt at defining what radiation hazards is and is not – and for whom. These attempts represent a powerful "distribution of the sensible" (Rancière 2013), which shape what can be seen, said, felt, or known about danger and recovery.

Additionally, I build my notion of nuclear embodiment on the rich anthropological accounts that highlighted the peculiar corporeal or emotional relationships maintained with nuclear things, while examining how such relationships promoted ways of dwelling in a post-nuclear world. For instance, in the context of irradiated landscapes, ethnographers have highlighted the experience of people that delve throughout chronic radiation exposure. In the ongoing aftermath of Chernobyl, Petryna (2013) tracks the politics of health around radioactive hazards by following citizens' narratives, their access to healthcare, the disagreement regarding the risk of illness, and the social effects pertaining to radioactive contamination. She argues that exposed populations near Chernobyl have pursued a "biological citizenship." In this understanding, citizens employ the knowledge of biological harm to negotiate state compensations and medical care, remaking themselves into recognized suffers of the state. Only through a politics of nonrecovery can survivors of the Chernobyl disaster access a stable influx of privileges in a struggling changing economical market, from communism to capitalism. Focusing on rural population living near the Semipalatinsk Nuclear Test Site, Magdalena Stawkowski (2016) explores a discourse of "adaptability," where residents have "embraced" radiation as a sign of their own genetic adaptation. By highlighting the experience of Kazakh inhabitants suffering from chronic ailments which they link to radioisotopes exposure from years of Soviet atomic testing programs, she argues that people have "developed notions of well-being that constitute an emergent kind of local-global, postsocialist, mobile, nuclear, and – in this case – mutant subjectivity" (2016: 145). This narrative of "adaptation" is a form of political subjectivization that enables Kazakh inhabitants to retain a sense of dignity in a harsh post-Soviet economic climate. Others have also examined these relationships in the domain of nuclear laboratory life. Focusing on nuclear weapon production, Masco (2004) highlights the technical aspects of research scientists who work with virtual nuclear detonations to document the production of a new sensibility that differs from the one experienced during real nuclear detonations. He argues that, by diminishing sensory experiences, nuclear materials are increasingly experienced through the lens of an aesthetic–intellectual project, which normalizes and blinds scientists to the political nature of their dangerous work. At the Lawrence Livermore National Laboratory, Hugh Gusterson (1998) examines the importance of gendered embodiment in nuclear science, highlighting how a masculine culture of expert rationality sustained the laboratory's nuclear culture in specific ways.

My notion of nuclear embodiment is empirically built on these works, highlighting the ethnographic specificities in terms of enacting expertise on radiation, as well as adding layers of complexity to the study of the normalization of radiation exposure in a world that is always becoming more contaminated by nuclear matters. In the case of Fukushima, the state attempts to activate particular nuclear embodiments in ways through which people experience radiation through pleasure and resilience, rather than panic or non-recovery. As the aforementioned scholars have shown, there is always a politics in making parts of radiation hazards visible or not; why the Japanese state promotes such nuclear embodiment and what are the political stakes behind it is a theme that this dissertation explores.

Secondly, in sharp contrast to the initial aftermath of this nuclear disaster, the work of citizen scientists gradually became encouraged and supported by state and market forces. In this, I argue that citizen science in post-Fukushima Japan indirectly served as a way through which state agencies and corporate polluters delegated the management of radioactive contamination to the victims of a nuclear catastrophe.

In exploring the work of citizen science after Fukushima, scholars have theorized citizen scientists' efforts through the lens of an alternative political space that resist, to varying degree of success, the normalizing forces of the government, industrial, and academic expertise of radiological protection. For instance, Sternsdorff-Cisterna (2015) argues that the relationship between citizen scientists and the state is now catalyzed and mediated by the acquisition of a scientific expertise – what he calls a "scientific citizenship." Kimura (2016), while acknowledging the sharp restrictions of the political potential of citizen scientists, argues that citizen science can serve both as a way to do and avoid politics. My research agreed with the nuanced political power of citizen science, since all forms of testing, measuring, and monitoring are inherently political (Ottinger 2010; Gitelman 2013; Pine and Liboiron 2015). They do, after all, represent a dissatisfaction toward the state management of radioactive contamination; otherwise they wouldn't exist.

Still, in focusing on radioactive governance, I also highlight how the expertise of citizen scientists gradually intersects with the state management of radiation hazards in unexpected ways. As opposed to scholars whose works focused on the emergence and rise of citizen science, my fieldwork was conducted five years after the nuclear disaster.[21] The chaos of the disaster had settled and I noticed that the political relationship between state actors and citizen scientists had evolved in directions that were different from their initial heavy clash. In particular, I found that the Japanese state and corporate nuclear industries were increasingly encouraging the endeavor of citizen science.

Consequently, rather than only theorizing the relationship of citizen scientists and state actors in a dichotomous and confrontational manner, my ethnography equally highlights the political undertone of such evolving alliances by showing how state and public responses merged together to create particular regimes of the sensible around radiation hazards. For instance, throughout my fieldwork, I noticed that citizen science was, in many instances, downplaying specific aspects of radiation hazards, while promoting ideas of post-disaster recovery that were akin to those of the state experts. This was particularly ironic since post-Fukushima citizen science was born from a concern over state institutional experts' ability to manage the risks of radioactivity. In this, alternative routes to state protection do not necessarily impede citizen science networks to "collaborate" with state actors in either downplaying specific aspects of radiation hazard or in reifying normative visions of post-disaster recovery at the expense of others. In Chapter 7, I used the term "conflictual collaboration" to capture the Janus face of resistance and collaboration in which state-sanctioned ideas about radiation danger and pathways to recovery become taken up and reinforced by some citizen scientists.

[21] Initially, the state saw grassroot movements as an attack on its authority, and tried to repress them.

To understand these new arrangements of governance, I draw from studies in political ecology, where governance accounts for a plurality of actors and institutions that compete and overlap in managing environmental problems and goals (Tsing 2005; Mathews 2011; Forsyth and Walker 2014; Gururani and Vandergeest 2014). For instance, recent works focused on the appearance of new actors in the scene of government, by examining how non state actors can "jointly produce ecological knowledges and hold the reigns of governance and governmentality" (Gururani and Vandergeest 2014: 346). In Chapter 7, I engage with such analysis to examine how state and citizen science created authoritative and unchallenged worldviews exclusionary of other perspectives. Understanding radioactive governance as a field shaped by various actors and forces is crucial to theorize how the relationship amidst state, civil society, and market forces can be cooperative, hierarchical, and complementary at the same time (Eckert et al. 2012).

As civil actors become an integral part in the state management of radiation risk, my research challenges the celebration of citizen science as an endeavor that resisted state and market forces, while highlighting undertheorized neoliberal implications in this literature.[22] The danger lies in a normalization of risk that produces societies in which self-responsible citizens have to take care of themselves amidst an increasingly polluted environment. As such, I argue that citizen science in Fukushima also echoes a neoliberal shift in the management of contamination, leading to reduced public expenditure, minimal government intervention, and risk privatization. To understand the implication of

[22] Indeed, the participation of citizens in scientific matters has often been hailed as needed advancements in the democratization of scientific expertise (Irwin 1995; Jasanoff 2003), enabling the population to empower itself and to contribute to a larger role in the governance of ecological crisis (Fairhead and Leach 2003, 2; Sismondo 2010, 184; Mukherjee 2016).

neoliberalism in citizen science, I draw from works that criticize neoliberal restructuring from the perspective of individual responsibility (Allison 2011: 111) and empowerment (Ottinger 2011; Topçu 2013).

Geographer Erik Swyngedouw argues that governance beyond the state is "part of consolidation of an imposed and authoritarian neoliberalism, celebrating the virtue of self-managed risk, prudence, and self responsibilities […]" (2005: 1998).[23] Throughout my fieldwork, I noticed that pro-nuclear lobbies were financially and epistemically supporting the work of some citizen scientists. These actors were notably promoting a specific rationale of risk/benefit associated with a neoliberal rhetoric of empowerment that not only downplayed specific hazards, but equally made safety the sole responsibility of victims. While civic efforts of radiation monitoring and testing have been praised by different scholars as representing a democratic scientific endeavor, my research explores the ethics and politics that were at stake when non-state actors produced knowledge about health, toxicity, and pollution in neoliberalism.

In the end, what is at stake in Fukushima is an increased normalization of residual radioactivity, which is transformed into an everyday concern, rather than being represented as something exceptional. This is not only done by state experts, but equally via the increased activity of citizen scientists that collectively track and monitor residual radioactivity. By highlighting major shifts in the structure for expertise and the regulation of life amidst toxic exposure, my research describes how the management of contamination risks evolving in an era where the impacts of modernization represent permanent marks on the planet.

[23] In Japan, the neoliberal entrepreneurism has similarly moved beyond the language of economy to promote social tropes of individual accountability, self-empowerment, and risk taking (Allison 2013; Kimura 2016b)

1.3 Methodology

The Fukushima nuclear disaster has led to a surge of academic writing and debates. Yet, at the beginning of the catastrophe few works provided a descriptive account of a society and its people based on extended ethnographical fieldwork. Against this lack of grounded data, anthropologists rapidly tried to disseminate field materials. This approach became epitomized by the notion of "urgent ethnography" (Slater 2013): a non-judgmental process of collection, archival, and recording of the aforementioned disasters, produced in a timely manner throughout the voices of victims themselves.[24] As Slater summarized:

> [W]ithout urgent ethnography, without listening to the voices of the people as early as possible, without the detailed accounts of everyday life in the immediate aftermath, […] long-term engagements may be seriously compromised. Memories fade quickly, particularly in post-traumatic situations; people get used to the situation and forget the details of events and thoughts of the first days, weeks and months. To understand the situation, it is necessary to have some direct accounting, however provisional and selective, fragmentary and partial, of life on the ground, as close as possible to the moment of the event. This is what we have attempted to provide (2013: 33).

[24] The notion of "urgent ethnography" was introduced in *Japan Copes with Calamity: Ethnographies of the Earthquake, Tsunami and Nuclear Disasters of March 2011* (Gill, Steger, and Slater 2013). Informed by a scholarship of disaster studies (Button 2010; Oliver-Smith and Hoffman 1999; Hoffman and Oliver-Smith 2002), this edited collection highlights the processes of social change through a key emphasis on the voices of affected citizens.

With its emphasis on local experience as the primary analytical frame, the work of urgent ethnography can be regarded as a traditional form of ethnographic research – a "thick description" (Geertz 1973) that represents "a descriptive account of a society and its people based on data collected through extended participant observation" (Slater 2013: 32).

While this ethnographic approach lays an important foundation to a series of claims about self-voice and self-respect it was not appropriate in the context of my research. Indeed, as I began my fieldwork, five years had passed since the disaster, rendering the sense of immediate urgency impossible to record. Moreover, the concept of a "thick description" amongst a single community for an extended period of time – which is still perceived as the traditional golden standard of ethnographic research – proved itself too restrictive to theorize broader conceptual problems, in my case the plurality of governance goals. In thick ethnography of disasters, there is often the tendency to contrast the struggles of affected victims against those of the state, something that I analyze further in Chapter 5.[25] This can lead to limited ethnographic perspectives that echo a romance of resistance versus domination (Abu-Lughod 1990; Ortner 1995), failing to see the internal tensions and complexities of given groups. While thick ethnography of specific groups remains an important part of my dissertation, and while I also examined the power struggle between institutional experts and citizen scientists, stopping there was not enough.

By theorizing how an amalgam of state and non-state actors came to govern radiation hazards, my dissertation represents a major shift from earlier anthropological

[25] Disaster studies in anthropology often gives voices to marginal groups, portrayed as clashing against the hegemonic forces of state governance. By demonstrating that hazardous contaminants do not exist in isolation from other aspects of social experience, and by recording the complexities of citizen responses, scholars have highlighted the factors that contribute to the local rejection (and sometimes acceptance) of residual radioactivity.

works on the Fukushima nuclear disaster. This required a different approach, namely a focus on multisite ethnography. Similarly to Petryna, this meant that I had to become scientifically literate in understanding radiation hazards, namely "inquiring into the circulation and assimilation of scientific knowledge at national, international, and local levels, as well as exploring their tensions" (2013: 17). As such, my fieldwork was not restrained by a given area, but "jagged in constantly sniffing things out on the ground rather than following a systematic grid or pre-ordained plan" (Allison 2011: ix). A multisited ethnography imposed its own set of challenges, such as the continual doubt that "one should have been elsewhere" or that the ethnographer is "not in any one place long enough to understand what was going on […]" (Mathews 2011: 29).[26]

My fieldwork took place in urban and rural areas of Japan, predominantly in Fukushima, but also in Tokyo and other cities. I first began my fieldwork by collecting information and archives about the nuclear history of Japan. I did so at the Hiroshima Peace Memorial Museum, situated in Hiroshima, as well as in the Citizens' Nuclear Information Center, an anti-nuclear organization based in Tokyo. There, I was able to get a sense of Japan's nuclear history, especially by looking at different post-war narratives around nuclear power. I have analyzed such narratives in museum representations, history documents, school textbooks, public relation movies of the nuclear lobby, comic books (*manga*), cartoons (*anime*), and pop-culture, among others. To complement my understanding of historical factors, I visited nuclear repositories and interviewed nuclear engineers that were raised in post-war Japan, as well as members of anti-nuclear

[26] Yet, as Mathews argues these doubts are also "analogous to the rootless cosmopolitan's fantasy about local belonging and the attractions of being in one place" (ibid).

organizations. I’ve also assisted different conferences about the history of nuclear power in Japan, namely in Tanpoposha, a prominent anti-nuclear organization in Tokyo and in Hiroshima Peace Institute, associated with Hiroshima City University. Focusing on these materials allowed me to explore how nuclear matter was structured via specific materiality and sociocultural context, as well as how expertise on radiation hazards was inseparable from the broader political economy of post-war Japan. In this, I looked at which states of knowledge about radiation risks were made visible or not, and which alliance of human and non-human gained priority.

To study citizen replies to radioactive contamination, I focused part of my ethnography on a group of Japanese mothers who evacuated from Fukushima to Tokyo and who later became embedded in the realm of citizen science. Through interviews, I highlighted the conditions in which trust toward state expertise began to crumble after the nuclear disaster. I have also conducted participant observation of mothers’ ongoing attempts to rationalize and express the potential threats of radioactive contamination by following them through public protests, workshops on radiation risks, food monitoring practices, and radioactive contamination tracking. In doing so, I examined the scientific countermeasures that they developed in order to legitimize their voice as authoritative narratives. I explored the aspects of radiation hazards that mattered for them, how they specifically embodied radioactive exposure, and how their regimes of the sensible contrasted with the state narrative of safety, as well as with masculine experiences of contamination. Throughout my fieldwork, I noticed that the category of citizen scientist was far from homogenous, especially in terms of occupation, age, gender, social strata, or political positions.[27] This forced me to look at how the implications of citizen science were inseparable from such prior factors. As such, I highlighted how different understandings of politics, class, rurality, and precarity influenced the expertise of mothers implicated in citizen science. I also tracked the connections that nuclear victims have created with other actors, such as lawyers, medical doctors, or nuclear scientists. By giving voice to the latter category of actors, I show that a crisis of expertise did not merely happen between the citizen and the state experts, but equally among scientific experts themselves. This enabled me to point out who counts as an expert or not for different groups, as well as which kinds of hazards gained priority.

I also contrasted the work of citizen science with anti-nuclear activists. By interviewing members of anti-nuclear organizations in Tokyo, and through participant observation of their protests to stop nuclear power, I was able to get a better sense of the category of politics in Japan. This enabled me to understand some of the societal pressures faced by citizen scientists, which make it hard for them to engage in confrontational politics. As such, I examined how citizen scientists express their political dissent through scientific expertise on radiation hazards. I focused on how citizen scientists mobilize a different regime of the sensible through science, by analyzing their pamphlets and narratives during trial hearing to evacuate children from Fukushima. Beyond the confrontational aspects advanced by mother evacuees, I also examined different instances of citizen science networks in Fukushima and Tokyo. In particular, I looked at how citizen science networks could collaborate with state officials and nuclear lobbies in reinforcing limited

[27] While it is tempting to merely associate this phenomenon with anti-nuclear movements, sociologist Aya Kimura (2016) reminds us that the emergence of citizen science after Fukushima was not driven by a single ideological conviction. Rather, it was established by people from various backgrounds.

understandings of radiation dangers and post-disaster recovery. To do so, I highlighted how citizen science data on radioactive contamination was collected, used, and interpreted.

Initially, I had much difficulty in interviewing state officials. Most of my inquiries were lost amidst the electronic labyrinth of optic fibers, while hitting the automatic reply of governmental mail box. As I later experienced, it was easier to enter the exclusion zone of Fukushima than to get a reply from an official. Much like the nuclear core of the power plant, state officials seemed to have melted away; the only thing that was harder to see than radiation was a bureaucrat in flesh and blood. When I was finally able to interview state officials, the data that I gathered proved itself to be mostly useless. Many told me things that were publicly available and disregarded my more specific questions. In one instance, an official literally printed information from a governmental website and began to read the sheet in front of me. It quickly appeared to me that many bureaucrats had a limited understanding of radioactive contamination; many had memorized ready-made narratives.

Consequently, I began to stop focusing on what state officials said, and rather began to examine what they did through everyday practices of post-disaster recovery and remediation. I attended state-sponsored revitalization symposia, examining the actors that came to speak as experts or as affected citizens. In particular, I analyzed how revitalization projects emphasized particular politics of recovery over other ones, as well as reinforcing specific tropes of resilience in Fukushima. The aspects of radiation hazards that were absent from such recovery projects provided insightful details into the state regimes of the sensible. Importantly, I focused on how different state ministries were implicated in governing different material-semiotic aspects of radioactive contamination. For instance, I assisted symposia on the future of nuclear power, looking at the types of uncertainty mobilized and how they affected the perception of risk. I conducted participant observation in laboratories that monitored radioactive contamination and centers that explained the decontamination process. In these places, I examined the consequences of rendering contamination technical; what aspects of radiation hazards were detected or not through such practices? Often, certain aspects of radioactive contamination could be more easily governed than others. To understand how the narrative of decontamination stood up beyond laboratories, I conducted participant observation in contaminated farms, where I looked at how farmers attempted to revive agricultural practices, as well as how the materiality of contamination resisted the state narrative of control over contamination. By looking at state practices through the lens of performances it became apparent that specific understandings of post-disaster recovery were promoted.

Fieldwork took place in a rapidly changing environment, where evacuation zones became smaller and smaller as my research advanced. Throughout the end of my fieldwork, a specific regime of the sensible around radiation hazards was increasingly solidified. This was evident in the creation of state-sponsored educational infrastructure, where members of the public experienced radiation-related information firsthand via ways of interactive games, joyful activities, and cute presentations. Through participant observation of these scientific hubs, I examined how peculiar aspects of radiation became tangible and affective.

An important part of my research was not merely molded by my theoretical interest in embodiment and affect, but through my own corporeal and emotional response to Fukushima. I began this research without prior knowledge about radiation hazards. Yet, as I began to read on the subject, I was increasingly reluctant to conduct fieldwork in Fukushima. I got so worried that I decided to base myself in the Prefecture of Saitama, straddled between the prefecture of Tokyo and Fukushima. The constant back and forth travel between Saitama, Fukushima, Tokyo, made me a de facto multi-site ethnographer. I constantly took the train to Fukushima, a decision that ended up costing me a lot of money. However, I *felt* safer. Throughout this ethnography, I borrowed my expert authority from "having been there," as anthropologists love to remind other social scientists. Yet, this ethnographic presence was only partial. Funded for a year and not living every day in Fukushima, I could afford to throw out my rain boots after having walked on radioactive mud, I could afford to take a critical stance on the safety of the food, and I could show fear while standing next to a pile of bags filled with irradiated soils. Many of my informants couldn't do the same.

I remember a very precise event that crucially helped me understand this position. In the spring of 2016, I was invited to witness the work of citizen scientists in Fukushima. These citizen scientists were mostly farmers attempting to revitalize the sociocultural life of their region. Their village, known as Iitate, was one of the most heavily contaminated regions of Fukushima, since weather factors had transported residual radioactivity. I was initially reluctant to accept their invitation. Yet, tempted by the opportunity of good data, I ended up living in the village for many days in a communal dormitory.

At 5:30 on a very quiet Sunday morning, I was shaken out of bed by Masayuki who wanted me to help him move a couple of things near their citizen science center. We took a small truck and went up into the mountains. Classical music was playing in the car as we circled the mountains. Repeatedly, we stumbled on Japanese monkeys that looked at our car with an expression of surprise on their reddish faces. The air was quite chilly and the road seemed to belong only to us. Masayuki wasn't much of a talker but often commented about the nature of the village. The sun was at an angle where the light seemed perfect, not too strong, not too weak. It was one of those days that you would end up remembering for the rest of your life. What had brought a 27 years old French-Canadian to ride the irradiated mountains of this village while listening to classical music?

At the center, we began to move some old planks of wood which resulted in propelling a fine mist of wood particles through the air. The sight of the mist instantly got me worried: "What if I breathe those particles? Are they radioactive? Why didn't I bring a mask, is it dangerous? What's the radiation level? Where are my gloves, where's my Geiger…" As I look at the dust that covered my everyday clothes, I began to feel edgy and disturbed, becoming a captive of the world of radiation. Every time a strong wind blew on the plain of the village, I imagined countless radioactive particles being snatched from the soil, suspended in the air, and drawn into my lungs.

A similar incident happened when Masayuki began to fill his gourd with water from a natural source. "If you're thirsty you can go and drink some water, it's clean (*kirei*)," he told me. I was taken aback by this unanticipated request. So many things were jostling in my mind; was it really safe, did he say *kirei* to mean pure or uncontaminated, should I ask him, was it too impolite to refuse? I took the smallest sip of water possible. As soon as I came back in the car, I started to feel anxious and sick, constantly wondering, "what if?" On the other side, Masayuki was gulping down large quantities of water without any problems.

These experiences made me realize that one cannot constantly live in a state of chronic anxiety, awareness, and alertness for the potential adverse health effects of radioactive contamination. It was precisely the affectiveness of this "what if" – this impossibility of solidifying a clear state of risk – that was one of the most energy-draining aspects of living in Fukushima. In that regard, citizens in the village rarely talked about the potential adverse health effect of radiation. Notably, Masayuki and I never discussed about health, only about the nature of Iitate, the name of plants, or the shacks that needed fixing. After a few days, I had to stop thinking about the danger of radiation, as it got me physically exhausted. I became tired of wearing a mask to protect myself from radioactive particles. I began to understand why people no longer wore them; at first, I did not really care, but after 8 hours my ears started to hurt, I couldn't speak well, nor breathed right. The thick boots and the long clothes in the harsh summer months, which served as tentative protection quickly became an impediment to everyday life. The noise of the radiation monitoring device that farmers possessed equally got on one's nerve. When I lay in bed at night I could still hear its annoying beeping in a corner of my mind. Who said that radiation was noiseless?

Many were aware that the level of radiation in their village could pose a non-negligible threat to children and in private, some citizens told me that it was "best for them not to come," or at least "not too long." Even some elderly women told me that they were quite scared about radiation health effects when they first heard of the disaster. Yet, for the residents of this village, it was also impossible to live in a daily state of health anxieties. Bringing up such subjects of conversation would have added to the numerous difficulties that the citizens of a poor and aging rural village were facing.

Still, anxiety was often silently creeping in many parts of this village. This was most apparent during a party, where many wet their nose with Japanese sake, engulfing large quantities of alcohol, a toxin used to fight the fear and stress induced by a carcinogen, radiation. I couldn't help, but to think of a similar experience that I read in Petryna's account (2013), where post-Soviet citizens were drinking themselves to death. On that day, the only cultural difference that struck me as apparent was the fact that people were drinking rice wine instead of vodka.

Fear consequently shaped how I ended up doing ethnography. Yet, fear was also a luxury that many couldn't afford and something that was not experienced equally. In talking about "chemosocialities," which are the "novel, altered, attenuated, or augmented relationships that emerge from shared and shifting chemical ecologies," Shapiro and Kirksey (2017: 484) highlight the fact that "thinking chemically" (2017: 482) is inseparable from one's own positionality. Thinking about radiation hazards as a young white male and as an academic was not the same as a mother in Fukushima, who might be worried about radioactive contamination, but equally embedded in a precarious financial situation that makes long-term evacuation a privilege.

In that regard, the ethnography presented here, embedded in my positionality which I studied deeper in Chapter 8, does not fully represent the deeply contested ideological and gendered terrain that surrounds radiation hazards in post-Fukushima Japan. Rather, I would like the reader to see the ethnographic accounts through the metaphor of a Japanese woodblock print. Like a Japanese print of the floating world (ukiyo-e) made unique by the assemblage of specific woodblock plaques, a focus on different sites produces a painting of its own by presenting a series of vantage points on radiation expertise. What I put forward was a series of ethnographic portraits that offer a critical, but situated insight into the politics of expertise, allowing me to explore limited facets about the governance of contamination in the wake of a nuclear disaster. The limits and constraints of this fieldwork were obviously it's partiality.[28] Still, this does not mean that I offer a relativistic account of this nuclear disaster, since relativism is a "way of being nowhere while claiming to be everywhere equally" (Haraway 1991: 191). On the contrary, this ethnography aims to provide embodied and partial knowledge, which produce a critical account, and that do not aim to reestablish another regime of universal truthfulness – the same kind of regime which had precisely led to this nuclear disaster.

1.4 Outline

The rest of this dissertation goes as follows. Chapter 2, entitled Nuclear Monsters and Nuclear Saviors, provides the historical background that led to the Fukushima nuclear disaster, while serving as a primer on the phenomenon of radioactivity. This first chapter argues that state expertise around issues of radioactive hazards was shaped by the political economy of post-war Japan. The normative cultural framing on nuclear matter emerging from these historical contingencies, as well as its materiality, affected the process by which the scope of radiation dangers were defined in a post-Fukushima scenario. The point that this chapter makes is that the political responses to the 2011 nuclear disaster didn't emerge out of the blue; they were molded in specific historical and political context, influencing the governance of radioactive contamination.

Chapter 3, entitled, Facing the Crisis, highlights the initial civic responses that emerged after 3/11. It primarily focuses on a group of Japanese mothers who evacuated from Fukushima on their own and who later became embedded in the realm of citizen

[28] In particular, I do not make any attempt to focus on the 2011 tsunami and earthquake. Although the nuclear catastrophe is part of the "Japan's Triple Disaster," focusing on the tsunami and earthquake goes beyond the scope of my ethnography, as well as the analytical length of this dissertation.

science. In particular, I highlight the evolution of their experience from evacuees to citizen scientists. I equally focus on the connections that nuclear victims created with other actors in the process, such as lawyers, medical doctors, or nuclear scientists.

Chapter 4, entitled “The Politics of Citizen Science” further elaborates on the case of citizen science and evacuee mothers. In particular, the chapter focuses on the forces that intersected with citizen science expertise in seeking the right to officially evacuate from Fukushima. I underline the political forces that mitigate the political potential of citizen science expertise. I show how their political activism was embedded in gendered, economic, and cultural factors, and how evacuees have nonetheless attempted to do politics through science, albeit in a very difficult way. Ultimately, I examine how the initial state governance of radiation hazards strongly revolved around the management of which voices counted as legitimate or not. This was rarely based on the knowledge that individuals possessed about radiation hazards, but heavily mediated through gendered expectations, sociocultural pressures, reified cultures of science, and non-negotiable politics of post-disaster recovery.

In Chapter 5, titled Governing by Contradiction, I examine the concrete strategies used by different state ministries and agencies to manage radioactive contamination. I contrast the effectiveness of these strategies with the experience of the population, but also contrast them within the state itself. If governance does not assume a unified system working towards similar goals and if the state is not a homogeneous entity, what are the effects of internal political tensions for the management of radiation? By focusing on three different state agencies, which produced different replies to the hazard of radiation, I show that reasserting normalcy for the state was done through a fragmented expertise that mobilized multiple materialities of radiation hazards. I argue that the Japanese state first attempted to manage public risk perceptions by resorting to different and ironically very contradictory materialities of radiation harm. These contradictions are, however, not to be seen as a hindrance to the state management of residual radioactivity. On the contrary, they allow for a pluralized form of governance, which downplay specific understanding of radiation harm, often in the interest of the Japanese state. Here, competing versions of radiation harm exist within the state (and not merely between the state and the citizen), while still having very similar political stakes.

Chapter 6, focuses on state-sponsored educational infrastructure created to explain the phenomenon of radiation to the population of Japan. I draw on three case studies to elaborate on the notion of "nuclear embodiment." In particular, I show that these nuclear embodiments aim to promote a specific relationship with nuclear matter. However, this relationship disregards much of the work and knowledge done by some citizen scientists, while equally downplaying the specific embodiment of Japanese mothers as described in the previous chapters.

Chapter 7, tackles the forms of collaboration amidst civil society, state actors, and market forces, while serving as a spring board to expand the notion of "conflictual collaboration." In sharp contrast to the previous chapters, I show that the work of some citizen science networks have evolved in collaboration with the official governance of the Japanese state. Such collaboration happens when the expertise of citizen scientists is embedded within politics of monitoring, neoliberal forces, and reified vision of post-disaster recovery.

Last but not least, Chapter 8 reflects on my own politics of expertise, or on the political implications that surrounded issues of knowledge production, expert voices, and translation amidst the narratives of ethnographers.

Chapter 2: Nuclear Saviors and Nuclear Monsters

An important part of this dissertation was written in Hiroshima, fifteen minutes away from the Atomic Bomb Dome, where the A-bomb nicknamed Little Boy was dropped. When I couldn't write, or wanted to ponder on my fieldwork in Fukushima, I went for a walk in the nearby Peace Memorial Park, where a former landscape of death had been converted into one of peace. There, I could buy an ice cream cone, jog when I felt like it, or picnic with friends. It was a nice place to relax and most of the time I forgot that thousands of people had perished from the aftermath of high doses of radioactivity, while the "lucky" ones were carbonized by the heat of the bomb.

Yet, every year on August 6th, the day the bomb was dropped, the park transformed itself into a politically charged locus, where Hiroshima the *place*, became Hiroshima the *event*. On that day, anti-nuclear activists used the opportunity to protest against nuclear power in Japan, while right-wing extremist groups blasted anti-American slogans through "propaganda trucks" (*gaisensha*) at more than one hundred decibels. The police always made sure that activists ceased their protests during the Peace Memorial Ceremony, when the Prime Minister and gathered citizens pray for the repose of victims, the abolition of nuclear weapons, and for lasting world peace. During such moments of serenity, the memories of Hiroshima's destruction, as the first city to be targeted by a nuclear weapon, became secured "within the global narrative of the universal history of humanity," producing, as Lisa Yoneyama (1999) argues, a postwar forgetfulness about the nation's past, when Japan was not a nuclear victim, but a former military and colonial aggressor.

My experiences in Hiroshima were stark reminders that the history of nuclear tragedies is enmeshed in the exercise of power, while being accompanied by unique elements of repression and contestation that continued to cast shadows on the present. The Fukushima nuclear disaster cannot be approached without a sense of Japan's particular nuclear history and culture, nor without an understanding of the global political and economic contexts that have shaped them. To understand the politics of expertise of radiation hazard after Fukushima it is crucial to address the context of nuclear things in Japan, as they have informed the expert reactions to nuclear disaster. Throughout this chapter, I provide the reader with a sense of nuclear history in Japan, as well as a primer on the science of radioactivity. I pay close attention to how Japanese state authority and international actors have structured the experience of nuclear matter in specific ways. I do so by focusing on the materiality of radioactivity and the sociocultural context in which it is embedded. In other words, in this study of state authority and expertise around nuclear things, I take radioactivity as an object of analysis and as an actor.

Illustration 4: *Anti-nuclear demonstrations in Hiroshima* (photo by the author)

2.1 The Materiality of Radioactive Elements

Hugh Gusterson has argued that there are many ways to see a nuclear missile: such as a token of security; an image of nightmares; a technical diagram; or a reason for not having children (1998: 2). Similarly, there are many ways to see radiation: through monitoring devices such as Geiger counter, on the radiation hazard tag of an airport custom's metal detector, or as a commodity in the form of suppository, where, around the 1930s, radioactive materials were marketed as a potent remedy to restore sexual power and increase one's vitality. The epitome of such belief came under the form of a 15-day course *Vita Radium Suppositories*, guaranteed to contain real refined radium and to be perfectly harmless (Health Physics Historical Instrumentation Museum Collection 1999).[29]

Illustration 5: *Vita Radium Suppositories*
(https://www.orau.org/ptp/collection/quackcures/radsup.htm)

Throughout my fieldwork in Fukushima, radiation also took specific manifestations: road panels that announced the radiation levels on the street, contaminated fruits left to rot on the sidewalk of evacuated towns, the trembling voices of my informants in the tape recorder,

[29] For more see https://www.orau.org/ptp/collection/quackcures/radsup.htm

the weird smell of an array of foods waiting to get tested for contamination, or the picture of a young girl with a huge scar from a thyroid operation, which anti-nuclear protestors believed to be linked with radiation exposure. In the following pages, I explore the shifting social-material forms of nuclear things, as well as how they were mobilized by state authorities so as to cement a specific expertise on radiation hazards. I aim to partly do so, by paying attention to what historian and STS scholar Gabrielle Hecht (2012) calls "nuclearity," a term introduced to signal how hazards, objects, or places get designated as "nuclear" or not. Hecht uses this concept in order to examine the situations and knowledge practices under which nuclear things get constituted. Nuclearity stands as a product of sociocultural contestation and an expression of technopolitical power, as it requires "instruments and data, technological systems and infrastructures, national agencies and international organizations, experts and conferences, journals and media exposure" (Hecht 2012: 330). As Hecht further explains:

> When (and where) nuclearity is densely distributed among these elements, it can offer a means of claiming expertise, compensation, or citizenship. It can serve as a framework for making sense of history, experience, and memory. When (and where) network elements are absent, weak, or poorly connected, nuclearity falters, fades, or disappears altogether, failing to provide a resource for people claiming remediation or treatment. (2012: 320).

The concept of nuclearity makes apparent the fact that there is not one nuclear ontology, and that nuclear things can be rendered exceptional (e.g., a nuclear bomb) as much as they can be rendered banal (e.g. a suppository). Yet, while nuclearity often discriminates along axes of class, race, and geography, Hecht (2012: 323) contends that "[r]adiation, however, doesn't discriminate." By saying that radiation doesn't discriminate, Hecht points the importance of considering radiation as an actant, that is in a Latourian way, as a force that produces effects while surprising those who would try to harness or control it. Inspired by the framework of Actor Network Theory, many scholars have insisted on the agential power of non-human actors to understand sociotechnical dynamics and politics (Mitchell 2002; Latour 2004; Hetherington 2013). For instance, political theorist Jane Bennett (2011) has focused on the vitality of matter, as an active power capable of asserting itself independently of human intentions (see also McLean 2011). For her part, feminist scholar Karen Barad (2003: 810) has framed this issue in a post-humanist notion of performativity, arguing that considering matter as "merely an end product rather than an active factor in further materializations, is to cheat matter out of the fullness of its capacity." Lastly, multispecies theories have explored the saturation of human nature by other natures (Helmreich 2009; Kirsky and Helmriech 2010; Kosek 2010; Lowe 2010; Raffles 2011; Myers 2015). While these works tackle different theoretical inquiries, they enable me to highlight the fact that different materialities of radiation may be "sources of unpredictability, unruliness and, in some cases, resistance to human intention" (Bakker and Bridge 2006: 18). Yet, if we follow radioactive elements as actors they whisper a different story than the narrative of governance promoted by the Japanese state experts. Such an understanding is vital to understand the politics of expertise around radiation hazards, since expert authority becomes the product of a series of alliances where the human part of it is never wholly in control. This emphasis does not aim to introduce an ever-increasing number of actors (Mitchell 2002), but rather attempts to examine how power/knowledge works in the governance of contamination.

Importantly, by highlighting the dynamism and mobile forces of radioactivity with their own powers, I do not intend to trace a single line that would divide the human realm from the nonhuman one. Nor do I intend to imbue matter with some sort of autonomous intrinsic vitality like Bennett. Such an understanding fails to theorize matter as something that is relational and that is never independent of the histories of knowledge production through which objects gain new meaning and power (Myers 2015). Rather, like Tsing (2005) did for trees or Mitchell (2002) for mosquitos, I set to make radioactive elements lively actors *simultaneously* natural and social, shifting and turning at the interplay of human and non-human practices. The challenge is to theorize an agency of radioactivity while simultaneously being mindful of how the Japanese state and other actors are inextricably linked with the construction of the forms, scales, and framings through which that agency expresses itself in given expertise linked with nuclearity.

Moreover, by resorting to the term nuclearity, I am careful to bypass the constraint of physical things like maps, Geiger counters, or propaganda posters. Indeed, it also remains important to highlight the affective and energetic forces that surround nuclear matter. Specific emotional relations have emerged from the scars of atomic bombings in Japan, hereby propelling and compelling particular atmospheres (Little 2012: 30). As scholars implicated in the realm of affect argued, an atmosphere is not a concrete thing, but rather a realm of emergent possibilities, indeterminate feelings, or energies (Anderson 2009; Stewart 2011; Little 2014). These atmospheres shape peculiar reactions and understanding toward nuclear things, but can also be tapped in for particular political purpose. In such processes, they leave an imprint on how nuclear-related expertise ought to be enacted. Historicizing the practices though which radioactive harm and nuclear matter become a phenomenon that people can feel and interact with in requires a sustained focus on how radioactive elements are made lively, embodied, affective, and energetic (Murphy 2006; Hecht 2012).

However, before fully exploring nuclear matter and its entanglement it is necessary to define the phenomenon of radioactivity and its intricacies. In the following part, I do not aim to provide a positivist explanation of what radiation is, but merely a short primer on how normative science has so far framed the issue. The “black-boxing” (Latour 1993) of radiological science will be explained later on. First, radiation and radioactivity are often considered as synonyms, but they involve different processes. Radiation simply refers to the transmission of energy in the form of waves or particles. Radioactivity, for its part, is a term used to describe the spontaneous disintegration of atoms; it is a process of decomposition where unstable atomic nuclei transform themselves into nuclei with higher stability, emitting radiation while doing so (Centers for Disease Control and Prevention N.D.). Radiation is a consequence linked with many processes (e.g., radiowave or light) and not just with radioactivity. A simple analogy can be found in an X-ray machine. An X-ray machine is not radioactive *per se*, but it has the potential to produce radiation. On the other hand, the radioactive pollutants released during a nuclear disaster have no “on and off” switch like the ones on a X-ray machine. They are both radioactive and produce radiation. Radiation can come from natural sources, mainly from cosmic radiation or from naturally occurring radioactive materials found in the air, soil, water, or food (Gale and

Lax 2013). It also emanates from man-made activities, like X-rays, medical CT scans, or in the case, the products of nuclear fission.

Radiation usually falls within two categories: non-ionizing and ionizing. Non-ionizing radiation is composed of the low-energy parts of the electromagnetic spectrum, such as the light that we see, radiowaves, or microwaves (Boland 2013). This particular form of radiation is of no interest in the case of Fukushima, but as I will show throughout this dissertation, it can be mobilized by Japanese educational systems so as to downplay the perceived harmfulness of a nuclear disaster. Ionizing radiation, for its part, is an energy that can penetrate the body and potentially cause cancers and other harmful effects in high dose (Centers for Disease Control and Prevention N.D.). This is the form of radiation that concerns us after Fukushima. Indeed, the Fukushima nuclear disaster led to the discharge of dangerous radionuclides, or unstable elements which disintegrate and emit ionizing radiation in the process. The major radionuclides of Fukushima were Iodine-131, Cesium-134, Cesium-137, and Strontium-90, as well as traces of plutonium, amidst many other radionuclides.[30] Each of these radioactive elements have a different life span. For example, Iodine-131 has half-life of 8 days, Cesium-137 has a half-life of 30 years, and plutonium 24 000 years.[31]

Ionizing radiation occurs under two forms, namely electromagnetic waves, such as gamma rays or X-rays, and particles, like beta or alpha ones. Rays and particles differ in

[30] Radioactive pollutants released during the disaster produce different types of radiation. Cesium-137 produces gamma rays, strontium-90 beta particles, and plutonium alpha particles. While beta and alpha particles are too weak to pass through one's body, they can become very dangerous if they are ingested (through food, drink, breathing, or injury).

[31] The half-life of a substance is the amount of time needed for its radioactivity to be reduced to half. Iodine-131 is no longer present in the environment of Fukushima, due to its very short life span. On the other hand, radioactive cesium remains a major source of contamination.

their capacity to do damage and their ability to penetrate materials. For example, alpha particles travel a short distance and can be stopped by the human skin, beta particles penetrate a little way into human flesh, and gamma rays, which are similar to X-ray, are very penetrating and require substantial shielding (WHO 2016). Ionizing radiation can pose a specific health risk by damaging tissues and DNA in genes of living beings (USEPA N.D.). In particular, ionizing radiation has enough energy to cut the chemical bonds of human cells and damage DNA (a molecule carrying information used in the growth, functioning, and reproduction of living organisms). In trying to repair themselves from such harm, cells can make mistakes, producing errors in the DNA (Sakiyama 2011). This causes a mutation in living cells, which is a permanent alteration of the cell's reproductive outcome. Consequently, this mutation can result in what is called a somatic effect, such as cancers that happens on the body of an exposed individual. It can also result in transgenerational effects, or mutations present in the germ cells (eggs or sperms that can potentially be transmitted to future generations.

The unit used to measure ionizing radiation in terms of its potential for causing harm is called the Sievert (Sv).[32] Since the Sievert is a large value, radiological safety uses smaller values, like the millisieverts (mSv) or microsieverts (μSv).[33] It is also expressed through the rate at which a dose is delivered (e.g., mSv per year or μSv per hour). Above a certain level of exposure, namely 100 mSv per year, radiation is known to be a cancer-causing agent, most commonly of the blood (leukemia), breast, thyroid, lung, stomach, and

[32] The Sievert is a numerical value that represents radiation's effect of the human body, taking into account the biological effects of different types of radiation (e.g., a, b, gamma ray) and the sensitivity of tissues and organs (Radiological Society of North America 2011).

[33] Respectively, one thousand μSv in one mSv, and one thousand mSv in one Sv.

brain, while also impairing immunity to infection, while increasing the risk of cataracts, heart disease, and stroke (see Gale and Lax 2013: 19; Morris-Suzuki 2014: 336). What is referred to as "low doses" of ionizing radiation, that is, below 100 mSv per year, can also increase the risk of longer-term effects (WHO 2016). With constant exposure to low doses of radiation (or chronic exposure) there can be a "delay between the start of the exposure and the observed health effect, such as cancer, benign tumors, cataracts, and potentially harmful genetic changes" (USEPA N.D; see also Dubrova 2003). As such, long-term effects might appear decades later.[34] Biological events that result from lower exposure are often referred as "stochastic," since they may lead, with varying probabilities, to potential hereditary defects or cancer. They contrast deterministic effects to radiation, which are the results of an exposure large enough to lead predictably (or deterministically) to organ malfunctioning and assured death. There is much scientific controversy regarding the health effects of long-term, low-level chronic exposure to radiation, as we will see later.

Lastly, an individual can be exposed to radiation or contaminated by radioactive materials. For example, when we take an X-ray, radiation rays passes through our body and disappear when the "off" button is pushed. We have not become radioactive and no trace of radiation remains inside our body. In other words, we have been *exposed* to radiation, but we are not *contaminated*. In order to be contaminated, radioactive elements, like the radioactive pollutants release during a nuclear disaster, need to be on or inside the body (Radiation Emergency Medical Management 2015). Radioactive contamination therefore works externally, that is, if the body is affected by nearby residual radioactivity, or internally, if radioactive elements end up being ingested or inhaled. In this case,

[34] As the World Health Organization (2016) cautions, the risk is "higher for children and adolescents, as they are significantly more sensitive to radiation exposure than adults."

radioactive materials can accumulate in specific body organs, remaining active for different periods of times (Centers for Disease Control and Prevention N.D.).

The specific materiality of radioactive hazards is, however, very complex. Not only is radiation hazard invisible to the naked eye, but it takes the form of rays or particles, come from natural or man-made sources, and even include a temporal displacement of harm. These different materialities may subsequently be mobilized in very calculated strategies. Through a focus on primary sources, secondary sources, and in-depth interviews with key people working in the nuclear domain of Japan, the rest of this chapter examines how these materialities have organized – partially – expert ways of seeing and knowing about radiation hazards, while intersecting with state expert authority in unexpected ways.

2.2 Cementing Nuclear Power in Japan

Barefoot Gen is a famous Japanese comic (manga), which tells the fictional story of Gen Nakaoka, a 6-year-old boy living in Hiroshima during the final days of World War II. Throughout the comic, the horrors wrought by the atomic bomb are vividly depicted; we see a Hiroshima that lies in ruins, full of corpses, as well as people who are dying from severe burns or from radiation sickness. A visit to the Hiroshima Peace Memorial Museum is another harsh exposé of the adverse health effects of external exposure to gamma radiation. Exposure to such radiation produced, as the exhibits of the Museum explains, frightening keloids (scars), hair loss, cancers, and other sicknesses.

Yet, while the museum makes such hazards clearly visible to the visitors now, nuclear harms was not always so visible. Indeed, after World War II, American forces occupied the nation of Japan until the end of 1952 and under this new regime, much of the detailed effects of atomic bombing on the human body were withheld from public discussion (Jacobs 2015). The ignorance of the suffering of Japanese victims of atomic weapons, known as *hibakusha* (literally person exposed to radiation), was such that members of the Japanese public were often unaware of the victims' suffering throughout the 50s (see Yoneyama 1999; Pelletier 2013).

For a short period, the nuclear bombings would remain a case of nuclear exceptionalism. Everything that was nuclear was either a remnant of the past, off limits, trapped in secrecy, or concealed during the American occupation. Immediately after World War II, the United States prohibited any kind of nuclear science in Japanese society. However, starting from the 50s, the emergence of superpowers during the Cold War, the rise of communist China, and the Korean war would soon change the geopolitics of East Asia and indirectly, the politics of nuclearity in Japan. Under such pressure, transforming Japan into a nuclear ally could strengthen the geopolitical power of the United States. Indeed, having nuclear plants in Japan could stabilize the global strategic nuclear balance, by showing that an American ally could make nuclear weapons if the need ever arose. Especially wary of the rise of communism in the East, American forces would once again introduce nuclear power in Japan, not under the form of a bomb, but under the promise of the peaceful goals of nuclear energy. The choice of Japan was a pragmatic one, heavily influenced by the political constraints and opportunity of American post-war occupation. As opposed to Germany, which was divided under democratic (West Germany) and communist regimes (East Germany), Soviet forces were never allowed to occupy a defeated Japan. Yet, how could American forces convince a country that had suffered from nuclear harm of the need to embrace nuclear power?

In order to do so, U.S. political forces had to shift the image of nuclear matter from a power that could obliterate life to a power that would be beneficial for the nation-state of Japan. It is precisely in this context that U.S. President Eisenhower launched the "Atoms for Peace" program in 1953. Under the care of the International Atomic Energy Agency (IAEA), the Atoms for Peace program proclaimed that the use of nuclear science and energy should serve "the peaceful pursuits of mankind" (Hecht 2012: 24). In such a discourse, atomic power would produce limitless clean energy, agricultural benefit, and helpful medical radioisotopes. Nuclear exceptionalism was this time manifested in political claims of peace, as well as in scientific stakes of technological wonder. The partner first qualified by this narrative was the very same country that suffered from the first atomic bombings: Japan (see Pelletier 2013). Subsequently, American leaders began to set Japan as a "follow-up democratic model for Third World countries that might be attracted to communism" (Pelletier 2013: 417 *author's translation*). The logic was that if the atomized Japanese people were convinced of the merits of civilian nuclear power, other nations could more easily be seduced (ibid).

At the end of the Occupation of Japan, American forces thereby began to financially back up political parties that were in accord with American interests (e.g., capitalism over communism and pro-nuclear position over anti-nuclear ones). Founded in 1955, the Liberal Democratic Party (*jiyū-minshutō* or *jimintō*) (LDP) of Japan was one such party. Unsurprisingly, the won the 1955 elections, becoming Japan first conservative government with a strong nuclear oriented agenda. The party held majority government uninterruptedly for almost 40 years and still remains the strongest factions in Japanese politics to this day.

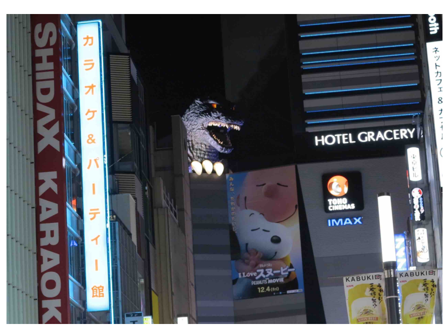
For aspiring Japanese politicians, the Atoms for Peace program was a golden opportunity and the technological ambition of nuclear power was soon placed at the service of the defeated archipelago. If Western nuclear power had caused Japan to fall by military means, its utopian promises of technological wonder might perhaps lead to the resurrection of the country (see Pelletier 2013; Suganuma 2016). By 1954, the first nuclear research budget was passed throughout the Japanese Diet, facilitated and supported by the enormous influence of American forces. Quickly promoted as part of the Japanese government national policy, sustained by the development of economic policy, and even endorsed in Japan's legal framework (Suganuma 2016: 204), the nuclear industry appeared as a well-oiled fast car exempt of a brake pedal.

Yet, numerous tensions in the application of this project soon emerged. Most famously, on March 1, 1954, a Japanese fishing boat, the Lucky Dragon Five, was exposed to radioactive fallout near the U.S. nuclear test site of Bikini atoll (Jacobs 2015). The death of a crew member by radiation exposure and the contamination of fish products later sold at the Japanese market brought an important collective awareness around radioactive danger. The incident added to the fresh memory of the bomb, as well as to the situation of the *hibakusha*, which was slowly resurfacing to public consciousness, notably through the work of local medical doctors and underground Japanese comic books (*manga*). Because of such incidents, the year 1954 lead to the emergence of strong, nationwide, anti-nuclear movements throughout Japan.

Anthropologist Kenneth Little argues that when "affect makes its jump between the visible thing, the idea, and the socially sensible, it leaves a vibrant and kinetic trace of uncanny connections that begins to mark otherwise disparate states of arrest" (2014: 239).

In public culture, this affective trace was best epitomized by the figure of Godzilla, a post-war metaphor of the danger of nuclear tests and radiation. Created in 1954, Godzilla is a big green dinosaur-like mutant monster, born from the radiation exposure of nuclear tests. In the early Japanese cinema of the 1950s, Godzilla is a monster that destroys and ravages Japanese cities with its powerful atomic breath. In order to tame the nefarious symbolism of Godzilla and reverse this rising "allergy to the atom" (*genpatsu arerugii*), which the Lucky Dragon Five incident had helped to cement (Pelletier 2013), the Japanese state embarked on a policy that aimed to change the public understanding of nuclear power. The management of particular relationship with nuclear matter was crucial to the success of this enterprise. In that line of thought, Masco argues that imaginative and affective atmospheres have played key roles in how nuclear fear became nationalized through specific terms. As he argues in the U.S. context of the Cold-war: "Military science funded extensive research on affects, feelings, and emotions with the goal of both psychologically strengthening and militarizing American society, using nuclear fear to calibrate officials and citizens alike through a new image of collective death. (2014: 18).[35]

Illustration 6: *A representation of Godzilla in downtown Tokyo* (photo by the author)



[35] For instance, while children of the early Cold War were taught to survive an atomic attack through the famous "duck and cover" drill (Jacobs 2010), a strong U.S. nuclear arsenal was deemed the ultimate deterrent so as to ensure global peace against the treat of communist annihilation.

Similar political, material, economic, and affective mobilization happened in Japan, but the path taken had its own sociocultural specificities. In Japan, a clear separation between nuclear arsenals and nuclear power plants was needed. As opposed to the U.S., nuclear power could never be used to produce atomic bombs that would act as a deterrence force against Soviet enemies. Atomic bombs were one thing, a thing of the past, that had hurt Japan more than once. A nuclear power plant was another thing, a thing from the future that would do good deeds for Japan. While nuclear power was first introduced to Japan by American forces looking to strengthen their geopolitical power, and while it was unthinkable that the Japanese politicians were not interested in evolving the civil nuclear program into an atomic arsenal, in public discourse the separation between the peaceful use of nuclear power and the danger of nuclear arsenals was as concrete as the Iron Curtain of Cold War. As many have argued if the rejection of war and the promotion of peace had not been injected into the framework of Japanese nuclearity, no plants would have been built on the archipelago (see Chanlett-Avery and Nikitin 2009; Pelletier 2013). This state of mind was best epitomized by Yasuhiro Nakasone, a key player in the promotion of nuclear power and future Primer Minister of the 80s. He became known for enunciating the three guiding principles that lead nuclear power in Japan: liberty (*jiyū*), democracy (*minshū*), and public openness (*kōkai*). While deeply political, nuclear power, to be socially accepted, was to remain apolitical in its public sphere, simply producing raw and clean electricity for the well-being of all. One way to consolidate such a scenario was to embark on an important pro-nuclear propaganda.

This propaganda was assured by a heterogeneous assemblage of politicians, bureaucrats, enterprises, media, and scientists, which came to be known as the "Japanese

Nuclear Village" (*genshiryoku mura*). This heterogeneous assemblage of actors led to the creation of diverse geostrategies that promoted and cemented nuclear energy throughout Japanese society (for more on the *genshiryoku mura* see Kainuma 2011; Koide 2011).

First, in a series of scenarios that seemed taken out from espionage novels, the U.S. Central Intelligence Agency (CIA) covertly recruited Japanese media tycoons to disseminate and introduce nuclear plants that used American technologies across Japan (Nakano 2014; Suganuma 2017). The nuclear industries, possessing an important financial budget for public relations, developed significant ties with the media industry of Japan (see Honma 2013). Gradually, the Japanese energy lobbies provided huge amounts of advertisement fees to newspapers and television networks. Because of such financial supports Japanese media were wary of criticizing nuclear power (Suganuma 2017: 220).

Secondly, nuclear enterprises also joined the propaganda, creating small televisual programs specifically directed at children to explain the safety of nuclear technology. In one such program, the radioactive element plutonium appears as a cute little animated figure called Mr. Pluto (*pluto kun*), a cartoon character created by the Japanese Power Reactor and Nuclear Fuel Development Corp.[36] Through such propaganda film, Mr. Pluto claims that he is not a monster (*obake*) and that he is working toward peace (*heiwa*).[37] Against the stereotypes (*osoroshi imeji*) and bad rumors (*warui uwasa*) that affect nuclear energy, Mr. Pluto's mission is to bring the "true story of plutonium," which is said to be safe and unrelated to the apparition of cancer. Mr. Pluto begs the viewer to be controlled

[36] The *kun* of Mr. Pluto (Pluto-kun) is a suffix that implies an infantile connotation. For the video see https://www.youtube.com/watch?v=sOFg8oWMHRM (Accessed 26 August, 2017).

[37] The term *obake* also refers to phantoms and implicitly pinpoint towards the past memory of Hiroshima and Nagasaki.

by the “wonderful wisdom” (*subarashii chie*) of humans, demonstrating that its purpose is also of use for high-tech projects, such as space satellites. To demonstrate its safety, a kid is shown drinking a plutonium-laced soda, with a happy and refreshed face. The subtext is clear: not only is nuclear power safe, but a little radiation is even good for you! Plutonium, which is a necessary part of nuclear arsenal and one of the most dangerous radioactive elements is reinvented as a mundane commodity (a soda pop), so trivial that it can even be drunk. As Hecht (2012: 8) argues, “For all the efforts at making nuclear things exceptional, there were opposing attempts to render them banal.” While Hiroshima and Nagasaki had “served as portentous pictograms of nuclear holocaust, material proof of the unbridled power of humanity to destroy civilization and nature” (Wills 2003), Mr. Pluto was a reminder of the gradual normalization of nuclear things, a new form of triviality that attempted to make people think and feel a particular way about nuclearity.[38]

Illustration 8: *Pluto-kun* (https://www.youtube.com/watch?v=sOFg8oWMHRM)

[38] Little has been written on Mr. Pluto, except for a general critique on its implied propaganda (see Gofman 1994).

Third, nuclear companies began to weave a tight web of relationships with Japanese governmental elites. For instance, bureaucrats in the nuclear regulatory agencies were promised highly paid position in the private sectors of electric power companies after their retirement, a practice known as *amakudari*, which literally means "descent from heaven" (Nakamura and Kikuchi 2011). Unfortunately, this positioned civil servants as special advisers in corporations of the business communities (Kurokawa 2016), leading to a strong case of regulatory capture, where nuclear regulators began to regulate in the interest of the so-called regulated (Kingston 2012).[39] Indeed, before the Fukushima nuclear disaster, nuclear safety felt under the tutelage of the Ministry of Economy, Trade, and Industry (METI). As a nuclear regulator, METI occupied a very ambivalent space, promoting nuclear power while also being the safety regulator.

Throughout the 60s, METI deployed vast financial resources to make nuclear energy a national priority for an island country that lacked oil and natural resources (Kingston 2012).[40] Since Japan had decided to pursue a policy of heavy industrialization in its post-war economic recovery (see Johnson 1982) stable and cheap sources of energy were required. The first Oil Crisis of 1973 cemented the necessity of nuclear power for Japan. For the state, nuclear power consequently became more than mere electricity; it stood as a symbol of the energy independence of a Japan that would become an economic

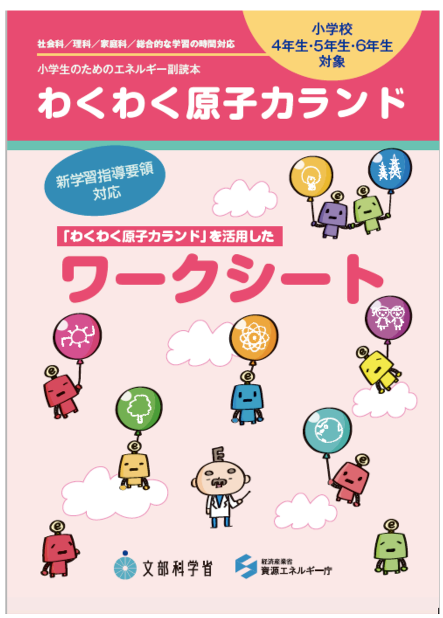
[39] The term "regulatory capture" comes from the economist George Stigler and occurs when regulatory agencies (such as the former nuclear regulators of Japan) end up being dominated by the very industries that they were supposed to regulate.

[40] METI used to be known as the Ministry of International Trade and Industry (MITI)

juggernaut.[41] Gradually, nuclear power became central to the post-war economic recovery of Japan and could be seen as a pillar for a strong modern nation state.

Fourth, national education programs solidified the discourse of nuclear safety amongst the younger population, while building a foundation of propaganda and nationalist pride. For example, educational material provided by the Ministry of Education downplayed any reference to nuclear accidents, such as the Chernobyl nuclear disaster (Pilling 2014: 265). On the other hand, textbooks called *Waku waku genshiryoku land* or "The exciting nuclear power land" were distributed to primary school children (Ministry of Education, Culture, Sports, Science and Technology and Ministry of Economy, Trade and Industry 2010).

Illustration 8: *Waku waku genshiryoku land*



[41] The Japanese state had always embraced technology as a way to create and maintain a gap between itself and other countries; the *wakon yōsai* idiom of pre-war Japan, translated as "Japanese spirit and Western techniques" is a good example (see Mizuno 2009). Nuclear power would, in this context, serve such purpose.

These textbooks described nuclear energy as safe and clean, while emphasizing the virtue of their technical prowess (see Takagi School 2003 for more on the problem of education). It is particularly important to note that Japan has a very specific education system, where the Ministry of Education and the Ministry of Science and Technology (an important actor of the nuclear village) have been fused together to create the current Ministry of Education, Culture, Sports, Science and Technology (MEXT). This fusion resulted in a pro-nuclear ministry that is also in charge of national education.[42]

Last but not least, scientists also constituted a crucial component of the pro-nuclear propaganda. Financial support from the utilities companies reached scholars under the guise of research funds (Suganuma 2016: 224) and pro-nuclear physicists constituted major players in the domain of nuclear safety (Nakamura and Kikuchi 2011). Academics who criticized the development of nuclear power and the possible risk of radioactive contamination were isolated from all major media appearance, scientific agencies, as well as from the most authoritative position in nuclear science (Suganuma 2016: 224).

2.3 Do Androids Dream of Nuclear Energy?

It should be noted that multiple pro- and anti-nuclear positions have always existed within Japanese political elites. Nuclear power is a highly-politicized issue and different states of mind are found amidst ministries, the National Diet (Japan's parliament), and Japan scientific organizations. In that regard, a true consensus around nuclear power never existed per se. Nonetheless, even while acknowledging the complexity of the Japanese

[42] For example, the current minister of MEXT is Hiroshi Hase, a former pro-wrestler who knows much about doing a perfect german-supplex, but little about the risk of radiation. In 2015, the Prime Minister Abe Shinzō, a fervent pro-nuclear proponent, announced that Hase would be a part of his cabinet and appointed him to MEXT.

political situation on nuclear power, it is safe to assume that a very influential assemblage of different actors aimed to garner cultural acceptance around the safety and necessity of nuclear power.

Often, this was done through carefully cultivating an affective relationship so that Japanese citizens could experience a socially appropriate response toward nuclearity. This was notably the case of Yukio, a former nuclear engineer that I interviewed on January 29, 2016. Yukio had become known as a whistle blower of Japanese nuclear security. His long-time predictions of the dangers and instability of nuclear power plants unfortunately became true after Fukushima. As he first told me during our interview:

> When I was young, I was first interested in geology, that's what I wanted to do. But in the 60s, the 'nuclear era' (*genshiryoku jidai*) was beginning and nuclear energy was present everywhere. Tōkai was built during this era [Tōkai Nuclear Power Plant, Japan's first commercial nuclear power plant]. Coal and oil were described as archaic sources of energy. Even in cartoons, nuclear power was everywhere; think of Astro Boy for instance! I was seduced by the promise of nuclear power. It was labeled as something that was completely safe and peaceful, something that was different from nuclear arsenals.

As Yukio further explained to me, nuclear power quickly won the heart of young post-war Japanese, who for instance followed the adventure of Astro Boy, a fictional character born under the pen stroke of cartoonist Osamu Tezuka. In the cartoon, Astro Boy is a little android created by the fictional Dr. Tenma, a roboticist working for the Japanese Minister of Science. This little android possesses an artificial heart powered by nuclear energy. As such, Astro perfectly encapsulated the dominant narrative of the nuclear era of the 60s, where nuclear power was no longer associated with the scars of atomic bombings, nor with its ensuing trauma of radioactive injuries. Indeed, where nuclear power once took life, it now protected it; in the comics, Astro is constantly shown as fighting against evil and injustice. The very own Japanese name of Astro (*tetsuwan atomu*), or *Mighty Atom*, is devoid of any negativity, rather embodying a new political environment around nuclear power, exempt of fear and harm. As Yukio explained to me, in this nuclear era, an android powered by nuclear matter gradually began to replace Godzilla as the cultural icon of nuclear power.[43]

Masco (2014) has discussed the importance of understanding how historically crafted images and logics of imminent nuclear danger allow feelings to be nationalized. In the U.S. one could think of the terrifying giant ants of the 1954 movie *Them!* (see Masco 2006), which represent the perils of mutation combined with communism. In popular depictions, it is interesting to denote the place that radioactive elements have in the creation of heroes and saviors, rather than mere monsters, such as giants ants or mutated green lizards. For instance, in post-war American cartoons, radioactive elements often endow human beings with supernatural powers. Peter Parker gets bitten by a radioactive spider and becomes the famous Spider-Man. The scientist Bruce Banner get exposed to Gamma radiation during a failed experiment and transforms itself into the incredible Hulk, a giant

[43] However, even the role of Godzilla gradually began to shift from a monster that ravaged Japan to a protector of life, fighting evil robots and monstrous creatures as to save Japan. This is clearly apparent when one looks at the movies of Godzilla from the 70s and 80s.

with superhuman strength. The X-Men are literally mutants who possess diverse abilities, such as regeneration capacities or laser visions.

Yet, in the Japanese collective imagination that Yukio described to me, radioactive elements did not empower human beings with such feats of strength. There was always a clear-cut separation between the human realm and the technological one. For instance, Astro was *created* by human scientists. Radioactivity can consequently be seen as a non-human element that remains under the control of human agency, harnessed for the well-being of the Japanese nation. Indeed, radioactive elements are not in a situation of accidents, where a radioactive spider, escape to bite human weaklings. Moreover, Astro, as a robot, is immunized to the potential harmful effects of radiation exposure. While Astro takes the appearance of a young boy, there is no sexual organs under his black metallic trousers. This suggests that Astro is not affected by the attributes of radiation-induced illness, which, as Masco summarizes, "includes a displacement in time (sometimes occurring decades after exposure) and a potential to be genetically transferred across generations" (2006: 300), one can argue that Astro disregards specific characteristics of radiation hazard. Indeed, as an android that is neither boy, nor machine, Astro stands as a hybrid, which, as Masco highlights, is an offspring of two different species stuck in "a form of generational stasis, allowing one to separate analytically the distinct genetic lines that came together to create the infertile being" (2006: 301).

As Yukio explained to me, nuclear scientists were immersed in such carefully crafted images, of little androids invulnerable to radiation, which are in fact powered by them. It is in such contexts that nuclear power incited seductive feelings of limitless energy, heroic saviors, and ultimately, the promise of the "good life" (Berlant 2011). The experience of Yukio, which is far from unique amidst the nuclear engineers of this generation, demonstrates that the introduction of nuclear power in Japan did not merely lead to the creation of material infrastructures, such as power plants and reactors. It also ushered the creation of symbolic and affective infrastructure (see also Masco 2014) trapping some forms of nuclear harm into the realm of the past.

Gradually, specific imaginary around nuclear power began to supplant former ones, while their affective logics often stranded far away from the material reality of radioactivity. Furthermore, as Yukio explained to me, coal and oil were depicted as archaic sources of energy and nuclear power promised a world that would no longer be dependent on such natural resources. As Yukio argued, this dream of renewable and limitless energy was epitomized by the Monju project, a reprocessing nuclear fuel facility plant that was supposed to "recycle" nuclear waste that could be used over and over again.[44] Nuclear power was in such a domain of technical expertise, of which the Japanese scientist could be proud of.

Yet, the carefully crafted fairy tale that surrounded nuclear power soon started to crumble for scientists like Yukio. First, he began to realize that the same people who had created the bomb, were, under the Atom for Peace program, now promoting nuclear power. In this, he became suspicious of the propaganda that aimed to advance the infrastructure of nuclear power in Japan under the banner of peace. In particular, he argued that nuclear power allowed Japan to potentially produce atomic weapons if the need was to arise. Pointing toward the reprocessing facility of Monju, Yukio explained that the project could

[44] The Japanese were the biggest promoters of nuclear breeders and reprocessing. Fast-breeder reactors were a cornerstone of Japan's atomic energy strategy dating back to the 1950s. They are supposed to use nuclear fuel from other atomic plants and are designed to produce more fuel than they consume.

process plutonium, which is an "essential resource for the creation of a nuclear arsenal."[45] Additionally, Yukio saw crucial safety flaws in the security system of nuclear power plants. As he emphasized: "Even the laws that surround nuclear infrastructure have been created to first promote nuclear advancement. They have never been created for public safety (*minkan hoken*)!" The constant promotion of nuclear power (*genshiryoku suishin*) over matter of technical safety became more problematic as he stumbled on serious data falsification by nuclear operators and the cover up of radioactive releases (Koide 2011).

These unfortunate discoveries led Yukio and other nuclear engineers of his generation to become ardent anti-nuclear activists through the 70s, cautioning many of the potential dangers of nuclear power plants. This culminated with the creation of the Kumatori 6, a group of six researchers, namely Hiroaki Koide, Tetsuji Imanaka, Keiji Kobayashi, Shinji Kawano, Toru Ebisawa and Takeshi Seo. Together, these scientists would create the *Nuclear Safety Research Group*, investigating the risks and demerits of nuclear energy for many years. Among anti-nuclear activists, these men were already the stuff of legends and had become nicknamed the "Six Anti-Nuclear Samurais of Kyoto University."[46]

On February 10, 2016, I participated in their very last *Nuclear Safety Issues Seminar*, given at the *Kyoto University Research Reactor Institute*. Many anti-nuclear activists were present on that day and explained to me that these researchers were "true scientists," working not for the nation-state, but for the people of Japan. While members of the Kumatori 6 were by now retired or deceased, their work had been pivotal in highlighting

[45] In 1994, Prime Minister Tsutomu Hata famously told reporters that "it's certainly the case that Japan has the capability to possess nuclear weapons but has not made them" (cf. Chanlett-Avery and Nikitin 2009: 6)

[46] For the Japanese website: http://www.rri.kyoto-u.ac.jp/NSRG/

the fact that nuclear power could never be qualified as foolproof. One of their long-time recurrent critiques was directed toward the blind trust that state officials and nuclear utilities had put toward nuclear technology, which were perceived has irremediably falling under the control of human actors.

Yet, in a similarly to Yukio's experience, the warnings of the Kumatori 6 never went beyond the ears of anti-nuclear activists. Indeed, since nuclear science was a tool for forging a strong nation-state, nuclear scientists were de facto expected to be the co-maker of a strong, powerful, modern, and energy-independent Japan. As Yukio put it to me: "As a young student, when I first started to study nuclear engineering, we were supposed to be doing research *for* the country; so questioning the safety of nuclear power always brought a lot of tensions…" As Yukio exemplifies, the normative culture of nuclear science had always co-evolved with the state vision of nuclear power. It was in such inseparable from the dominant values embedded in it – namely a source of clean, safe, and unlimited energy contributing to the furthering of Japan's economic prosperity. For this reason, those who criticized nuclear power like Yukio or the Kumatori 6 were excluded from the major scientific activities. The Japanese scholar Unryu Suganuma (2016: 225) perfectly summarized the situation of such era:

> […] anti-nuclear power scholars have not received any research funds from the government or private corporations, such as TEPCO [Tokyo Electric Power Company]. […] Their opinion [sic] have been shut down from the public by all major media, including newspapers, television networks, academic journals, and weekly mass magazines. As a result, the only place that the anti-nuclear power

scholars have been able to publish their opinion is the Japanese Playboy Weekly magazine, which the public does not take seriously.

Members of the Kumatori 6 had precisely been the victims of such pressure and all had retired with the position of assistant professor (*kōshi*) – the lowest rank of academic professorship. Many believed that their cogent public critique of the nuclear village had earned them an honorable form of purgatory as “permanent assistant professors.”

2.4 The Nuclear Safety Myth

Beyond “rogue” nuclear scientists, many local communities had initially refused to have power plants installed on their land and rejected the safety rhetoric of the nuclear village as mere attempts of propaganda (see Dusinberre and Aldrich 2011). Unable to alter such dissensus on nuclear power, state officials had to find a way to bypass such difficulties. They did so by searching for sites where resistance would be least likely (Aldrich 2008). Consequently, bureaucrats in METI developed economic policies that would reward cooperation with the nuclear utilities, by presenting nuclear power plants as a way of saving the rural lifestyle of small villages, notably affected by depopulation or depressed economies. It was precisely these “third-rate” peripheral regions, like Fukushima prefecture, that were seen as producers of energy for the main metropolitan centers (Tokyo), creating an asymmetrical relationship between rural and urban spaces, between center and periphery, which was not merely economical, but also informational and technological (Yamashita 2012). As Allison (2013: 186) argues, residents of these regions often had to accept the potential dangers of nuclear power in order to acquire revenues and jobs. In this, the very strength of the nuclear safety myth ironically rested on a basis of precarious social and economic conditions (see also Nixon 2011 for the link between poverty and contamination).

Issues of resistance toward nuclear matter were also conducted by the strong anti-nuclear movement of Japan, which, as we saw earlier, rise to prominence after the Lucky Dragon Five incident. In January 2016, I had the opportunity to learn more about the complex history of anti-nuclear movements in Japan, by visiting one of the main anti-nuclear public interest organizations, the Citizens' Nuclear Information Center (CNIC) situated in Tokyo. I was initially taken aback by the small size of the center, since CNIC is supposed to be one of the most prominent anti-nuclear organizations of Japan. There, I met a core member of the organization, Shuzi, who explained to me that governing power (*shihai kenryoku*) and huge financial capital (*kyodai shihon*) from America had influenced nuclear power. During our interview, Shuzi argued that a strong combination of state control and capitalist forces had produced an extremely powerful organization, which was highly reluctant to sharing information around nuclear accidents.

Illustration 9: *The archives of CNIC* (photo by the author)

In such a context, CNIC had been actively trying to investigate the situation of nuclear power by following small nuclear incidents throughout Japanese media. The center had for instance revealed that there was insufficient investigation during an hydrogen explosion and water leak at the Hamaoka nuclear power plant in 2001. Nonetheless, Shuzi informed me that the known situation of the list of nuclear incidents in Japan was probably only the "tip of the iceberg" (*hyōzan no hikkaku*). As he further pursued:

> Enabling the information to become public (*kōkai*) first and rapidly has never been part of the mentality of the government. We have always faced many problems in trying to access particular information [about nuclear leakages or incident]. A lot of data is simply never made public. For example, information surrounding physical protection or the data gathered by private contractors is almost impossible to obtain. Many companies refused to share it, under the pretext that this information is part of the 'company's secrets.' Of course, we understand that such needs exist, but it needs to be a little bit more balance. If things are never made public how can you create appropriated policies and law?

CNIC's difficulty in gathering data was made quite apparent when I had the opportunity to browse the center's archives. The so-called archives in question consisted mostly of vivid orange binders, filled with different journal clippings on nuclear-related themes from around the world. In the aftermath of the Chernobyl disaster, Kuchinskaya (2014: 2) highlights the double twist that surrounds radioactive contamination in Belarus, arguing that an imperceptible hazard was made publicly invisible. Similarly, in regards to chemical exposure, Murphy (2006) argues that imperceptibility is generated throughout the history of knowledge practices, by means of strategic suspensions of perception. This situation, in which chemical exposures are "granted or not granted existence" (Murphy 2006: 7), creates historically specific terrains of invisibility, the outcomes of what she calls "regimes of perceptibility" (2006: 111).

The hardships encountered by CNIC echo Kuchinskaya's and Murphy's findings, as company secrecy or state irresponsibility had rendered already imperceptible risks doubly invisible, forcing members of CNIC to collect scraps and bits of information via ways of journal clippings. Moreover, Shuzi explained to me that the anti-nuclear movement of Japan had faced difficulty beyond its tense relationships with the Japanese state or nuclear utilities. As he argued, the movement itself had succumbed to internal tensions by the end of 60s, resulting in the creation of multiple factions, each possessing different agendas and demands. For instance, some factions were against nuclear weapons, while other factions were both against nuclear arsenal and nuclear power plants. These tensions, as well as other historical contingencies, soon contributed to the apparition of a strong apolitical stance amidst anti-nuclear activists. Asahi, a retired salaryman and member of CNIC further commented on this situation when I interviewed him on May 6, 2017:

> The current 'apolitical stance' [of the anti-nuclear movement] is a consequence of the political movements surrounding May 68. During 68-72, political movements and parties were very intense, but they have gradually been efficiently repressed. After the tumultuous period of the student movements (*daigaku funsō*), there was a sort of 'allergy' to politics. In the 80s and 90s, if you had an opposite [political]

> ideology (*datsu ideorogī*), you were inevitably depicted as someone who was against the government (*datsu seiji*/*datsu seitō*). Neutralism (*chūritsu shūgi*) was the norm. Now, the word 'political' (*seijiteki*) has become a sort of taboo (*tabū*), especially in the last 20 years. The communist party (*kyōsantō*) has also contributed to such an atmosphere. The communist party had always maintained a very strong anti-nuclear position. Yet, there was a lot of anti-nuclear individuals who did not want to be associated with this party. That's why a lot of anti-nuclear nowadays have started to embrace a 'non-political' discourse – to distance themselves from the communist party.

The political radicalism of those years – and their ultimate failure – would subsequently facilitate the "proregime discourse of the antinuclear movement as akin to a terrorist movement that regular citizens should stay away from" (Kimura 2016: 120). This allergy to the political does not imply that members of anti-nuclear organizations believed themselves to be apolitical. As Asahi explained to me: "In the anti-nuclear organization, we do, of course, talk about politics and we do think that it's political, but we do that among ourselves. In public we don't talk politics."

In the Indonesian context, Tsing (2005) argues that sociocultural practices linked with nature's protection may act as a strategy for becoming socially engaged without being perceived as explicitly political. She contends that Indonesian students in the 60s and 70s joined "nature lover" clubs as a means to enact activism in a "non-political" way. The position of anti-nuclear activists in Japan is similar and has forced many activists to distance themselves from entering reified political system. However, by doing so, the anti-nuclear movement failed to pierce the broader sphere of influence and power of Japanese political elites. What is important is that the capacity of anti-nuclear activists for political agency was very much the product of such a history.[47]

In the end, while nuclear power was never seamlessly internalized by members of the Japanese society, the anti-nuclear movement largely failed to gather a successful momentum that could translate itself into a concrete political strength. Nuclear power consequently became embedded in the political, economic, and social context of modern Japan (Fujigaki 2015). As explained earlier, this political culture of propaganda, deceit and collusion would strengthen the creation of a nuclear safety myth, where the dangers of radioactive elements often remained externalities in the Japanese discourse of nuclear power. This separation finds its expression in the ignorance of the suffering of the Japanese victims of atomic weapons, in the little figure of Astro Boy, in the exclusion of critical scientists like Yukio, or in the lack of public accessibility to nuclear information. The myth of nuclear safety would eventually engender an "inadequate education in radiation emergency medicine for hospital physicians and medical staff working near nuclear facilities" (Japan Broadcasting Corporation 2008: 132). For example, radiation emergency treatment did not receive priority within the Nuclear Disaster Prevention System and the basic laws for disaster prevention lacked the perspective of medical doctors (ibid).

Radiation itself remained an externality in the 1999 Tokaimura nuclear incident, when two workers were killed by radiation exposure.[48] According to the IAEA, the cause of the accident was "human error and serious breaches of safety principles" (World Nuclear

[47] This capacity for political agency would come back to influence the civic response to the Fukushima disaster, especially in the domain of citizen science, as we will see later on.
[48] In 1999, three Japanese workers received high doses of radiation while preparing fuel for an experimental reactor; two of them died as a result from the exposure (Japan Broadcasting Corporation 2008)

Association 2013). Mitchell (2002) has argued that the entire politics of the twentieth century correspond to the attribution of agency to human actors, subsequently treating all other forces as a passive world of nature. This was precisely the politics of nuclear things in Japan. When radiation did harm, such as in the aforementioned incident, it was the result of a human error. For the political and industrial elites of Japan, the existence of nuclear power depended on "designating certain costs as external, certain claims as secondary" (Mitchell 2002: 300). In the search for consensus on the peaceful use of nuclear power, the dangers of radiation were not necessarily brushed off, but rather depicted as results of the un-peaceful use of nuclear energy or as a remnant of a past that many wanted to forget about. Radioactive risks were external to the national project of clean energy, economic achievement, and technological development.

For industrial growth, this was not merely unique to nuclear power. In his detailed study of industrial disease in Japan, historian Brett Walker (2010) highlights how the path between unbridled industrial prosperity and health effects often required that the later be sacrificed. Walker argues that the pain of industrial pollution, caused for example by methylmercury poisoning throughout the early 70s in Japan, was less easily interpreted and contextualized as dignified, since it went against the national endeavor of post-war economic recovery. Nuclear power was a sacrifice toward unbridled industrial prosperity, but it was also a sacrifice unique to Japan, as the only country attacked by nuclear bombs.

While industrial chemicals had not yet been officially acknowledged as hurting the public collective imaginary, the case of nuclear power was different.[49] As the only country

[49] Throughout the 70s, numerous cases of industrial contamination have affected Japanese communities. As Walker (2010) contends, the "big four" were the Niigata methylmercury poisoning (1971), the Yokkaichi asthma (1972), the Toyama "it hurts, it hurts disease" (1972), and the Minamata methylmercury poisoning

that suffered the wrath of atomic bombings, nuclear power had initially been linked with tropes of annihilation. Thus, incredible efforts were required to shift such an image. Moreover, while industrial factories were invariably icons of modern progress for Japan, nuclear power was *the* ultimate icon of progress. Indeed, it was the electricity produced by nuclear power that enabled factories to produce their much-needed chemicals or commodities.

From a physical viewpoint, radiation is energy in the process of being transmitted, which travels through space. For nuclear things to get accepted after Hiroshima, Nagasaki, and the Lucky Dragon Five, radiation couldn't be anything else. Radioactive elements had to be presented as falling under the control of human agency – at any cost. From something that produced awful keloid scars in the aftermath of Hiroshima and Nagasaki bombings, the new incarnation of radiation was also made banal and ordinary; part of a commodity chain in nuclear power plants, producing enough energy to boil water, whose steam would make an electrical generator turn on itself.

As exemplified so far, nuclear power was part of a very nuanced atmosphere of both good and bad things. Most of the time, these contradictory discourses co-existed and evolved together. They were mobilized for peculiar reasons and by different people. Yet, there were always specific categories of harms that had to remain invisible. As opposed to the experience of Cold-War Americans, nuclear power in Japan was no part of the brinkmanship between East and West. It was devoid, officially speaking, of an imaginary of annihilation and destruction. The governance of nuclear things was a political problem, where how to govern nuclearity was invariably linked with the governance of its

(1973). It would take decades for the Japanese state and corporate polluter to publicly acknowledge such harms.

imagination. War, nuclear arsenals, and radioactive hazards confronted peace, dreams of infinite energy, and safety. Without such clear divisions, nuclear power would have ceased to be accepted. Recognizing nuclear power as a source of harm, rather than an icon of modern progress, was to go against Japan's entire modern experience. Organizing these exclusions was a complex political project, but human interests, fears, and desires did become part of the material form of radioactivity. Expertise surrounding nuclear matter ultimately consisted of "a certain way of organizing the amalgam of human and nonhuman, things and ideas, so that the human, the intellectual, the realm of intentions and ideas seems to come first and to control and organize the nonhuman" (Mitchell 2002: 42-43).[50] Much of this expert organization would come to a crash in 2011 – or would it?

2.5 An International Perspective on Radiological Safety

Before examining the case of the Fukushima nuclear disaster, it is also vital to acknowledge that international forces have shaped the expert politics of radiological safety in their own ways. These "international" forces, more than often American or European ones, have laid the foundation for the current regulations on radiation safety, while organizing their own expert amalgam of human and nonhuman agencies.

The politics of radiological safety is highly complex, as well as being riddled with numerous scientific disagreements. In general, the field of radiological protection adopts a linear non-threshold (LNT) model, based on the seminal work of American geneticists Hermann Joseph Muller and Curt Stern. This model argues that there is no safe threshold of radiation exposure. It states that risk is proportional to the level of exposure: "a lethal

[50] Moreover, the sensorial imperceptibility of radioactive contamination made it an easy hazard to conceal.

dose will produce a lethal effect, half of that dose will produce half of that effect, and so on, with no level being completely harmless" (National Research Council 2006 cf. Goldstein and Stawkowski 2015: 72).[51]

In parallel to the gradual acceptance of the LNT model, in the 1950s, a host of international institutions became increasingly motivated by the need to set working limits on occupational exposures to radiation, especially for the growing nuclear utility industries (see Hecht 2012). This project was initially promoted by IAEA, whose understanding of radiological protection was to "provide an appropriate standard of protection for humans, without unduly limiting the beneficial practices giving rise to radiation exposure" (Hecht 2012: 97). The collection and analysis of all available data on the biological and environmental effects of ionizing radiation was imparted to the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) and the final responsibility for setting internationally authoritative standards went to the International Commission for Radiological Protection (ICRP) (Hecht 2012: 185-186).

Yet, the effort to articulate a radiation protection culture in the form of quantitative and qualitative recommendations were met by an important hurdle. Indeed, since all exposures are, according to the LNT model, detrimental to one's health, how can a permissible threshold be set in ethical ways? In order to deal with this problem, ICRP promotes an exposure philosophy known as ALARA or "As low as reasonably achievable." While enabling the setting of particular baselines of radiological safety, this exposure

[51] This model, while generally being accepted by the scientific community, has always been in conflict with three other models: "the threshold model (which proposes that low doses are harmless); the radiation hormesis model (which proposes that small doses can be beneficial); and the supralinear model (which proposes that ionizing radiation at very low doses is more harmful per unit dose than radiation at higher doses […]" (Goldstein and Stawkowski 2015: 70).

philosophy also came under scrutinity. As Hecht argues, it became apparent that "As Low as" reflected the "consensus that all radiation exposure has some health effect" and that "reasonably achievable" actually represented "a concession to economic and political imperatives (and power)" (Hecht 2012: 44; see also Cram 2016). Furthermore, many scholars have criticized the independence of ICRP, contending that the organization brought economic and political benefits to the nuclear lobby by minimizing the issue of health damage from radiation, notably around low dose exposure (Nakagawa 1991; Ribault and Ribault 2012; Asanuma-Brice 2014).[52] As we will later see, these organizations have played a crucial role during the Fukushima nuclear disaster.

It is also important to understand that the data about radiation exposure, which international institutions aimed to turn into global knowledge, was mainly coming from a very specific source: the atomic bombings of Japan. Indeed, the bombings of Hiroshima and Nagasaki had produced a "golden opportunity" to study first-hand the effects of radiation exposure on human beings (for more see Gusterson 1998: 105). After World War II, these studies were initially pursued in secret by American authorities. Survivor data, known as the Lifespan Study, was first collected by the Atomic Bomb Casualty Commission (ABCC), later to be succeeded by the Radiation Effects Research Foundation (RERF), which continues to produce research on the survivors, including their children. As Goldstein and Stawkowski (2015: 72) argue, the original work produced by the Lifespan Study would create "standards for all sorts of later understandings involving ionizing radiation, public health, community and worker safety, environmental litigation, etc. in the

[52] In the aftermath of the Fukushima disaster, an Independent Report revealed that the Japanese Federation of Electric Power Companies (FEPC) had successfully lobbied ICRP radiation specialists so as to relax radiation protection standards (National Diet of Japan 2012: 5.2.3). FEPC notably covered the travel costs for ICRP members attending international conferences through the Radiation Effects Association (ibid).

burgeoning nuclear industries associated with the post-World War II years – both war-related and energy-related."

Yet, while the Lifespan Study attempted to enact global expertise about radiation harm, a focus on the situated nature of the knowledge it produced reveals crucial limitations. First, while the ABCC was founded in 1946, the actual study began in the 50s. Consequently, the study did not include the people that had passed away from the effects of high doses of radiation. Physician and epidemiologist Alice Stewart claimed that this omission led to an unrepresentative study population, since only healthy survivors were part of the study (Stewart and Kneale 2000; see also Green 1999).

Secondly, the study only focused on external exposure by radiation rays due to waves of gamma and neutron radiation. After an atomic explosion, these rays expose individuals to short-term and high external doses of radiation. The study was insufficient to understand the risks associated with the numerous radioactive particles released during the nuclear fallout (Takahashi 2012; Yagasaki 2016). Beyond exposing individuals to external rays of radiation, a nuclear bomb produces nuclear fallout, which consists of residual radioactive material propelled into the atmosphere. These are not rays, but particles that mix with the dust and ash created when a nuclear weapon explodes. In Hiroshima, the fallout got mixed with pyrocumulus clouds, producing the infamous "black rain" (*kuroi ame*). Crucially, the Lifespan Study never included the estimates of inhaled or ingested radioactive particles in their calculations. Nor did the study includes estimates of the exposure to residual radiation, especially for citizens who had returned in the area after the bombings. In this, the Lifespan studies cannot provide scientific standards on the dangers of internal radioactive contamination.

Third, the actual study of external dose of exposure was dependent on a process of dose reconstruction, which is, as historian Robert Jacobs (2014: 5) argues, “more aspirational rather than factual.” In cases of external exposure, radiation passes through the body, damages the genetic material, and then leaves the body. If an individual does not wear a radiation monitoring device at the time of the exposure, there is no way to know the actual level that this individual has received. Thus, the dosage estimates produced by the Lifespan Study were based on the remembered positions of the hibakusha. Since the epicenters of the bombs were known, it later became possible to gage where the bursts of radiation waves were directed and to recreate mathematically the dose received by irradiated victims. Yet, the data of the Lifespan study was based on the subjective memories of the irradiated victims, which were asked to remember their initial location during the nuclear explosion. According to Jacobs, this was sometimes done 10 years after the event itself.[53] As we will later see, a very similar pattern of radioactive exposure measurement was used after Fukushima, with the aforementioned pitfall that such methods entail.

In the end, the scientific status of the Lifespan Study, especially what they found or what they fail to find, would continue to play, as Goldstein and Stawkowski (2015: 93) argues, “an important role not only in scientific debates about the genetic effects of ionizing radiation, but also dozens of other debates taking place in scientific journals and courtrooms that still rely on Hiroshima and Nagasaki atomic bomb data as the standard against which all other information is compared.” One of those debates concerns the

[53] Mentioned during his public speech entitled “Beyond Hiroshima and Nagasaki: The History of 2,000 Nuclear Weapon Tests and Global Hibakusha,” given at Hiroshima City University on August 25, 2018.

harmfulness of radiation at low doses. Indeed, the Lifespan Study never brought scientific evidence that indicated cancer risk or immediate adverse health effects at doses below 100 mSv per year. Indeed, the study would lead scientists to the conclusion that high doses of radiation, above 100 mSv per year, may cause cancers. However, it never established a firm causal link of diseases below 100 mSv (United States Nuclear Regulatory Commission 2015).[54] The debate around the harmfulness of high doses versus low doses of exposure still rage to these days, only fueled by Fukushima.

Ultimately, these findings were mobilized for different purposes. For instance, organization like ICRP or UNSCEAR have taken a precautionary approach by taking into account the LNT model. However, the lack of evidence of adverse health effects below 100 mSv, sitting particularly well with the nuclear industry's desire to set a permissible threshold for exposure, was often mobilized as synonymous that low doses were not dangerous. This viewpoint gained traction as nuclear industries and the imperatives of war became more important. In particular, the nuclear arms race of the Cold War began to redefine how "harm" was to be understood (Goldstein 2014).[55] The latter point is made salient in examining the hardship that John Gofman faced when asked by the Atomic Energy Commission to establish a Biomedical Research Division at the Lawrence Livermore National Laboratory.[56] Gofman, whose earliest researches were in nuclear physics and chemistry, notably in close connection to the Manhattan Project, became

[54] Even nowadays, for different agencies such as ICRP, UNSCEAR, or IAEA, available scientific evidence does not indicate clear cancer risk or immediate effects at doses below 100 mSv per year.

[55] Johnston describes statements contending that "low-level exposure to radiation represents no human threat," as being "artifact[s] of Cold War-era science that [were] shaped to meet government and industry needs" (2011 *online*).

[56] This project was created to evaluate the health effects of all types of nuclear radiation.

instrumental in the adoption of the LNT model (see Committee For Nuclear Responsibility). However, by 1969, in the midst of the Cold War, his warnings about the risks of low dose exposure were downplayed. Gofman argued that the main intention of the atomic energy program of the Department of Energy was as follows: "We must prove that low doses of radiation are not harmful" (Gofman 1994 *online*). Such a view, he contended (ibid), was necessary so as to deal with the problem of nuclear waste during the arm race:

> No problem — there's a safe dose, nobody's going to get exposed to more than the safe dose. The clean-up and disposal of waste has been estimated to be in the billions, if they're really going to clean up Hanford [a site that manufactured plutonium for nuclear arsenal] and Savannah River and all the rest. You won't have to bury things in these fancy vaults. You won't have to worry about transport. You can even dispose of it in ordinary landfills. That will be the result. That's what the future will be. If low doses don't matter, the workers can get more and their families can get more by being in the vicinity. That's what we face.[57]

The 1986 Chernobyl Nuclear Disaster further drove the aforementioned debates surrounding radiation harm. Anthropologists and those sympathetic to the ethnographical approach would later set out to write about the disaster, laying an important foundation to a series of claims about self-voice and self-respect (see Pena-Vega 2004; Phillips 2004; Brown 2013; Petryna 2013; Kuchinskaya 2014). By putting emphasis on local experiences as their primary analytical frame, anthropologists have highlighted the numerous claims of

[57] See https://ratical.org/radiation/CNR/synapse.html

health damage that victims and local experts perceived as being linked with the residual radioactivity of Chernobyl.

While international expert organization such as the IAEA and UNSCEAR have acknowledged some of those ailments, most famously thyroid cancers in children (caused by the ingestion of radioactive iodine), they claimed that the most significant health impacts were psychological effects, notably due to the fear of radiation and ensuing psychological distress (Chernobyl Forum 2003-2005; see also Petryna 2013). The emphasis on the psychological harm of radiation finds its epitome in the notion of radiophobia. As anthropologist Magdalena Stawkowski (2017: 360) summarized: “Radiophobia was first recognized by science experts and industry specialists after the 1986 Chernobyl disaster in Ukraine and used to describe public reaction considered out of proportion to the real risk of the accident.”

Yet, these international assessments of Chernobyl’s health effects rested heavily on the hegemonic understanding of radiation harm – as defined by the limited study of Hiroshima and Nagasaki. The impacts of atomic bombings and nuclear accidents were, however, far from being identical, especially in the duration of the exposure to radiation and in the nature of radionuclides released. Nuclear disasters, like the one at Chernobyl, have produced radioactive fallout, with some contaminants having very long life spans. This brings a different set of questions, such as the impact of low-dose to radiation in the long term. Yet, instead of bringing the pitfalls of such uncertainties to broad day light, the accident of Chernobyl has resulted “in increasingly vigorous expert assertions concerning the solid scientific grounds for current policies and the expert control over areas of uncertainty” (Stephen 2002: 92).

The downplaying of radiation danger was notably explained by the political tensions of the Cold War, which were crucial in shaping the current understandings of radiation hazards. As Petryna (2013) argues, many Western scientists have dismissed scientific studies produced locally after Chernobyl, from fear that their findings were compromised by the political situations of the disaster. This was made evident in the disagreements about the genetic effects of low-dose radiation exposure between James Neel, a central American figure in radiation studies of Japanese populations, and Yuri Dubrova, who analyzed the 1986 Chernobyl nuclear power plant accident. Anthropologists Donna Goldstein and Magdalena Stawkowski (2015) have produced an exhaustive exploration of such debates, arguing that the gradual acceptation of the Hiroshima-Nagasaki studies' findings was partly due to the politics of the Cold War, where American scientists elevated US-Japanese data at the expense of their Soviet counterparts (see also Brown 2013). While the A-bomb survivor studies have become an accepted gold standard for understanding radiation dangers, Soviet scientific studies on low-dose exposure that show negative health impacts were considered "ideologically tainted" (Goldstein and Stawkowski 2015; see also Takahashi 2012). This is a legacy that continues to affect radiological protection by producing scientific uncertainty around radioactive contamination, especially around low-dose exposure. As Goldstein summarizes: "[The] Cold War helped to create a post–Cold War atmosphere that at some level discourages the study of a broader range of contemporary illnesses that might be traceable to past contamination, or similarly discourages litigation using public health concerns against the government or its corporate partners from this era" (2014: 583).

In the end, the insights of anthropological studies on Chernobyl have not been to highlight who was necessarily "right" or "wrong." Rather, they examined the contexts through which certain regimes of expertise were legitimized and undermined. The Fukushima Nuclear Disaster provides a different sociocultural context to study such problems and the rest of this dissertation highlights the structures of power that shape the governance of radiation hazards.

Chapter 3: Facing the Crisis

The nuclear safety myth might have enjoyed a prosperous life in Japan. But then, March 11, 2011 happened and all of Japan nuclear power plants were shut down or suspended for safety inspections. Before 3/11 Japan had 54 nuclear reactors providing more than 30% of the nation's electricity (Kingston 2014). The closing of nuclear power plants forced Japanese political elites to confront head-on the future of energy policy in Japan. Initially, the Democratic Party of Japan (*minshutō*) (DPJ) led by Prime Minister Kan Naoto undertook a "National Discussion" on Japan's nuclear policy through a deliberative polling implicating the public in 2012. Crucially, the government of this period presented three policy options, including a 0 % nuclear dependency scenario by 2030 (Mikami 2015). For a while, it seemed that the future of the nuclear infrastructure was uncertain, leading many to believe that nuclear power had perhaps come to an end in Japan.

Yet, a change in government, in which the DPJ was replaced by the much stronger conservative and pro-nuclear Liberal Democratic Party (LDP) in 2012, led to the abandonment of this policy and the new administration of Prime Minister Abe Shinzō, the leader of the LDP, reinstated nuclear power as an important base load of energy policy.[58] In 2013, during a successful pitch for Tokyo to host the 2020 Olympic Games, Prime Minister Abe Shinzō even argued that the situation at Fukushima was "under control" and that radiation "has never done and will never do any damage to Tokyo" (McCurry 2013 *online*).

[58] In April 2014, the Prime Minister Abe Shinzō unveiled Japan's new national energy strategy, reinstating nuclear energy as a "key source of energy even as the shambolic cleanup and decommissioning at the Fukushima Daiichi lurches from one blunder to the next malfunction, and radiation contaminated groundwater flows into the ocean" (Kingston 2014: 1).

As Chapter 2 highlighted, the politics of expertise around radiation harm was shaped by overlapping communities, nationalist ambitions, and economic developments that long mitigated particular hazards over other ones. In that sense, the aforementioned narratives of safety were not particularly surprising and it can be argued that the legacy of Mr. Pluto was not dead, but simply taking different forms. In 2011, this legacy resurfaced under a 4-minute video animation that attempted to explain the nuclear disaster to the children of Japan. In this video, children are introduced to "Tummy hurting Nuclear Boy," a cute little animated character, who stands for the Fukushima power plant. The video explains that Nuclear Boy (*genpatsu kun*) suffers from tummy aches (*onaka ga itaku natta*). In the video, one can see Nuclear Boy, crouching down, holding his belly and saying the following: "Ohh! I hope that it's not a big poo poo (*unchi*)… but I can't hold it anymore…!!!" A "big sound" is eventually released from the rear end of Nuclear Boy. Soon after the suspicious sound, a character with a big nose called *Nioi kakunin man* (literally: the man who can confirm the smell), comes to see the situation of Nuclear boy. "Ohh, fortunately it was not a poo poo, but only a big fart (*onara*)!" claimed the big nose man. In order to prevent further unfortunate farts, Nuclear Boy is fed with some medicine. As we are told: "Nuclear boy might release some other little farts [radioactive pollutants], but there's no need to worry, the odor will soon fade away and far-away people won't even notice it! The smell of fart will leave after one week!" Nuclear boy is seen smiling, while wearing a big diaper (*omutsu*) to prevent further leaks.[59] Perhaps Nuclear boy could have made good use of that 15-day course *Vita Radium Suppositories*…

[59] Hachiya, Kazuhiko. 2011. Onaka ga itaku natta genpatsu kun. https://www.youtube.com/watch?v=5sakN2hSVxA (Accessed 26 August, 2017). The translations are my own.

Here, what should have become the epitome of nuclear exceptionalism – a nuclear disaster – became trivialized as a mere fart (see Hecht 2013). While Tummy hurting Nuclear Boy was an attempt at reassuring the population of Japan (apparently created by the artist Kazuhiko Hachiya), it can also strike the viewer as being an obviously ridiculous video. However, when one considers the multiple and intersecting national, transnational, and local forces that have worked to solidify the paradigm of nuclear safety in Japan, then, this video is not particularly shocking. As anthropologist Marylin Strathern argues if "we see present day cultures as the offspring of past ones, we see new combinations forever being put together out of old cultural elements." (1995: 428)[60]

Still, what about the Japanese citizens who watched this video? Did people believe that everything was all right – as stated by *Nioi kakunin man*? Did they simply brush off radioactive contamination as a mere fart? In order to track people's responses to the official discourse of safety promoted by the authority, I turn my attention to the sphere of citizen scientists who came together after Fukushima.

Before providing a deeper engagement with the politics and expertise of citizen scientists, it is important to ask a few questions, such as who were the people that didn't trust the official safety narrative, why did they become weary of state management, and how did they become involved in citizen science? The eclectic arrays of citizens involved in the tracking and monitoring of radiation hazards after Fukushima makes the category of citizen science hard to pin down in its essence. Because of the impossibility of representing

[60] Following Strathern's sayings, the replies to the risk of radioactive hazard after Fukushima did not simply appear in a vacuum. Rather, they were invariably tied to prior political and sociocultural conceptualizations that surrounded the deep structural and affective investment in Japanese nuclearity.

the whole spectrum of grassroot actions, this chapter primarily focuses on a particular group: Japanese mothers who have

voluntarily evacuated from Fukushima. In the following pages, I examine how the range of embodied experiences of a radiation event produces a conflictual rationalization of radiation harm, which leads to different understandings of acceptable baselines than those promoted by the state. Employing an ethnographical approach, I follow the story of one voluntary evacuee, a mother named Natsuo, whose experience forms the primary analytical framework of this chapter. I use her background to highlight the numerous changes that citizens have faced in the aftermath of Fukushima, demonstrating how exposure became part of “everyday life and multiple temporalities” (Murphy 2006).

In the case of Natsuo, the changes were numerous: from evacuee, to citizen scientist, and political activist. I predominantly focus on Natsuo’s story for pragmatic reasons, as this enables me to highlight a linear progression from the first time signature of this disaster to the second time signature. Importantly, I do not simply center on Natsuo per se, but use her story as a connective thread where other actors – ranging from medical doctors to lawyers – graft themselves into her life. Doing so highlights the range of political constraints that different actors faced in enacting expertise on radiation hazards.

In the end, Natsuo offers a different narrative from the one presented by government officials—an alternative story that exemplifies how voluntary evacuee mothers resist, through the mobilization of technoscientific practices and knowledge on radiation hazards, the official discourse of safety. At the same time, I show how these mothers’ involvements in citizen science produces alternative ways of articulating their lives. My data was collected through interviews, as well as from participant observation around Natsuo’s attempts to rationalize the threats engendered by radioactive contamination, notably via means of public protests, radiation workshops, and food monitoring. Many of my informants also used their knowledge of radiation hazards for legal and judicial purposes, something that contrast other cases of citizen science after Fukushima (Kimura 2016). Mothers like Natsuo were embedded in citizen science network to get themselves and their children evacuated from Fukushima. Doing so, however, had forced many of these mothers to articulate their expertise in specific ways, as they had to carefully juggle between the apparent political stakes of their works and the taboo of politics so firmly entrenched in Japanese society. Navigating these tensions was rarely an easy task.

Since this chapter focuses on Japanese women, it is also necessary to flesh out the category of women in Japan, since gender is a "generative ingredient" in the politics of expertise that marshalled explanations to argue for the existence or nonexistence of contamination (Murphy 2006: 6). By now, critical feminist engagements have championed the fact that the gendered categories of woman and mother are far from universal given (Haraway 1991). In that regard, a brief account of the historical and political contexts through which ideas about gender have emerged in Japan provide a better understanding of the peculiar difficulties that women face after Fukushima. According to Mary Grigsby, the traditional roles of Japanese women have long been "[...] those of wife and mother or sexual playmate and entertainer, all of which have located women in the private sphere in accordance with the tenets of Japanese society" (1999: 195). Indeed, during the Meiji era (1868-1912), the Japanese state considered women within the traditional family unit (*ie*) as inferior beings subject to the moral authority of their father and husbands (Skov and Moeran: 1995: 22). This belief found its epitome under the term of "good wife, wise mother" (*ryōsai kenbo*). Setting the traditional gendered relationships in Japan, this ideal perceived women as devoted wives, as well as mothers who had to care for the well-being of her children (see Polleri 2013).

Gradually, the advent of the Shōwa government (1926-1989) emphasized the maternal and reproductive side of the Japanese woman, as men were called to serve as soldiers or as administrators to carry out Japan's colonial expansion through Asia during WWII (see Skov and Moeran: 1995: 22). Under war time pressures, the state began to recognize women as possessing a central role within the family household, although such a role was that of a subordinate, especially to ensure family stability and population growth (Skov and Moeran, 1995: 22). As Skow and Moeran (ibid) argued, this definition of women as both mothers/reproductive beings has marked a conservative trend that lasted until the late 1970s. As a result, rearing children was exclusively associated with women's roles. Even though female roles have evolved since the 70s, gendered stereotypes were reinforced by the pressures of capitalist and consumer industry, as advertising still depicts housework and child care has the sole responsibility of Japanese women (Skov and Moeran, 1995: 37) where the wife's sphere is often at home (West 2011: 189). What the reader needs to remember is that the perception and management of radiation hazards by Japanese women are invariably embedded in the aforementioned context.

3.1 Natsuo's Story

"There's a giant incinerator burning decontamination waste near my home in Fukushima… Ashes are falling on people's clothes, and when I made my concerns known to the local officials, I was told that I shouldn't worry, as they use special filters… But honestly, how can you live in such conditions?" That's how Natsuo ended our conversation in a small coffee shop near downtown Shinjuku in 2016. She no longer has the energy she initially had at the beginning of our interview, two hours earlier. Now, her brown eyes seem lost in a not-so-distant past. Perhaps she was pondering the many changes that radioactive contamination had brought into her life.

When the 3/11 earthquake happened, Natsuo was working in the town of Fukushima, the capital city of Fukushima prefecture. She recalled the sheer power of the earthquake: "The whole office shook like hell, everything began to fall from the walls… I thought to myself 'That's it… I'm going to die…'" When Natsuo came back to her hometown of Koriyama city, she was unaware that the nuclear power plant was also damaged. She learned on TV that something "seemed wrong" with the Dai'ichi nuclear power plant: "During that time, I tried to get as much information as I could, but the media weren't being clear on the situation. So, I began to investigate on the web, going on YouTube to access American news."

When it became clear that a nuclear meltdown had happened at the Fukushima Dai'ichi plant, the Japanese state launched an "in-house" evacuation order and people in the immediate vicinity were advised to stay indoors and remain prepared to leave the area if ordered. Three days later, on March 15, the evacuation order covered a 20- to 30-kilometer radius, and all people living in this area were advised to prepare for an imminent evacuation on March 25, 2011. At that time, Natsuo was living in Koriyama city, situated within the prefecture of Fukushima. Koriyama city, however, was 60 km away from the power plant and not included in the mandatory evacuation zone. Nonetheless, Natsuo became wary of the overall situation. As she explained: "The foreign news were advising a perimeter of 80 km for the evacuation process, but for us [the Japanese] it was only 20 km. Why wasn't it the same for us? It didn't make sense to me."

With a young daughter living in Koriyama, Natsuo decided to fly to Tokyo to stay with her sister, waiting for the disaster to settle down. A couple of months later, she returned to Fukushima, believing that the risks of radioactive hazards were over. As she explained to me, "Of course, I was still worried about radiation. But in those days, I heard Dr. Yamashita, a well-known specialist on radiation exposure from Nagasaki, saying repeatedly that it was safe in Fukushima and that no health effects would appear." Temporarily appeased, Natsuo brought her daughter back to Koriyama to resume school. However, her daughter began to suffer from diarrhea, nausea, and recurrent nosebleeds during which the blood had "a very dark and unusual color." Children of her work colleagues were also suffering from similar ailments, and these symptoms planted a seed of doubt in Natsuo's mind. Spurred on by her anxiety, Natsuo began a journey of self-education, reading everything she could find about the potential side effects of radioactive contamination. She even got her hand on a Geiger counter and began to measure the radiation in her house. As she told me:

> "On the first floor of our home the levels of radiation reached 0.6 microsieverts per hour and I measured 1.2 for the second floor. Outside of our home, the radiation level peaked at around 2.7 microsieverts per hour. I did not know what those numbers meant at first, but when I searched on the Internet, I discovered that this was quite abnormal!"

By taking matters into her own hands, Natsuo highlights a peculiar aspect of the Japanese civic response to this nuclear disaster, namely the access to technological infrastructure (e.g., internet and monitoring devices) in order to learn about radioactive risk. In 1986, many victims of the Chernobyl nuclear disaster did not have a similar opportunity (Kuchinskaya 2014). For instance, through searches via internet, Natsuo learned that that the government changed the safety standard for radioactive waste (*anzen ni sairiyou dekiru kijun*), increasing its former threshold by more than 80 times.[61]

Importantly, in contrast to toxic disasters such as oil spills, nuclear radioactivity is intangible, colorless and odorless. There is an apparent uncertainty related to the risk of radioactive contamination, especially when low doses of exposure do not produce immediate results like death. The materiality of radiation harm made it easy to blindly follow state experts in the initial aftermath of a nuclear disaster, like in the case of Chernobyl. However, in Fukushima, scientific practices of monitoring made the materiality of radioactive contamination perceptible in a different way. With her Geiger counter, Natsuo began to highlight the limits of state expertise. Alarmed by the ailments of her daughter and the levels of radiation that she had measured in her house, Natsuo decided to leave Fukushima for good and became a voluntary evacuee.

Still, as voluntary evacuees Natsuo and her daughter received little recognition from the state and were put on a waiting list for access to temporary apartments. Indeed, state housing support (*jūtaku shien*) for nuclear victims first prioritized individuals that were forced to evacuate from their home. After many months of waiting, they were assigned an apartment in the prefecture of Kanagawa. Unfortunately, Natsuo’s daughter, who was

[61] The standard passed from 100 becquerels per kilo to 8000 becquerels per kilo. (Yagasaki 2016: 7)

temporally living with Natsuo's sister in Tokyo during the waiting period, was already enrolled in a junior high school and couldn't move to Kanagawa. Meanwhile, Natsuo's husband remained in Fukushima for his work. While he was supportive of his wife's efforts, leaving work would have jeopardized the precarious economic situation of their family. In this way, the radioactive contaminants released during the disaster were not Fukushima's only unstable by-products; as Natsuo noted, "Our family has also become fragmented" (*bara bara*) and we can only be together once every few months." Within this context, radioactive contamination has brought uncertainty into the social roles that Natsuo used to view as inseparable not so long ago: those of wife and mother (see Introduction). Radioactive dangers were subsuming traditional assumptions, bringing a "potential conflict between the two roles that young women are expected to fulfill" (Slater et al. 2014: 496).

Worried about the adverse health effect linked with radioactive exposure, Natsuo sought medical advices, but the state limited which doctors people could see for medical screening (see Kimura 2016). Therefore, in order to receive information about their overall radiation exposure, citizens had to participate in the 2011 Fukushima Prefecture Health Management Survey. Yet, Natsuo was dissatisfied with how the state-sponsored survey determined exposure levels. First, to calculate their initial dose of external exposure, the survey asked Natsuo and her daughter to describe their displacements in the aftermath of the disaster. Thus, much like it had been the case for the Hiroshima-Nagasaki Lifespan study, exposure levels were "calculated" based on the memory recollections of victims. For Natsuo, there was nothing empirical or scientific in this process. "Calculating [based] on your own memory is not enough," she told me angrily. "Especially for evacuees who might not remember the whole sequence of events clearly!" Unsure of her own memory, Natsuo believed that her real dose of external exposure will never be known. She found this upsetting, for even though external exposure means that the radiation passes through the body without remaining inside of it, the potential for genetic damage remains. Overall, Natsuo felt that she and her daughter were unnecessarily exposed to radiation and believed that the dosage estimates she received were inaccurate due to the restriction of the survey. Indeed, the Fukushima Prefecture Health Management Survey did not take into consideration the risk of internal exposure, which represents a separate hazard in addition to external exposure. “If they had been really concerned about the population they would have taken urine samples to gage internal contamination…” Natsuo told me.

What’s more, new data had revealed to Natuso that the state initially underestimated the spread of the radioactive plume throughout Fukushima. As Natsuo lamented to me, “Now we know that the radiation level in Koriyama was quite high after March 15. If we had been given accurate information from our government, I would not have made my daughter come back. I truly regret what I did…” In the aftermath of the disaster, state experts from MEXT had withheld crucial information on the prediction given by a computer modeling, designed to provide projections on the dispersion of radioactive fallout through weather patterns (see Cleveland 2014). “How can you trust experts in such condition!?” angrily told me Natsuo.

3.2 Countermeasures

Natsuo’s story demonstrates that the governance of radiation hazard in top-down control measure was failing to smoothly operate for some citizens. Dissatisfied with the state’s management of radioactive hazards and pushed by the will to protect her daughter, Natsuo looked for other citizens who shared her concerns. Through contacts she discovered the Network to Evacuate People from Radiation (NEPR) which is how I initially met her. NEPR was initially created to support a legal case filed on behalf of several children who needed a court to rule in favor of their being evacuated. On June 2011, 14 children in Koriyama city filed a lawsuit at the Fukushima District court of Koriyama, demanding their right to study in a safe environment, where the annual dose of radiation received would be less than 1 mSv per year. In 2016, at the Tokyo Bar Association, I interviewed Masuji, one of the lawyers involved in this trial. As he explained to me: "On this special case, the Japanese court rejected the demand to evacuate children while acknowledging the possibility of radiation risks to their health. From a legal viewpoint, the government basically told them that if they were to evacuate they had to do it by themselves!" Slowly shaking his head in despair, Masuji went on to mutter the following: "Asking children to take their own responsibility… How crazy is that!"

This decision echoes a governance imbued in neoliberal language that reduces risk to individual choice and points toward the banner of individual responsibility (*jiko sekinin*), one of the main narratives of the Japanese platform for neoliberal restructuring after the economic crisis of the 90s. As Allison explains in that regard: "Under its new banner of 'risk and individual responsibility,' the government asked its citizens to remake their subjectivity and become strong and independent individuals 'capable of bearing the heavy weight of freedom'" (2015: 41).

After the failure of this legal proceeding, NEPR diversified its mandate, notably by entering the realm of citizen science. It quickly became a rallying center for citizens interested in the problem of radioactive contamination, as well as for voluntary evacuees from Fukushima that had relocated to the metropolitan area of Tokyo. Many members of the network were also housewives and mothers from the Greater Tokyo Area, who were concerned about the possibility of radioactive contamination beyond Fukushima. Young men were often absent from NEPR, a point that I equally noticed in many citizen science network that I visited.

In regard to harmful exposure, STS scholars have argued that the acceptance or rejection of toxicity is heavily constituted by normative gender roles (Shapiro 2015: 374; Murphy 2006). In similar ways, the absence of young men from NEPR can be explained by the fact that perceptions toward radiation risks are heavily influenced by gendered identities. As the anthropologist Rika Morioka argues: “While mothers expressed their concerns, fathers tended to be uninterested in the health effects of the radiation. Fathers whose traditional bread-winning role was at the core of their masculinity came into conflict with the traditional role of the mother as a caretaker making it harder to protect children” (2015: 2). The construction of Japanese masculinity historically linked to the economic interests of the nation state (Morioka 2015; Allison 2015: 38) explains the absence of bread winner men within many citizen science networks. Indeed, the few men that were present during the meeting of NEPR were already retired and no longer had economic obligations.

In 2016, most NEPR meetings revolved around the raised exposure threshold of 20 mSv per year. NEPR members found it impossible to excuse the fact that their own government had increased the minimum radiation threshold for evacuating the public. On March 12, 2016, I interviewed Hideyo, a radiation physicist associated with ICRP, the organization that had recommended an increase of radiation exposure after Fukushima.[62]

[62] Hideo was an expert in radiation physic and radiation biology. He had also worked for the Japan Atomic Energy Agency (JAEA) in the Research Group for Radiation Transport Analysis, Environment and Radiation

During our interview, Hideyo argued that mothers like Natsuo should be more worried about the harmful effects of second-hand smoke than radiation per se. As he explained:

> We know that radiation is much safer than tobacco or stress… In regard to cancer, we have a 200% excess risk, while 5% for 1 Sievert. People that enter a restaurant filled with smoke in Fukushima are affected by that also. For me, that's very dangerous and I don't understand why the government doesn't put a control on smoking in public places.

What counted as radiation harm for Hideyo felt within the traditional cancer-centered approach of most environmental baselines, where probabilistic risk assessments of radiation harm are based on estimated numbers of fatal cancers that might result from a particular radiation exposure. This viewpoint automatically disregards ailments that cannot be brought under traditional medical science. In contrast, the main concerns of the mothers belonging to NEPR were utterly different. For many, radiation harm was not experienced in relation to a reified percentage of increase of fatal cancers. Rather, it was perceived to be linked with thyroid cancers among children, with repeated cases of inflammatory problems, skin disorders, diarrhea, nausea, or, in the case of Natsuo's daughter, as a recurrent nosebleed during which the blood had a very "dark and unusual color."

For instance, two years after the disaster, Natsuo became sick with Reiter syndrome, a form of collagen disease.[63] As Natsuo noted to me, "Usually, it's supposed to leave after

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Sciences Division, Nuclear Science and Engineering Center. I interviewed Hideyo in Tokyo.

[63] Reiter syndrome is a type of reactive arthritis that occurs because of an infection. For more see Cedars-Sinai N.D.

one year, but I still haven't recovered from it, and it's been more than three years." She went on to tell me that there are three known reasons why this illness occurs, but none of the tests that she took could pinpoint the actual cause of the disease. Could her ailments be linked with radiation contamination? Natsuo had come to believe so, but no one would ever know. As she explained, "When you're sick from the flu, you know that your sickness is coming from there, but not with radiation. You don't get sick right away; you might not even be sure of the real cause. Even the experts can't know for sure."

Far from possessing a scientifically ungrounded fear toward radiation, Natsuo demonstrated a clear understanding of the latitude of radiation harm during our interviews. She made a clear separation between acute radiation sickness (*kyūsei*) and chronic low dose exposure. While high doses of radiation exposure present immediate and irrefutable danger to life, Natsuo's chronic ailments, which she perceived as being linked to low-dose radiation exposure, exemplified a different perception of radiation harm, where hazards are latent and possibly linked with irrefutable changes, as also emphasized in the endocrine disruption literature (Boudia and Nathalie 2007; Langston 2010). As Natsuo argued: "When people think about radioactive exposure, the first thing that comes to their mind is cancer. But there's much more than that… [With low doses] you don't die right away. It brings a lot of small problems." Her perception holds that radiological contamination does not simply affect life, but also the *quality* of life. It is precisely this subtlety—a distinction that cannot be overstated for the affected individuals—that, according to Natsuo, the governmental experts have never been able to grasp.

In that regard, Natsuo was angry about the official narrative of state experts who claimed that radiation exposure was too low to bring adverse health effects. Indeed, the baseline of 20 mSv per year is blind to the possibility of ailments beyond fatal cancers. This is due to the fact that the Sievert was never a measure created to appropriately consider the risk of internal exposure, nor to assess other health failures or genetic disorders beyond cancers. Yet, for Natsuo radioactive harm was not merely embodied as a potential increase of the chance of developing a cancer, but equally as a harm that made the ordinary travails of existence more acute.

3.3 Bodies of Flesh, Bodies of Knowledge

In a hospital of the Greater Tokyo Area, I heard a similar argument, given by Dr. Rin, the medical director of this establishment. On a busy Friday morning of July 2016, Dr. Rin found the time to receive me during her tightly run schedule. Right after the disaster, she had formed an organization of medical experts that did not agree with the 20 mSv limit set by the government. She was supportive of NEPR, having already come to talk during one of their workshops.

Dr. Rin first explained to me that the difficulty in stabilizing a relationship of cause and effect was excruciated by the materiality of radiation harm, since there is no way to know the exact source of a cancer. In that regard, she was especially critical of the international scientific community, which argued that radiation "can induce cancers that are indistinguishable from cancers resulting from other causes" (World Health Organization 2013: 19). As she contended: "It is easy to claim such things, as there are simply no ways of knowing the exact source of a cancer." Trying to assign a cancer with the influence of radioactive particles is almost impossible, as the cancer produced by these particles is not different from normal cancers, like bowel cancers. According to Dr. Rin, this was a source of uncertainty that could be mobilized in the way that best suited the interest of divergent groups:

> One of the biggest problems is that we were not able to properly calculate the dose of many individuals after this disaster. Now, radioactive pollutants have already – in good part – left the body of the affected individuals [e.g., Iodine-131 which has a short life span], but the genetic damages remain and with possible unknown result. We don't exactly know what will happen, but saying that the rate of cancer will increase, this is clearly not a mistake. However, it's going to be hard to differentiate it after.

Moreover, as a mother herself, Dr. Rin understood the problems that evacuees like Natsuo were facing:

> I've been hearing a lot of complaints from people in Fukushima, Tokyo, and Kanagawa, often about children being prone to nosebleeds, immunity systems which seems to have decreased, repeated cases of stomatitis, skin disorders… There's still no clear scientific consensus on that. Could it be that the doses were higher than we thought? Could microparticles of cesium be involved? I don't know, but I have to listen carefully… Otherwise, I might miss the truth. When clinicians close their eyes and their ears, it's the end.

As her narrative highlighted, Dr. Rin struggled to make sense of the hazards of radiation exposure after Fukushima. She also struggled about the role that she should embody as a medical expert. Just like the uncertainty of radiation hazards, there was no consensus-making. Masuji, the lawyer implicated in the initial evacuation trial of the Koriyama District Court, equally understood the difficulty that medical experts like Dr. Rin were facing. Indeed, he had first developed his expertise in the controversial field of genetically modified foods. "It's the same kind of gray zone," he told me. "It's very similar to radioactive contamination." From a legal perspective, it is difficult to provide evidence of a harm that has yet to potentially appear. As Masuji further commented:

> Radiation harm is more than thyroid cancers. The risk of radiation exposure is not simply linked with strong illnesses. There's a panoply of other 'smaller' ailments: dizziness, tired eyes, and a sore body (*karada ga darui*). These ailments represent a kind of liminal space between health and sickness. It's a kind of 'pre-sickness' period if you want. Below a certain level, it's easy to pretend that radiation effects are simply psychological, since you don't have an immediate cause and effect.

Furthermore, it is "scientifically impossible" to say that a given dose of radiation will be safe or dangerous for any specific individual (Stephens 2002: 98-99). This is due to the stochastic aspect of radiation harm. As the anthropologist, Stephens (ibid) summarizes:

> It is crucial […] to distinguish between deterministic effects, which are clearly dose related (i.e., a certain amount of radiation will predictably result in cell or organ

> death), and stochastic effects, which are not linearly dependent on the size of dose. There are no absolute threshold levels for stochastic effects, such as radiation-induced change in one cell that may result in a series of malfunctions in other cells and organs. Here the issue becomes *probabilistic* effects, which tend to increase with increasing dose.

In May 2016, I interviewed Ken, an expert in radiation physics and biology employed in one of Japan's top institutions for the study of quantum and radiological sciences.[64] He further explained to me the intricacies of probabilistic effects:

> The problem is that you don't necessarily need a lot of [radiation] exposure to trigger a severe harm. The cell just needs to be damaged in the 'right way,' which can lead to the 'right kind' of even. Some people might be more prone to having the DNA mutation that will end up causing severe cancers, for example. That's what we call the stochastic level; it can happen or not and it is linked with probability. The probability is in the dose that you received, but the severity of the effect is not.

Much like the difficulty of Natsuo, the aforementioned narratives exemplified the hardship of rationalizing radiation harm through the prism of risk or uncertainty, where a dose of exposure is associated with known adverse health effects. As Morris-Suzuki explains, "'Risk' exists where an event may or may not occur, but the odds of its occurring are

[64] The individual in question requested that his institution remained unnamed.

relatively well known; ‘uncertainty’ is the situation where the broad parameters of a risk are understood but science is not (or not yet) capable of accurately assessing the odds” (2014: 349). The experience of mothers like Natsuo goes beyond risk and points toward what Murphy calls “dual uncertainty” (2006: 11), where “any incidence of chemical exposure is difficult to pinpoint” and “experts disagree about the import and even the existence of widespread, low-level exposure.” Additionally, it echoes a form of indeterminacy between cause and effect, where ailments might or might not be linked with radiation exposure, and where the severity of health effects are unrelated to the amount of dose received. STS scholar Astrid Schrader contributes to this point by arguing that “[t]he very idea of an epistemological uncertainty presupposes an a priori separation of the epistemological question of ‘how we know’ from the ontological status of ‘what we know,’ where only the former, that is, our knowledge is allowed to vary” (2010: 277).

Claiming that uncertainties “assume the possibility of certainties as horizon or telos,” Schrader introduces a new set of scientific objects that she calls phantomatic. As Schrader argues; these phantomatic objects “don’t emerge as such, but appear as traces and are associated with specific matters of concern” (2010: 275). Similarly, evidence of what counted as radiation harm for mothers like Natsuo was something that normative science couldn’t brandish as definitive “matters of facts,” which have clear boundaries, well-defined essence, and well-recognized properties (Latour 2004: 24).

A unique experience of temporality underscored the embodiment of radiological harm amidst the evacuees of NEPR, one that points toward the issue of latency.[65] Indeed,

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[65] As Murphy (2013 *online*) explains: “Latency is a synonym of lag. It is the period of time between a stimulus and a response, the gap between one event and another. In technical terms, latency time in medicine is similar to an incubation period. Latency time is the lag between infection and infectiousness. Or, it is the wait

for Natsuo, radiation had created an impossible situation—namely, a state of not knowing whether her own symptoms were clearly linked with radiation exposure or if they would worsen with time. During workshops organized by the network, I heard mothers saying things such as: “The government is saying that radiation levels are too low to pose serious health effects… But who knows what might happen in the future?” Throughout their comments, radiation hazards echoed an “indeterminate relationship between being and becoming and between ‘past’ and ‘future’” (Schrader 2010: 278). While a baseline of 20 mSv per year might be safe in the *immediate*, mothers belonging to NEPR contended that genetic damages and their potential adverse health effects could transform one’s own body in a time bomb, producing new understanding of what counted as harm.

These feelings of temporal doubts were precisely what cast Natsuo in the role of carrying an agonizing burden that was now part of her daily life. Her experience of radiation risk was challenging the “conception of time as homogenous flow of self-identical moments, in which a cause by definition precedes its effect” (Schrader 2010: 278-279; see also Csordas 2011). In this, Natsuo’s present was being torn between an uncertain future and a past where her original exposure and damage remained unknown. Each of these indeterminate origins executes what Kim Fortun (2001) calls the “future anterior.” As Fortun (2001: 354) explains, “The future inhabits the present, yet it also has yet to come—rather like the way toxins inhabit the bodies of those exposed, setting up the future, but not yet manifest as disease, or even as an origin from which a specific and known disease will come.”

between chemical exposure and symptom. To be latent is to be “not yet:” a potential not yet manifest, a past not yet felt.”

As opposed to men, women embodied specific aspects of radiation harm, which notably has a potential to be genetically transferred across generations. Indeed, beyond somatic injuries, that is, injuries that happen on the body of an exposed individuals (e.g., cancer), transgenerational effects were usually the kind of radiation harm that stressed many mothers belonging to NEPR. Ken, the radiation biologist and physicist, further explained to me this phenomenon:

> In the transgenerational effect, exposure to radiation can cause a mutation in the human germ line (the sperm or the egg). Notably, it increases the probability of a mutation risk in the sperm and if this sperm ends up becoming a human, this being will carry the mutation. This mutated sperm only matters if it ends up becoming a child. And since men produce so many of them there is a chance that this specific sperm will never become a child. [Women] have a limited number of eggs in their lifetime. If an egg had been affected by radiation and has a mutation in its DNA it can still be present 10 years after the initial exposure. So, for a girl that has been exposed at 12-13 [years] it can be a very different situation than for man. What effect does this particular genetic mutation will have is another problem of its own. It can be a meaningless change, which will never produce harmful impacts, or it can be something that will end up causing troubles. The problem with this kind of mutation is that, as scientists, we can only say something like: 'The child that you have now might be different if it wasn't for that genetic mutation, but *how* we don't know. So, it is basically a kind of hypothetical risk that can never be disapproved, and that as nothing to do with radiation, it's a type of risk.

Like a remorseful ghost that finds no finitude in life nor in death, the kind of radiological evidence put forward by normative science was producing risks that could never be fully disaproved, haunting mothers as to what exactly will or will not happen for their children. Here, harm could not only move beyond present concerns, but equally beyond finite individuals, as exemplified through the figure of a yet unborn child. Similarly to the case of endocrine-mimicking chemicals that manifest health effects in the next generation (Murphy 2013), the type of harm described by Ken exemplified an embodied response that "may not even be felt until the next future generation" and that affect "life not yet born, and hence future life" (Murphy 2013 *online*). Consequently, Natsuo argued to me that Japanese state screenings for health effects that could take decades to appear were only good at reassuring the population in the moment.

Beyond temporal issues, generational concerns also demonstrate that the spatial embodiment of radiological hazards was not merely experienced through one's own corporeality, but equally through the bodies of children. In that regard, motherhood defies the picture of the radically free and self-sufficient individual, often associated with tropes of neoliberalism (Einion and Rinaldi 2018). Similarly, mothers belonging to NEPR argued that children couldn't be expected to fall sick from "averaged baselines" of radiological protection and they were critical of the process through which state experts determined areas of safety in Fukushima. For instance, the government had installed numerous monitoring posts that displayed the current atmospheric level of radiation on an electronic board. The data obtained was compiled to separate Fukushima into three specific areas of radiation danger, with one being safe enough to pursue daily life (below 20 mSv).

However, since residual radioactivity accumulated itself on the ground, results near the soil were often higher than what was being monitored by the posts. The baseline of 20 mSv per year, which only considers the amount of external radioactivity in the air, was not acceptable for mothers like Natsuo, since they claimed that children might be playing in highly contaminated schoolyards or near hot spots, areas where the level of radiation could be significantly higher. Indeed, ditches, drainage and playgrounds can all accumulate contaminated water or radioactive soil, thus presenting a risk of exposure to children, which are closer to the ground and tend to put things in their mouth. Even the family dog could be a vector of potential harm; by swooping itself into a hot spot the animal could bring dangerous radionuclides back home, where children would pet him.

As a mother further argued during a NEPR meeting: “These posts are strategically placed and the areas around them are constantly cleaned so that the levels of radiation will appear lower!” Eager to show me that they were not lying, members of the network arranged a trip to Fukushima, so that I could verify their claims. Armed with Geiger counters, we left Tokyo in a small van and drove around Fukushima, becoming “hunters of Sieverts,” as we measured the level of residual radioactivity in different cities. By comparing our data with those of monitoring posts it became apparent that a clear mismatch existed. The fallout had produced residual radioactivity, which had accumulated itself in patchy locations. Therefore, while a monitoring post displayed a level of 0.374 μSv per hour, a few footsteps away gave us a result of 3.604 μSv per hour, an increase by tenfold. A member of the Network dutifully compiled our results in a black notebook, making sure to write down the location and time of the monitoring. In the end, learning to track radiation through self-monitoring practices had contributed to increase the crisis against state expertise, especially by highlighting the fact that state monitoring was partial. In this way, radioactive contamination began to echo a change in the relationship that citizens maintained with the Japanese state.

Illustration 10: *Citizens testing radiation with a Geiger counter in Fukushima* (photo by the author)

This relationship between citizens and the state was now catalyzed by the acquisition of a scientific expertise—what anthropologist Sternsdorff-Cisterna (2015) calls a "scientific citizenship." In a mere five years, Natsuo had indeed experienced new ways of expressing herself, in ways that she would never have thought possible. Microsievert and transgenerational effects, once obscure terms reserved to a few scientists, were parts of a set of new words that many activists had to master. Scientific knowledge had helped Natsuo to develop novel modes of political expression, in which she constantly asked things such as *Hontōni* (Really? Is it true?).

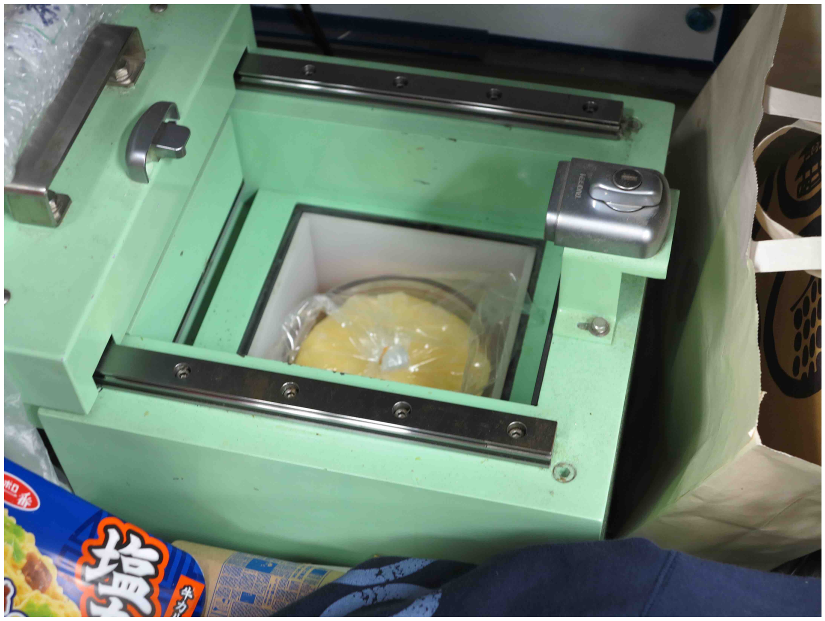
Beyond radiation tracking, the issue of radioactive contamination in food was on the mind of every NEPR member. Many mothers that I interviewed were initially dissatisfied by the lack of state-sponsored data surrounding food contamination after the nuclear disaster. This led to the creation of many networks, where citizens began to test food for radioactive contamination. Three members of NEPR were notably associated with such endeavor, having even contributed to the creation of a small center where food could be tested for a nominal fee. In 2017, I visited this monitoring center, which was located in a quiet residential neighborhood of Tokyo. The director of the center, an elderly woman called Emiko explained to me that many mothers wanted to measure the radiation levels in their food after the disaster. Doing so was, however, hard and very expensive. Emiko therefore had the idea of creating a non-profit organization and with much financial difficulty was able to buy a Becquerel Analyzer. The machine, a NaI (Tl) scintillation detector FNF-401S, could detect traces of gamma-radiation from radionuclide iodine 131, cesium 134, cesium 137 contained in food or drinking water. The center possessed a single machine. With a tag price of 4.5 million yen, or roughly 50 000 $, it had been impossible for the members of the center to purchase more than one machine. Still, this single scintillation detector had been put to great use. As Emiko explained to me:

> Many people wanted to measure their food to know if they could sell it [on the market]. The testing has helped people to alleviate their anxiety (*anshin*) by providing a clearer idea of the situation. At the beginning, things like fruits, especially their skins, or the spinach (*hōrensō*) had very high levels [of becquerels] and no one could sell their stuff. Even now that 6 years have passed there are still some foods that have high levels of radiation.

Practices of food monitoring enabled citizens like Emiko to critically assess the governmental management of this disaster. Emiko argued to me that while state officials initially encouraged people to consume food, they were rarely providing data to back up their claims. As another member of the center contended to me: "At least, it has enabled us to see that what the government was doing and saying was strange (*okashii*). It forced us to ask things like: 'Is it really right (*tadashii*)?'" Throughout the years, the small center had shared many of its monitoring results with NEPR, enabling people to accumulate an impressive knowledge of food contamination. During meetings and workshops organized by NEPR, I witnessed mothers speaking about the types of food that were most prone to radioactive contamination and that thereby should be avoided, such as mushrooms, green leafy vegetables, citrus (*yuzu*), sea cucumber (*namago*) or sea weed (*wakame*).

However, the government quickly tried to diminish the expert legitimacy of such endeavors. As Kimura (2016: 111) explains, state experts began to highlight the technical shortcomings of civic monitoring centers, "such as the lack of certified staff members to operate detectors and the uncertainty of ensuring the best conditions for testing." For instance, MEXT had argued that measurement made by scintillation detectors, the kind of monitoring device use by Emiko, could be imprecise and that germanium semiconductor detectors should instead be used (Kimura 2016). In doing so the state initially attempted to delegitimize the work of citizen scientists. This is a relationship that would, however, drastically change later on.

Illustration 11: *Testing food in a citizen science network* (photo by the author)



3.4 Who is an Expert, What is Expertise?

Since NEPR believed that mainstream nuclear experts were government-patronized scholars (*goyōgakusha*) and hence unable to speak out against the government's positions, members organized their own lecture series by inviting experts that were critical of the "safety campaign" (*anzen kyanpēn*) – or the governmental attempt to downplay the damage of radioactive contamination. In the aftermath of this disaster, NEPR had not merely developed expertise around radiation tracking or monitoring. Additionally, their expertise encompassed a profound knowledge of the nuclear village: every member knew the main actors and safety agencies implicated in the nuclear safety of Japan and often criticized the government for inviting so-called "pseudo-experts" to their official risk communication symposia.

One of the most popular experts that spoke at NEPR was Dr. Sayaka, a former chief director of a leading Japanese institute of radiological science in Tokyo, which was part of an important independent report on Fukushima. As a doctor of medicine who specialized in radiation and cancer, Sayaka possessed an in-depth expertise around the hazards of radiation exposure. Like her medical colleague Rin, she was critical of the 20 mSv limit put in place by the government. She perceived this as a decision that sacrificed the health of people. As she told me in an interview shortly before the 5^{th} anniversary of the disaster: "As an expert, I truly don't understand how the government is thinking, it's just crazy (*kangaekatta shinjirarenai, kurējī*). Even now, the limit of radiation exposure is stricter in the medical domain than for this disaster; it makes no sense!" Dr. Sayaka was particularly shocked by the state's attempts to make people come back to Fukushima and by T.V. commercials telling the population that there were no more problems and that the radiation was gone. As she argued:

> We just don't have control over it, it's too long… It takes too much time for everything to come back to normal, to come back to the way it was. It cannot become clean. As a scientist, I am really concerned about the potential health effects. The government is criticizing us [the medical community], by saying that we are 'overdoing' it and are looking to scare people… That's not our goal, we are simply explaining the *basis* of radioactivity's potential harm. They keep talking about the harmful influence of the stress that we cause; of course, stress does play, but its harmfulness is nothing in comparison to radiation damage!

To further explain the intricacy of her case, Dr. Sayaka took out numerous slides and began to explain the phenomenon of radiation harm in front of me:

> Basically, the energy of radiation is stronger than the chemical bonds of our DNA. This energy can easily produce complex double strand breaks of DNA. The cells, in trying to repair themselves from such harm, end up being more prone to making mistakes in their regeneration. This can bring mutations and genomic instability. What you have is an accumulation of mutations that can end up causing a cancer even years after the exposure.

As she criticized: "There are a lot of state scientists who are saying that the situation at Fukushima is all right, but they don't even have the slightest basis of knowledge on DNA damage!" Moreover, in case of internal contamination, each radionuclide affects the body differently and has its own biological signature (see Cram 2015: 525). Sayaka explained to me that Strontium 90 was such a problem: "It mimics calcium and enters your bone marrow. It stays there for long periods and weakens your immune system."

By insisting that her knowledge as a physician qualified her to speak on state policies of post-disaster recovery, Sayaka attempted to shift the focus of radiation hazards to her area of expertise: radiation medicine and cancer. Her explanations highlighted the agential power of radioactive harm in ways that contradicted the state politics of safety. Mediated throughout a medical expertise, radioactive hazards became gendered, age dependent, and was seen as being more than a harm that affects finite or single individual. From this perspective, an increase of radiation threshold was unacceptable for Sayaka.

Yet, despite the expertise and qualifications that Sayaka possessed to talk about radiation harm, I never once saw her speak in state-sponsored risk communication symposia. Not only had she not been invited to such symposia, but even discouraged to participate in them. Indeed, in the aftermath of this disaster, the institute where she worked released a statement on behalf of all its scientists, with the aim of quickly silencing the internal conflict of its own community around radiation hazard. As Sayaka told me: “When I tried to be a part of the safety commission after Fukushima, I was told that my opinion would be ‘inconvenient’ (*futsugō*) and that if I was to do so I could have my budget cut! This was a lot of pressure (*sugoku puresshā datta*)!” For Sayaka, the state had simply been cherry-picking its experts, while silencing dissonant voices. In this, she held the firm belief that Fukushima was not a mere problem of medicine per se. With many decades of experience under her belt she argued to me that scientific expertise could simply not be detached from political grasp. For Sayaka, the endless debate on low-dose radiation was not a scientific matter anymore, but a political, economic, and social problem.

Many mothers belonging to NEPR were also anxious about the threat posed by radioactive iodine (iodine-131) and its link with thyroid cancers. As Natsuo explained: “We see the number of thyroid cancers increased year after year. We’re no experts and we still know that there is something wrong with that, but the government doesn’t seem to do anything!” Ironically, the thyroid is the endocrine gland that enables the growth of children, which is symbolically what mothers like Natsuo felt deprived of: the possibility of a bright future that will enable their children to flourish. Members NEPR had become critical of the state-sponsored information that surrounded the increase of thyroid cancers amidst children in Fukushima. As a mother complained during a meeting:

> “The Prefectural Health Survey (*kenmin kenk*ō *chōsa*) has found that 137 children are suffering from thyroid cancer. However, they keep saying that thyroid cancer is

> not linked with radiation exposure in Fukushima. That it's the result of a screening effect. They tell us that they have done too much testing, that the tests are too precise and that's why there are many thyroid cancers. What does that mean? That doesn't mean anything, that's stupid. A cancer is a cancer!

Beyond state experts, many had also lost faith in the Japanese media. As Natsuo explained to me:

> "I've seen this very nice TV program last night on NHK. It was about a doctor called Akira Sugenoya who went to Chernobyl to perform thyroid cancer surgery on children. He's now the mayor of Matsumoto [in Nagoya prefecture] and he's offering his help to shelter the children of Fukushima. But the TV passed those programs at 3 a.m. in the morning… No one watches that at this hour! NHK [Japan's national broadcasting organization] is supposed to be a public television, but they don't do much for the public…

Feeling abandoned by state experts and the media, NEPR members tried to gain information about thyroid cancer through alternative means. I heard many of them talked about the work of Dr. Mori, a medical doctor and epidemiologist known for his research about toxicity and contamination. In a study of his own, Dr. Mori had linked the apparent increase of thyroid cancers with the radiation exposure of Fukushima, hereby publicly contesting the epidemiological study led by state experts. A fervent critic of the Japanese government’s denial of radiation health risks below 100 mSv, Dr. Mori had published his research finding in a top international journal on health science.

Yet, this feat had not been a source of praise for Dr. Mori. In fact, he had quickly been attacked by the experts of FMU for promoting findings that were not in “accordance with scientific terms.” Dr. Mori, whom I later met at his university office had a different take about what “in accordance with scientific terms” implied. As he contended to me: “These people [FMU] don’t even want to discuss with me! Simply because I have an opposite opinion. The state officials and the scientists that work for them don’t even think about what me or my team have been saying; all they can think about is ‘are they pro or con?’” Because of his proclivity to contradict the findings of FMU, Dr. Mori had been branded as an emotional and hot-tempered scientist by his opponents. In a bittersweet smile, he replied the following: “It’s ironic that I’m being deemed as ‘emotional’ by members of the state. It’s rather the government reactions that are quite emotional. If you look at the management of this disaster, there’s simply no calculation to what they are doing, it’s a series of short-term responses based on the current vibe of the political bath…” Much like Sayaka, what Mori deplored was a specific scientific culture that promoted allegiance to one’s camp over evidence-based opinion.

Since the state had provided research funding to the scientists whose aim was to revitalize life in Fukushima, the research of Mori was conducted on his own salary. Similarly to psychologist Takeo Doi’s (2002) notion of communal groups, which exist in “concentric circles” without any interpenetration among them, these medical experts believed that the state was merely listening to the members of its own circle, leading the government to control (*shihei*) who could talk or not. They believe that having different opinions had withheld them from engaging in collaborative work (*kyōroku*) and deplored what they perceived as a lack of proactive dissent within the Japanese normative scientific culture. As Mori argued to me: "If you have a different opinion, there's really not much discussion that you can do… That's a sad culture for the world of science."

A similar viewpoint was also shared by Dr. Natsume, a major player in an important independent report that was commissioned by Japan's legislature after the nuclear disaster.[66] Having booked an appointment with an expert trained in medical sciences, I expected to hear the usual explanations about the danger of radiation exposure. Rather, Dr. Natsume told me of the numerous difficulties that he faced in managing the *Fukushima Nuclear Accident Independent Investigation Report*. As he first argued:

> Japan does not even have the necessary building blocks for a good democracy. In this society, being a politician is not a profession, it's an occupation. Politicians are elected by their own constituency, not by the people. You know, this independent commission, well, it was the first of its kind in Japan! Nothing was decided in advance behind closed doors, no press club, everything was open, everything was made public!

Throughout his report, Dr. Natsume had come to the conclusion that the nuclear disaster was caused by a desire for conformity, which resulted in dysfunctional outcomes. He argued that a culture of groupism, highly promoted by the normative preference for

[66] The Independent Report of the National Diet of Japan (the national legislature of Japan) emphasized that the cause of the nuclear disaster was "man-made" and held not the natural disasters accountable, but the government, the nuclear regulators, and TEPCO (National Diet of Japan 2012).

Japanese hierarchy and harmony (*wa*), had permeated the bureaucracy and scientific culture of the Japanese nation-state, hereby facilitating the apparition of regulatory captures in nuclear security. As he further commented on that point:

> In Japan, order works by structure, while in other countries order works more by function. Group think[ing] is not something uniquely Japanese, but we are more prone to it, we are even proud of this culture! Think for example, of Japanese social system norms, such as lifetime employment in the same organization, senioritiy-based promotion before meritocracy, or even about *amakudari*.[67]

For Natsume, groupism had permeated Japanese society and supposedly resulted in the forbidding of dissent, the creation of a lack of transparency, while impeding any forms of accountability after Fukushima. As he claimed: "In such scenario, you're not able to say your opinion, you become obedient… If you move outside of your group you'll be stigmatized!" In order to further prove his point, Dr. Natsume highlighted the downfall of the *Act on Promotion of Support Measures for the Lives of Disaster Victims to Protect and Support Children and Other Residents Suffering Damage due to the Tokyo Electric Power Company's Nuclear Accident* (Act no. 48). In a nutshell, Act no. 48 was supposed to provide a freedom of choice for the affected citizen of Fukushima by being based on the recommendation of their independent report. More precisely, Act no. 48 was created for people who wished to stay in Fukushima, as well as for people who wanted to leave. On paper, this new policy was highly promising. However, in 2016, when I first meet Natsume,

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[67] *Amakudari* is literally translated as "descent from heaven." The term is used for describing retired Japanese bureaucrats that take position in private firms.

the national government of Japan had already announced its goal to lift evacuation orders for all areas excluding those above 50 mSv per year. This official policy of repatriation went against the intent of Act no. 48. Mr. Yoshiyuki, the assistant of Dr. Natsume and the project manager of the independent report, was equally disappointed by this decision. As he claimed to me in 2016:

> Right now, what we are seeing is the complete opposite of what we've been working for. For the government, everybody has to go back, or otherwise you are left on your own. Again, it's that same kind of mentality – that 'all or nothing mentality.' There's no middle ground! The biggest problem is that the government perceives the evacuees as one big homogeneous group. But the hazards of radiation have brought a case-by-case problem, that is dependent on age, gender, or occupation.

For Dr. Natsume and Mr. Yoshiyuki, this pressure resulted from the normative Japanese culture of group thinking. "Even in regard to this policy, we are seeing the pressure to conform; either you are with the group or you're not!" claimed Yoshiyuki. For Natsume, discussing the rhetoric that the government employed to mitigate the biological risks of radiation was meaningless. As he claimed: "We know that the government discourse makes no sense, but have you ever heard anyone complaining? Have you seen an attorney general coming forward? Have you seen the media talking about that? No one has moved, why?" For Dr. Natsume, the source of the problem surpassed the expertise of radiological science and was to be found amidst a culture of regulatory capture and groupism. "And then, if you want to talk about Sieverts and all of that, you go on interviewing another medical doctor!" he told me.

In the end, much of the recommendations made by their independent report were never enforced. The report had remained one of the many Fukushima-related white papers in the closet of some bureaucratic office. Dr. Natsume argued to me that the whole thing had been staged, performed for mere political correctness. "It's a kabuki theater!" he angrily told me at the end of our interview. Upon leaving his office, I could not help but ponder at the metaphor of the kabuki theater, a very classical Japanese dance-drama. The kabuki is an extremely stylized form of theater, always defined by a strict play structure. The performer wore flamboyant costumes and possessed stage names that are passed from generation to generation. Ironically, this comparison serves as a reminder that staged performances have always been at the origin of scientific expertise (Shapin and Schaffer 1985). This is perhaps what Natsume deplored.

Beyond medical doctors and epidemiologists, nuclear experts had also become critical voices against the state management of this disaster. This was notably the case of Hiroaki Koide, a retired professor of nuclear engineering from Kyoto University. On February 20, 2016, I was invited by NEPR members to assist one of Koide's speeches at the Mitaka City Social Education Center, situated in Tokyo. There Koide painted a worrying picture of radioactive contamination:

> In some part of Fukushima, everything has been contaminated. Try to imagine for an instant the sheer scale of such contamination. Think of this building and its surroundings: the roof, the windows, the parking… it's an enormous scale. At the

> beginning of the disaster, I went to the contaminated zone of Fukushima, where people still lived. My jacket was so contaminated that I had to throw it away! It's important to communicate those risks to the population and to at least let the children evacuate from the contaminated areas in question. Nuclear power plants are like houses without toilets. You can put the contaminated soil of Fukushima in plastic bags, which is what the government is doing, but it doesn't stop radioactivity. The half-life of Cesium 137 is 30 years, and that's only the half-life! I'll be dead in 30 years! When people like me talk about the risk of radiation we are accused of impeding the revitalization of Fukushima (*fukkō no jama*), but the victims are not only in Fukushima, they are all over Japan!

By highlighting the complaints of so many experts, I am not interested in pinpointing whether any of them were right or wrong in their explanations of radiation hazards. Nor, am I interested in understanding whether a so-called cultural desire for conformity within Japanese culture explains the source of this disaster. Rather, what I wish to highlight is the pressure, criticism, and power plays that the aforementioned scientific experts have faced by presenting a contradictory narrative about radioactive contamination. While their scientific expertise brought to light the dangerousness of radioactive elements, hereby mobilizing a politics of harm that stood in dissensus to the state narrative of repatriation, radiation still couldn't be externalized as the only matter that mattered. For many of those experts, the narrow-minded framework of their political and scientific elites was often a much more fearsome pathogen than radioactivity itself, having managed to discourage their warnings about radiation hazards.

And indeed, a difference of opinion surrounding the governance of Fukushima had kept many of such experts from participating in official symposia, hereby mitigating their authority in the normative scientific culture of Japan. In private some of these experts argued that the tourist industry of Fukushima should cease to exist, as health was the most important thing. Unsurprisingly, these arguments were not popular within an official policy of repatriation. In consequence, many of the aforementioned experts ended up speaking in small public auditorium, community centers, anti-nuclear groups, or housewives' club – places that were far away from the centers of power and scientific authority.[68]

If experts like Dr. Sayaka, Dr. Mori, or Hiroaki Koide were nowhere to be found in state-sponsored risk communication symposia, then who were the experts that the state relied on? This question was on my mind throughout the fieldwork, forcing me to scrutinize the experts invited to the official risk communication conferences. By attending official conferences, I realized that the experts that had become "successful" at collaborating with the state were those that shared a consensual vision around issues of post-disaster recovery. Indeed, experts mobilized by the state were not necessarily invited for their actual expertise on radiation hazard, but for their similar depiction of the "regime of the sensible" (Rancière 2013) around radiation hazards, which fell within the narrative of recovery that the state wished to promote.

During my fieldwork, this was particularly epitomized by the figure of Dr. Ryugo Hayano, a professor in the Department of Physics at Tokyo University. In the aftermath of the nuclear disaster, Prof. Hayano had watched the *Nuclear and Industrial Safety Agency*'s press conference and synthesized their data into easily understandable information through

[68] As mentioned, some of the threats faced by these scientists included accusations of anti-patriotism, difficulties in publishing in Japanese scientific journals, as well as financial cuts in their research funds.

his Twitter account. This had led him to become an important public figure, prompting his appearance in radiation risk symposia. In a subsequent effort to revitalize the Tohoku region, Hayano had invited young foreign students to Fukushima, arguing that the overall external dose of radiation accumulated during their trip was similar to the dose of natural radiation present in other countries. This had led him to publish a highly downloaded medical paper, where he argued that the current conditions of irradiation would not cause severe harm. He explained more fully his data at the 2016 *International Symposium on Disaster Management and Recovery for Children and Communities*: "You see, the external exposure of Fukushima is not particularly higher than in other parts of the world. In fact, you can see that the highest peak is due to the natural radiation that these children received during their plane trip to Japan!"[69]

Still, it is crucial to acknowledge the fact that Prof. Hayano did not possess expertise on medical science. As a theoretical physicist with an area of expertise on anti-matter, Hayano had studied Fukushima in an improvisational manner. Hayano himself acknowledged this fact, by proudly stating that his highly downloaded article was his "first medical paper!" (see Hayano et al. 2013). Hayano fell into the category of what STS scholar Mikihito Tanaka (2015) calls the "quasi-expert," that is, an individual who works in fields that are related to nuclear matters, but who do not have the appropriate knowledge to actually tackle issues of health hazards. Notwithstanding this, Hayano was increasingly called on to speak during state-sponsored risk symposia, such at the *Fukushima Medical University Symposium*, held in Fukushima city on March 8, 2016, where he contended that

[69] Symposium organized at the Soma Civic Center in Soma city, Fukushima. May 7-8, 2016. In Japanese: Kodomo to shinsai fukkō kokusai shinpojiumu jikkō iinkai kokusai shinpojiumu 2016 - Sōma chihō no 5-nen no ayumi (International Symposium Disaster Management and Recovery for Children and Communities 2016 – History of the Five Years of the Soma Area).

the fear of radiation was unjustified. While Hayano was not a lapdog scholar belonging to the state (*goyō gakusha*), his current discourse of social empowerment and radiation safety squarely felt within the state policies of repatriation. As such, Hayano had reached a degree of public visibility and authority that other experts with a more appropriate expertise could never obtain due to their upbringing of a different regime of the sensible around radiation dangers. The notion of expertise had become a weird conundrum, where a shared consensus around issues of recovery was more important than the actual knowledge possessed by experts. This represents a shift of expertise that is not without potential drawbacks. Indeed, it contributes to the marginalization of radiation risk by independent quasi-experts who are genuinely trying to help, but who paradoxically become purveyors of ignorance. In 2018, Hayano's work notably faced criticism for having underestimated the radiation doses of a population located in Date city, Fukushima (see Asahi Shimbun 2019).

In the end, a crisis of expertise occurred at multiple scales, creating a widening gap that was not merely between state experts and citizen scientists, but equally amidst experts themselves. How does the concept of an expert, its role, function, and power, stand up in this context of expert crisis? This question was on the mind of many of my informants, but few seemed to have the answer. Tetsuji Imanaka, a nuclear engineer who conducted research on the environmental impact of residual radioactivity in Chernobyl, as well as neutron dose evaluation of the Hiroshima and Nagasaki atomic bombings, seemed haunted by such question. After the Fukushima nuclear disaster, Imanaka was involved in a survey of Iitate village, an area that suffered from high levels of contamination, but that was not initially evacuated as it fell outside of the official exclusion zone. In 2016, I attended to two seminars, where he spoke about his experience.[70]

During his 2011 survey, Imanaka had measured high levels of radiation ranging from 30 μSv per hour to 150 μSv per hour.[71] Residents of Iitate, who were still living in the village at that time, told Imanaka that "scientists in white suits" had appeared in the weeks that followed the disaster. The villagers never saw these scientists again, nor did they hear anything from them. As opposed to these "scientists in white suits," which were probably institutional experts, Imanaka quickly warned the villagers of the very high level of exposure afflicting their village. His own experience in Iitate ultimately led him to clash with the radiation risk management adviser of the Fukushima Prefecture, Dr. Yamashita, who had suggested that it was not necessary to evacuate beyond the restricted areas. As Imanaka bitterly argued during one of those symposium: "These [institutional] experts can't even explain to people what to eat or not. They will never be able to answer simple questions such as 'What do I do with my family?' The only thing that they were able to say after the disaster was 'to not leave Fukushima.'" After Fukushima, Imanaka had become angry by the traditional depiction of scientific experts as holders of "yardsticks" of truth. The position of scientists should not, as he contended during his public speech, be linked with the ability and authority to decide for the life of hundreds of thousands of people:

[70] The first seminar was entitled "Dai 112 kai genshiryoku anzen mondai zemi" (112 th Nuclear Safety Issues Seminar), given on February 10, 2016. The second seminar was "Le nucléaire en sursis. Du local à l'international: Bilan et déductions Quelles politiques énergétiques pour demain?" given on March 22, 2016 at the Maison Franco-Japonaise.

[71] The normal background radiation levels in Fukushima ranged between 0.02 and 0.13 μSv/hour before the nuclear disaster Fukushima Prefecture N.D.).

> People often ask me if they can live in Fukushima or not. Honestly, it's not a simple question that can only be answered by science. I can tell you what the levels of radiation are and my role as an expert is to provide as much as information as I can on the risk of radiation exposure. But a Geiger counter cannot evaluate the sheer magnitude of the harm brought by radioactive contamination. You need to realize that a nuclear scientist is something that does not exist! When we refer to someone as a 'nuclear scientist,' we are in fact referring to fragmented expertise. Most of the time, we are talking about nuclear engineering, which is obviously a by-product of the science of engineering. It comes with its own paradigm and has its own limitations. Be careful about people who claimed to be 'nuclear experts' after this disaster. We do not think enough about *what* constitutes a science…[72]

Ultimately, the disaster had exacerbated a political schism amidst scientific experts. Just like the nuclear era described by Yukio in Chapter 2, where the legitimacy of experts was embedded in a particular set of oppositions – being pro or anti-nuclear – Fukushima had created its own conceptual dichotomy, in which experts supporting the official policies of revitalization confronted the experts who were perceived as criticizing the state management of this disaster. Because of such a schism, experts could only position themselves through dualistic viewpoints, each resting within their own mutually exclusive domains. Once again, politics was endowing the understandings of radiation hazards with practices and narratives that downplayed certain voices from being heard as "experts." The parallels with the pre-Fukushima era were striking.

[72] Speech given on March 22, 2016, during a conference entitled "Le nucléaire en sursis. Du local à l'international: Bilan et déductions. Quelles politiques énergétiques pour demain ?"

Chapter 4: The Politics of Citizen Science

Almost five years after the nuclear disaster, Natsuo had become one of the most active members of NEPR. On March 5, 2016, I followed her to the forefront of a public demonstration organized by their network against the raised threshold of radiation exposure. For more than two hours near downtown Tokyo, Natsuo and other mothers shouted slogans such as "Let the children escape from Fukushima!; We won't be silenced by the government!; The nuclear disaster is not over!; Radiation is still a problem!; End the state's brainwashing campaign!" Not far from me, an elderly woman protester shouted, "Professionals in the radio-medical domain are not allowed to receive a dose that is higher than 0.2 millisieverts, but mothers and children can live in an area of 20 millisieverts? What is wrong with Japan!?" As the demonstration approached the commercial district of Shinjuku, the rallying cries of protestors were drowned out by the popular music emanating from the giant sound systems of nearby shopping centers. Natsuo's hand-written sign became dwarfed by the twenty-foot-tall electronic billboards dominating the streets. At the end of the demonstration, everyone shook hands and went their own ways. Members of NEPR, who were not so long ago criticizing the state, returned to being regular people—just mothers minding their own business.

As this vignette demonstrates, members of NEPR did not shy away from using their recently gained citizen science knowledge for advocacy purpose, going as far as to take their critique to the streets of Tokyo. In the case of citizen science after Fukushima, this is unusual. For instance, Kimura (2016) argues that many Japanese women involved in citizen science have hesitated from radical activism, as doing so is considered incongruent with the ideal feminine citizen-subjectivity. She highlights women's struggles with radioactive contamination as a "private problem that had to be dealt with in a highly secretive manner" (2016: 24). Ultimately, she contends that political radicalization through food monitoring failed to take place in post-Fukushima Japan. This does not imply, however, that citizen science is apolitical. Indeed, the simple fact of testing food for radiation can be understood as a political act, since it echoes a lack of trust toward governmental authorities.

Yet, members of NEPR went much farther than simply resorting to monitoring or tracking practices to convey a symbolic distrust of state expertise. As opposed to the citizen scientists described by Kimura, mothers like Natsuo embedded their knowledge in political actionability, as manifested during demonstrations, speeches, or judicial trials. Still, much like Kimura's findings, many of my informants initially argued to me that their work was not "political" (*seijiteki*). In chapter 1, the taboo surrounding the word "politics" has already been explained as a remnant of sociohistorical factors. Building on such foundations, this chapter delves deeper into the politics of citizen science and highlight the pressures that shape the political potential of their expertise in given ways. By picking up on Natsuo's story and other members of NEPR, I trace the sociology of their knowledge in conjunction with the realm of citizen science, examining how they describe their work, while dealing with the political of politics.

4.1 Japan Police Town!

When I first met Mari, one of the main representatives of NEPR, she was very clear to emphasize the fact that their organization was not anti-nuclear and that they were not associated with any political affiliation whatsoever. As she explained: "Political parties are too tempestuous (*hageshii*); we don't want to be their ally…" Somehow, I was perplexed. After all, the whole endeavor of trying to evacuate people from Fukushima appeared highly political to me. In this, I began to wonder how members of NEPR understood politics, why they claimed that their work was apolitical, and how they ultimately hoped to enact their dissensus against the state management of radiation hazards. To answer such inquiries, it is particularly useful to contrast their expertise with the activism of Japanese anti-nuclear organizations.

In order to do so, I drew on the case study of the Anti-Nuclear Tent (*datsugenpatsu tento*), an organization established as a means to protest nuclear power and the health dangers associated with radioactive contamination. The Tent, located in the Tokyoite governmental district of Kasumigaseki, was built during a human chain protest that surrounded METI headquarters on September 11, 2011.[73] Amidst the tall bureaucratic skyscrapers of the area, the Tent stood as a disorderly installation filled with colorful placards and elderly people. Its broken-down aspect grabbed pedestrians' attention, while displaying slogans such as "Don't erase the voices of Fukushima! Don't trust the government and the big media! Save the children of Fukushima!"

The Tent served as a base of action for ending nuclear power in Japan and was run by Mr. Yasunari, an elderly man convinced that the government was minimizing the harmful influence of residual radioactivity. As the director of the Tent Mr. Yasunari explained to me: "Our goal is simple: to stop and decommission nuclear power plants!" In

[73] The Tent in Kasumigaseki was known as the Tent number 1. Additionally, there were two other Anti-Nuclear Tents, including one only reserved to women.

2016, I spent much time getting to know Mr. Yasunari, as well as the other members of the Tent – mostly elderly individuals in their late sixties.

Illustration 12: *The Anti-Nuclear Tent* (photo by the author)

After interviewing members of Tent, I soon learned that many were once part of the *All-Campus Joint Struggle League* (*zenkyōtō*), the Japanese equivalent of May 68. This social movement consisted of a series of student protests against the traditional values of capitalism, consumerism, and American imperialism. Therefore, even before 2011, many members of the Tent had already developed a strong anti-nuclear agenda and a distrust for their government. They believed that Japan was not a democracy, but, as Yasunari explained to me, a "police town." For members of the Tent raised in the tumultuous period of May 68, nuclear power was an undemocratic source of energy. Many argued that nuclear energy was never developed to produce stable electricity, but rather to create the atomic bomb. As such, for members of the Tent, nuclear power plants were not born for the demos, but for the polemos or militaristic purposes. The history of nuclear energy was for them embedded with mass destruction and inequality. Similarly, Yasunari was convinced that the government had minimized the harmful influence of radioactive contamination after Fukushima, so as to restart nuclear power as soon as possible. Stating his disdain for capitalism, Yasunari explained to me that nuclear power had built a needless dependence toward electrical consumption:

> We waste too much electricity and the government makes us believe that we need more of it! The neon in Ginza is it really necessary? And the L.E.D. all over the city? We have become too comfortable. This consumption is not even linked with our actual needs! When the power plants stopped after Fukushima, we still had light! It was enough! The restart of nuclear power is simply for the financial sake of the electrical companies and for the benefit of the government. It's not for the well-being of the population!

For these anti-nuclear activists, nuclear power was experienced as a problem of extravagance (*zeitaku*), as well as a problem of undemocratic values that put the utilitarian interests of electric companies at the expense of citizens. Since nuclear power was long associated with a form of Japanese independence, criticizing it was also an act of anti-patriotism (see Chapter 2). In that regard, members of the Tent were constantly harassed by ultra-nationalists (*ikkokumono*). "They came not so long ago and broke our door…" told me Yasunari while pointing at the Tent entrance. "It's the third time that we had to replace it! Be careful if you ever see some right-wing propaganda truck (*gaisensha*)!" Beyond physical threats from Japanese national extremists, the Tent was also facing a Strategic Lawsuit Against Public Participation (SLAPP) brought by the Japanese state. As Yasunari retorted: “The government is trying to burden us with the cost of a legal defense, so that we will stop our fight. They are claiming 110 millions of yens. But we won’t be intimidated!” Usually, a SLAPP lawsuit is intended to silence critics by burdening victims with the cost of a legal defense until the opposition is abandoned. Yet, when citizens began to support the Tent with financial donations, the government accused members of the Tent of illegally occupying a private governmental property and ordered the “evacuation” of the Anti-Nuclear Tent, sitting next to the offices of METI. In the wee hours of August 21, 2016, a bulldozer came and swiped the small barracks clean off the ground.

As opposed to citizen scientists like Natsuo, who first learned about the danger of radiation through their own experiences of the 2011 nuclear disaster, it is important to highlight the fact that anti-nuclear activists had formulated their understanding of radiation hazards through prior knowledge of nuclear power and its infrastructure. In the context of Mexican forest industry, Mathews described how members of the public evaluate state knowledge performances according to “well-entrenched framings of the state, expertise, and how officials and experts ought to behave” (2014: 103). In a very similar way, anti-nuclear activists also evaluated official knowledge about radiation through their own specific framing of state experts. This often led anti-nuclear actors to rationalize radioactive contamination as the extension of an already established political and social precarity. Indeed, protesters of the Tent projected radiation as a ubiquitous threat to life, the product of an undemocratic legacy born from the bastard union of warfare and capitalism. When I interviewed members of the Tent, it was not rare for me to hear phrases such as “Radioactivity (*hōshanō*) is the devil (*akuma*)!” or “The atom is wicked (*kaku ha aku*)!”

Witnessing my interest in anti-nuclear movements, Yasunari encouraged me to participate in weekly protests held in front of the Prime Minister's residence (*Sōri Kantei*). In aftermath of 2011, these protests had gathered thousands of angry citizens who appealed for the end of nuclear power in Japan. Five years after the disaster, weekly protests held in front of the Prime Minister's residence had shrunk in size, containing no more than a few dozen anti-nuclear activists. During these weekly gatherings I heard violent vocal outbursts such as "Do you hate Abe? I despise him! (*Abe ha kirai desu ka. Watashi ha dai kirai!)"* and saw unflattering representation of the Prime Minister in the shape of a larva, with written remarks such as *kokumin mushi* (the nation's larva). Much like the Anti-Nuclear Tent, these protestors were also facing threats from Japanese ultra-nationalists. In January 2016, I remember a particular instance where a black sedan abruptly stopped in front of the protestors, prompting everyone to hold their breath. A pale and frail man got out of the car and seeing that this was one of their friends, a protestor exclaimed the following in apparent relief: "Geez! I thought that it was going to be someone scary (*kowai hito*)… Don't scare us like that!" Moreover, people that participate in weekly protests were under the constant scrutiny of "undercover" public security officers (*kōan keisatsukan*), scribbling notes during the protestors' activities. I stopped coming to those weekly gatherings when public security officers began to scribble too many notes about me, the only white foreigner present in those protests. I became a bit paranoid and wondered if my research visa in Japan would not suddenly come to an end.

Through these weekly gatherings, I also ended up meeting Shun and Yui, founders of another anti-nuclear NPO that aimed to provide a safe locus for families to participate in anti-nuclear protests. Before the disaster, Shun and Yui had never taken part in any protests. Yet, as a chiropractor, Shun had a better knowledge about radiation hazard than most citizens. Consequently, he was shocked by the change of radiological standard that followed the disaster. This prompted his interest into the realm of anti-nuclear activism and he began to participate in protests with his friend Yui. Yet, they faced difficulties, as they both explained to me during an interview:

> We just found anti-nuclear demonstrations so dark and dreadful (*kowakatta*). So we decided to create a locus where even mothers with a baby cart could participate! It was important to make a place that was safe and friendly for the family, a kind of parade for everyone!

For people like Shun and Yui, the change of radiological standards highlighted a sharp disconnection between the well-being of the population and their governmental elites. Both felt as if they were "coming back to the old history of Japan." As Shun explained to me in further details: "During the war, you had the *kamikaze*, you had to die for honor, for the country. Now, it's the same, people are told to be resilient to this disaster." Through their organization Shun and Yui were looking to create a locus of hope (*kibō*) against the pervasive path that they saw in Japan's future. As they both pursued:

> We need to prepare the way for the future. We can't prepare ourselves against the threat of nuclear power, it's the evil of humans. We cannot stop earthquakes or tsunami, but we can stop nuclear power. *How* to live is the most important thing, but right now, we are not living, we are *surviving*! It's easy to stop all that, the

government just has to say 3 syllables YA – ME – TA [we stop]. How many years will be necessary for them to be able to say those 3 mere syllables?

After interviewing them, I was invited to participate in one of their anti-nuclear protests, which took place in Inokashira Koen, a suburb of Tokyo. There was a weird contrast between the joyful appearance of the protest and the mottos inscribed on their signs, which read as follows: "We won't forgive the restarting of nuclear power" (*genpatsu sakaido yurusan*). While Shun and Yui had successfully created a political locus of dissensus that was safe and friendly, their endeavor was not without potential drawbacks. I was especially surprised by the high number of policemen and patrol cars that were present during the protest. A bit perplexed, I asked the following to one of the protestors: "Is this police presence really necessary? I mean, there's only a bunch of kids and elderly protestors. It's not like you're going to cause any trouble!" The man laughed and replied the following: "The police is here to *protect* us! You never know what might happen because of the right-wing extremists…" Even when anti-nuclear demonstrations were organized by citizens such as Shun and Yui, who never had any history of political radicalism (as opposed to the members of the Anti-Nuclear Tent) a police presence was still necessary to protect them from the possible threat of extremists.

In the end, fieldwork amongst anti-nuclear activists made me realize that embracing such a stance could be very problematic. Mari, the main representative of NEPR, was quite aware of such problems. Originally from Fukushima, she had helped mothers like Natsuo find a locus where evacuee could freely speak about their concerns. Still, she had faced many difficulties in doing so. As she argued: "It can be very difficult for mothers to raise their voices (*koe agetakunai*). The risks are high. If you criticize the government you'll be labeled as a traitor (*hikokumin*)." In light of such pressure, reasons for an apolitical stance were crystal clear: it enabled members of the Network to symbolically dissociate themselves from the anti-nuclear realm and more importantly, from the pressures that these groups face. Many members of NEPR were mothers who did not want to be publicly associated with such movements from fear of potential backlashes.

4.2 Politics by Science

Amidst the difficulties explained so far, how could members of NEPR express their opposition against a state management of radioactive hazard, which they considered unacceptable and unjust? Anthropologist Scott Schnell provides a useful insight in that regard:

> In a society like Japan's where harmony and cooperation have been relentlessly promoted as fundamental principles of social interaction, it is often difficult to pose a direct challenge to the authorities. […] Thus when people feel compelled to express their opposition, they are likely to do so through less direct means, such as in the form of festivals that 'spontaneously' escalate into violence, or in invoking vague fears of upsetting the ancestral spirits (2008: 215).

For members of NEPR, a discourse supported by the work of citizen science had enabled them to articulate politics through science, a tactic that is also found elsewhere through the world. Indeed, in the context of Peruvian extractive mining, anthropologist Stefanie

Graeter argues that scientific documentation of heavy-metal contamination in the Mantaro Valley allows citizens to express political responses of "fundamental disagreement over the governance of life and death in Peru" (2017: 119). She highlights how scientific evidence formed the basis of political advocacy, subsequently generating "conditions of political actionability—the ability to act on knowledge politically" (2017: 119-121). In similar ways, by mobilizing an apolitical scientific discourse around radioactive contamination, NEPR could indirectly criticize the decisions taken by their own government.

Once again, it is useful to compare NEPR's epistemic basis with the activism of anti-nuclear actors, especially to highlight the subtleness of their political criticism. When I conducted fieldwork with members of the Anti-Nuclear Tent, many were appalled by the fact that TEPCO – the electric utility monopoly owning the Fukushima power plant – was saved from bankruptcy by becoming nationalized through governmental ownership. As a consequence, members of the Tent routinely went off to protest in front of TEPCO headquarters, situated in Ginza, one of the richest neighborhoods of Tokyo. In 2016, under a freezing winter rain, I witnessed anti-nuclear activists restlessly yelling at the employees of TEPCO: "You will die (*shinimasu yo ne*)! You're all criminals (*hanzai*)! Why don't you take your responsibilities (*sekinin*)!? Give us back our lives! Give us back our clean water and pure air! What about the children!? Children are our treasure!"

In sharp contrast, the demonstrations of NEPR were never filled with the aforementioned threats or criticisms. On the contrary, dissensus was first and foremost expressed through the mobilization of a scientific discourse about radiation hazards. For instance, during NEPR public protestations, one could hear things such as: "This time the number of thyroid case has reached 172 cases! 131 children have already been operated and 41 are awaiting their turn! All of that in a screening of 300 000 people! This is not normal!" Moreover, the emphasis on scientific narratives was epitomized by their banners and placards, which read like this: "The incidence rate of thyroid cancer is 50 times higher in Fukushima!" or "The normal incidence of thyroid cancer is of 1 individual per 1 million. Fukushima has 167 individuals in 380 000 [see picture]."

Illustration 13: *Public protest by NEPR in Tokyo* (photo by the author)

The pamphlet that anti-nuclear activists distributed to passersby were also affectively charged with emotional stories. Beyond unflattering representation of the Prime Minister Abe Shinzō in the form of a larva, I remember receiving a particular manifesto with a drawing of Godzilla urinating on the shore of Fukushima, with three-eyes mutant dolphins jumping in a sea of yellow water. On the other hand, the pamphlets that the NEPR publicly distributed were always backed up by scientific fact that aimed to explain the specific dangers of radioactive exposure. On one of such pamphlets, the organization had mobilized state data to contradict the official interpretation of radiation risk. On their flyer, one could see a MEXT produced map of the aerial dispersion of radioactive pollutants fragmented in colorful zones, each linked with specific amounts of radiation level. Below the map one could read the following:

> The third zone corresponds to what nuclear workers call a 'radiation controlled areas.' In such zones, individuals need to wear special protection equipment as shown in this picture [the picture represented an employee of TEPCO covered from head to toe in a white protection suit]. It is also forbidden to eat, drink, and move objects from the site. As we can see on the map, places that fell within this zone are not just in the prefecture of Fukushima, but also in Tochigi, Gunma, Ibaraki, Chiba and Tokyo.

Moreover, I often heard anti-nuclear activists claimed that the food produced in Fukushima was "poisonous" (*doku*). Such sayings had enraged a technical advisor employed by MOE, whom I interviewed on March 2, 2016 in Fukushima. This technical advisor explained to me that Japan had adopted the strictest baseline of radioactivity in food throughout the world (100 Bq/kg) and that there was consequently no need to worry about food safety. Yet, based on the knowledge that members of NEPR had garnered – by inviting, for instance, medical doctors – they knew that a baseline of 100 Bq/kg was not necessarily a synonymous of safety. As Dr. Rin had explained in that regard:

> For the old people, the 100 Bq/kg threshold might be all right, but for the young or the pregnant women there can be risks. Even if the levels are low, they tend to

accumulate themselves into the body, and while some muscles might eventually expel some of the contaminants, other body parts don't. For example, radioactive cesium can enter the ovaries (*ransō*) of women and it stays there without getting expelled; that's a risk that can be transmitted to the child and the future generations.

Members of NEPR knew well about the bioaccumulation of radionuclides in the body and often discussed the toxicity of specific radionuclides, or their differential impact between sexes and age. Flyers distributed during their demonstration were subsequently framed through such explanations. For instance, one of their flyers contained the pre-disaster level of radioactive cesium in a set of different food products. In 2008, one could learn that the average value of radioactive cesium in rice was of 0.012 Bq/kg.[74] In other words, there was almost no trace of radioactive cesium in food. The flyer argued that the new food consumption threshold of 100 Bq/kg – one of the strictest in the world – still represented an incredible increase *in comparison* to the actual level of cesium that people previously ingested (0.012 Bq/kg).[75] By mobilizing such scientific knowledge, members of NEPR were able to highlight the arbitrariness of the safety of the 100 Bq/kg baseline. Such a mobilization was highly political, enabling citizen scientists to criticize the regime of the sensible around radioactive hazard (Rancière 2013). Indeed, as Rancière argues: "Politics revolves around what is seen and what can be said about it, around who has the ability to see and the talent to speak, around the properties of spaces and the possibilities of time"

[74] According to the 2008 business report of the *Japan Chemical Analysis Center*.

[75] This, of course, only represents the acceptable threshold of radiation and does not necessarily represent the *actual* quantity of cesium that is ingested by the population.

(2013: 8). In similar ways, by bringing a situated scientific objectivity to the forefront, NEPR highlighted a different narrative than the state discourse on food safety. Much like the work of Donna Haraway (1991), their critical inquiry went against non-embodied, irresponsible, apolitical, and unlocatable forms of knowledge.[76] By putting forward situated aspect of radiation harm, NEPR brought the possibility of political responsibility (Haraway 1991), criticizing the government management of radiation hazards as a form of governance that denied “the stakes in location, embodiment, and partial perspective” (Haraway 1991: 191).

The generational gap between anti-nuclear activists and members of NEPR also provides an important insight on how occupational factors influence political voices. Indeed, many anti-nuclear activists that I interviewed were already retired (*intaisha*) and in such were no longer “full-fledged member of the society” or what the Japanese called *shakaijin*. Much like childhood, which is as a period of individual freedom in Japanese society (Polleri 2013), the age of retirement provides individuals with a greater degree of independence. No longer restrained by economic or social pressure, retirees can be more vocal in their discontent and criticism. On the other hand, many members of NEPR were still *shakaijin* and as working adults they were socially expected to restrain themselves from criticizing their government. A critique mediated through the realm of science could successfully overcome such difficulties.

Still, for citizen scientists like Natsuo and Mari, radioactive hazard was not a mere problem of scientific facts that could only be explained by the language of Sieverts and

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[76] As Haraway explains: “So, not so perversely, objectivity turns out to be about particular and specific embodiment, and definitively not about the false vision promising transcendence of all limits and responsibility” (1991: 190).

becquerels. Indeed, beyond a change of allowable threshold, Natsuo argued to me that there was an important gap of values (*kachikan*) that supported the ways of post-disaster recovery between the evacuees of Fukushima and their political elites. In her personal life and private thoughts (*honne*), Natsuo equally rationalized radiation hazard through a rampant feeling of political precarity and structural injustice – and she very much agreed with the narratives of anti-nuclear activists. I had long discussions with Natsuo and Mari about how the disaster had made them rethink about the place of democracy in Japanese society. Yet, when I first started to interview members of NEPR, my informants exclusively spoke in scientific terms. When I became a regular face at their meetings – hereby leaving the "public" sphere – we began to grow closer and openly discussed about the "mischief" of Prime Minister Abe Shinzō. The mobilization of science was, however, crucial to initially develop this relationship of trust.

In their official stance and public position (*tatemae*), members of NEPR were careful to strictly enact a scientific discourse. Doing so helped them to bypass accusations of being biased by a political ideology (e.g., anti-nuclear). Pragmatically speaking, it also enabled NEPR to reach towards a broader audience, such as mothers and housewives living in Tokyo who wanted to hear more about food contamination, but that might be wary of doing so through the realm of anti-nuclear activism.

In the end, the expertise of NEPR had emerged from a cultural context that was different from the situation faced by anti-nuclear activists. Rather than publicly highlighting moral claims of injustice around nuclear power, NEPR had embraced a scientific research program that epistemically anchored their politics. This tactic provided a three-fold advantage. First, it assured safety for their members. Secondly, it enabled them to reach toward people who might be turned off by any semblance of political affiliations. Third, it legitimated their criticism of state-sponsored radioactive governance as unbiased by politics.

4.3 Fūhyō Higai

In spite of such efforts, I soon noticed that the aforementioned tactics were becoming less effective, especially as citizen scientists were gradually accused of contributing to the spread of harmful rumors. Indeed, in the aftermath of this disaster, state officials and political elites began to hamper the political potential of citizen scientists by depicting their strategies as egoistic behaviors that impeded the recovery of Fukushima through the creation of harmful rumors (see Kimura 2016). During my attendance in state-sponsored symposia, Fukushima was often described as being afflicted by such rumors and people that refused to eat food produced in the prefecture were labeled as "being stuck in the 2011 mentality" by state experts.

Known as *fūhyō higai* in Japanese, the notion of harmful rumors focuses on the "damage done to businesses providing commodities or services in Fukushima," while evoking "notions of the various participants in the dynamic, with a certain emphasis on the idea that someone is victimised or harmed by the rumors, and a concomitant implication that those who participate in the rumour-mongering are perpetrating harm" (Yamaguchi 2016: 71-72). As the aforementioned description highlights, the term fūhyō higai is highly nebulous. It falls within what geographer Erik Swyngedouw (2009: 613) calls the post-political enemy par excellence, where the target of concern is "always vague, ambiguous, unnamed and uncounted and, ultimately, empty." Medical doctors that I interviewed were often baffled by the use of this term. As Dr. Rin argued on July 1st, 2016: "The government keeps saying that Fukushima is suffering from 'harmful rumors' (*fūhyō higai*). Why do they call it that way?! Radioactivity is not a *fūhyō higai*, it's a *jitsugai* (real harm)! There are *true* risks, the soil is still extremely contaminated."

In order to learn more about the implications that surrounded this term, I contacted the Reconstruction Agency (*Fukkō-chō*), the principal apparatus of the Government of Japan tasked with the reconstruction process of Fukushima. Created after the 2011 triple disasters, the Reconstruction Agency acted as a "control tower" for all reconstruction efforts. One of its main role was to accelerate the revitalization of Fukushima, notably in the attempt of repatriating evacuees to their hometown by rebuilding the physical, economic, and emotional infrastructures of its cities (see Reconstruction Agency, 2016, 2016b).

After back-and-forth communication, I was given the go-ahead for an interview with Mr. Tadanobu, an official linked with the Public Relation branch of the agency situated in Tokyo. On May 11, 2016, Mr. Tadanobu first explained that tourism in northeastern Japan was in a dire economic state and that its food industry was at its lowest point, especially due the persistence of rumors associated with the upbringing of radiation risk. As he contended to me: "We help people for the creation of new business and against harmful rumors." Against the difficulty that the prefecture was facing, the main mission of the Agency was to create an "environment prompt for return" (*kaeru kankyō*), with decent infrastructure, lively businesses, and employment opportunity.

When I asked Tadanobu to shed some light upon the specificities of those so-called rumors, I was handed a pamphlet entitled "Eliminating Negative Reputation Impact," which was supposed to answer my question. However, I realized that the pamphlet did not contain any definition of the rumors in question. For instance, it did not argue that radiation levels below 20 mSv per year were safe, nor that claiming the contrary was considered as a case of harmful rumor. The only thing that came close to answering such a question was a world map that compared the atmospheric radiation level of Fukushima with other major foreign cities like Munich or New-York. Underneath the map, a legend explained that "The air dose rate in Fukushima Prefecture is about the same level as other major cities overseas" (Reconstruction Agency 2016: 4), hereby alluding to the safety of the region.[77]

The absence of clear scientific guidelines as to what exactly constitutes a harmful rumor is interesting. Notably, this can be explained by the fact that the notion of fūhyō higai is not concerned with the scientific basis of radiological harm, but rather with the economic aspects of it. Indeed, the concept of harmful rumors primarily define radiation hazards as an economic problem, which as Mr. Tadanobu explained, was linked with a decrease in tourism, as with the difficulties faced by local food industries. In this context, those who refuse to buy Fukushima's products can be seen as lacking empathy and moral compassion for the victims afflicted by financial difficulties.

Externalized and objectified under this form, radiation hazard no longer became a mere problem of scientific expertise, but a particular economic and affective problem that needed to be tackled through more than scientific risk communication. By governing radiation hazards under this aspect, the Reconstruction Agency bypassed the scientific

[77] This comparison does not consider the full extent of risk faced by the citizens of Fukushima as the measurements provided by the pamphlet only consider external exposure. For instance, the levels of radioactivity in New-York are mostly the result of natural background radiation, gamma-rays that pass through the body and leave (e.g., naturally occurring radiation from the soil or the sun). Fukushima is dealing with the release of radioactive pollutants, particles that can stick to the body or be inhaled/ingested, hence potentially producing chronic exposure.

narratives of different actors, like those of citizen scientists. Furthermore, it took the blame away from the state and corporate polluter, by transposing radiation harm as something that the citizen scientists were doing, as they tested foods that the government deemed safe. The notion of fūhyō higai is as such inseparable from a neoliberal discourse that assigns "blame to the individual rather than to any underlying set of condition such as economic or domestic stress" (Allison 2013: 42). Misunderstanding and prejudice were the hazard. Radiation? Not so much.

It is also noteworthy to highlight the presence of a gendered politics in the governance of contamination through the concept of harmful rumors. First, by framing harm around economic concerns, the notion deflects particular maternal embodiment associated with radiation hazards, as explained in the previous chapters.[78] Moreover, it stabilizes normative gender values. After Fukushima, scholars had shown that Japanese fathers were far from indifferent toward the adverse health effects of radiation exposure. However, many were constrained by their expected societal position. As Morioka explained:

> Most fathers did not actively participate in the efforts to guard their children from harmful radiation, because protecting children's health was not within the realm of their masculine role. State-sanctioned gender expectations about what it means to

[78] This is made particularly apparent by the Reconstruction Agency measures that support the health of evacuees. For instance, the category "health and living support" is understood through mental recovery projects that attempt to create a "motivation in life," while supporting community building (Reconstruction Agency 2016c: 3). In addition, the understanding of fūhyō higai disregard the specific temporality of radiation risk by stabilizing them in the past and by downplaying the future effect of chronic exposure. This is epitomized by the mandate of the Agency, which will last for 10 years before being dismantled. Redefining radiation risk in the past contributes to canceling the need for continued and long-term radiation protection, as it happened after Chernobyl (Kuchinskaya 2014: 64).

> be a good father, namely to be a good worker, powerfully dictate what constitutes masculinity in Japan and may even prevent men from fulfilling the most fundamental responsibility of fatherhood – protecting the lives of their children (2013: 195).

The economic narrative embedded in the notion of harmful rumors strongly reinforced this gendered expectation, hereby forbidding many men to enter the realm of citizen science. This normative context also dictates that the place of the women is to be found right next to her husband, as a form of affective support, rather than in citizen science networks. Furthermore, throughout my fieldwork, it also became apparent that the narrative of harmful rumors was not merely backed up by the government, but indirectly cultivated by an important part of the population, especially in the rural areas of Fukushima. As Natsuo explained to me:

> There are a lot of old people [in Fukushima] who refuse to believe information that doesn't appear on television and it's very hard to convince them. They'll tell us things like 'this ain't true, this ain't true' (sonna koto nai, sonna koto nai) or 'The country is saying that it's safe, so why do you contradict them?'

Mothers, like Natsuo, who criticize the management of the disaster were hereby seen as promoting harmful rumors. In that line of thought, Allison (2013) has highlighted the ostracism and discrimination that voluntary mothers have felt by leaving Fukushima. As she argues (2013: 184):

> Charges of disloyalty and selfishness – captured by the new buzzword *hikokumin* (non-citizenly) – got waged against those leaving the country or even the region (outside those mandated to do so by the government in the evacuation zones in a thirty kilometer range from the Fukushima Daiichi Nuclear Plant). Staying close to home and sticking it out became a badge of loyalty and trust (but also a matter of sheer livelihood for some).

The notion of harmful rumors, which deploys affective forces of selfishness (see Kimura 2016), also highlights the issue of spatiality in how citizens like Natsuo are ultimately able to enact an expertise on radiation hazards. Indeed, Natsuo had felt much pressure when she was initially living in Fukushima and couldn't be as vocal as she was in Tokyo. In this, it is important to realize that the region of northeastern Japan was long considered as the "rice granary" and "vegetable garden" of the country (Scoccimarro 2013; Ishii and Morlans 2014). In Fukushima, rice has been grown for many generations and the damages associated with contamination are not only economic, but also symbolic, as they tarnish the rich traditional values of agriculture. Consequently, an important part of the population does not necessarily embody radiation harm through the prism of potential adverse health effects, which were the main considerations of Natsuo.

It is also important to highlight the fact that the population of rural regions is usually composed of elderly individuals for whom the risk of low-dose exposure might be less relevant.[79] Amidst such factors, Natsuo had found much difficulty in voicing her specific

[79] Indeed, elderly people might die from old age before developing fatal cancers attributed to radiation exposure.

concerns in Fukushima. On the other hand, a region like Tokyo offered a wider range of possibilities for citizen science. For instance, the anonymity of a big metropolis had made radioactive food testing easier, as mothers did not have to fear the backlash of their neighbors. The strong communal ties of a small rural village in Fukushima would have made this simple task unthinkable for many mothers.

Both Natsuo and Mari argued that NEPR would have never succeeded in Fukushima. As they explained: “We can’t do what we are doing in Fukushima! The pressure is real. People don’t want to talk about radiation, being a plaintiff (*genkoku*) is a secret. Other members of the community will tell you to stop spreading ‘rumors.’ So, it’s quite hard to express oneself directly (*hakkiri*). People from the Tohoku have a high culture of endurance (*gaman suru*).” As citizen scientists, the political potential of their expertise was ultimately constrained by important spatial and cultural issues.

4.4 Mothers as Spokespeople

On March 27, 2016, Natsuo took one of her biggest leaps toward political accountability. She did so by speaking as a representative of NEPR during an important social forum that brought together social movements, NGO, and advocacy campaigns with the aim of seeking international legitimacy after Fukushima. As a one-week gathering held in Tokyo, the forum had assembled an eclectic band of international participants, whose life had all been affected by nuclear power. When I met Natsuo before her speech, she seemed pale as a ghost. Speaking with other members of NEPR was one thing, but speaking in front of an audience filled with foreign attendants was something else. Nonetheless, she delivered her speech without fletching. As explained in front of a full-packed audience:

> The Prefecture of Fukushima has sent us a basic questionnaire as a part of the health management survey of prefectural residents. We were asked to write down our movements during the first four months that followed March 11, 2011. My daughter and I did our best to write down our whereabouts and sent the survey back. Later, we received a letter from the authorities indicating that I had received 1.9 mSv of radiation exposure during those four months, while my daughter had received 1.8 mSv. These exposure levels were simply calculated on one's memory of movement and are utterly unreliable. If the government had been really concerned with our health, I wish that they had carried out blood and urine tests for all residents in affected areas since the early stage of radiation exposure. In September 2013, I was diagnosed with collagen disease. It's an immunological disease associated with infection. The doctor explained that it would be cured in about one year, but I am still under treatment for this condition and need regular blood tests. I feel pain in my joints and in my entire body, especially when I get up in the morning. The doctor told me that I also have Hashimoto's thyroiditis [thyroid disorder].

From someone who, not too long ago, knew nothing about radioactive hazards, Natsuo had become engaged in a constant process of learning to authenticate her own experience as a form of expertise that could be recognized as legitimate. Interestingly, in 2016, governmental authorities and state experts equally began to deploy mothers as spokespeople. Yet, they did so in order to legitimate a very different narrative than the one made by citizen scientists like Natsuo. This mobilization of mother's voices was notably epitomized during the *Fukushima Medical University International Symposium*, an important event that commemorated the fifth year of the disaster.[80] In the aftermath of the disaster many mothers living in Fukushima had forbidden their children to play outside, as they worried about radioactive exposure. The panel of experts at FMU explained that this had brought specific health problems of its own. By staying too much inside, the physical ability of children in Fukushima was apparently underdeveloped and many had scored a very low mark at the national physical ability test. A kindergarden teacher invited to the symposium argued that children had become afraid of nature, emphasizing the facts that they collected and killed insects when playing outside. Near the end of the symposium, a young mother from Fukushima was invited to convey her experiences. The mother in question was a former evacuees and a current resident of Date city, a small rural village in Fukushima. What follows is a summary of her story:

> I just couldn't keep it. Moving from place to place after the disaster. Going back and forth between our house and the temporary housing. I couldn't continue the life of an evacuee, so I finally decided to return to Fukushima in the affected areas. At the beginning, I decided to take measurement near my home and the results that I saw were quite high, 3, 5, or even 30 μSv per hour. My family and I went on to decontaminate the house and we removed everything by ourselves. We've cut the trees, scraped off the topsoil [of the garden], and cut some more trees. After various emotional conflicts, I came to realize that living with your family members is the

[80] The symposium, held in Fukushima, was entitled "Five Years Since the Great East Japan Earthquake, Tsunami and Nuclear Crisis" and given on March 8, 2016.

origin of happiness. I know that my children have been exposed to radiation during that time, but since they have a good metabolism, they can probably eliminate radioactive material from their body quite fast. I don't know if my children will face some problem in the future, but anyhow the world is full of other risks, like food additives. Decontamination is not the most important thing for Fukushima. Now I've stopped measuring radiation levels at all. I think that with a lot of hugs it's going to be fine!

During the Q&A period that followed, the young mother claimed that she did not disregard the impact of radiation, but that she wanted to transmit a message to her children about what matters the most in post-disaster recovery. An expert on the panel argued that she shouldn't worry, stating that "people in Fukushima have made their own choices and [that] every choice was a good choice!" While scholars have argued that states depoliticize controversial issues by transforming them into technical problems (Mitchell 2002; Ferguson 1994), the symposium was rather embedding radiation hazard as a matter of affective choice, with experts stating that every individual choice was *de facto* a good one.

In his critique of the STS subfield of public engagement, Brian Wynne (2007) argued that public participation around issues of science, technology, and risk, often reinforced normative models of the public, as opposed to challenging unacknowledged normativities. In that regard, it is crucial to acknowledge that the young mother was a form of invited public involvement by the experts of FMU. This, as Bryan Wynne reminds us, "always imposes a frame which already implicitly imposes normative commitments—an implicit politics—as to what is salient and what is not salient, and thus what kinds of knowledge are salient and not salient […]" (2007: 107). Notably, by inviting a witness who returned to Fukushima and who "understood" that radiation exposure was not necessarily the prime factor of risk, the symposium stabilized a specific regimes of the sensible around public radiation-related behaviors, where anxiety (*fuan*) was more harmful than radioactive contamination. As opposed to 2011, members of the public were not simply the targets of information dissemination by state experts, but equally "messengers who [could] convey information to their fellow citizens" (Kimura 2016: 56). Such a tactic is particularly useful "when the distrust of scientific governmental institution is high" as in the case of Fukushima (ibid).

The experts of the symposium did not praise the invited mother for her initial involvement in measuring radiation levels by herself, but for her emotional empathy and consideration toward her children. Ironically, this is also what Natsuo had attempted to do – albeit through the realm of citizen science. Yet, like many citizen scientists, Natsuo had not been praised for her efforts. By challenging the "regime of the sensible" (Rancière 2013) around radioactive hazards, that is, by claiming that exposure was dangerous and by wishing to evacuate permanently from Fukushima, it remained highly doubtful that Natsuo would have the opportunity to share her experience in such state-sponsored symposia. The aforementioned forms of risk communication made it clear that mothers' voices were relevant to tackle the issue of radioactive contamination, but insofar as they enacted normative feminine attitudes that promoted the stability of the household and not as actors that mastered radiological science through citizen science.

In Crafting Selves, anthropologist Dorinne Kondo (1990) examines Japanese discourses of identity and gender as crafted in the contexts of power relationship. By focusing on contradictions and tensions, Kondo destabilized the stereotype of the homogeneous Japanese society. Similarly to Kondo's findings, the symposium made me realize that the category of mother was far from homogeneous. With so much at stake, voluntary evacuees like Natsuo had felt forced to relegate their traditional gendered roles, not to mention the stability of a household or financial security, to second-rank priorities. Obviously, not everybody had the sheer will to do so. Indeed, juggling between the role of citizen scientists, evacuees, and mothers required much sustained effort that quickly wore people out. Since Fukushima is also a poor prefecture, radioactive contamination imposed itself on the top of a long list of burdens. This could quickly form an unbearable pile of problems (*yamazuni*), as Natsuo once told me.

In her case, Natsuo was confronting the threat head on, challenging as it may be. Still, many evacuees were reluctant to talk about the fact that they were coming from Fukushima. "Their children often faced discrimination (*ijime*) when other kids learn that they are from Fukushima," explained Natsuo to me. Indeed, through my fieldwork I've heard incidents of *ijime*, where children from Fukushima were called *baikin*, meaning "something harmful," like a "germ, bacteria, or mold." Natsuo had never experienced these problems. Yet, she too had heard of discriminatory practices in the prefecture of Niigata, where citizens had for instance refused to let evacuees from Fukushima approach their cities.

In light of such factors, it became evident that not everybody was willing to take the path crossed by citizen scientists like Natsuo. And indeed, few mothers could speak in front of an audience of two hundred people as successfully as Natsuo did. This was quite apparent, as I tracked the efforts of mothers that did not belong to NEPR. For instance, in

2016, I assisted a speech given by Akiko Uno, the founder of the National Refugee Association. Like Natsuo, Akiko Uno was a voluntary evacuee who had abandoned her life in Fukushima from fear of radioactive exposure. She had formed a group consisting of mothers who were seeking the right to evacuate from an environment that they considered harmful to themselves and their children. During a symposium organized by the association *Friends of the Earth*, Uno had invited mothers to share their experiences as evacuees. Yet, as opposed to Natsuo, many mothers could barely voice their concerns. They spoke by looking downward, while painfully muttering inaudible dialogue. At one point, a young mother burst into tears. All one could hear was the woman sobbing and the sound of high-pitched feedback from her microphone. The body of that young mother, silently convulsing with tears, pointed toward a different set of experiences than the ones faced by Natsuo.

As already explained, many mothers also epitomized the fact that the change of radiological standards (20 mSv per year) was first embodied as a subject that was “taboo” in the community, while being particularly hard to address due to the fear of backlashes from one’s own community. In this, simply bringing up the concerns of radioactive contamination demanded a great deal of effort, which often went against the Japanese societal constraint of harmony (*wa*) and consensus. Not every mother had the courage to do so.

Similar tensions were also echoed by Mari. Even though she had invested herself body and soul in NEPR, her own son was reluctant in approving of her doing. As she explained: “My son’s wife is in poor health. So he doesn’t talk to her about that [the risk of radiation]. He doesn’t want her to be worried. But he encourages me in secret…”

Stopping for a brief moment to readjust her glasses Mari burst into tears: “Even my own son can’t understand what I’m doing… I just want him to understand…”

In the end, utterly different embodiments of what constituted hazards in the aftermath of this disaster were present amidst members of the same family, and this crucially shaped how expertise on radiation hazards was to be enacted or not.

4.5 Migoroshi

As Natsuo was slowly adjusting to her new life, the LDP announced that financial supports for voluntary evacuees would end in March 2017. Such a policy leaves many voluntary evacuee mothers with few choice but to return to Fukushima. Like other mothers, Natsuo was skeptical of the governmental revitalization projects (*fukkō*) that aim to repatriate citizens to their former hometown: “All I see on TV are ads about revitalization, but they don’t mean anything for us.” She argued that the government was promoting a “revitalization without people” (*ningen naki fukkō*), only directed toward economic recovery.

In the years that have passed since Natsuo’s evacuation, her daughter, who was originally an elementary student, has become a young woman; she is already accustomed to a new life in Tokyo, and there is no point in her going back to an environment that would expose them, in Natsuo’s view, to chronic low-dose radiation. Indeed, for Natsuo, radiation damage continues to leave an unwanted legacy for children like her daughter, who are forced to bear a responsibility that should not be theirs. In an attempt to change this situation, and in sharp contrast to the government-sponsored revitalization process, Natsuo was looking to create a new legacy for her daughter. Specifically, she aimed to achieve this legacy through the creation of a diary (*techō*) that can relate one's personal history of exposure and sickness. In 2016, I followed Natsuo to the Big Pallet Fukushima Conference Centre, where an assembly for the creation of an irradiation booklet was being established.

A survivor from the Hiroshima nuclear bombing, an elderly woman named Eiko Ono, was present at the assembly. As an irradiated survivor (*hibakusha*), Mrs. Ono was in possession of an "A-bomb survivor health notebook" (*hibakusha kenkō techō*). This notebook certified that Mrs. Ono was a victim of the bombing and, as such, guarantees government coverage of her medical fees in case of illness. Mrs. Ono believed that many of her illnesses were linked to her original radiation exposure, and she encouraged the citizens of Fukushima present at the assembly to begin tracking their displacements and health histories as soon as possible. She also explained that the notebook had relieved worries about financial matters, and was in favor of the creation of a similar handbook for residents of Fukushima. After hearing her speech, Natsuo agreed that the evacuees from Fukushima needed something similar. "I believe that this is absolutely necessary, and I want that for my daughter!" she claimed.

As described in Chapter 3, Natsuo had already begun a similar project through citizen science; with a Geiger counter, she had measured the radiation levels around her house, compiling these results in a personal notebook, while also inserting her own medical ailments. Yet, the irradiation booklet proposed by the assembly stood as something that was completely different than from her own individual record. Such a booklet, modeled upon the one that former *hibakusha* had received, could enable individual accounts to stand as a potential archive of this disaster. The concretization of such a notebook was far from being concretized, but according to Natsuo, this endeavor had the potential to act as a counter narrative to the state discourse of safety, transforming self-evacuees as recognized victims. In talking about issues of temporality in toxic exposure, Murphy (2013 *online*) points how latency can "exceed the scope of individual lives," while going "beyond current regulatory regimes." For Natsuo, the booklet stood as a locus where an unwanted legacy of latent harmful effects could perhaps one day gain scientific and expert credibility. She argued that the creation of a booklet could be legitimized not by an accumulation of personal stories, but by the gathering of scientific data around radiation levels.

Importantly, advocacy for such handbooks also demonstrated that voluntary evacuee mothers experienced the threat of radioactive contamination as a form of financial precarity, particularly in light of potential medical costs and cut financial helps. This put forward the issue of class stratification. As Natsuo argued: "All the rich have left Fukushima. It's easy to do so if you have money, but for the poor it's not the same." In her study of social precarity following the Japanese bubble crisis of the 90s, Allison argued that "Japan is becoming a place where hope become a privilege of the socioeconomically secure" (2013: 34). A similar process is happening after Fukushima, as long-term evacuation is something that poor mothers like Natsuo can barely afford.

Still, by being actively engaged in rationalizing the unwanted legacy of radioactive contamination, Natsuo attempted to provide her daughter with the gift of a safe (i.e., uncontaminated) environment (*anshin kankyō purezento*). To articulate this gift, mothers like Natsuo have to become "experts" in radiation protection. Being a "good" and "wise" mother now means becoming experienced in an array of novel embodied practices, such as measuring radiation with a Geiger counter, testing food for radioactive contamination, participating in workshops on nuclear issues, or tracking displacements and illnesses in a health handbook. These new citizen-led understandings of radioactive contamination subsequently laid the groundwork for new forms of being, where self-erudition, accusations of anti-patriotism, allegations of rumor mongering, and financial precarity are now part of voluntary evacuee mothers' lives. Perceiving childcare as the exclusive task of mothers has long been a pervasive trait in idealized Japanese normative culture. And although caring for their children is exactly what voluntary evacuee mothers are doing in the aftermath of the Fukushima disaster, their efforts are (ironically) being depicted as conflicting with state revitalization policies. Against this complex backdrop, motherhood was also embodied as a set of discordant practices and discourses that clashed with the fundamental principles of Japanese social interaction, wherein harmony, cooperation, and consensus are relentlessly promoted.

In a post-Fukushima Japan, many members of NEPR argued that citizen science was a means to protect life (*inochi wo momoru*). Yet, the term that all informants used for the word "life" was *inochi*. As a member explained to me: "*Inochi* is more than the biological understanding of life. It's more than physical harm (*kenkō higai*), it is also the mind, the soul, the heart, and the spirit (*seishin*). But the *seishin* is becoming weird after Fukushima…" In a normalize state of emergency, mothers like Natsuo do all they can to protect their children – even as they are agonizingly aware of how short they are often falling in their efforts. In talking about modern power, Foucault (1980) described a shift from disciplinary power (a power that takes life) to new forms of governance in what he calls biopower – that is, the prerogative of a nation state to make live and let die. A word that Natsuo and Mari constantly uttered to me while talking about the state governance of radiation hazard was *migoroshi*. Its literal translation, "letting someone die," clearly echoes Foucault's biopower.

4.6 We're Losing because of Money!

Near the end of my fieldwork, NEPR efforts to develop a counter expertise around the uncertainty of radiation hazards coalesced during a trial hearing at the Fukushima District Court. The 2016 trial was tentatively aiming to gain an official recognition for the voluntary evacuees, as well as to reverse the government decision to cut their financial subsidies. Six lawyers were representing the defendants, families from Fukushima, which mostly consisted of young mothers, notably including Natsuo.

In order to assess the danger of radioactive contamination from a legal viewpoint, the lawyers had embraced a global perspective that heavily focused on other nuclear disasters, as well as on areas of uncertainty. Chernobyl had helped to provide such a baseline, upon which the defense was modeled.[81] Yet, in a context of scientific uncertainty, how to legally locate a harm that had yet to potentially happen was unclear. To bypass this problem, the lawyers were looking to articulate their defense around the precautionary principle, which defines actions on issues considered to be still uncertain (e.g., low-dose exposure). This principle was used to justify discretionary decisions in situations where there was the possibility of harm from living in low-dose irradiated areas. Notably, under this principle, the burden of proof about the absence of harm is supposed to fall on those proposing an action, not those opposing it. The lawyers were attempting to frame their case around three main points: The uncertainty of risk (*risuku no fukakujitsusei*); the potential

[81] The lawyers aimed to resort to the "Chernobyl Law," which stipulates that individuals have the right to evacuate above 1 mSv per year.

irreversibility (*fukyagaku-sei*) of health damage; and the late occurrence (*banpatsusei*) of low-dose danger. A case based on the precautionary principle was intended to deal with uncertainty in areas where the absence of evidence and the incompleteness of scientific knowledge could carry profound unforeseen events. As science couldn't judge whether low-dose exposure in Fukushima was safe or dangerous, the lawyer Masuji, who was notably defending the case of Natsuo, argued to me that the potential adverse health effect of radiation could not be rationalized through a dualistic pattern of "safety" or "danger." The law, as he argued, was in need of much sought after gray zone:

> We can't figure the risk of radioactive contamination and the health damage with the power of present science. So much of this is a problem of the limit of science (*kagaku no genkai*). I don't see our case as a problem of scientific argument, but as a discussion of another dimension based on the outcome and limit of science.

During the hearing, the defendant lawyers presented a thick document that revolved around many of the uncertainties gathered by the citizen scientists of NEPR: unknown past levels of exposure, the unaccountability of the dangers linked with internal contamination, food contamination, the presence of radioactive hot spots, and the partiality of air dose monitoring. In addition, two mothers were invited to speak, so as to share their experience.

The first speaker was Natsuo. Assembling the knowledge that she gathered as a citizen scientist, she gave a very technical talk, describing the level of microsieverts per hour that she had measured in her house, while explaining in detail the adverse health effects that she faced. If I hadn't known Natsuo, I could have mistaken her for a scientist employed in a professional laboratory. Distancing herself from any affective position, Natsuo relied on scientific measurements of radioactive exposure in an attempt to highlight legal transgressions linked with the state limit of radioactive exposure. In this scientifically infused pleading, her embodiment of radioactive hazards as a mother was absent.

The second speaker, a young mother from Fukushima called Akane, was invited to share her own story and diligently came forward to speak with a baby resting on her shoulder. As she articulated:

> Children don't understand why they always need to wear a mask. They don't understand what a hot spot is, all they understand is that they can't play outside, that they are not allowed to do this or that, and that they can't have fun! They can't do anything, and that's supposed to be what we call protection? I'm always thinking about radiation, is there some radioactivity on those flowers, can I let my baby touch them? Children can't protect themselves. I loved Fukushima so much, but now it has been dirtied! We can't enjoy nature as we did!

In sharp contrast with Natsuo, Akane had strategically deployed her own affective experience as a mother, emphasizing strong stereotyped images of Japanese motherhood. Indeed, the traditional role of mothers in Japan was to give physical and emotional support to their children. As Morioka argues: "Motherhood, empowered by the moral imperative to protect children, gives women a license to trust their feelings and challenge other prevalent cultural norms of obedience to governmental and corporate authorities" (2013: 198). In such narrative, gendered experiences complicated the operative vectors that surrounded the setting of an acceptable baseline. Yet, Natsuo and Akane's musings also highlight the Janus face of women's roles in regard to radioactive protection. While Natsuo stood as the rationally calculating citizen scientist, Akane embodied the logics of feminine motherhood. Both demonstrated the polarized facets of women's role in citizen science, where motherhood and science hardly merged together.

These pressure constitutes a major speed bump in how women, as either citizen scientists or mothers, are able to enact an expertise on radiation hazards. Still, the defendant lawyers were able to bypass these constrains by precisely inviting two mothers, whose narratives complemented each other in front of the legal realm. Yet, such a tactic ultimately proved itself to be insufficient. Indeed, when the hearing was concluded, the judge stated that the plaintiffs' facts were going to be analyzed, adding that a new hearing would be scheduled in the upcoming months. Puzzled, I glanced at Mari in the hope of some explanations. "That's their tactics," she argued to me, "they keep rescheduling hearings. So the trial drags on and on and on... We're losing because of money, not because of our knowledge!"

Many of these legal activities had heavily eroded the meager finance of NEPR, which was supported by public donations. Members were emotionally frustrated to see that their efforts were failing because of monetary constraints. It took a sheer amount of energy to pursue a path that did not have reassurance of success. People like Natsuo had already gone through so much – how much longer would they have the strength to pursue a fight that might not even bear fruits?

In the aftermath of the trial, the bus that brought us back to Tokyo was dead silent. People were simply tired. Exhausted. Worn out. At the end of my fieldwork, I noticed that fewer people participated in the demonstrations and workshops of NEPR. Fighting without seeing the materialization of results was putting people through a meat grinder that slowly began to take their energy piece by piece. It equally took a toll on me. Many of my informants burst into tears at the end of our interviews and I wasn't used to such fieldwork. Japanese rarely let go of their feelings when they initially meet a stranger. This was perhaps due to the fact that I was a foreigner, a *gaijin*, and that it was "easier" for them (or less shameful) to display their true feelings (*honne*). Still, at the end of my fieldwork, I couldn't bear to see people cry, I couldn't keep on hearing their "dark stories" (*kurai hanashi*) and I became tired of feeling like a voyeur, rather than an ethnographer. Japan was my first anthropological love – the very country that made me want to become an anthropologist. But by the end of my fieldwork, I couldn't wait to leave Japan.[82] I never understood how people like Natsuo could find the sheer strength to simply go on. But I could understand why some citizen scientists would abandon their fight – and no one could judge them for that.

[82] Of course such reaction is also inseparable from my own positionality. Some researchers might not have had such a hard time holding grief, but I discuss more what the fieldwork triggered in me in Chapter 8.

Chapter 5: Governing by Contradictions

So far this dissertation examined civic replies to radioactive contamination. This chapter will now highlight some of the different strategies that the state employed to govern radiation hazards. In the case of environmental pollution or toxic disasters, a key anthropological area of interest surrounds the study of communities' experiences. By demonstrating that hazardous contaminants do not exist in isolation from other aspects of social experience, and by recording the complexities of citizen responses, anthropologists have highlighted the factors that contribute to the local rejection (and sometimes acceptance) of industrial pollutants (Auyero and Swistun 2008; Little 2009; Button 2010; Singer 2011; Petryna 2013).

In that regard, scholars have criticized states for deploying standardized responses toward issues of risk (Perrow 1984; Wynne 1992), as well as for failing to consider matters of class, race, or gender (Button 1999; Klinenberg 2002). For instance, in the aftermath of BP Oil Spill, government scientists have sought to produce operational facts, which have cultivated a fixed understanding of crude oil and normal life. By objectifying the toxicity of oil under a single facet, anthropologist David Bond (2013: 708) argues that the "revised environment fully contained the disaster, insulating the biological reach of this oil spill from human considerations and rendering personal accounts of sickness implausible and illegible." As Bond furthers argues: "Techniques of sequestering and inspecting the oil spill came to underwrite a new regime of disconnection between the disaster and the public" (2013: 708-709)

Emphasizing this regime of disconnection is a crucial contribution made by anthropology and the first half of this dissertation has demonstrated that this was indeed the case after Fukushima.

A focus on the regime of disconnection between the state and the citizens, however, risks simplifying the complexities of the state apparatus. In other words, it remains important to highlight the regime of disconnection found amidst state actors. Sherry Ortner (1995) argued that studies focusing on civic resistance are "ethnographically thin" as they fail to see the internal politics of dominated groups and their cultural richness. Her claim is particularly strong when applied to the anthropological studies of state replies toward toxicity, since they rarely take the complexity of contemporary forms of environmental governance as a starting point.

In lights of this statement, it would be naïve to assume that the Japanese state has simply provided a homogeneous reply against the materiality of radioactive contamination. Recently, in the context of Matsutake mushrooms farming, Michael Hathaway (2014: 398) has argued that environmental governance, often viewed as "fairly consistent, unified, and applied towards an over-arching goal," is in fact "diverse forms of governance, which operate with a multiplicity of aims, and often at cross-purposes." As he explains: "[…] unlike some portrayals of environmental governance that largely assume a unified system working towards similar goals, governance comes from a number of sources and exhibits a range of forms, which at times overlap and contradict each other" (ibid; see also Tsing 2005).

Inspired by these approaches, this chapter focuses on three state entities that govern different and contradictory materialities of radiation harm through economic, technical, and cultural scenes. The three institutions in questions are the Ministry of Economy, Trade and Industry (METI), the Ministry of the Environment (MOE), and the Reconstruction Agency. In talking about to the governance of social difference, anthropologist Elizabeth Povinelli (2011) contends that contradiction and disharmony are not interferences to the power of nation-state, but equally means of conserving power by providing different degrees of maneuverability.

Likewise, the governance of multiple aspects of radiation hazard after Fukushima is necessary so as to reassert broader control and authority in a context of post-disaster crisis. In this, the Japanese state does not encourage a singular reading of nature, resources, or irradiate localities, but rather attempts to manage multiple forms of radiation hazards for greater governmental maneuverability.

5.1 Post-Political Uncertainties

The Ministry of Economy, Trade and Industry (METI) is undeniably Japan's most influential ministry. It is the heir to the former Ministry of International Trade and Industry (MITI), which was fundamental in cementing nuclear power via economic policies (see Chapter 2). As a former nuclear regulator, METI occupied a very ambivalent space before the Fukushima disaster, as it was both promoting nuclear energy, while serving as its safety regulator. Indeed, before 2011, nuclear safety was under two umbrellas, the Nuclear Safety Commission, which was under the authority of the Japanese Cabinet, and the Nuclear and Industrial Safety Agency, under the tutelage of METI. In order to eschew future conflicts of interest, both discredited umbrellas were replaced in 2012 by the Nuclear Regulation Authority as an administrative body of the Cabinet of Japan and part of MOE.

While METI no longer serves as a regulator, it still remains one of the main governmental actors in the recovery process. Notably, it sanctions and rejects the evidence linked with this disaster, as well as leading the reconstruction policies and decommission of the nuclear power plants (see also METI 2014, 2015). In 2012, METI released one of its first public documents entitled "Japan's Challenge Towards Recovery." Throughout this document, the triple disaster was predominantly analyzed in terms of economic factors, while issues of "recovery" focused on the safety of nuclear energy, the environmental challenge of fossil fuel, or the practical use of renewable energy. In its thirty-eight pages, there is no mention of radioactivity hazards. The only thing apparent is a grid explaining the different radiation doses that one can find on earth. At the top of the grid is Guarapari Beach, one of Earth's most naturally radioactive places. At the bottom is the standard dose received around a light water nuclear plant, with a parenthetical explanation stating that the actual results are far below the given value. Yet, the grid has no explanation of the numerous manmade radionuclides released during disaster. By looking at this document it seemed that the hazards of radioactive elements had failed to materialize, being trapped in a politics of invisibility.

I attended a series of public talks produced by METI, only to witness a similar pattern. The series was delivered all over the country and included prominent experts in business administration, economic critics, and policy planners. Entitled "Japan without resources, a symposium toward the shape of our future energy" (*Shigen no nai nihon, shōrai enerugī no sugata ni kansuru sinpojiumu*), the series of speeches was explicit in pinpointing nuclear power not as an option, but as a necessity, even in the aftermath of Fukushima.[83] In these speeches, Japan was stereotypically compared to Easter Island and with its former residents, who supposedly used all of their natural resources to a point of no-return. The energy problems of the archipelago were depicted as being intrinsically different from the problems faced by European countries; Japan was an island nation and thus unique among modern Asian countries. The subtext was clear and reminiscent of the 1973 Oil Crisis that had cemented the necessity of nuclear power for Japan: the black swan of Fukushima should not impede of rational thinking in energy matters so to avoid reaching beyond the nation-state for expensive oil and natural gas. Since all nuclear power plants were closed after Fukushima for safety inspection, the audience was told that Japan was in a "very precarious situation." For the sake of the nation, nuclear power should be restarted as soon as possible.

According to the panel of experts invited during the series, the shutting down of nuclear power had resulted in three specific problems. First, Fukushima had led to a decrease in the self-sufficiency rate of electrical resources. Kyōji Yoshino, the Policy Planning Coordinator of the Agency for Natural Resources and Energy at METI was quick to sustain this point. He did so by highlighting the deficit trade balance of Japan and by claiming that the nation "suffered from one of the highest levels of dependence in its history." Given its long-term tense relations with Asian countries it was seen as unfit for Japan to depend on external supplies. Moreover, according to Ryūzō Yamamoto, a Professor of Business Administration at the University of Tokiwa, the decrease of electrical independence had led to a lack of international competition: "If we pursue in this actual

[83] The following quotes and explanations are derived from two particular speeches held at the Fukui Public Hall (16 March, 2016) and the Hyōgo Prefectural Civic Centre (13 June, 2016).

way, Japan will lose much of its expertise to China. We are even behind Korea in terms of innovation!" Japan was depicted at the cusp of a critical turn. "If Japan opts for the wrong energy politics, the country will end up being lost for another 30 years!" pursued Yamamoto.[84] Nuclear power was seen as providing a stable, Japan-made energy and vision of the future.

The second problem resulted in a rise of power costs. Indeed, after Fukushima the government had applied strict energy saving measures. Yet, rather than praising such savings, the audience was told that the life quality of Japan had decreased. Energy security in Japan was depicted as being in a level of crisis not in regards to the actual needs of the country, but in comparison with other countries.

The last problem concerned the apparent increase in carbon dioxide. After the release of radioactive pollutants, METI could no longer play on the trope of clean energy to promote nuclear power and resorted to a different rhetoric: global warming. Following the stopping of nuclear power, Mr. Yoshino argued that emissions of carbon dioxide had increased dramatically due to reliance on fossil fuels. Renewable energies, such as solar panel technologies, were depicted as inefficient measures. "In winter and during the night there's just no light. The risk with renewable energy is that we don't have any control over it," claimed the economic critique Kazuyo Katsuma. After Fukushima, renewable energy was shown as getting an ungrounded preferential treatment (*yūsenteki*), as well as being

[84] While the electrical contribution of nuclear power no longer stands as a realistic energy baseload (DeWit 2014), the technological expertise linked with nuclear power was seen as undiscardable (see also Kawato 2013). Shutting down nuclear power was synonymous of depraving the country from an important part of its technological expertise, bringing negative consequences for international competitiveness (see also Kawato 2013: 478).

something that could not be economized (*keizai dekinai mono*). "We need to be more realistic and to look at it from a bigger scale," claimed Katsuma.

To counter these three problems, a new energy policy was proposed, under the acronym of "3E+S." This policy emphasized: 1) Energy security (E1), 2) the Environment (E2), 3) Economic efficiency, and 4) Safety (S). The 3E+S perspective was said to be the most realistic policy to tackle the three aforementioned problems. More interestingly, the policies relied on an energy mix that aimed for a restart of nuclear power. By 2030, 20-22% of the produced energy would come from nuclear power.

At the end of these speeches, a heated discussion always ensued between the state officials and the members of the audience, who seemed eager to voice their concerns. For instance, an enraged elderly man shouted: "Why are you putting us right back into that mess after Fukushima! We won't be able to live in Japan for 2500 years if another nuclear disaster happens!" Another one argued:

> You want to know what's the 'best energy mix? It's to cut all nuclear power! I was always told that nuclear power was safe and good for the environment, but that was all false! You are going to do the same thing again! You spend all your time saying that it's safe, but there is a gap between what you are doing and what you are saying!

Everybody applauded the man, while the expert panels fidgeted in their seats. The last speaker claimed that radioactive contamination had already polluted a good part of Tōhōku and that nuclear power should be stopped before it was too late. The only thing that Yoshino could reply was that it was the only solution to take care of global warming.

Electricity had been the main subject of presentation and amidst such tensions one could equally feel it in the air. At the end of the discussions, the panel of experts was invariably surrounded by members of the audience, who eagerly tried to pursue the conversation around the contamination of Fukushima. They often fought over technical matters, stating that the problem of radiation was far from being over, by invoking, for instance, the long lifespan of certain radionuclides.

In his study of Mexican forestry expertise, Mathews argues that state officials have silenced public opposition by "claiming to translate generalized knowledge to local contexts, seeking to imprison their audiences in a slot of local knowledge" (2011: 4). Yet, even in this context, Mathews argues that officials faced a feeling of "uncertain authority" as "translating between the general and the local makes them vulnerable, worried about their lack of local knowledge" (2011: 4). Mathews's definition of expertise, where experts are troubled by the public resistance encountered, stands in contrast to Timothy Mitchell's conceptualization (2002), where an expert "seamlessly enlists audiences and produces subjectivities" by rendering things technical (2011: 174-175). By focusing on the public performances linked with scientific knowledge in Mexico, Mathews argues that technical knowledge does not necessarily silence the political.

Instead, he contends that each redefinition of technical knowledge "redefines expertise, the role of audiences, and forms of witnessing" while also redefining "how and where political debates about justice can take place" (Mathews 2011: 23). Similarly, the dynamic present during these public talks did not imply a unidirectional relationship, in which participants simply listened to the expert teachings. It also implied a back and forth exchange with the state experts in question, with disagreement regarding the "regime of the sensible" (Rancière 2013) after Fukushima.

Indeed, both parties tried to mobilize different categories of uncertainty around nuclear power. But members of the audience were trying to make "visible what had no business being seen" for METI, that is, radioactive contamination (Rancière, 1998: 30 *cf.* Swyngedouw 2009: 607). While none of the presentations were designed to address the topic of radioactive hazards, the Q and A periods were spaces of intense political debates where the audience tried to reframe the problem produced by the disaster, not around the politics of deficit trade level, rise of power costs, or global warming, but around the threat of radioactive release, which many saw as currently impeding the future of Japan.

Yet, these in-depth debates, which aimed at challenging the very framework of what could be discussed or not after Fukushima, were unconditionally ignored by the panel of experts who tried to bury the audience within technical matters (see Mikami 2015: 117 for a similar argument). Indeed, in the expert narrative of METI, nuclear power was still considered as a key factor in the resolution of many problems, including global warming, the revival of the economy, or manufacturing and technological growth. Even in a post-Fukushima context, nuclear power was not depicted as an option, but reframed as an apolitical necessity that had to be enacted for the well-being of the nation state. While the audience tried to reinsert the issue of radioactive hazards in Fukushima, they remained confined in what Erik Swyngedouw has called after Rancière a "post-political moment," that is, a moment that "replaced debate, disagreement and dissensus with a series of technologies of governing that fuse around consensus, agreement, accountancy metrics and technocratic environmental management" (2009: 601).

In the series of presentation produced by METI, the clear and present dangers that had arisen from Fukushima were not radioactive hazards per se, but, as we saw, an increase of carbon dioxide, a rise in power cost, a loss of competitive expertise, and a decrease in the self-sufficiency rate of electrical resources. In consequence, METI's understanding of the risks linked with this nuclear disaster ought to be seen as being co-produced with expertise in political economy around nuclear power (Jasanoff 2004), where knowledge and order co-evolve. This excludes certain regimes of the sensible, in this case, radioactive hazards. Such a co-production led to specific readings of future uncertainties that impeded the materialization of radioactive health hazard as a main factor of concern for METI. This remains problematic since METI is one of the main governmental actors in the disaster recovery process.

Importantly, while METI does not produce nor track data relating to radioactive contamination, the practical operations for designating areas under which evacuation orders are issued fall under its jurisdiction. Consequently, if radioactive contamination is depicted as an important health hazard it will invariably forfeit the lifting of evacuation areas, the reopening of nuclear power plants across Japan, and more crucially, the economic policies previously highlighted in the 3E+S. This point was made even more apparent during an interview conducted with Junsō, an informant formerly employed by METI and TEPCO. Junsō had notably been involved in the negotiations surrounding the reorganization of evacuation zones with the local municipalities of Fukushima. As he explained: "Even after I was able to build trust with the local people, I had the difficulty of dealing with people from outside who refused to see the real ongoing situation because they benefit from thinking about imaginary damages." My informant was clear to emphasize the fact that the only cases of disaster-related deaths were caused by the stress of evacuation and not by radiation exposure. In Junsō's narrative, radioactive contamination was clearly a post-political problem that couldn't be open to contestations. When uncertainties did arise, they were of an "individual" nature, as he had emphasized. Hence, they were perceived as an anomaly of Japanese preferential culture. As Fisker-Nielsen explains in that regard: "At the local level in Japan, the individual is normally understood as standing in the way of collective national, political or economic interests. This is increasingly seen as political rhetoric devoid of substance which caters to elite interests (2012: 20)." Moreover, the expertise of Junsō around nuclear matter was imbued in "technostrategic language" (Cohn 1987), that is, terminologies that abstract the realities of nuclear materials, preventing the expression of specific values, and allowing experts to reject the idea that they can also be victims of their creation. Indeed, Junsō described the problem of radioactive contamination by referring to terms such as "negotiation," "due diligence," "agreement," or "transaction." In such terms, it is noteworthy to consider the fact that the agency of radioactive contamination falls under the will of human beings.[85]

In inquiring about radioactive contamination, I was struck by a series of contradictions rarely problematized by my interlocutor. For instance, Junsō did not believe that current technology for tracking radioactive contamination was advanced enough, that a complete decontamination of Fukushima was possible, nor that absolute safety could exist in terms of nuclear power. Yet, amidst those contradictions, radioactive hazard was not an issue worth discussing. Why is that so? Some have argued for explanations that highlight Japan's conventional political culture, stating that:

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[85] This is something that is very consistent with the previous chapters (see Chapter 2), where radiation was deemed to be under human control.

> Men working for dominant institutions that prioritize the economy have built the system that created nuclear energy plants. They believe in the system and have invested their life work within the system. If radiation from Fukushima proved to be harmful to their families and could eventually destroy the economy, they would have to fundamentally re-evaluate their role. To consider the threat of radiation from the technology they have created is to doubt the system in which they help maintain, as well as their values and life choices (Morioka 2015: 6).

This is clearly a part of the story. However, this explanation also foreclosed the numerous complexities of post-disaster management polities, while promoting a culturally deterministic approach. Additionally, the lack of materialization surrounding radioactive hazards can be explained by the mobilization of specific categories of uncertainties, which were perceived as being in a more urgent state of care that the possible uncertainties linked with health hazards. As anthropologist Gregory Button (2010) reminds us, uncertainties do not simply exist. They are equally produced and mobilized, resulting in specific political, economic, and social formations.

In this, the uncertainties surrounding the potential dangers of radioactive contamination (e.g., chronic low-dose exposure, ecological collapse, or health hazards) were not approached once; they were dislodged by what METI officials considered as being more important future uncertainties, like energy security or global warming. For a state agency like METI, which has jurisdiction over industrial policy and energy security, these uncertainties have the power to trigger political risks of higher scale than those linked with radiation exposure.

By emphasizing post-political uncertainties that foreclose the very possibility of different regimes of the sensible around what or who matters after Fukushima, METI bypasses matters of radioactive hazards. This articulation brackets discussions that do not fall within METI official consensus of current urgencies as being “out of place,” as exemplified by the tension filled debates of their public talks. The irony is that a form of double depoliticization arises, as the issue of Fukushima’s radioactive contamination is being depoliticized through perceived political priorities (e.g. reducing carbon emission), which are themselves paradoxically taken as post-political, that is, as things that have to be taken care of and that are not open to debate.[86] Only by instantiating specific categories of post-political uncertainties around nuclear power could METI enact – or in this case downplay – radioactive health hazards.

5.2 Everything is Under Control

In the aftermath of the nuclear meltdowns, radioactive pollutants were scattered across Fukushima, sticking to diverse surfaces such as soil, lawn, rooftops, stones, trees, or drain spouts. The “Act on Special Measures Concerning the Handling of Radioactive Pollution” was enacted in response to this unprecedented situation. By 2012, MOE became the responsible authority for decontamination work in the affected urban and agricultural areas (Ministry of the Environment. N.D.).

[86] Here, the term depoliticization should be understood in a Rancierian way, where “true” politics is a process of dissensus that confronts an established framework of perception, thought, or action.

During my fieldwork, I spent an important part of my fieldwork in the Decontamination Info Plaza (*Josen jōhō puraza*), a governmental center established in January 2012 as a joint program between the prefecture of Fukushima and MOE. Located in the town of Fukushima, the Plaza served as a center point for the dispatch of experts giving guidance on decontamination activities. Through interviews with technical advisors, I was able to learn more about the situation surrounding the contamination of Fukushima, while participant observation of the Plaza's facilities provided useful information about decontamination policies.

For instance, radioactive decontamination was often explained through diverse models. In one of such models, small figurines representing workers could be seen removing radiation-contaminated objects in a street gutter. On the roof of a miniature building, another worker was depicted using a high-pressure water jet machine to wash away radioactive substances. Lastly, in the backyard of a miniature house, workers were shown removing the grass of a garden, before scrapping off the topsoil of the lawn with the help of a bulldozer. The contaminated soil was then put in a large sandbag.

Similar displays explained that these sandbags would be sealed completely to prevent any seepage and that they would be covered with a thick layer of uncontaminated soil, hereby reducing the risk of radiation exposure. With an inner layer coated in thick rubber, these bags were described as being sturdy in the open air, while ensuring maximum durability. There was no need to worry about potential tearing, as a technical advisor explained to me. For additional security, radioactive wastes would be kept in temporary storage spaces. Scale models and video displays provided a picture of temporary storage spaces as surrounded by fences to keep people out.

Decontamination practices, as a technical advisor explained to me, had been very effective in reducing atmospheric radiation, as well as in safeguarding the health of residents. Throughout such efforts, it became apparent that evacuation zones could successfully be lifted. I was told by an advisor that the situation in Fukushima was "getting better day after day" and that evacuees could, in a very near future, come back to their beloved village.

Beyond its focus on decontamination, the Plaza also provided the latest information on radiation dose maps. When I inquired as to how such maps were created, I was brought outside in front of a radiation monitoring posts.

Illustration 14: *A monitoring posts in Fukushima* (photo by the author)

After the disaster, the tracking of residual radioactivity was first conducted by MEXT through aerial monitoring. Now, huge white and greyish cylindrical monitoring devices had been installed all over the prefecture of Fukushima. Each post displayed the atmospheric level of radiation on an electronic board and the data obtained was used to separate Fukushima into three areas of radiation danger. The number displayed on the screen of the post near the Plaza was 0.264 μSv per hour. The advisor told me that this number was normal and that many places in the world had higher level of radiation. Witnessing my interest in radioactive monitoring, the advisor prompted me to visit the Environmental Radiation Monitoring Centre of the Fukushima Prefecture Centre for Environmental Creation. As he explained to me, this center was in charge of environmental monitoring in the coastal region. I was sure to find advanced forms of monitoring and testing bounded to provide more answers to my questions there.

At the Environmental Radiation Monitoring Center, I was greeted by a scientist named Akira, who, eager to make me visit the newly built facilities, brought me in front of the Center's interactive screen monitoring. As he first explained to me:

> You can see that the radiation levels of Fukushima are represented by different colors: green, blue, and red. Right now, we've been doing a lot of observation in the red areas, which are still restricted. Especially Namie, Futaba, and Okuma. These towns will have high levels for a very long time and we don't think that they will lower much.

Every time I entered a room with radiation devices, I was forced to follow a strict containment procedure by Akira. This was to make sure that no contaminants could get in or out of the laboratories, which were designed as radiation controlled areas. The procedure went as follows. First, a patch of blue sticky tape collected the dust on the sole of my shoes. I then had to take off my shoes before putting on special slippers. Again, I had to walk on a piece of sticky blue tape, before finally receiving a laboratory coat. As one exited the premise, the pattern had to be done again. No one was allowed to drink, eat, or smoke, and testing samples of contaminated matters – from tree pine needles to seawater – were sealed in the appropriate containers, clearly listed. No details were omitted; it was even forbidden to take a single pen out of the lab for fear of contamination. In this center, I could physically see the boundaries that separated me from an imperceptible potential harm – radioactive contamination.

All testing facilities were brand new and impressive. One annex in particular had a ubiquitous scent of burnt ash, giving the scientific laboratory a crematorium-like atmosphere. As Akira explained to me, this was the result of huge commercial incinerators, as every sample needed to be dried out before testing. The next room had an ever more pungent smell of rotten guts and putrid flesh. Pointing at a chrome table filled with light films of fish oil, Akira commented: “That’s the table where we dissect the fish in order to test them. Radioactive contaminants have also fallen in the seabed and the species that live there are more prone to bear high levels of exposure. There’s still a lot of bottom fishes that we can’t eat.”

Illustration 15: *The laboratories of the Environmental Radiation Monitoring Center* (photo by the author)

The last room was reserved for high-tech machines that could monitor internal exposure. These machines resembled squared metallic vacuum that continuously sucked down the ambient air through a special filter. It was then possible to estimate the internal level of contamination by measuring the contaminants in their filters. The center also possessed one of the few devices that measured the level of tritium in the water, a pollutant that cannot be removed from water, as it is a radioactive isotope of hydrogen. Lastly, the Environmental Radiation Monitoring Centre shared its office with the Japan Atomic Energy Agency (JAEA), an independent agency conducting R&D in the field of nuclear energy. I had the opportunity to catch a glimpse of its hangar, where busy employees were working on sensor drones and unmanned aerial vehicles whose purpose was to collect data on the extent of radioactive contamination.

During my visits to the Decontamination Info Plaza, I was told that mountain and forest areas couldn't be decontaminated, as doing so would result in soil erosion and disastrous landslides. I therefore asked Akira about the impossibility of decontaminating these areas, as well as inquiring about the potential adverse health effects these restrictions would cause. With a shy smirk, he replied the following: "Well, mountain analysis and observation are part of a different section. At this center, we don't really take care of that. We only focus on the human environment, where people live." I was struck by this remark, since Fukushima is mostly composed of mountainous and forest areas. Yet, this was seen as irrelevant to the human environment.

Li (2007: 126) has argued that in order to render a set of processes technical and improvable, an area of "intervention must be bounded, mapped, characterized, and documented." Similarly, the monitoring of radiation hazards under chromatic pallets, the saying of Akira, “we don’t take care of that,” and the motorized drones present in the Center, implied the fragmentation of radiation along clearly divided lines: environmental, social, and technological. Through the activities of this Center, radiation was rendered technical, seen as a testing sample, a piece of dried fish, a murky substance boiling in a tube, a snip of dead pine needles, a sampling of sea bed soil, a slight film of oil, a plastic cup on a conveyer belt, and the dusty filter of a metallic lung. Fragmented under such forms, the uncertainties that surrounded radioactive contamination as a hazard could be weighted, measured, estimated, and ultimately – controlled.

By creating clear cut boundaries between the social and natural realm – as mutually exclusive domains – institutional scientists like Akira could precisely create a promise of expert control. While the technical practices of the center were engaged through complex social values, these were delimited as external to the practice of monitoring, allowing the center’s activities to process smoothly, while resulting in the creation of boundaries that forbade the possibility of interpenetrations from other scales. Yet, through such delimitation, radioactivity was only materialized as a form of harm that fell within three predetermined colors: green, blue, and red.

The mitigation of the network-like aspect of radioactive hazards should not be explained by the fact that Akira and his team believed to be a part of a “culture of no culture,” that is, a community defined by the shared cultural conviction that its shared convictions are not cultural, but rather timeless apolitical scientific truths (Traweek 1988). The limits of their expertise is rather the result of state environmental regulation where elements are often studied as “isolated entities of purely technical qualities without context” (Murphy 2017: 495). This scientific infrastructure forced scientists to deal with radioactivity as “matters of fact,” objects with clear boundaries, well-defined essence, and well-recognized properties (Latour 2004). Radiation, understood as technical practices of monitoring, undermined the more nuanced, subtle experiences, embodied through what Latour calls “matters of concern,” which unlike their predecessors have “no clear boundaries, no well-defined essences, no sharp separation between their own hard kernel and their environment” (2004: 24).

At the Environmental Radiation Monitoring Center, decontamination and monitoring echoed expert practices where radioactivity was isolated, taken away, measured, and controlled. Yet, how was this carefully woven discourse of containment held up beyond the case studies of scale models and laboratories? Recent anthropological accounts have demonstrated that the rendering of the technical is never a secure accomplishment and that expert discourses are often punctured by challenges that they can hardly contain (Li 2007; Mathews 2011). Such a point was made particularly apparent when I had the opportunity to visit the city of Tomioka through contacts garnered at NEPR.

In the aftermath of the nuclear disaster, Tomioka city was initially evacuated, since it fell within the 20-km radius of forced evacuation. In 2016, the evacuation zones were rearranged and Tomioka was now partly situated within the second areas of evacuation (20 to 50 mSv/year). As such, no one was technically permitted to live in Tomioka, but small trips were allowed so that citizens could retrieve personal objects from their household. In order to access the exclusion zone, members of NEPR had chartered a small van. As we left Tokyo and came closer to our destination, road panels announced that the radiation levels could oscillate between 0.1 and 4.4 μSv per hour.[87] Upon seeing those monitoring

[87] 3.8 μSv/h is roughly equivalent to 20 mSv per year.

boards, one member exclaimed: “Once we arrive at our destination be sure to tighten your mask and don’t forget to wear your protective coat! When the visit will be over dispose of your coat and mask in the plastic bag that was given to you. We don’t want to bring radioactive contamination in the bus!”

As we entered the city of Tomioka, the sight that lay under our eyes was an eerie one. Tomioka was a ghost town, with the most striking sight being the rust, as if the brittle skin of the town had crumbled apart. With phantom-like spookiness, the windows of shopping malls were stuck in time, exhibiting the same household items from five years ago. The colors of storefronts posters had faded away, reinforcing the ghostly appearance of the town. The only sign of recent human activity was the presence of newly built monitoring posts, whose presence was a clear sign that the state aimed to reopen the city in the near future.

Illustration 16: *Road panels indicating the level of radiation in Fukushima* (photo by the author)

Near the former train station of Tomioka, our group had a chance to see first-hand the actual process of radioactive decontamination. The train station of Tomioka was literally packed with the by-products of decontamination work. Piles and piles of contaminated rubble were lying in big black plastic bags, as far as the eyes could see. Not far from our group, dozens of decontamination workers were present, scrapping the grounds of Tomioka, while putting contaminated soils in plastic bags. The contrast was extreme between the two groups; NEPR members covered from head to toe in white protective apparel and the decontamination laborers, working a few dozen meters away from us, chain-smoking and without masks. Our group was obviously unqualified to do any forms of decontamination whatsoever. Yet, we were able to enter an area that qualified as a decontamination site without restriction. Indeed, no gates or police presence had restrained us from entering the site. After spending half an hour in Tomioka, our group left the city as easily as we had entered it; without any forms of control whatsoever. The disposable masks and raincoats were secured in sealed garbage bags, but despite such precautions it became clear that we had brought radioactive contamination with us. Everyone's boots and shoes were covered with the dusts and mud of Tomioka. As opposed to the strict containment procedure of the Environmental Radiation Monitoring Center, nothing had prevented the exit of radioactive pollutants in Tomioka.

The discourse of control promoted by MOE also appeared highly dubious when I spent part of my fieldwork in Iitate, a small rural village located in Fukushima. In 2016, MOE had ended most of the village official decontamination, which consisted of removing parts of the irradiated top soils. As a testament of this decontamination, mountains of black plastic bags, filled with contaminated soil, could be seen all over the area, forming a stark contrast against the emerald-green mountains of the village. While the expert narrative from MOE contended that these bags should be stored in spaces located at a safe distance from the nearest workplaces, the reality was otherwise. In Iitate, bags were lying on top of each other, left everywhere as far as the eye could see. Few sites were protected by fences.

Illustration 17: *Vinyl bags in Iitate* (photo by the author)

This situation was supposed to be temporary, but Iitate farmers that I interviewed believed that the government had no long-term plan to manage the radioactive waste. The sheer number of bags had become a source of problems for the inhabitants. As the deputy headman of Iitate argued:

> Iitate used to be in the top 10 of the prettiest villages in Japan. Now, there are 1.5 million bags all across. They are left right next to the paddy fields. Citizens are seeing these bags every day and ask themselves, 'Can we really go back?' They are

> being told that everything is safe, but when they see those bags how can they be sure.

Iitate was indeed a very pretty village. During my stays in the springs of 2016 and 2017, I often rode with the locals in the nearby mountains, simply to enjoy the nice panorama provided by the village. Yet, as soon as we left the mountains, the endless rows of plastic bags brought us right back in the world of radioactive contamination. No escape, not even for one day. On state-sanctioned maps, clearly divided in chromatic pallets, there was no impression of what was happening in Fukushima. The feeling of living amidst pyramids of radioactive laced bags was left utterly absent from the materiality of maps. As a villager further commented on that issue: "I can understand the mothers that don't want to come back to the village. Just look at that [the bags]. Who would want to raise a child in this environment?" The number of bags was so problematic that MOE offered financial incentive to the residents who would accept to store these bags on their land plots. This had created tensions amidst the community, as many didn't want their neighbors to rent their land plot for waste disposal.

In talking about endangered ecologies, Puig de la Bellacasa (2015) has attempted to engage our understanding of soil as a living community rather than as a mere receptacle for crops. This understanding of soil was echoed by Iitate's farmers. Beyond the panorama of black plastic bags, state-sponsored decontamination had caused much discontent for farmers, especially since topsoil is considered to be an organic treasure. As farmers explained to me, not only is topsoil rich in nutriments, but the land is passed down from generation to generation. Throwing the topsoil of a farmland is like throwing part of one identity. Residents of Iitate were also dissatisfied by the actual efficacy of the decontamination projects. For instance, many bags had already begun to break down due to the build-up of gas released by rotten soil. Plants and flowers had started to grow inside the bags, while tearing them apart.

For the residents of Iitate, this series of failure reinforced a lack of trust toward state experts, forcing many to pursue decontamination on their own. In 2016, I witnessed experiments conducted on rice paddies, where farmers had developed decontamination processes that they could carry on their own. I was invited to participate in one of these decontamination project. Water was first induced into a rice paddy up to 5 cm deep and then mixed with the surface soil by using traditional weeding tools. The muddy water was pushed out by using tennis court brushes. In doing so, farmers were only outfitted with their everyday clothing, a pair rain boots, a straw hat, and some long garments. This was a sharp contrast with the decontamination workers, who are outfitted with protective garments. By engaging in such activities, usually restricted for professionals, residents exposed themselves to unnecessary forms of exposure.

As opposed to the clear boundaries present in the Environmental Radiation Monitoring Centre, the residents of Iitate also experienced their environment as an agglomeration of extremely interconnected entities. As a farmer explained to me:

> We can’t go into the woods to hunt, pick foods, or do any kind of forest management [because of the contamination]. So the population of wild animals, vermin, and pests has risen. They constantly destroy the renovations that we make.

> Every time people come back to their house they find rat feces. It's really a kind of vicious cycle.

Radiation had brought down specific ways of being in Iitate that couldn't be revitalized by putting contaminated top soil in vinyl bags. Things that look as insignificant as moss ended up representing an important vector of contamination. As a citizen scientist residing in Iitate explained:

> Moss is one of the most radioactive things in the forest, it's concentration of cesium is 10 to 100 times higher than wild grasses, which themselves vary from 500 to 8000 Bq/kg. Of course, we don't eat moss, but the animals do and we eat those animals. It causes a lot of bioaccumulation in the muscles of wild beasts. Even after 30 years, moss is still going to be very radioactive.

By eating plants or mushrooms that accumulated high-levels of radioactivity, animals became important vectors of contamination. Wild boars for instance had extensive migratory patterns, traveling far beyond the vicinity of Fukushima, where highly-contaminated flesh could be eaten by unsuspected hunters. Radioactive testing made by the villagers had revealed contamination levels as high as 15 000 Bq/kg in wild boars (see also Stoetzer 2014). Animals were no longer delicacies that villagers could hunt, but "environmental sentinel" (Masco 2006) that provided new means of visualizing an invisible harm. In the end, long-lived radionuclides cycled the ecosystem, traveling through the dynamic motion of weather patterns, animal feces, and the bodies of residents, which would be contaminated and re-contaminated over multiple generations (see Jacobs 2014). Decontamination was not a notion that made sense in Iitate. Radioactive elements could only be moved away, which equally created other problems.

Residents of Iitate also criticized state monitoring, which only provided them with the average radiation level found in their village. This information was rarely useful for farmers, since the dispersion of contaminants was heterogeneous. Indeed, areas deemed safe were often filled with hot spots that had levels falling within evacuation measures (above 20 mSv per year). For farmers, the official depiction of radiation levels through clear cut chromatic zones did not provide much help. While the color-charted areas made much sense in front of a computer, radiation did not follow these divisions. Because of the perceived inefficacity of state measures, residents had decided to track radiation by themselves, notably as a means to keep the map of their village relevant. Many possessed Geiger counter that could measure the level of external radiation. In the house of one farmer, I witnessed self-made models that exhibited a 3D topography of Iitate's geographical landscape. These models had been made through 3D printers and the level of radiation had been monitored by the citizens themselves. In particular, the local knowledge of the geography of Iitate had helped citizens to attain a level of precision incomparable to that of the government map. In this, citizens had soon learned that radiation doses could be higher at the bottom of a slope or that the woods behind one's home might impact the radiation level of inside houses.

In the southern part of the village, the state had installed barricades to block access to highly radioactive areas (*kikan kin'nan kuiki*), where the annual cumulative radiation dose still exceeded 50 mSv per year. Near the gate, a lonely policeman acted as a guard, trapped in a small wooden cabin. The gate, which was three meters in length, was supposed to separate us from an environment that was considered dangerous, but in fact anybody could have easily crossed the forbidden zone left unmonitored beyond those three meters. Many citizens, however, had access to the areas in order to check on the condition of their houses. As opposed to the radiation controlled areas, cars of the villagers went in and out, without any forms of decontamination. Cars were filled with radioactive dust and mud. As I took a picture of the gate, one resident looked at the guard with an embarrassed smile, telling him the following: "He's a foreigner (*gaijin*) you know, he just wants to see…" Looking at this guard squeezed in a small cabin, I could not help but to ponder the meaning of these gates.

Illustration 18: *The gates of Iitate* (photo by the author)

It was forbidden for a *gaijin* like me to enter the area, but the same interdiction did not apply to local people? A local resident was harshly critical of this double standard arguing that "[t]he people of Fukushima are no longer normal people (*Fukushima no hito,* *ippan no hito ja nai*).” While maps, monitoring, and gates were supposed to lend a sense of control by demarcating which areas were dangerous or not, their function was more symbolic than pragmatic.

In conclusion, the efficacy of decontamination was questionable at best, while monitoring was partial and far from revealing the extent of radioactive contamination in Fukushima. On top of monitoring problems, the only thing that radiation posts measured was radiation under the form of gamma-rays. Yet, the disaster had also released numerous radionuclides that emit ionized particles (alpha and beta particle). These ionized particles, which can be hazardous if inhaled or ingested, were not taken into account by state monitoring. The governmental testing for food contamination faced similar problems, as only radioactive cesium was being taken into account. Here the nefarious potential effects of radioactive elements like plutonium were being ignored. In her study of “sick building syndrome,” Murphy (2006) argues that what is uncontrolled and undetected by technoscientific practices remains irrelevant to given projects. Similarly, what cannot be rendered technical or contained, such as internal contamination by alpha and beta particles, is sidelined from the state narratives of remediation and control. A ministry like MOE could only highlight problems for which a technical solution already existed. In this case, basing its remediation on the level of external gamma-radiation as measured in the air throughout monitoring posts.

While these measures clearly had their limit, mediating radiation hazard through such practices had enabled MOE to pick up where the experts at METI had failed. Indeed, they had finally tackled the problem of radioactivity head on, instead of framing the subject in a post-political moment. Rather than relying on post-political uncertainties that downplayed the risk of radioactive hazards, MOE had opted for a set of narratives and practices that sought to manage and bound the uncertainties of residual radioactivity. It did so by transforming its nature as a biophysical entity that could be isolated from the human environment. Under this language, radioactivity became accessible to governance by state experts.

Of course, radioactive contamination as experienced in the lived environment often clashed with the discourse of control promoted by the state. Yet, decontamination and monitoring practices were also efficient instruments of power to engender a return to normality. Indeed, such practices enabled state experts to lift evacuation zones, something that was crucial for their politics of repatriation to Fukushima. By configuring and providing access to knowledge about radiation hazard in such ways, state experts projected a particular politics of control around Fukushima. Remedial measures were not those that necessarily provide the best means to minimize the risk of radiation hazards, but often those that gave an appearance of control, in the settling of things that never settle.

5.3 The Phoenix of Fukushima

Through public performance and revitalization projects that played on affective tropes of resilience and nostalgia for one's native land, it came to my attention that the Japanese state increasingly began to seduce bodies beyond scientific forms of expertise. In 2016, this approach was epitomized during a forum organized by the Reconstruction Agency, entitled *Great East Japan earthquake 5 anniversary reconstruction forum – Toward a new stage of the reconstruction/creation*.[88] Organized in Tokyo, the forum was a place saturated with

[88] In Japanese: Higashinihon dai jishin 5-shūnen fukkō fōramu, aratana sutēji fukkō sōsei e

"talk of improvement" (Li 2007: 1) and centered around the buzzword of "resilience" (*rejiriensu*). As the Reconstruction Minister Tsuyoshi Takagi emphasized during the Forum's inaugural discourse: "Houses have been rebuilt, so are the roads, and the cities' infrastructure!"

During the Forum, Fukushima was shown as quickly recovering from the nuclear meltdown and to sustain this fact, the audience was told that the atmospheric level of radiation had decreased by more than 65% since 2011. For instance, the current state of radiation levels in the cities of Koriyama (0.12 μSv/h) or Naraha (0.10 μSv/h) was shown as being "about the same levels" in Munich, Shanghai, or Paris, hereby implying that radiation had reached normal levels. We were also reminded that the only deaths of this nuclear disaster were caused by the evacuation procedures and not by radiation exposure. The governor of Fukushima, Masao Uchibori, was present at the Forum and joyfully declared the following:

> I want to give you two numbers: seven percent and zero percent. Seven percent is the current area of evacuation among the whole prefecture of Fukushima. People that have evacuated because of radiation and that are not able to live there. Zero is what we are aiming for! That seven percent should be brought down to zero!

The electrified audience burst into a set of energetic applause and was told that a "normal life could be recovered!" The governors of Iwate and Miyagi, the adjacent prefectures of Fukushima, shook their head in approval while declaring that a resilient spirit was necessary to overcome the disasters: "We cannot just walk away even if it seems impossible! One small light is enough to enable us to advance in a tunnel!" The governor of Fukushima then introduced the audience to the concept of Fukushima Pride (*Fukushima puraido*), which consisted of two points. As he argued: "First we want to turn the negative into zero and secondly turn that zero into something positive." The "negative" in question was not explained, but Uchibori's narrative implicitly referred to the notion of harmful rumors (see Chapter 4). Additionally, members of the audience were introduced to the Reconstruction Agency's vision for a "New Tohoku" (*shin tohoku*), where Fukushima and the adjacent prefectures were to become models of a "leading society introducing robust and highly resilient social infrastructure" (Nemoto 2014: 16). In such scenario, Fukushima would become the "world's ideal place to live," providing a new model that could be applied nationwide, where resilience was promoted as a key value for the future of Japan (Reconstruction Agency N.D.). This was apparent in the Reconstruction Agency's promotional videos, where children of Tohoku said things such as "When we smile we can stay healthy and live a long time!" (Reconstruction Agency 2016d).

During the Forum, the need for repatriation to Fukushima was often explained by the fact that evacuees were longing to return to their former areas of habitation, highlighting the psychological suffering induced by the separation from their native land – or what the Japanese call *furusato*. More precisely, the term *furusato* is a cultural notion imbued with nostalgic feelings of one's native place. It evokes images of a rural Japan, often linked with agricultural labor or natural landscapes. Yet, as anthropologists have pointed, there is an inherent irony in this nostalgic yearning. Since most Japanese are now born and raise in the city, the gap "between the furusato as an actual place and as an idealized symbol of primordial native identity has widened into a chasm" (Gill 2013: 202). In such, the furusato is not a place *per se*, but rather a nostalgia-driven ideal for what is seen as lacking in modern Japan (Robertson 1988; Schnell 2008). This nostalgia is thereby found in something that "one has never known or never seen" (Stoler 2013: 27). The furusato also stands as a "depositories of an amorphous 'Japaneseness'" (Dusinberrre and Aldrich 2011: 701). Indeed, as a "signifier of a wide range of cultural productions" (Robertson 1988: 494) the furusato was employed from corporate advertising to the shaping of a Japanese identity exalting nationalistic values.[89]

Accordingly, the kinds of experts invited to the Forum were not nuclear engineers nor medical doctors, but actual citizens that were deeply affected by the hardship faced by their furusato. Speakers included a famous musician born in Fukushima, as well as women's association of traditional handicrafts. Many shared their post-disaster discourse of resilience, while being confident that their furusato would recover from the nuclear catastrophe. Upon seeing the state of devastation afflicting his former native land, the violinist burst into tears, muttering the following: "Oh, what has happened to my dear furusato!" He was later invited to play a sonata so vivid that members of the audience sitting next to me began to cry, muttering things such as "This is so wonderful."

In order to contribute to the revitalization project, the audience was told by a TV anchor to enjoy the rich cultural tradition of Fukushima and to "spend your money, have fun, and buy souvenirs! That's the best thing you can do for the people of Fukushima!" And indeed, in the village of Iitate, souvenir kiosks had been built in the few convenience stores that remained open. Below numerous pictures of people smiling, tourists could find small revitalization project kiosks that sold different memorabilia. It was possible to

[89] In such, the *furusato* can be seen as a phantasmagoric fossil, whose radioactive quality can be tapped in as an archive of cultural values and commodity (Little 2012: 32).

purchase different products of Iitate and to enjoy the specificity of their *furusato*, which was known as *madei*, a term that implies a slow and joyful life movement.[90] Giant mascots and television crews were notably waiting for tourists outside of these kiosks, especially to look at what had been bought.

Leading a "normal life" (*futsū*) needed to be eulogized and to emphasize this celebration a singer came on stage to chant the praises of the revitalization process. To this day, I can still whistle the song in my head, which went something like this: "We have rebuilt our homes to be as beautiful as in our memory!" Ultimately, the Forum had produced a clear message: One could come back to his furusato despite a nuclear disaster and everything would be just fine, as long as one was resilient. Here, resilience was inseparable with affective tropes for one's native land. Through such a discourse, the government was framing the return of evacuees as a question of return to one's *furusato*, where nostalgia was seen as a form of collective loss.

Beyond the Forum, this mobilization of Fukushima's furusato was happening throughout Japan. In the Tokyoite district of Chiyoda, numerous food fairs, cultural workshops, and art exhibitions had been arranged by the Reconstruction Agencies. During these activities, people could enjoy the "flavor of furusato" (Robertson 1991), while praying for the recovery of Fukushima. Catch phrases such as "*furusato torimodosu*" or we "will regain our furusato" had become the unofficial motto of the revitalization policies of Fukushima. In the train station of Fukushima City, visitors were welcomed by *Kibitan*, the yellowish mascot of the prefecture, while a cartoon character called *furusato midori*, a little boy with green hair and clothes, provided information about radioactive contamination in

[90] As Gill (2013: 209) explains: "madei being a Tohoku dialect term that signifies a slow, thorough way of doing things.

order to fight against the “harmful rumors” afflicting the prefecture. At the entrance of the train station, the charms of the native land were presented under colorful kiosks and interactive stands that made use of pictures and art projects. All these exhibits were promoting the food terroir, cherry blossom viewing, hot springs, and historic festivals of the region. A new baseball team had even been created after the disaster under the well-thought name of *Fukushima Hopes*. An enormous signboard at the station read of the promise of happiness: “*Fukushima no mirai ni mukatte! Happy Fukushima, Fukushima mo happy, min’na happy!*” (Toward Fukushima future! Fukushima is also happy, everybody is happy!).[91]

Illustration 19: *Sign at the entrance of the Fukushima train station* (photo by the author)

In addition, the Prefecture of Fukushima was aiming to lead the robotic industrial revolution of Japan with machines that could be used for the decommissioning of the Daiichi power plant. Events such as “Robot Festa Fukushima” were held in order to

[91] Most of this discourse points toward a specific temporality, namely, a happy and resilient future. This narrative sharply contrasted how mothers like Natsuo understood future temporalities (see Chapter 4).

increase interest in robots amongst returnees. During such events, one could learn about snake-like robots that wiggle through complex pipe structures for inspection purposes of the power plant. New industries promoting renewable energy were said to soon appear in Fukushima. In the train station of Fukushima, interactive stands explained wind and solar power. The subtext? Fukushima was leading place to live, with traditional charm and soon to be blooming industries standing at the cutting edge of technology.

In this official narrative of reconstruction, the notion of the *furusato* was an affable signifier saturated with images of tradition, novelty resilience, and local natures. This mobilization enabled the state to promote a very specific understanding of post-disaster recovery, as well as of radiation hazards. Indeed, by emphasizing the affective connections that citizens maintained with their native land, and by raising the specter of a precarious furusato affected by "harmful rumors", the Reconstruction Agency reinforced images of a pure and unified Fukushima, rather than focusing on the saturated tensions of spaces exacerbated by radioactive contamination. On paper, post-disaster recovery policies were supposed to take into account the different intentions of evacuees, like returning to Fukushima or settling in other areas of Japan (Reconstruction Agency 2016c: 2). But by performing a nostalgic storytelling of the furusato, the Reconstruction Agency was the driver of a particular politic that did not promote long-term evacuation. Indeed, the series of speaker present during the Forum only included individual who felt saddened for their beloved furusato, while hoping for its prompt recovery. The discourse of voluntary evacuees was nowhere to be seen in the Reconstruction Agency narrative. An utopian future was in rather modeled through the figure of an "imagined community" (Anderson 1983).

Yet, specific interpretations of the *furusato* also influenced the socio-cultural understanding of post-disaster recovery, hereby opening different notions of political spaces that conflicted with the official governance of Fukushima. Throughout the span of my fieldwork, conflictual interpretations of the furusato were epitomized by the narratives of evacuees that were forced to live in temporary housings. I repeatedly visited residents of the Iwaki Yotsukura Onigoe temporary housing, an apartment complex created by the Japanese state in order to temporarily lodge evacuees. Situated in the southern part of Fukushima prefecture, many evacuees of this complex were young families and elderly individuals whose houses were still situated in the exclusion zones.

In the aftermath of the disaster, few believed that the evacuation order would have last for so long. Three months after March 2011, when some of these evacuees were able to come back to their houses to temporarily retrieve personal belongings, they discovered starved pigs eating away the flesh of their dead horses. This was a harsh welcome, in which the original furusato was now inseparable from such haunting images. By their infrastructure, the temporary housing was small and cramped. As opposed to city dwellers, the evacuees of this center were people of the countryside used to live in spacious environment. Nights were long and many argued that they felt trapped. This continuous strain had caused a lot of pressure on family ties and divorces had become common in the temporary housing complex. Radiation did not only cut chemical bonds, but equally, marital ones. What used to be forever no longer holds after Fukushima.

In opposition to the enthusiasm of state officials, the evacuees of this center were harshly critical of the decontamination processes, supposed to provide them with a clean furusato for their return. As a resident explained: “They don’t tell us the before and after difference of radiation levels when they do the decontamination! We had to do this by ourselves. I don't know how to do this…" As another evacuee argued: "They spray our roofs with water to get rid of the radioactive pollutants, but the water just fall right down near the house with all the contaminants in it…"

In March 2016, when I visited the temporary housing for the first time, evacuees could not come back to their original hometown. The level of radiation exposure was still too high or their houses in Fukushima had crumbled down due to the passage of time. On the other hand, life elsewhere was made impossible from a lack of financial support. Indeed, many evacuees were still facing problems in receiving compensation for their losses from TEPCO, the owner of the Fukushima Daiichi Nuclear Plant. To make matters worse, financial supports initially provided by the government had been cut. As an elderly woman argued in that regard: "People at Futaba city still have theirs, why was our cut? We are victims also!"

Amidst such hardships, evacuees had started to get accustomed to this supposedly temporary housing by individualizing their small barracks, making it feel more like their former furusato and the agricultural traditions linked with it. For instance, one evacuee had made her own garden amidst the hard rock pebble of the center. "I've scrapped all the pebbles by myself and filled the hole with soil. It took 17 bags. Look! There are even small vegetables growing!" proudly told me an evacuee named Asami. In many ways, this garden was the reflection of a return toward normativity, in an ironic context that could hardly be described as normal. The people of this temporary evacuation center had almost lived here for six years: children were even born in this center. Under such conditions, one could not help, but ponder at the meanings that the term temporary embodied. Radioactive contamination was altering the very conception of time, producing a sense of homelessness in the notion of furusato that was going beyond the loss of a place per se. Temporary housings were now home to normalcy, where emergency was becoming an integral part of those evacuees' everyday life. From then on this was their home, the temporality in which they were prisoners. No bright future ahead. Living day to day. Surviving.

In the housing complex, this specter of no future provoked the image of a past *furusato* that was pure and untouched as echoed by the lamentation of many residents: "What happened to our furusato…" Yet, as scholars argued, pre-disaster Tohoku long faced its share of problems from poverty to depopulation (Dusinberre and Aldrich 2011) and never was an idyllic *furusato*. In that regard, the small garden of Asami can be seen as a nostalgia for a nostalgia, "a kind of desperate regression toward the desire to soon experience an imaginary security one *knows* without having ever had […]" (Berlant 2011: 180). A phantasm that provides a commodified notion of the *furusato* – monetary deprived in this case – but with tangible values to hold on to, as a form of "bargaining with what is overwhelming about the present" (ibid).

In March 2017, I was told that the center would close and that evacuees would have to return to their former furusato. Many residents believed that the government wanted to repatriate them as quickly as possible to show that Japan is safe for the 2020 Olympics. As Asami argued to me: "People keep talking about the upcoming Olympics. What's the link with us and Hirono [the village where she was from]? The country and the furusato need to be clean so that they can go on with their Olympics, but we surely don't see that revitalization money."

Illustration 20: *Temporary housing in Fukushima* (photo by the author)

Evacuees were unsure of what they were going to do when the expulsion deadline would pass. As an elderly woman told me: "Well, maybe I'll live with my daughter, but I'm unsure if it will work. I've tried in the past and it didn't go really well." Indeed, a lot of elderly people shared similar problems: afraid of being a nuisance to their children, many preferred to live alone. Due to the concern of radiation, their children and grandchildren had started their life elsewhere. Yet, if those elderly people come back to a town where no young people live, social problems will appear and the furusato will return to a precarious marginal settlement (Ōno 2008).

In Hirono, the former hometown where many will have to move back, they are still places with low radiation levels and other with higher levels. Therefore, not all evacuees will be able to go back to their former areas of residence, and crucially, to their original furusato. In the end, many will return, but to a furusato that now has little meaning for them anymore. Indeed, the former connections (*tsunari*) and human relationships (*ningen kankei*) that used to be a part of their former furusato are no more. In such context, many argued to me that the revitalization project of the state was like a "rice cake drawn in a picture" (*e ni kaita mochi*). In other words, it was pretty, but it had no substance.

While a lot of people from Iwaki Yotsukura Onigoe were evacuees from the town of Hirono, others came from different parts of Fukushima. Kim Fortun (2001: 10) argues that once socio-geographical boundaries have been destabilized, it can be complex to "discern what a community is and who is part of it?" While this was initially the case amidst the residents of the center, evacuees have also created a new community among themselves. "We are all from different regions," told me an elderly woman, "At first we did not know each other, but now we are *nakama* (companion)." Thereby, when the center closes, this new community will dissolve itself and home will once again break apart. These evacuees are constantly deprived of what the Japanese call *ibasho*, "a place where one feels comfortable at home" (Allison 2013: 174). The pre-disaster nostalgia imbued in the very concept of the furusato now confronts the nostalgia of a disrupted environment and social relations that cannot seem to be patched due to radioactive contamination. The nostalgia that these evacuees described through the notion of furusato was not the optimistically laced version heard at the Reconstruction Agency. Their understandings echoed pain: the "impossibility of return that rests at the painful core of contemporary nostalgia" (Freeman 2015: 39; see also Choy 2011).

Nonetheless, evacuees were tired of living in this housing complex. "There is always one problem after the other," mumbled one woman to me. Children were often the trigger of such difficulties. As the same woman explained: "There was some big altercation with kids playing around and making noise. That bothers people and everybody gets angry at each other." In their former furusato, it was easy for children to play in the nature without disturbing anyone. Yet, in the temporary housing, children cannot act as children anymore. The long-term evacuation caused by radioactive contamination brought more than a physical displacement; it also brought a displacement of their very essence. In their new home, children are taught to stay put and to act like an adult.

For some of these children, especially those that were born in the center, the furusato will remain a phantasm. It is a concept that they did not experience nor recalled through the nostalgia of a former place. How can they yearn for something upon which they do not know of – as the Reconstruction Agency narrative argued?

Different kinds of evacuees, and alternatively different conceptualizations of the furusato were found at the Fukushima Children's Home Fund, a NPO founded to provide a place where children could safely play, live, and study. As opposed to the temporary housings, the Children's Home Fund (CHF) rested away from Fukushima, in another prefecture called Nagano. In 2016, children from Fukushima resided year-round and attended school nearby, while being under the care of the center staff. After contacting the organization, I was invited to visit the establishment by Takeshi, the director of CHF.

Before the disaster, Takeshi lived in Fukushima with his wife. When the meltdown was confirmed, he left the prefecture for Tokyo: "As soon as it happened I decided to fly with my family. I didn't care about the money; health was more important!" Like the voluntary evacuee Natsuo, he reported to me that children in Fukushima had recurrent nosebleeds during the night: "It was a thick, non-stopping blood flow, with a very dark color… and the government calls that 'damages by rumors' (fūhyō higai), what is wrong with them."

I asked how the idea for CHF first came to his mind. In the effort to evacuate children from Fukushima he reached toward different organizations: “I’ve called, sent mail, but no one was listening to me!” To raise the specter of radiation was seen as impeding the collective effort of resilience and reconstruction. As he pursued: “So, it became apparent that it was something that I simply had to do by myself. And that’s what I did.” Takeshi was extremely critical of the revitalization programs that aimed at reviving the socio-cultural life of Fukushima. As he went on: “The government will fund any organization helping people to stay and live in Fukushima. But for those who want to leave there’s nothing. We don’t receive a single yen from the government.” Takeshi believed that it was impossible to “live in harmony” with radioactive pollutants. Evacuation was the only conceivable way for him. Thereby, creating a man-made radiation-free environment was the only way to create a whole new furusato, that he could perhaps once again regard as home.

It took at least a good forty minutes before arriving at the center of CHF, a big wooden house typical of the Japanese countryside. There, I was introduced to the staff and residents, including a child that just came back from a hiking trip. Seeing the kid’s happily exhausted face, Takeshi commented: “Here children can have fun, they can play in the nature, and hike in the mountains! None of this is possible in Fukushima without exposing oneself to radiation.”

In the afternoon, members of a farming union surprised the children by bringing fresh watermelons. We played a traditional game call *suikawari*, involving the splitting of a watermelon with a stick. Like the piñata, we were blindfolded and made to turn on ourselves until dizzy. The first shots missed by a few, but the green fruit finally cracked under a strong strike. This was one of the rare moments where I put my notebook aside and started to enjoy fieldwork. As opposed to my stay in Iitate, I did not stress about radioactive exposure, nor did any thoughts for the presence of possible harmful radionuclides crossed my mind while biting into a juicy piece of watermelon.

Illustration 21: *The game of suikawari* (photo by the author)

That's when I understood that it was likely the same for these children. This center was a place where children could be children again; representing a sharp contrast with my experience in the Iwaki Yotsukura Onigoe temporary housing. As Takeshi later told me: "Here children don't have to wear some mask or long clothes to protect themselves from radioactive dust. In Fukushima, they are constantly reminded of radiation. It takes a lot of energy on a person." The government was, however, promoting a different furusato that what Mr. Takeshi advocated for. Takeshi did not believe that violin sonata, as beautiful as they were, could actually mitigate the risk of radioactive exposure. For him, the furusato of Fukushima had become a locus of radiation exposure. It was precisely in such context that parents from Fukushima were willing to send their children away from their former furusato to live in the center of Takeshi.

This was the story of the half-dozen children that were staying at the Fukushima Children's Home Fund during my visit in 2016. "Some kids have been there for almost three years," Takeshi told me while everybody was sleeping. Since Nagano is far from Fukushima many rarely get to see their parents. This center was slowly becoming their new home and the rural area of Matsumoto their new furusato. In the aftermath of Chernobyl's, Petryna (2013: 73) highlights how the socio-economic conditions of a post-Soviet era "continue to lead individuals to neglect their bodies in exchange for something: the stability of a household, authority over the 'fact,' of survival." The specific situation in Matsumoto points toward the contrary. For the worried parents that sent their children away, the concept of home had mutated from a locus of social family ties to a locus of chronic low-dose exposure to radiation. Home was becoming the place of safety, which could perhaps support new forms of family ties, as epitomized by the numerous faceless conversations that parents have with their children over the phone. In Japanese two words are used for safety in regard to radiation harm: *anzen*, denoting a pragmatism of safety and *anshin*, which refers to an affective safety. For Takeshi, post-disaster recovery had to rest on both of those conceptual pillars, but *anzen* had to *first* support *anshin*. Amidst worries of adverse health effects from radiation exposure, the nuclear family was taking different meanings. After Fukushima, different generations can no longer live under the same household. As opposed to Petryna's account of "biological citizens" (2013), the precarity of biological risk cannot become commodifiable. What was turned into a tangible driver was rather the idea of a new and pure *furusato* that can be exchanged against a contaminated one.

As evacuees, Takeshi's couple surprisingly grew stronger. "It was the right thing to do for us," he claimed to me. "My wife and I can work on many projects together." One of these projects included the tending of grape fields. Matsumoto is famous for its Kyohō grape, a concord like variety, which literally translates as "giant mountain grapes." On a sweltering hot Thursday of July 2017, I worked alongside Takeshi, carefully wrapping countless bunches of grapes to protect them from animals. This work would not have been possible in parts of Fukushima, as forests and mountains are out of the jurisdiction of decontamination processes. This means that you can no longer tend for any activities that took place in such areas without potentially exposing yourself to radioactive contamination. Subsequently, this implies the disappearance of the furusato as some people formerly experienced it. The ideas of a pristine environment, enjoying the fruits of nature, or hiking through mountains are parts of this imaginary. Such a culture cannot live with the effect and affect that radioactive contamination brought after Fukushima. The disappearance of that culture implies the disappearance of what the Japanese state was precisely looking to save: the furusato.

The grapes of Takeshi were more than food; they also stood as the symbol of a new furusato, a new rural idyll that produces a perceived safety. His grapes tending embodied a "critical nostalgia" that allowed for "an imagination of a future that is better, where tradition and history are experienced not as a nightmare, […] but as dream-images of possibility, capable of embracing a bit of healthy disorientation and destabilization on the way to something better" (Freeman 2015: 4). Importantly, for Takeshi, the former furusato could never be brought back for symbolic reasons that were equally as important as the material risk of radiation. Takeshi was critical of the repatriation policies due to the fact that they were made possible by a change of radiological safety standard. For him, this was nonsense and he refused to enter knowledge-based institutions at the local scale through citizen science. Indeed, Takeshi maintained a paradoxical relationship with such scientific approach; while he did not disregard radiological science (contrast Stawkowski 2016), he had no use of citizen science, having already evacuated elsewhere.

After working in the grape field, Takeshi brought me to a panorama up in the mountain. While munching on his grapes he argued the following: “Right now Fukushima is like a bubble, but it’s going to pop one day. Money is like a drug. A lot of people will come back to Fukushima because the government is promoting employment and kickbacks, but honestly, what is more important?” Upon leaving this scenery, I couldn’t help but to think about the *panorama-kan* of the Meiji era. These entertainment halls were big rotundas, filled with diverse historical scenic paintings, giving the illusion of reality through effects of perspective. They performed a propaganda function for what Imperial Japan, as a new nation-state, was supposed to stand for (Kusahara 2005). Was Fukushima becoming one of those *panorama-kan*? Takeshi seemed to believe so.

In the end, the experience of evacuees demonstrates that the former essence of one’s furusato was decaying away and at a faster rate than the 30 years half-life of Cesium-137. Masco (2006: 28) describes the nuclear uncanny as a disorientation of the self and the environment, making us acknowledged that one’s experience of the environment is always culturally specific. In a way, this is often what the Reconstruction Agency performances of the furusato disregarded. State-sponsored performances did not acknowledge the fact that the furusato was not a place per se, but a sociocultural conceptualization live and experience in ways that were no more possible after radioactive pollution. If some evacuees were truly nostalgic for a return it was not necessary for a given physical place, but rather toward an unreachable phantasmagoric temporal locus found before the disaster.

Notwithstanding that fact, an incredible number of financial subsidies were injected in the revitalization of Fukushima, promoting a nostalgia for a furusato that no longer existed in many instances. As Marilyn Ivy (1995: 65) argues in that regard: “Dominant ideologies in Japan still depend on a politics of nostalgia suitable for an advanced capitalist polity: a nostalgia for a Japan that is kept on the verge of vanishing, stable yet endangered (and thus open for commodifiable desire).”

The commodifiable desire that Ivy highlights is exactly what is at stake in the state-sponsored revival of Fukushima’s furusato. For instance, an extremely lucrative market is available for the actors that pretend to make contaminated areas into habitable zones. The national government budget for radioactive decontamination is of an astonishing 1.9 trillion yen (Ministry of the Environment N.D.). Decontaminating the furusato then becomes an interesting locus for disaster capitalism, where profit shares rarely come back to the people living in Fukushima. Decontamination contracts exemplify this, as local contractors are no match for the major general contractors from Tokyo, who end up being in charge of such projects (see Fukushima Booklet Publication Committee 2015: 40).[92]

Tropes of resilience and nostalgia for one’s furusato were supposed to provide an environment prompt for return – but one should ask for *whom* exactly? In Tomioka, I witnessed giant incinerators burning irradiated debris. On its front, the logo of Kajima Corporation, Mitsubishi, and the Ministry of the Environment were inscribed. Under those logos one could read “*ganbarō tomioka machi*,” or “Let’s do our best, city of Tomioka!”

[92] In a similar vein, the national government claimed that TEPCO would cover the cost of the decontamination and decommission measures (Ministry of the Environment, N.D.). What this saying fails to acknowledge is that TEPCO became nationalized in 2012 (see Hymans 2015). As a now governmentally owned company, what TEPCO has to cover fall back on the shoulder of the Japanese state, and in the long run to the taxpayers. Numerous cases of collusion are found along decommissioning projects. The successful applicant of a high-scale subsidy project on contaminated water had been won by a joint project, proposed by TEPCO, Toshiba Corporation, and Hitachi-GE Nuclear Energy, Ltd (METI 2016).

This *ganbarō*, which can be translated as "perseverance," seemed to be highly profitable for Mitsubishi, the conglomerate that provides nuclear services and reactors, as well as for Kajima Corporation, a Tokyo-based super-general contractors. Could one really come back to a place where radioactive waste was being burned and called that their furusato?

Like the slow decomposition that epitomizes the phenomena of radioactivity, where a radionuclide slowly transforms itself into a new periodical element, the notion of furusato had undergone a transmutation toward alternative modes of being, knowing, and belonging. Between the governmental narrative and the evacuees' viewpoint, resistance to the specter of radiation hazards was inscribed in the same term, but nonetheless referred to different politics of harm and recovery. A contaminated furusato articulates one's political standpoint toward perceived state's inequality, as well as the risks of radioactive contamination. On the other hand, an utopian future was modeled through a furusato that was resilient and unified against radiation, as the nation-state itself.

The people who started their life elsewhere like Takeshi did not simply pick another place to live, but made a strong political commitment about what and who matter in a post-Fukushima Japan. Even the people who cannot evacuate indirectly provide – through their broken morals and financial conditions – a sharp contrast with the culture of resilience promoted by the government. In the end, an engagement with the furusato was a political touchstone which remained trap in a double bind; the phantasm of a place that was pure before, confronted the phantasm of a place that could become pure again. Both phantasms were differentially articulated and remain important windows to understand how the politics of radioactive hazards outgoes reified forms of scientific expertise.

5.4 Internal Contradictions, Pluralized Governance

In the anthropology of toxic disasters, ethnographers have highlighted the hierarchical competition that pits institutionalized expert knowledge against local forms of knowledge. For the Chernobyl nuclear catastrophe (Stephens 2002; Petryna 2013), for the Bhopal gas leak (Rajan 1999; Fortun 2001), for the B.P. oil spill (Button 2010; Bond 2013), or for Hurricane Katrina (Adams et al. 2009), anthropologists have held that the right to establish the terms under which the influence of a disaster is determined can be seen in terms of power struggles, between state elites and local victims.

Yet, the scalar shift of knowledge/power, used to highlight how one party (generally the state or corporate polluter) generates knowledge to gain power over other actors, has made social researchers less attuned to the multiple forms of expertise that exist amidst that heterogeneous things that we refer to as the "state." To understand the evolution and enactment of state expertise in context of crises around its legitimacy, a theorization of such tensions is not only necessary, but crucial.

This chapter has made it evident that multiple layers of contradiction exist in the governance of radiation hazards. Obviously, between the state and the citizens, but equally within the state itself. Indeed, METI, MOE, and the Reconstruction Agency, were all mobilizing different forms of expertise, as well as different materialities of radiation hazards. Each of these state agencies attempted to manage public risk perception in ways that were often contradictory. For instance, while one ministry refused to discuss radioactive contamination, another ministry was implicated in creating decontamination process. While one ministry claimed that renewable energy was getting an ungrounded preferential treatment, another agency aimed to promote green energy in Fukushima. While carbon monoxide was described as a harm that was more serious than radiation hazards, tons and tons of radioactive waste were being burned in giant incinerators. The irony seemed to be pilling as high as the mountains of vinyl bags in Fukushima.

These internal contradictions in the governance of radiation hazards demonstrate a difficult transition from the first-time signature of this disaster to the second-time signature. Now that a sense of urgency had disappeared, how could state experts best manage radiation hazards? Which risks came into being or not? Which forms of hazards felt under their technical expertise? Such were not easy questions to tackle – even for a state.

Yet, these tensions, following Povinelli (2011), are not to be seen as necessary conflictual or unproductive for the state politics of post-disaster recovery, since each of these forms of expertise coalesced toward a particular politics, which sought to mitigate the risk of radiation hazards, while making people come back to Fukushima. In that regard, different enactments of state expertise around radiation hazards should not be seen as clashing against each other in unproductive ways. On the contrary, each scenario mobilized by state experts were merging together so as to address the different practices of resistance that surrounded a lack of trust against their establishment. Frictions, as Tsing (2005) argues, are what enables things to move ahead.

State governance of radioactive hazards through contradictory expert dynamics invites a reflection on the unity of the state. Doing so adds nuanced layers of internal frictions to the concept of "sociotechnical imaginaries," which consist of "collectively imagined forms of social life and social order reflected in the design and fulfillment of nation-specific scientific and/or technological projects" (Jasanoff and Kim 2009: 120). This concept has notably led scholars to contrast U.S. and South Korean nuclear governance, where American sociotechnical imaginary is a vision of “a potentially runaway technology that demands effective ‘containment’” (Jasanoff and Kim 2009: 119) and Korean sociotechnical imaginary a vision of risk-benefits calculus “framed in terms of their implications for the nation’s future” (Jasanoff and Kim 2013: 193). Ethnographical explorations of the internal contradictions of state radioactive governance provide a more heterogeneous lens about nuclear policy, by conceptualizing how nuclear matters are also managed through important contradictions.

Lastly, one of the most striking aspects of this pluralized governance in Fukushima is an important shift beyond mere technical forms of scientific expertise. As opposed to Max Weber (1978) who argued that dehumanization is part of a successful state, one can see that the Japanese state did not aim to get rid of affective stances in its depiction of Fukushima. Quite the contrary, affective sensibilities of different intensities were gradually becoming an integral pillar of their expert practices, as emphasized by the specific mobilization of the furusato. In this, state politics of radiation danger were no longer simply based on a monopoly of cold technical expertise that predominantly defined the first-time signature of this disaster. As we will see in the next chapter, this politics of emotion would end up being exacerbated like never before.

Chapter 6: Nuclear Embodiment

In "Risk Society" (1992: 22) sociologist Ulrich Beck describes radioactive risk as being invisible, odorless, and senseless—in brief, an imperceptible threat that demonstrates the inadequacy of our ability to govern its hazards.

Yet, when I conducted fieldwork in Fukushima signs of a nuclear disaster were clearly present. Cities like Tomioka were ghost towns, with traffic lights still changing from yellow to red on abandoned streets. In the town of Yotsukura, temporary housing had been built to shelter evacuees. As a testament of the decontamination projects launched by the government, mountains of black vinyl bags, filled with contaminated soil and debris, formed Mayan-like pyramids. Beyond this gloomy scenery, affected citizens were embedded in the mobilization of various technoscientifc practices in the hope of making radioactive threats visible. In the cities of Iwaki and Iitate, I witnessed citizens wearing electronic pocket dosimeters, devices used to measure the external dose of radiation exposure. Often, these devices had become more than a tool, acting as an inseparable bodily prosthesis to augment one's corporeal senses (Haraway 1991)

Yet, in the scope of my fieldwork, radiation never seemed more tangible than in government-sponsored scientific hubs created to explain the phenomenon of radiation to the population of Japan through a series of public activities. In these scientific hubs, members of the public could begin to palpably apprehend radiation events through interactive games, sensory devices, and responsive infrastructure all working on a plane of aestheticization and emotion. In other words, radiation took the form of a sensory and affective experience sponsored by the state. Despite the visitors' smiles and laughter, one could not forget that these were the same people who had so profoundly—and so corporeally—experienced nuclear hazards firsthand.

Nuclear things have a rich and paradoxical relationship with human bodies. For instance, drawing on Foucauldian techniques of the body, Gusterson explored the peculiar culture of the body amidst nuclear scientists at the Lawrence Livermore National Laboratory in California, arguing that a radical polarization between the worlds of mind and body is crucial for “maintaining the stability of laboratory life and the felt legitimacy of nuclear weapons work” (1998: 130). Masco (2004) focused on the technical aspects of research scientists who work with virtual nuclear detonations to document the production of a new sensibility that differs from the one experienced during real nuclear detonations; he argues that, by diminishing sensory experiences, nuclear materials are depoliticized and normalized, blinding scientists to the political nature of their dangerous endeavor. On the other hand, Hecht (2012) pointed out that the baselines of radiological safety were invariably racialized as they rarely included data of African workers in uranium mines, thereby making some bodies visible and other invisible.

Inspired by these works, this chapter pursues similar issues by focusing on the recent creation of government-sponsored radiation education activities in the aftermath Fukushima. More precisely, this chapter examines how state expertise on radiation hazards is increasingly being disseminated to the public via specific feelings and corporeal relations with radioactive matter. I contend that a normalization of radioactive contamination is promoted through a process that I call “nuclear embodiment,” in which radiation is made visible, palpable, enjoyable, and affective. However, as was similarly found in the aforementioned studies (see also Myers 2015), these nuclear embodiments are partial and selective in their nature—meaning that government-sponsored radiation education programs simultaneously promote a specific form of nuclear disembodiment, disinformation, and secrecy as they make only certain aspects of radiation tangible through their sensory and embodiment activities. The result is the promotion of a nuclear embodiment that shift relationship with radiation from what used to be a synonym for man-made danger after Fukushima toward a specific vision of natural wonder, technological amusement, and scientific amazement.

6.1 Embodying Knowledge, Expertise, and Toxicity

In the initial aftermath of this disaster, the Japanese state was maligned for its failures to adequately inform the public about the meltdown and to protect citizens from the ensuing exposure. Ethnographic accounts have criticized the institutional experts' assessments of the radiation risks and the post-disaster policies. For instance, the Japanese government's explanations of the radiation hazards were described as producing uncertainty regarding the potential adverse health effects of long-term, low-level chronic exposure to residual radiation (Asanuma-Brice 2014; Morris-Suzuki 2014; Hirakawa and Shirabe 2015). The rhetorical marginalization employed by the Japanese government was understood to be the result of a traditional risk communication strategy, where authorities initially "[chose] and nominated their experts to be in charge of assessing radiological risks and then of communicating such risks to the population" (Shirabe et al. 2015: 3; see also Slater et al. 2014). Subsequently, there arose the feeling that the institutions built by the experts no longer served the population of Japan, as described in the previous chapters.

This public skepticism, along with ineffective risk communication on the part of the government, has led to the creation of numerous citizen science networks, where people track radioactive contamination through the mobilization of technoscientific practices. And while much has been written on how citizens were able to produce novel forms of expertise about radioactive contamination, the same attention has rarely been paid to the evolving approach of the Japanese government. In other words, an important theoretical and empirical focus has been on exploring the evolution of citizens' replies at the expense of examining the evolution of state expertise.

The result is an important knowledge gap in terms of the creation of the scientific expertise of the state, which indirectly paints a portrait of an archaic institutional apparatus that resists change. Such an approach sidelines the fact that the Japanese government's own scientific expertise is complex, having faced major troubles and changes. As the previous chapter began to highlight, the practices and performances of the Japanese government around radiological protection have also demonstrated an articulation of scientific expertise through different means that surpass the old approach of knowledgeable individuals informing laypeople, by mobilizing, for instance, nostalgic tropes of resilience around the notion of the native land.

Going further, this chapter demonstrates that the Japanese government's techno-political management of radiation risks today differs greatly from the early authoritarian strategies that were epitomized after Fukushima. By examining how parts of Japan's government-sanctioned expertise on radiation risk are now inseparable from corporeal and affective entanglements (Myers 2015), I aim to shift the understanding of the Japanese state as being a homogeneous entity that simply provides traditional forms of risk communication. I do so by inserting my work in a theorization of expertise that possess, as Boyer (2008) argues, significant blind spots and inattention to the practices and dynamics of embodiment.

Anthropologists of science and medicine have long been interested in the notion embodiment, recognizing the central importance of bodily experience in human knowledge. Often building on the phenomenological approach of Merleau-Ponty (1962) and on the Foucauldian (1979) framework of discipline, anthropologists have demonstrated that the sensorial body is rooted within the modalities of power relations, as well as within sociocultural, gendered, and technological contexts that need to be considered (Martin 1987; Scheper-Hughes and Lock 1987; Murray and Sixsmith 1999).

More recently, scholars have taken up embodiment as a novel way to study expertise. Citing how issues of expertise are decorporalized through a mere emphasis on intellectual processes, Boyer (2005) has attempted to reconsider expertise as a corporeal social phenomenon through case studies among journalists in East Germany. In her study of protein modelers, Myers (2015) highlights the entwining of material and conceptual models by tracking how scientists move and feel by applying the chemical constraints of molecules.[93] These recent trends in anthropology and Science and Technology Studies put forward the fact that bodily and affective relationships play a key role in how hardly perceptible matters are made visible. Drawing from such works, I look at how an expertise on radiation is inseparable from specific feelings about radioactive matter that are promoted through particular sensory interactions.

[93] Additionally, how subjects become corporeally aware of nonhuman entities while somatically judging their environments amidst toxic uncertainties has become a topic of increased interests (Murphy 2006; Shapiro 2015).

In talking about nuclear embodiments, it remains important to bring into the conversation issues of performativity and performance; especially since embodiments always require a kind of performativity.[94] In particular, I turn my attention to the idiom of rendering, which insists on "paying attention to how models *rend* the world" (Myers 2016: 20). This performative approach to representation argues that models never simply describe the world; rather they are performative as they also "sediment particular ways of seeing and knowing" about things (Myers 2016: 19).[95] Furthermore, scholars have argued that the enactment of expertise involves the performance of uncertainty and ignorance (Carr 2010: 13: Mathews 2014). Such performances are often made possible by stabilizing specific material-semiotic characteristics of toxicity (Mukherjee 2016) and nuclear things (Hecht 2012). Similarly, examining scientific knowledge on radiation through the lens of performativity and performance enables to pay attention to the aspects of radiation hazards that are promoted or not in Japanese educational hubs. How is radioactivity being front staged in these centers? What risks are made apparent or not?

Pragmatically speaking, this chapter focuses on the case studies of three government-sponsored radiation education programs aimed at engaging the general Japanese public after the Fukushima nuclear disaster. Much of the empirical and case study research on which this chapter draws was undertaken in the context of participant observation of the public's interactive experience, where I highlight the visitors' embodied interactions with the technologies, models and displays that explain radiation, as well as

[94] The notion of performativity was used to develop nonrepresentationalist theory around issues of reality and gender, especially by STS feminist scholar (Butler 1993; Barad 1996; Mol 1999; Myers 2016). It also echoes the fact that staged performances were at the origin of science (Shapin and Schaffer 1985).

[95] In the context of protein crystallography, this enables Myers to ask what forms of life matters or not in the hands of protein modelers (2016: 20).

the predominant emotions that propagate through sensory interactive experiences. In this, I pay close attention to the peculiar aspects of radiation that are made tangible and somatically affective, as well as those aspects of radiation hazards that are concealing and disembodying. In other words, I highlight the "regime of perceptibility" (Murphy 2006) that make some hazards visible but leave others invisible, while examining the practices through which exposure, as an effect between lived environment and bodies, become a phenomenon that people can feel.

In interviews conducted with state officials, I was often told that Fukushima was afflicted by "harmful rumors" surrounding the real extent of radiation harm (see Chapter 4). It is in such context that educational centers were created, so as to provide "basic information" (*kiso-teki jōhō*) that could help create an "environment prompt for return" (*kaeru kankyō*) for the recovery of Fukushima. A focus on performance and embodiment shed light on the actual understanding of recovery, by accentuating the aspects of radioactive hazards that are recognized (or concealed) in the so-called basic information that educational centers promote.

By now, accounts regarding the normalization of nuclear materials in Japan have highlighted the political, economic, and social contexts in which nuclear power was embedded (Fujigaki 2015). As described in Chapter 2, a myth of nuclear safety was successfully solidified through the influence of pro-nuclear lobbies and national education, which together built a strong foundation for propaganda as well as nationalist pride. After the meltdown in Fukushima, new educational textbooks were issued in Japanese school, where the general guideline for teachers was to create an understanding that no clear evidence has demonstrated that low-dose levels of radiation (i.e., below 100 mSv) cause disease (see also Takagi gakkō 2003).[96] By drawing on a framework of embodiment and performance, contributions can be made to these studies by showing how the trivialization of radiation risks is a phenomenon that is increasingly being governed through the promotion of specific embodied and affective experiences with nuclear matter.[97]

6.2 Decontamination Info Plaza

Situated in the city of Fukushima, the Decontamination Info Plaza was established in January 2012 as a joint program between the prefecture of Fukushima and MOE. As briefly explained in Chapter 5, the purpose of this information center was to provide information about radiation in general, as well as explanations about monitoring methods, workshops on decontamination, and advice on contaminated sites. Basic information on radiation was presented to the public in a very accessible, visual, and interactive form.

As its name indicated, the Plaza was largely dedicated to providing information about the decontamination of Fukushima, seen as having contributed to the sharp decrease of radiation levels in Japan. As explained by a poster, the decontamination process consisted of four main steps: collecting and removing radioactive pollutants; containing these pollutants in vinyl bags to impede the risk of re-scattering; shielding the waste with soil covers; and storing the waste in safe locations. Not far from this explanatory poster was a vinyl bag like those used during the decontamination process, described as being

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[96] Japanese scholars have equally criticized data falsification by nuclear operators and the cover up of radioactive releases (Koide 2011), as well as the culture of secrecy and regulatory capture that surrounded nuclear power (Kurokawa 2016).

[97] In the context of nuclear science, appealing ways have long facilitated the integration of complex information, sometimes blending education within propaganda. The 1957 Disney TV episode Our Friend the Atom is a perfect example of this. But in regard to nuclear disasters, an appealing and interactive approach is wholly novel. The dangers and political stakes of resorting to such forms of explanations after a nuclear disaster are in such quite unique.

sturdy enough to resist tearing. In fact, visitors were encouraged to "test" its durability through first-hand tactile experiences, and center officials seemed pleased to see visitors pulling on the corners of the bag.

An interactive model was also available to help younger visitors to understand the process of decontamination. The model consisted of a miniature house in a transparent plastic box that was filled with small white and red balls. The white balls represented uncontaminated soil; the red balls stood for radioactive pollutants and were encrusted on the house rooftop, in the miniature trees, and amidst the uncontaminated soil. With a toy shovel, it was possible to pick up the red balls and to dispose of them in a scale-sized plastic container. Visitors could literally pick up the symbolic radioactive contaminants in order to isolate them from the rest of the environment.

In this case, "the environment" was contained within a perfect one-meter-square plastic box, which is ironic when one considers that the MOE was behind its conceptualization, and the MOE should know better than anyone how utterly pervasive and uncontainable the environment actually is. Much like Latour's (1993) modern critical stance about purification, this model created two entirely distinct ontological zones: that of the human and that of nature.[98] In the model, residual radioactivity was conjured as a biophysical entity that could easily be isolated from the human environment. Yet, the clear conceptual separation between the human and the natural environments that this model operationalized often crumbled under the embodiment and performance of the experience.

[98] Latour argued that our modern paradigm and norms consist of two practices (which have started to be confused). Latour stated that the first set of practices (the practice of translation) creates "mixtures between entirely new types of beings, hybrids of nature and culture" (1993: 10). The second practice (the modern critical stance of purification) then proceeds to create two separate realms, which need to remain distinct: "that of human beings [culture] on the one hand; that of non-human [nature] on the other" (1993: 10-11).

Importantly, the boxes in this decontamination model were not merely working on an intellectual level. Rather, they stood as "interactive objects" (Myers 2015; see also Sismondo 1999) that demanded participation from the visitor while simultaneously undergoing continual transformation (i.e., being contaminated, being clean).[99] By playing with the toy shovels and trying to "successfully" get rid of the radioactive pollutants in the plastic box environment, decontamination acquired a certain tangibility that felt like a game of sorts. As a rendering, a model always "embodies, performs, and sediments" specific ways of knowing, while being "inflected with the affects of their modelers" (Myers 2016: 133).

Illustration 22: *The decontamination box model* (photo by the author)

In similar ways, the decontamination model performed radioactive decontamination as something that was possible and fully efficient. Yet, as seen in Chapter 5, radioactive elements did not fully felt within the narrative of human control. Moreover, the embodiment of decontamination was only partial, as the children did not have to put on

[99] Models are consequently not "just things that stand in for knowledge or phenomena; they are also enactments that generate new ways of knowing and things known" (Myers 2016: 132)

protective suits before separating the red and white balls. In this, there was no recognition that the decontamination process presented potential health hazards from radiation.

Also at the Decontamination Info Plaza, one could learn that radiation naturally exists in daily life, be it from cosmic rays, or naturally occurring radon gas, or even the potassium ingested through food. Signs and pamphlets did explain that radiation could also be man-made, but the center heavily rooted these man-made occurrences in discussions about radiation exposure for medical treatment. For instance, x-rays and CT scans were described as exposing individuals to high doses of radiation—much more than what could be found in Fukushima (Takamura N.D.).

One could also ostensibly learn about the specific threats the meltdown in Fukushima had engendered, although representations of these perils were anything but threatening. Through posters and displays, radionuclides such as Plutonium-239 and Cesium-137 were represented as cute and non-threatening little figures (see also MOE 2016). Each radionuclide had its own specific characteristics, such as pronounced eyebrows, large ears, or a notable hairstyle. For instance, rather than being described as a dangerous radioactive molecule that mimics calcium in order to enter an individual's bone marrow and cause lifelong radiation exposure, Strontium-90 took the form of a friendly looking yellow figure with eyes, a mouth, and a cute antenna on the top of its head. And while children could interact with these adorable anthropomorphic radionuclides, there was no discussion about how exposure to these radionuclides could cause bodily harm.

In the back of the center, a series of cartoonish posters explained the phenomenon of radiation. In them, a teacher—depicted as an old and wise owl—explained radiation to a bear, a rabbit, a squirrel, and a little girl. While radiation could pose a biological threat, the wise owl explained, the body's own enzymes could quickly repair any damage. Alongside this scene, a small, blue, cape-wearing hero was successfully applying a Band-Aid to a damaged body.

In addition to these visual aids, other interactive elements also helped learners to grasp the phenomenon of radiation. What's more, a cloud chamber (*kiribako*), which is a particle detector used for visualizing the passage of ionizing radiation, allowed visitors to literally see radiation in action. One could also learn to manipulate radiation measuring devices, such as the scintillation radiation counter PA-1000 or the semiconductor radiation counter PDM-122, through testing the amount of naturally occurring radioactivity in different commonplace materials such as rice or ceramics.

Carr argues that "expertise requires the mastery of verbal performance, including – perhaps most importantly – the ability to use language to index and therefore instantiate already existing inner states of knowledge. (Carr 2010: 19). Interestingly, these radiation measuring devices, described as educational tools (*kyōiku tsūru*), often had honorific suffixes added to their names.[100] For instance, the diminutive suffix *chan*—a cute pronouncing of the suffix *san*, translated as "Mr." or "Mrs." to connote a non-threatening, childish, or feminine context—could be found on two of these measuring devices (i.e., *Arufa-chan*, *bēta-chan*). Numerous tactile electronic screens displayed information about radiation in demonstrably accessible language (*hōshasen tte nani*). In "*Hōshasen tte nani*" ("What is radiation?"), the Japanese particle *tte* demonstrates informal reported speech, evoking a feeling of non-technicality and showing that the discussion is directed toward the public (rather than a body of experts).

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[100] In Japanese, names are often followed by various honorific suffixes, such as *san* or *sama*.

Beyond the interactive displays, the center hosted numerous technical advisors to answer visitors' inquiries. One such advisor, Kaoru, was an extremely enthusiastic individual, eager to teach visitors about radioactive contamination. He was quick to note that over 99.9% of the people screened throughout the prefecture were shown to have no signs of internal contamination by radioactive cesium. "In such conditions, there is absolutely (*mattaku nai*) no need to worry about the food we ingest," he argued. Furthermore, he contended that the small additional increase in the external dose of exposure, caused in part by residual radioactivity, would be negligible. In his estimation, chronic exposure to radiation only increased a person's risk of dying of cancer by 0.005% per every millisievert of accumulated dose.

Against this optimistic background, Kaoru was critical of the anti-nuclear organizations that advocated for a full-scale evacuation of Fukushima due to the belief that many parts of the prefecture were unsafe for habitation. As he bitterly retorted, "You cannot work on the problems that radioactive contamination has brought while being linked with an ideology … The anti-nuclear activists are victimizing the people of Fukushima to suit their [own political] needs!" Yet, in criticizing this ideological bias, Kaoru was unaware of the ideology that permeated much of the center's performance about radiation. Indeed, to fulfill the need for expert knowledge, the prefecture of Fukushima has turned to the Japanese government and international experts in radiation and nuclear power; this has resulted in a cooperation with nuclear agencies, such as the International Atomic Energy Agency (IAEA) and the Japan Atomic Energy Agency (JAEA), whose main aims are to promote the nuclear power industry.[101] Teaching performances were in such not neutral, but equally embedded in a pro-nuclear ideology.

In his mind, there was a clear difference between the people of Fukushima and the anti-nuclear activists: "We have accumulated data and learned a lot during these five years, to the point where we can now assess the level of risk that we are facing. This learning process is the key to the reconstruction (*fukkō*) of Fukushima!" Yet, as demonstrated by the Decontamination Info Plaza itself, this learning process had to be embodied through an experience of pleasantness and enjoyment. And as Kaoru pursued, many people lacked knowledge about radiation and might not fear it appropriately: "The distress of anti-nuclear is ungrounded," he noted, emphasizing that "They have an intuitive fear about radiation."

Against this background, it was important that information about radiation be transferred in ways that did not instantiate fear—or, if fear was inevitable, it should at least be what the technical advisors considered "proper fear" (*tadashiku osoreru*).[102] For instance, measuring devices should not induce feelings of anxiety. Against that, the technical advisors of the centers argued that the citizens of Fukushima had to become physically accustomed to such manipulations. Consequently, they heavily encouraged residents from the city of Fukushima (the main visitors of the centers) to touch these devices' buttons, to play with them during mock tests, or to hold them at the proper height for measurements. Kaoru's desire was that people develop more appropriate relationships

[101] Connections between these organizations and pro-nuclear corporate lobbies have already been made apparent, especially when "nuclear industry experts might be motivated to downplay the perceived consequences of a nuclear accident" (Kuchinskaya 2014: viii).

[102] As Shirabe et al. argue, this term implies that the "correct" fear is invariably "the one established by the authorities," and thereby relegates different opinions as reflecting the "wrong" understanding (2015: 3).

toward radiation; this explained why nuclear embodiments were performed in non-threatening ways, with colloquial languages that even children could easily understand.

Through such technoscientific mobilizations, members of the public gained the means to empower themselves (as the center's technical advisors argued). At the Plaza, Geiger counters were no longer mere tools, but had already become an established extension of one's body—a necessary biomechatronic body part for living and being in irradiated environment that would put Haraway's (1991) metaphoric cyborg right at home in Fukushima.

6.3 The Fukushima Prefecture Centre for Environmental Creation

Another important state-sponsored educational infrastructure was the Fukushima Prefecture Centre for Environmental Creation (*Fukushimaken kankyō sōzō sentā kankyō hōshasen sentā*), situated in Miharu and inaugurated in July 2016. The center was established by the prefecture of Fukushima, with the financial support of the Japanese government, to act as a central organization to conduct research and to provide education on radioactive contamination. One annex in particular, the Environmental Innovation Centre Exchange, was established to explain radioactivity to Fukushima's population. This annex felt within the government-sponsored revitalization projects (*fukkō*) that attempted to reinvigorate the public's trust regarding living in Fukushima. The educational annex was mostly visited by young families and a technical advisor explained to me that the center purpose was to "deepen the understanding of children about radiation," especially by making their experience enjoyable.

At the entrance, a large-bellied hippopotamus-like mascot welcomed visitors while also returning waves and accepting hugs from children. Indeed, even before entering the center, young visitors already seemed to be having a good time. The center's most popular attraction was an enormous spherical theater, where visitors could immerse themselves in a 360-degree multisensory experience. Here, citizens were bombarded with sounds, images, and videos all aimed at explaining the phenomenon of radiation in under 10 minutes. For instance, while an enormous Boeing plane passed above theater-goers' heads in the cinematic sky, the risks of radiation in Fukushima were minimized through making comparisons to the amount of gamma rays that one received during a continental flight.

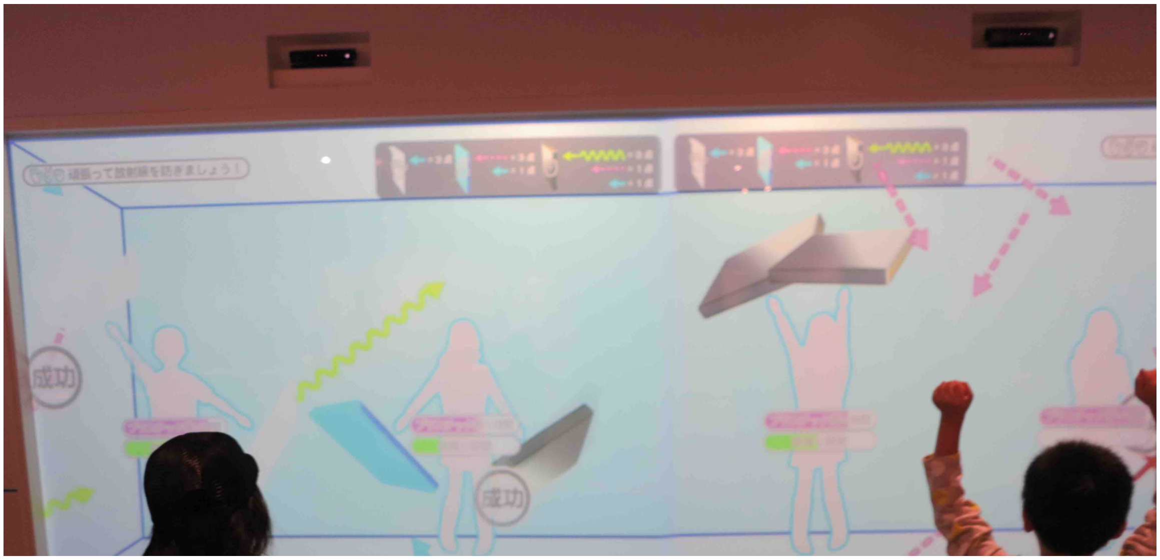
Furthermore, radiation was said to be everywhere, from radio-waves to micro-waves. Visitors were also told that, without radiation, no life would exist on earth. And while ionizing radiation (the form of radiation released by radionuclides) was shown to be potentially damaging to one's DNA, the theater's narrator emphasized that special enzymes in the human body could counter the risk of genetic damage. At this point, a three-meter long strand of damaged DNA materialized before visitors' eyes, then immediately repaired itself. With neck straining upwards, one child could be heard exclaiming "That's so awesome!" ("*chō suge!*").

One of the largest rooms in the center was the radiation laboratory, where visitors could deepen their understanding of radiation and where learning took the form of enjoyable games and devices. Children were invited to consider the many benefits of radiation, as emphasized by an interactive display with a sign that read, "Look inside! The Penetrating Power of Radiation."

In front of a giant interactive screen, children could also, through the movement of their bodies, learn to block radiation rays or particles. By selecting the proper material (e.g., a piece of paper), they had to block either alpha particles, beta particles, or gamma rays. They could thereby pretend that their bodies were thick metal plates that could be used to hamper harmful external exposure. By doing so, the children collected points, and at the end of the game, the child with the highest score won. In the context of Mexico forestry, Mathews argues that the "making of public knowledge is always a public performance that also seeks to define the boundaries of the political" (2011: 175).

Similarly, the making of public knowledge in the Fukushima center embodied a specific politics through a regime of the sensible that promoted pleasantness and happiness around radioactivity. Beyond the fact that children had to physically participate in this learning process, these games were performative in that they aimed to "sediment particular ways of seeing and knowing" (Myers 2015: 19). However, these ways of seeing and knowing disregarded specific explanations of radioactive hazards. By transforming radiation protection as a game, where external radiation was to be blocked, there was no mention of the risk of internal contamination from radioactive particles, which represent an important hazard if internalized through breathing contaminated air or ingesting contaminated food. And because the children's game blocks radiation in "real time," there is was no mention of any delayed health effects of radiation exposure, such as potential harmful genetic changes.

Illustration 23: *The screen game* (photo by the author)



Through these embodiment activities, children could literally see and most importantly *play* with the radiation that had ironically been the perpetrator of so much misery in Fukushima—but only in partial and specific ways. Importantly, this aestheticization of scientific knowledge implied a profound sense of investment (as play) that dismantled the clear separation between the individual and the fearsome agent of radioactivity. Through such kinesthetic and affective sensory interactions (Myers 2015), visitors gradually became aware of the non-human entity of radiation in new ways.

Visitors could also experience guided tours of the Japan Atomic Energy Agency (JAEA) and the National Institute for Environmental Studies research facilities, located in the same complex. There, children were given tiny white lab coats whose only function was to ensure that parents could take pictures of their children in a cute outfit. After viewing germanium detectors and a spark chamber that allowed a viewer to see radiation through energetic ionizing particles passing through the device, visitors were gathered together and introduced to a brand new instrument that measured radiation levels in water. After the visit, children could notably read m*anga* (Japanese comics) that tackled a specific question about radiation, such as food safety or radiation health effects. Written by a local entertainer in Fukushima, the overall approach to the comics was one of adorable and charming aesthetics.

Anthropologists of embodiment have made an important call for a cultural phenomenology of embodied experience (Scheper-Hughes and Lock 1987; Murray and Sixsmith 1999; Boyer 2005) and in that regard, a striking fact about the centers studied so far is that information about radiation was performatively cultivated, always presented with a very cute appearance—something the Japanese call *kawaii* (Yomota 2006).

In Japan, the notion of "cute" does not have the same puerile significance that it possesses in the English language and North American culture. And while *kawaii* as a term is often translated as "cute," "adorable," "charming," "lovely," or "pretty," it also points towards a specific aesthetic, behavior, and mindset that evokes joyful, feminine, and childish connotations while promoting a non-threatening appearance.[103] It is also important to note that in Japanese society, making things cute is a well-accepted practice that is encouraged amidst a diverse set of social strata and contexts.

In the present context, *kawaii* echoes the analogy of a "flavor-coated pill" (Cheok 2011: 252) in that it facilitates the integration of frightening information in an attractive way, bringing "the user to a desired frame of mind and attitude and then deliver[ing] content that might not otherwise be received." The center cute and interactive presentations

[103] In similar ways, childhood is rarely considered an "inferior" stage of human growth; rather, it tends to be perceived as a locus of individual freedom inaccessible to adult society in Japan.

allowed visitors to experience radiation as a non-scary entity, subsequently putting a gloss on radioactive contamination. In that regard, the terms *osen* ("contamination") and *higai* ("damage") were largely absent. Indeed, there was no mention of the fact that the international standard of radioprotection had been changed after the Fukushima nuclear disaster, nor that specific radioactive pollutants could stay in one's bones or ovaries for extended periods of time. Rather, mothers and their children—the majority of the visitors—were drawn into a pleasant world of *kawaii*.

6.4 National Institute of Radiological Sciences

The last case study concerns the National Institute of Radiological Sciences (NIRS), or *Hōshasen'igakusōgōkenkyūjo*. NIRS is a world-leading radiological institute with a mandate to study the effects of radiation on the body. Since 2011, NIRS had assisted in the restoration of the areas affected by radioactive contamination by managing research projects that address the needs and concerns of Fukushima residents. Early on, NIRS was called on to collaborate with the government to create probabilistic models for estimating human exposure to radiation as a means of predicting potential adverse health effects.

On April 24, 2016, the institute held a public open house entitled "I Want To Know More! What You Can Do with Radiation" ("*motto shiritai! Hōshasen de dekiru koto*"). Members of the public were invited to see the institute's research facilities, which were buzzing with young families and excited children jostling each other to admire the latest PET scan technology, various radiation emergency instruments, and the enormous cyclotrons used in nuclear medicine for the production of radioisotopes.

Children could try the equipment used by the institute's Radiation Emergency Medical Assistance Team while they waited in line to be photographed in front of a high-tech minivan that dispatched medical care in cases of radiation exposure accidents. Usually reserved for emergency situations, the emergency van had become the background for a role-playing scene (*kosupure*), with costumed children saluting their parents in military-like fashion.

A special elevator led down to the Heavy Ion Medical Accelerator, situated in an impressive subterranean facility. As I walked through the underground maze of this metallic behemoth, it became apparent that families were overcome by the sheer scale of the apparatus, whose interior looked like a sci-fi anime scene. Indeed, as one parent said to his child, "It looks like a spaceship, right?" ("*Uchūsen mitai ne?*"). For this open house, the research institute felt almost like a fairground. Every station had its own stamp stand; children collected as many stamps as possible in what was known as the "stamp rally," wherein children ran as fast as possible between stamp stands, then presented their completed sheets to staff members. In one child's words, "Look! I've done it! It's all filled!"

In the institute's auditorium, families could learn about the effects of radiation exposure. Numerous stands provided explanations regarding radiation's medical applications, while others explored the link between lifestyle and radiation risk. A stand on histology (i.e., the study of the microscopic anatomy of cells and tissues) enabled visitors to see what cancer actually looks like. As opposed to the healthy cells, the carcinogenic cells exhibited a darker color, as exemplified by the samples that could be manipulated. Similar to the radioactive pollutants of the interactive box at the Decontamination Info Plaza, hazards linked to radioactive exposure (in this case cancer) were disembodied from personal experiences, by depicting them under the forms of samples embedded between two glass slides.

An anatomic model of the thyroid gland was also present and could be assembled like a 3-D puzzle. Suddenly, what was a major concern for Fukushima residents (i.e., the apparent increase in the incidence of thyroid cancer amongst the prefecture's children) was now embodied by a harmless model that could be manipulated in one hand. Nearby, children were learning about the composition of the human body by affixing organ-shaped stickers in their rightful places. The station called "Impact of Fukushima" consisted of four posters that largely focused on the decontamination process and the disaster's ecological impacts.

The most popular "attraction," however, was the whole-body counter (WBC), a machine that measures the internal level of radioactive contamination in a person's body. Children and parents waited in line for their results without a hint of fear; indeed, the queue was filled with smiling, laughing people who passed the time by chatting with the technical advisors. The end result was always a computer print-out with a technician stating that each body was "just fine" (*daijōbu desu*). This test, conducted in the affectively charged atmosphere of the open house, contrasted sharply against the initial government-led radiation exposure surveys which—as many residents informed me—had been conducted in an impersonal manner, with each person's results arriving in the mail.

While the WBC might initially have seemed like the epitome of radioactive risk embodiment, there was no discussion regarding what this machine could (or could not) see. Notably, a WBC does not measure the potential for future genetic damage, but only the overall amount of radiation in a person's body as a whole. This can be misleading, as one expert in radiation/chemical carcinogenesis explained to me in 2016:

> While the average result of a test might appear to be low, one particular spot in the body can have a very high amount of internal contamination. Even on a single organ, like the stomach, there can be a lot of heterogeneity [in the dispersion of radioactive contaminants]. This is enough for a cancer to develop, as a cancer does not "understand" the term "average," but concentrates itself on a spot. A result that is "below average" does not imply a lack of risk, not at all.

Similarly, in a private interview, a radiation biologist employed by NIRS explained the reasons behind the use of the WBC: "We are doing those tests because we can do them. In theory, the screening can make people feel better."[104] Consequently, the test was also a performance, an assurance that aimed to provide emotional safety, rather than biological safety.

At this open house, the institute provided what Stewart has described as "collective saturations of the senses" (2011). There were almost too many things to see, press, or squeeze. Yet the end result was an established trajectory that promoted a pleasant atmosphere in which radiation was no longer a scary external force but rather a somewhat enjoyable lived affect.

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[104] As historian Robert Jacobs explained to me by email, while WBC are useful for performative reasons, an important aspect of that performance is also "shielded" in the fact that the thick steel plates that are parts of its construction are often made from steel manufactured before 1945. This is due to the fact that any steel manufactured after that year would have trace amounts of radiation from the numerous atmospheric nuclear weapons testing. Ironically, the ubiquity of global nuclear fallout is hidden behind a device that is now used to manufacture the illusion that there is little distribution of radionuclides from a nuclear disaster.

Illustration 24: *The Whole Body Counter* (photo by the author)

Notably, NIRS's expertise is focused on radiation protection in the medical domain. In the previous sections, the boundaries between the natural and the artificial were often mobilized to make radiation seem normal, as exemplified by the levels of natural radiation received during flying on an airplane. Yet, at NIRS, man-made radiation was not synonymous with an artificial property that was necessarily dangerous. In fact, the man-made technologies promoted by this institute were affectively linked to technologies that sustained life (as opposed to the harmful radionuclides of a nuclear disaster). For instance, the radiation-related devices exhibited at this open house were used to produce helpful particle therapies to treat cancer. Here, "radiation damage" was not something to be afraid of; rather, it was a useful agent that could penetrate the body and kill harmful tumors, as was demonstrated on medical dummies during the event.

In this instance, radiation education was channeled not in terms of suffering, but of sustaining life in awe-inspiring ways. The radiation biologist that I interviewed was aware that these explanations were not necessarily linked with the risks that citizens face after a nuclear disaster. At the same time, he argued that scientists and officials were "stuck with the barrier of language," especially in trying to provide basic information about the complexity of radiation science. As he sustained, explaining radiation through X-rays, for instance, allowed for a "kind of basis that everybody can understand." Yet, the problem was that the displays and technologies of the centers embodied and performed specific forms of structural information that selectively amplified the aspects of radiation that were good over its negative effects.

Before the Fukushima nuclear disaster, Japan had one of the most well-respected nuclear and radiological scientific communities in the world. The disaster was a harsh blow on their expertise and caused the nuclear community to share a pessimistic vision, as well as sense of crisis toward the future perspective of nuclear research in Japan. Many scientists that I interviewed shared a common fear in that regard: the fact that good students might not come to work in nuclear-related research after Fukushima. Performing a regime of the sensible that describes radiation as dangerous, rather than being linked with the wonder of science and technology, is something that would hamper this vision of post-disaster recovery.[105]

6.5 Expertise by Other Means

One of the most vivid memories I have of my visit to the Hiroshima Peace Memorial Museum, which documents the atomic bombing of Hiroshima in World War II, is of a piece of yellowish carbonized fingernail on exhibit to attest to the horror of the event. Such sights are commonplace in the museum, which stresses the consequences suffered by the

[105] Focusing on children, as the open day did, was also a way to reinvigorate nuclear interest in a new generation that is too young to clearly remember the aftermath of the 2011 nuclear disaster.

bombing's survivors due to external exposure to gamma radiation, such as hair loss, leukemia, and keloid scars.

Yet, in sharp contrast to the bodily "artifacts" at the Hiroshima Peace Memorial Museum, which transform a former military aggressor into a victim of nuclear war, the nuclear embodiment promoted by Japan's government-sponsored radiation education eliminate disturbing aspects of radiation exposure and fall within historical established processes of control that aim to diffuse the threat of widespread societal unrest, to reclaim political control and economic stability, and to pacify a fearful public—and in ways that are often more beneficial to the nation states than to affected individuals.

Such historical processes have long been imbricated in contradictory politics, where nuclear bodies (i.e., bodies of flesh, as well as bodies of knowledge) were simultaneously rooted in processes of visibility and invisibility. For instance, against the background of the Cold War, many authors have traced the devastation of communities and generations of Soviet and American workers who were contaminated during the nuclear arms race, during which radiation dangers were successively rebuked, diminished, and disputed. Brown (2013) describes the secrecy and control of the scientific knowledge that characterized the production of plutonium during this era in the Soviet Union and the United States, as well as the dismissal of those who attempted to speak out about issues of safety or health.

After Chernobyl, Kuchinskaya (2014: 2) has described the whitewashed response that followed radiation harm in Belarus, noting "how imperceptible hazards, such as radiation, are made publicly invisible." Petryna (2013) highlights a different scenario in which post-Soviet Ukraine, as well as the notion of citizenship, were produced through the active acknowledgment and management of radiation exposure through its citizens.

In the industrial context, Cram (2016) describes how the state makes radiation part of the everyday lives of workers through a politics of "permissible exposure." However, what is deemed "acceptable" and "permissible" is also changeable, as it is intertwined with the imperatives of war and the nuclear industry. This cost-benefit calculus that normalizes radiation exposure as a necessary part of modern life found its nefarious epitome in the notion of radiophobia, used by pro-nuclear lobbies to describe public reactions that are considered to be out of proportion to the "real" risks posed by radiation. However, by structuring the fear of radiation as a mental health issue (i.e., a "phobia"), radiophobia acts as a means to control discussions about radioactive pollution in ways that not only blame the potential victims, but prioritize market policies at the expense of public health (Stawkowski 2017).[106]

In terms of whether radiation hazards are made evident or not (and for what purposes), processes of nuclear embodiment in Fukushima simultaneously produce both spaces of knowledge as spaces of deliberate unawareness regarding residual radioactivity. Still, in contrast to Petryna, radiation hazard in Fukushima is not made visible so as to legitimate a different political order (capitalist vs. socialism), but as part of a national security project that aimed to achieve stability in a context of crisis, especially when expected performance of revitalization and radioactive decontamination are impossibly high. Indeed, as the Japanese states is faced by technological impossibilities of remediation of radioactive waste (see Chapter 5), educational infrastructures function as symbolic sites that aimed to manage the perception of a post-Fukushima Japan. When faced with throwing

[106] Radiophobia reduces threats of social-political-economic instability within the larger political economy of the nation state, encouraging continued support for the nuclear industries, along with the goals of defusing public health concerns and rebuilding public trust in living in an irradiated environment (Stawkowski 2017)

vast amounts of money at goals that cannot really be met (successfully decontaminating Fukushima), an embodied and affective governance of radiation hazards becomes an arena in which the Japanese state generate the sense that its goals are met and that it is adequately managing the problem of contamination while making progress.

In the context of the upcoming 2020 Tokyo Olympic, these nuclear embodiments also perform a Japan that is clean and already on the path of full recovery. Moreover, minimizing radiation hazards and promoting the wonder of radiological science and technology promote a renewed interest in nuclear energy. If Japan was to phase out from nuclear power, the country would lose its ability to construct a nuclear bomb.[107] A non-nuclear Japan would shift the balance of geopolitical power in East Asia. This also explained why pro-American organizations like IAEA are implicated in the aforementioned scientific hubs.

The nuclear embodiments described highlight an important shift in the politics of expertise of the Japanese state. Gone were the monotonous speeches that characterized the official symposia of the first time signature. Instead of only explaining facts in a top-down intellectual approach, the expertise of these centers allowed visitors to experience the information firsthand through interactive encounters, by merging epistemic forms of knowledge with performed corporeal understanding. Yet, while these approaches were innovative in their interactivity and freedom from jargon, they were less so in their content.

Following a revised radiation threshold for what is considered to be safe in Fukushima, nuclear embodiments contribute to a particular iteration of radiation hazards and disaster recovery. Indeed, for mothers like Natsuo, these programs indirectly create a

[107] Amongst tense regional conflicts that implicate a nuclear China and North Korea, this is a form of expertise that Japanese elite cannot afford to lose.

social atmosphere where choosing to avoid being exposed to low-level radiation for long-term safety is considered the wrong choice. By emphasizing specific aspects of the phenomenon of radioactivity, such educational infrastructure contributes to the strengthening of this atmosphere and encourages the return of evacuees to their hometowns.

Masco (2006: 317) argues that "Creating 'sustained human and environmental well-being' in a post-nuclear environment […] requires a complex new form of governmentality." In the ethnographic vignettes presented, this governmentality took the form of an affective and sensory embodiment of nuclear materials—not unlike the pleasure of breathing in toxic car fumes, better known as "new car smell" (Weston 2012). Indeed, amidst the smiling children and cute animations, radiation took the form of "ordinary affects" (Stewart 2007), providing an emotional space that "allow[ed] people to live with contradiction" (Weston 2012: 429). Importantly, this partial mitigation of radiation risks was not enacted through consensus regarding safe exposure limits, but rather through a manipulative sensory embodiment that promoted a widespread acceptance of radiation—and that was politically supported by the nuclear lobby, like IAEA or JAEA. In fact, the government-sanctioned experts have done such a good job of making radiation appear "natural" that few people challenge this depiction.

At the same time, the state power relies heavily on the embodiment of deliberate unawareness about the very complex nature of radiation risk in order to skirt what Masco (2006: 28) has described as the "nuclear uncanny," or moments of perceived "dislocation and anxiety" that produce a "disorientation of the self and the environment" linked to the "material effects, psychic tension, and sensory confusion produced by nuclear weapons and radioactive materials." The nuclear embodiments highlighted in this chapter contrast the anxieties brought on by the nuclear uncanny and differ from the practices of government where improvement always become technical and quantitative (Ferguson 1994; Mitchell 2002; Li 2007: 12). Rather, this practice of governance makes improvement affective and corporeal, making a place for feelings of comfort and acceptance surrounding ubiquitous and lovable radioactivity. One clear example of this can be found at the train station in Fukushima, where visitors can buy radium eggs (*rajiumu tamago*) that are par-boiled in the waters of the Iizaka hot spring, famous for its natural radium. In a few delicious bites, radiation is made completely palatable. *Itadakimasu*! (Bon appetite!)

6.6 Enjoying the Nuclear Ride

Institutionalized, government-sanctioned expertise remains a central pillar in the technocratic risk management of the Fukushima nuclear disaster, but it no longer takes the form of a hierarchy where experts formally dole out information to lay individuals. Rather, it is also taking on novel politics forms, textures, and sensibilities—that attempt to turn a state of emergency (*kinkyū jidai*) into a state of pleasure. Indeed, interactive sensory engagement is becoming increasingly important in such contexts, subsequently forcing STS scholars to embrace the broader politics of expertise in a way that moves beyond information commodities or discourse analysis.

In this chapter, a focus on embodiment and performance has enabled me to pinpoint what these expert practices sought to highlight about radiation, by looking at what is promoted and excluded from their technical and affective domain. Nuclear embodiments are not simply intended to make certain aspects of radiation tangible; they are equally in the business of making other aspects intangible and disembodied—and both of these processes are happening simultaneously. In the initial years since the Fukushima meltdowns, new political rhythms and relations have emerged. These novel approaches to institutionalized expertise create new forms of what has been called "chemosociality"—that is, the longstanding relationships and emergent social forms that arise from chemical exposures and dependencies (Shapiro and Kirksey 2017).

Talking about expertise and authoritative grasp scholars have argued that official performances of knowledge are always contested and reworked by members of the public (Li 2007; Mathews 2014). Similarly, it is important to acknowledge that these government-sponsored nuclear embodiments and the qualitative information that they promote are not uniformly internalized by the population of Japan. While some visitors were happy that the state had embraced a qualitative approach to radioactive risk communication – making them easier for them to understand radioactivity phenomenon – reply to these centers were also polarized. For instance, members of NEPR, were appalled by these public exhibitions, which they say directly undermine their fight for the right to remain evacuated from an environment they consider dangerous. Members told me that the whole endeavor was little more than a "safety campaign" (*anzen kyanpēn*) and a form of "brainwashing" (*sennō*). For Natsuo, these state performances were disregarding her gendered embodiment of radiation hazards as described in Chapter 3 and 4. Even among the experts at NIRS, clear tensions were present. I met one high-ranking individual who had voiced a preference for the evacuation of children from irradiated areas rather than the construction of child-focused educational centers.

While the degree and extent to which nuclear embodiments are being assumed by different members of Japanese society are polarized, it is possible to argue that these new forms of expertise do not merely depict the phenomenon of radiation exposure. Indeed, they also participate in promoting a very specific regime of the sensible around radiation hazards, one that plays on the tropes of pleasure and not panic in the face of radiation. These exhibits prioritize certain kinds of "chemosocial communities," namely, those that "form around shared pleasure, rather than shared suffering" (Shapiro and Kirksey 2017: 484).

Not so long ago, in the midst of the Cold War, American children were taught to "duck and cover" to protect their bodies against the effects of a nuclear explosion (Jacobs 2010). Through these embodied practices, they were taught to "survive" against a future threat that had yet to *potentially* come through Soviet nuclear bombings. The nuclear embodiments of this chapter embody a different politics.

They do not represent a normalization against *potential* annihilation, nor a politics of victimization in a post-Hiroshima Japan, but a normalization in a Japan that is *already* post-Fukushima. These nuclear embodiments point toward a form of governance that reframe ongoing exposure as normal, while attempting to socialize the victims of a nuclear disaster into learning to embody – as to live comfortably with – the radiation that infests their environment.

In a context, of "normal accidents" (Perrow 1984), where the rampant increase of hazardous materials in our environment has made everything become "post" (Beck 1992), retrieving former baselines of pre-pollution events are but naïve nostalgic endeavors. Against this, new imaginative expert projects that can mold both place and processes are required (Masco 2014), so as to condition bodies to see, know, and be affected by hazards that won't go away. Averting the crisis of expertise and managing the reconstruction of what "normality" involves in a post-Fukushima Japan include a fundamental reorganization of governance, where the dissemination of radiation hazards cannot simply rest on hard-heated manner in which government-packaged expertise about radiation was initially promulgated. These shifts in the management of radioactive hazards are revealing about how the governance of contamination is evolving amidst the edge of irreversible ecological change.

Much like it was once the case for the threat of "invisible" microbes, a public and educational infrastructure is being built around the formerly imperceptible hazard of radiation. But why, exactly? Surely, there has been an epistemological shift in the ways in which knowledge is being produced and consumed in Fukushima—in other words, a shift in terms of what information is coded through public and state knowledge about safety, normality, unsafe practices, and radioactivity. But there is an even deeper shift emerging within this practice, too—one that corporeally taps into sensation, affect, and sense-making.

It is this second, deeper shift that brings a change in life lived alongside man-made radioactive pollutants—an affective, ontological, corporeal shift. Nuclear embodiment, as I have presented it, is a potential normalizing force of which we should be wary. After all, it is a shift that brings us closer to the experience of Major Kong in the film *Dr. Strangelove Or: How I Learned To Stop Worrying and Love the Bomb*—a shift that enables us to affectively enjoy the nuclear ride of the Anthropocene without thinking about it too much, and all while shouting at the top of our lungs, "Yeeee Haaawwww!"

Chapter 7: Conflictual Collaboration

As we approached a metal gate near a small ditch, I began sweating profusely—my Geiger counter was registering 13 microsieverts per hour, a high level of radioactivity.[108] Alarmed, I glanced at my guide, Mr. Shogo. He was unperturbed, however. "See?" he said with a wry smile. "I told you the radiation level would be high near the gate!" Mr. Shogo was not a nuclear scientist but a former farmer from the village of Iitate in Fukushima Prefecture. He belongs to a citizen science nonprofit network that aims to revitalize the sociocultural lives of the citizens affected by the release of radioactive contamination.

With the aim of helping Iitate's residents shed light on the invisible harm afflicting their village, Mr. Shogo nonprofit had provided them technology to measure and analyze the residual radioactivity in the environment. Five years after the disaster, citizen-led initiatives were thriving in Iitate, even though MOE had ended much of its official decontamination of the village, deeming it free of harmful radiation. Yet these grassroots practices continued because many Iitate residents were dissatisfied with how the state experts had assessed radioactive contamination. As one local man angrily told me in 2016, "The government has decontaminated a 20-meter radius around our houses, but they didn't do any kind of follow-up. And every time it rains, the radioactive pollutants in the nearby mountains are washed down, and it gets recontaminated." Against this backdrop, citizen science practices provided answers that state officials failed to supply. As one resident summarized it:

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[108] In 2010, before the disaster, the normal background radiation level in the Fukushima prefecture oscillated between 0.02 and 0.13 μSv/hour (Fukushima Prefecture N.D.). The 13 μSv/hour registered by my Geiger counter represented a marked increase in radiation levels, with this increase being attributable to the release of radioactive elements from the Fukushima Daiichi Nuclear Power Plant.

> This is a disaster that we couldn't see with our eyes, a problem that we couldn't smell or hear. At the beginning, we had no way of knowing if our radishes [*daikon*] were contaminated or not. And that's hard, because that's a big part of our culture. Everyone was wondering what life would come to under these conditions. That was our biggest problem. But by "seeing" the radiation through the data [that we have produced], we were able to know what to eat and what not to eat. We could know how dangerous it was. Our anxiety [*fuan*] has disappeared.

As described in previous chapters, the rise of citizen science in post-disaster Japan appears to be a "renaissance in civil society" (Aldrich 2013: 264), since citizen scientists endeavor to resist the normalizing forces of governmental, industrial, and academic expertise on radiological risk protection. In this context, citizen science networks developed independent safety channels outside the normative medium of Japanese bureaucracy (Rosenberger 2016), allowing citizens to critically assess institutionalized perspectives on radiation hazards and to "circumvent the state's expertise to protect the health and life of current and future generations" (Sternsdorff-Cisterna 2015: 456). And while dynamic forces like postfeminism, scientism, and neoliberalism sometimes render radical political activism inappropriate for Japanese women, practices of radiation monitoring legitimize alternative views to an official assessment of the radioactive contamination (Kimura 2016), thereby making it possible for citizens to do politics by science. Citizen science thus illustrates how people use the "practice of politics" (Li 2007) to refuse the status quo and challenge dominant forms of governance.

At the same time, however, many resident-led radiation-monitoring practices I witnessed in Fukushima were conducted in places, like Iitate, that were arguably uninhabitable because they had such high levels of radiation. After all, in 2011, Japanese officials increased the acceptable radiological exposure dosages for the public. Thus, residents publicly engaged with residual radioactivity even though it was unsafe for them to be living there in the first place, at least according to the previous safety standards.

Here, citizens' intervention in matters of radiological protection echoes a different set of debates than what previously examined, notably around neoliberalism, according to which citizens have to take care of themselves (Ottinger 2010b). Indeed, socially innovative forms of governance, like that of citizen science, are often supported by state and market forces pursuing a neoliberal agenda (Lave 2012; Swyngedouw 2005). Such agendas seek to reduce public expenditure, protect corporate polluters from accountability, guarantee minimal government intervention, and privatize risk, meaning that risk becomes a matter of personal business rather than the state's responsibility (Harvey 2007). These practices of civic environmental monitoring echo Michel Foucault's (1991) idea of "governmentality," according to which nation-states exercise political sovereignty by governing people's conduct. The self-responsible citizen thus becomes an "entrepreneur of himself" (Foucault 2008: 226).

When I was invited by the Iitate nonprofit to help farmers decontaminate rice paddy fields, wearing only a pair of rain boots as protection—while my guides assured me it was safe (*anzen*) to do so—I began to ponder the Janus face of resistance and risk privatization that epitomizes the work of citizen science network in Fukushima. As I watched farmers working with their feet in radioactive mud, I asked, How does this fostering of science in society intersect with official state politics of governing post-disaster Fukushima?

In many instances citizen science in Fukushima involves "conflictual collaboration," in which citizen scientists—even though they resist the Japanese state's practices of monitoring radioactivity—collaborate with state actors or nuclear lobbies in either downplaying radiation hazard or reifying normative visions of post-disaster recovery at the expense of others. This is particularly ironic given that post-disaster citizen science emerged out of a concern over whether institutional experts could manage the risks of residual radioactivity (see Chapter 3 and 4). Conflictual collaboration, as a set of alternative practices of resistance that intersect with governmental tactics, straddles the gap between governmentality ("the conduct of conduct") and the "practice of politics," which challenges governance.

In anthropological studies of political ecology, governance accounts for a plurality of institutions that compete and overlap in managing environmental problems and goals (Gururani and Vandergeest 2014; Mathews 2011). Consequently, even though different actors often focus on common projects, they can successfully maintain separate political agendas, as in the case of forest industries (Tsing 2005) or matsutake mushroom farming (Hathaway 2014). The notion of conflictual collaboration reveals a different story, namely how *separate* projects lead to a *common* agenda. In Fukushima this means that citizen scientists' resistance can also evolve into collaboration with the state politics of governance, legitimizing hegemonic visions of radiation danger and normative vision of recovery. Ultimately, civic resources and efforts used to resist and reinterpret official narratives of contamination end up reinforcing a state-sponsored normalization of the disaster.

7.1 An Alternative to State Expertise?

As explained earlier on, the state, amid its discourse of radiological safety, initially saw citizen science networks as an attack on its authority and swiftly repressed them. But when I conducted my fieldwork, citizen science networks were no longer a novelty as opposed to 2011. The chaos of the disaster had settled down, and I noticed that the relationship between state actors and citizen networks had in some instance evolved in new directions: the expertise of some citizen scientists was now intersecting with the official governance. How does a situation like this develop?

To find out, I interviewed core members of different networks, as well as the citizens who participate in radiation monitoring and tracking. I paid close attention to the factors that led them to initially clash with the state, while participant observation of the networks' activities allowed me to understand how data about radioactive contamination were collected, interpreted, and used. Citizen science networks came to downplay radiation harm and understand recovery as a form of permanent resettlement in Fukushima for three reasons: the production of apolitical data, neoliberal forces, and tropes of social recovery.

7.2 The Truth Is Out There

In 2016, on the top floor of a crowded Tokyo building, I attended a workshop on do-it-yourself (DIY) radiation-monitoring devices organized by a network of citizen scientists. With a dozen participants, I had the opportunity to build a Geiger counter of my own out of a kit designed by the network. The kit was composed of a number of parts: a motherboard, LCD displays, resistors, and a low-voltage pancake mica window.

There was a look of excitement on the participants' faces—many Japanese and a few foreigners—as each of us received our kits and started to decipher the instructions. The whole task required dexterity, since participants had to weld the right color resistors to the motherboard without burning themselves. After a few hours the task was completed, and all of us proudly held our Geiger counters in the air as the organizers of this Tokyo-based network snapped a photo of our achievement. Workshop participants were invited to test their newly made Geiger on a contaminated piece of wood brought from Fukushima, which triggered an elevated reading on our screens. Like many of the participants, I had become familiar with this network by hearing about their DIY Geiger workshop. Intrigued, I initially attended one of their conferences, where a founding member of the organization revealed why he became involved in citizen science:

> There were a lot of problems with how governmental measurements were being conducted. For example, the measurements [of radiation levels] were taken 30 meters in the air and only concerned gamma rays, while we suspected that other rays, like beta ones, could also be present. Even when measurements were made public, through the United States military, for instance, it took more than a year before reaching the public! So this kind of data was useless to the public.

In light of what they perceived as ineffective state measures, the founders of the Tokyo network decided to measure the radioactive contamination themselves and provide their measurements in real time on the internet. To maximize the usage of their limited number of Geiger counters, they began tracking contamination with monitors attached to their cars, like the camera-mounted cars that capture images for Street View in Google Maps. Yet the scope of this work was overwhelming. As a result, the organization decided to focus instead on running workshops to enable local citizens to build their own monitoring devices.

Throughout these efforts, the Geiger was described as a Promethean gift that could produce raw data for a population urgently in need of information. The latter point was emphasized by the group's motto: The Truth Is Out There.

These workshops quickly became a success, enabling participants to build their own Geiger counters and upload radiation data on a centralized website created by the Tokyo network. As one of the founders proudly exclaimed, "Citizen science has beaten the preplanning of any governments in a matter of weeks!" Members boasted that 40 million measurements had been collected so far—a shining example, they thought, of what citizen science can accomplish, even with its limited capacity. Rapidly, DIY Geiger counters enabled citizens to track radiation where no data were previously available, thereby more closely addressing residents' concerns. During the conference one resident from Fukushima, holding his own homemade Geiger, thanked the organization for helping him "see" radiation and lower his anxiety (*anshin*).

Yet, in the midst of its success, the Tokyo network began facing public and political pressure to clarify its position on radiological safety, something that as we saw is particularly problematic for Japanese citizen science. Worried that any sort of political affiliation might compromise the integrity of their data, the network's core members decided not to take an official position on the danger or safety of radiation exposure. "We are often asked if we are antinuclear or not," the group's director said. "Well, we always respond that we are pro-data!" During the workshop, participants made few remarks about the relationship between radiation risks and the measurements on the screens of our Geiger counters. No one explained, for example, what a microsievert is and how it relates to human health.

No founding members of the network dealt with issues of scientific legitimacy regarding radiation hazards. Rather, the Tokyo network was simply providing technical means to generate raw data, which actors could then freely use and interpret. This outcome led to the first instance of conflictual collaboration: downplaying and normalizing the extent of radiation dangers.

This became evident when some core members began to visit Fukushima High School in 2016 in order to produce a series of DIY workshops. Since the network focuses on producing raw data, its work is perceived by those in the Japanese educational system as a scientific endeavor unbiased by political affiliation, as opposed to, for instance, antinuclear networks that produce data on radioactive contamination with clear political aims.

Therefore, in collaboration with the science teachers of this school, the teenagers of Fukushima learned to make their own Geiger counters. During these workshops, teenagers were asked if they knew about their locality's radiation level and then had the chance to measure it. The Tokyo network even created smaller Geiger counters that elementary students could build. As a network member explained to me, students were surprised to see that the radiation level of their environment was often lower than that detected during an intercontinental flight, making them feel confident about the safety of living in Fukushima.

The analogy is not considered a political position on radiological safety but simply a matter of highlighting the "facts." But by depicting the Geiger counter as a tool that simply produces raw data, the Tokyo network does not engage with the limitations of this monitoring device, which fails to thoroughly represent radioactive hazards in Fukushima.

While the aforementioned comparisons paint an optimistic view of radioactive levels in Fukushima, they are in fact misguided, as a doctor of medicine specialized in radiation and cancer explained to me.

DIY Geiger counters are useful only for measuring levels of external radiation present in the surrounding environment, but they are not intended to gauge the risk of alpha- or beta-emitting particles, which can cause cancers if inhaled or swallowed (Jacobs 2016). Measurements produced by Geiger counters also produce a limited understanding of radiation harm, since they do not consider the temporality of radiation-induced illness. Lastly, Geiger counters measure external radiation levels, but they do not tell users how different radionuclides react to bodies of different ages or sexes. In fact, the science of radiation protection is generally based on protecting the health of the average individual (an adult male), which is a theoretical concept based on mathematical averages. Measurements gleaned with Geiger counters to gauge potential health effects on a population lead researchers to turn a blind eye to the potential risks faced by segments of the population, in this case children, that are not captured through radiation protection's data standards.

In doing so, the Tokyo network's technologies and protocols reinforce a limited understanding of radioactivity education (*hōshanō kyōiku*), by mobilizing a scientific language that is already compromised and that falls within the limited understanding of the Japanese state's management of radiation risk, which disregards internal contamination, neglects to account for future long-term risks, and dismisses individualized radiation risks (see Chapter 6). What's more, government publications on the revitalization of Fukushima indicate that the state is now mobilizing the raw data produced by the Tokyo network in an attempt to downplay radiation risks. In a 2016 document produced by the Fukushima prefectural government, the radiation detected by the DIY Geiger counters is listed as comparable to the levels detected in other cities around the world, like Beijing or New York. This gives the impression that radiation exposure in Fukushima has reached normal levels—a tactic that reframes the discussion of radiation risk in terms of simple, naturalistic explanations unrelated to the specific risks found in Fukushima (Hirakawa and Shirabe 2015).

In the management of environmental issues, knowledge often travels via uneven power relationships (Tsing 2005), in which it can be mobilized by powerful actors to advance a specific purpose or political agenda (Mathews 2011, 143). Similarly, when I pointed out that the Tokyo network's data were being used to minimize radiation risk, one of the network's core members expressed surprise and displeasure but contended that this was the price to pay for producing raw data.

While the Tokyo network initially sought alternatives to state measurements of residual radioactivity, their technoscientific practices of gathering raw scientific data ended up directly (through school workshops) and indirectly (through official state documents) endorsing state-sanctioned generalizations about the nuclear disaster. Separate projects can thus harmonize with a common agenda, particularly in crystallizing normative understandings of radiation hazards.

7.3 It Can't be Helped

Every three months, Kimiko organized meetings in her citizen science network, situated in the southern part of Fukushima, near the town of Suetsugi. There, local residents discussed their personal levels of radiation exposure and shared tactics to lower their doses. Even though the Suetsugi network had one of the smallest centers that I visited during my fieldwork, it had become famous for collaborating with an NGO called Ethos, known for having ties to the nuclear lobby.

I heard about this peculiar relationship at the 2016 Fukushima Medical University International Symposium, where Jacques Lochard, the chief representative of Ethos and a member of the International Commission on Radiological Protection’s Main Commission, came to discuss his NGO’s work with the Suetsugi network. During his speech, Lochard explained that Ethos was founded after the Chernobyl disaster with the aim of improving the living conditions of victims of nuclear accidents. One way to do so, he argued, is to involve citizens in post-disaster management. In Fukushima, Ethos’s mission was similar: to empower the population with knowledge about radiation.

Yet, while Ethos claims to be an independent organization, it is an offspring of the European nuclear lobby, created by the Commissariat à l’énergie atomique et aux énergies alternatives and joined by AREVA, a multinational nuclear power group, with financing from Électricité de France, an important player in nuclear energy (Ribault and Ribault 2012). Ethos’s work with Chernobyl victims has promoted citizen empowerment in areas afflicted by chronic exposure, leading to new forms of neoliberal abandonment, in which the responsibility for dealing with harm is transferred from the nuclear polluters to the population (Topçu 2013).

In Fukushima the neoliberal implications of Ethos’s agenda were comparable (Kimura 2017), although critics assumed that Ethos seamlessly imposed its program of self-responsibility in a traditional governmental way. Ethos, however, never reached out to

Suetsugi residents to set up a network (as it did with Chernobyl victims). Rather, as I learned from Kimiko, the director of the network, it was the citizens of Suetsugi who initially contacted Ethos, knowing full well the organization's pronuclear agenda. Why would citizens do such a thing?

To answer this question, it is important to consider that laypeople's reflexive capability to articulate responses to issues of radioactive contamination is inseparable from preexisting historical and political factors, as in the cases of northwest England (Wynne 1992), Soviet Ukraine (Petryna 2013), and Kazakhstan (Stawkowski 2016). In the region of northeastern Japan, bureaucrats in the Japanese Ministry of International Trade and Industry had long developed economic policies that rewarded collaboration with the nuclear utilities by presenting nuclear power plants as a way of saving the rural lifestyle of depopulated, economically depressed villages (Kainuma 2011). It was precisely the "third rate" peripheral regions, like Fukushima Prefecture, that were given the role of producing energy for the main metropolitan centers like Tokyo (Allison 2013). This created an asymmetrical relationship between rural and urban spaces, one that was not merely economic but informational (Yamashita 2012). The resources that Suetsugi citizens had for resisting the state's management of radiation hazards were thus initially constrained.

When I first visited the Suetsugi network, five years had passed since the official evacuation of the town on April 22, 2011. When the evacuation order was lifted, one month later, citizens were left with two options: come back to Suetsugi or voluntarily evacuate. But because the livelihoods of this poor rural area were heavily tied to food production, long-term evacuation was not a viable option for many residents. Moreover, in contrast to technology-rich metropolitan areas, citizens of Suetsugi had no access to preexisting information centers with radiation-monitoring devices, such as those maintained by antinuclear organizations, consumer activists (Sternsdorff-Cisterna 2015), or hacker science (Hemmi and Graham 2014). The only information available was state-sponsored monitoring data. But as Kimiko argued, “These measurements didn’t mean much to us. What was a high or low level of exposure? This was very ambiguous.” Returnees were thus concerned about the adverse health effects of radiation exposure, especially after the increased threshold for radiation exposure. As Kimiko explained, the departure of the first government nuclear adviser, Toshiso Kosako, who resigned in protest of the state’s policies of 20 mSv per year, amplified citizens’ anxieties.

Feeling abandoned by state experts, Kimiko invited academic experts to Suetsugi to gain general knowledge about radiation, but academics were unable to answer fundamental questions like Can I eat the food produced in my garden? Kimiko therefore began to educate herself on the internet, and she eventually reached out to Ethos, taken in by its culture of radiation protection and the concrete steps it provided to improve the living conditions of nuclear victims. With the initial help of Ethos, the residents of Suetsugi created their own independent citizen science network, where, as Kimiko put it, “radiation was no longer taboo” and “people could talk about radiation with a smile!” This was an environment that the state had failed to provide, according to Kimiko. While Ethos did not provide monitoring devices, it gave them something that a poor and depopulated rural region did not have: visibility. The association with Ethos enabled the Suetsugi network to raise funds for radiation-monitoring materials, while pressuring the regional government district to provide dosimeters to the citizens.

It was therefore citizens' ongoing feeling of abandonment by their own state, coupled with the perceived inefficacy of academic experts, that forced them to collaborate with this nuclear-affiliated NGO and to mobilize resistance against the uncertainty brought about by radioactive contamination. Connecting with Ethos made sense given that residents had few choices regarding post-disaster recovery. In this context of neoliberal precarity, the only option available was to monitor the radiation. "It can't be helped [*shikata ga nai*]," as one member said.

When questioned about the ethics of collaborating with Ethos, Kimiko told me that being pro- or antinuclear is not relevant to the network. "It's not linked to our reality or our lived experience," she said. "We might be receiving different experts, but in the end it is the individuals who make their choices." Still, processes of collaboration are never symmetrical, and collaborators can initially have different agendas for working together (Tsing 2005). While the citizens of Suetsugi are looking to regain a sense of control over their lives, Ethos has vested interests in collaborating with the nuclear victims.

Since Ethos is associated with ICRP, it promoted the ALARA exposure philosophy to the citizens of Suetsugi. This philosophy is based on a cost-benefit calculus that manages radiation exposure as an unfortunate, but necessary part of modern life (Cram 2016). Yet, as explained, ALARA is also a neoliberal concession to economic and political imperatives, one that minimizes issues of chronic low-dose exposure and bring benefits to nuclear lobbies (see Chapter 2). Consequently, the epistemic collaboration that Ethos maintained with the Suetsugi network has led to questionable interpretations of this calculus.

This was made evident during the Suetsugi network's quarterly meetings for returned citizens. While attending one of these meetings in 2016, I noticed that members wore dosimeters to measure their cumulative dose of external radiation. The dosimeter data were compiled electronically so that citizens could follow their exposure histories. The citizens involved in the Suetsugi network argued to me that their doses of external radiation were low because they were not much different from what is present in other parts of the world; they interpreted this as a sign that it was safe "enough" to pursue their lives in Fukushima.

Beyond monitoring external doses of radiation, the Suetsugi network also tested food. During one meeting, I witnessed an elderly man present shiitake mushrooms from the forest. "What is it? What is it?" asked one member's child. "Some mushrooms," replied the organizer. "We'll test them for radiation—but don't touch them before that, OK?" The mushrooms were sliced and put in a blender. "I want to press the button!" exclaimed one child. The resulting brown paste was then put into a device that measures radioactive contamination in food, and the children bounced excitedly, shouting, "Not yet? Not yet?" (*Mada*, *mada*). Many members of the Suetsugi network argued that Japan's current radiation threshold for food—100 becquerels per kilogram—was the strictest in the world, and that tested foodstuffs often fell below this threshold. Yet, the average amount of radioactive cesium present in food before the disaster was near nonexistent and some experts stated that any increased ingestion presents important risk of adverse health effects (Kodama 2011; Yagasaki 2016). Indeed, the becquerel is not a measure that expresses adverse health effects of consuming contaminated food, as it does not take into account the toxicity and longevity of different radioactive pollutants, something that ETHOS failed to explain.[109]

Through its philosophy of exposure, Ethos also promoted a specific understanding of recovery that minimizes long-term evacuation. Indeed, the agenda for post-disaster recovery lies in tracking and measuring radioactivity in an attempt to lower people's exposure through ALARA. It is therefore no surprise that the government, keen to resettle the population in Fukushima, quickly began to embrace the work of Ethos and the Suetsugi citizen science network.

Indeed, since 2015, the Suetsugi network was invited to become part of a system of consultation in the Japanese government, and Kimiko began to give talks about their tracking and monitoring activities during state-sponsored symposia. This ultimately led the Suetsugi network to receive government funding, allowing them to pursue their work without seeking donations. Such a case is not unique to Suetsugi, given that the Japanese state and international pronuclear lobby are incorporating forms of citizen science into their agenda. For instance, the Tokyo network participated to the 2016 Nuclear Security Summit to discuss solutions for a safe nuclear future; in 2015 the group gained recognition from the International Atomic Energy Agency (IAEA) for its DIY Geiger counter (importantly, the IAEA's main aim is to convince the population that the radiation risks posed by the nuclear industrial complex are low, necessary, and acceptable).

This collaboration is an important departure from the traditional expert-led management model adopted in post-disaster Japan, whose nuclear experts initially

[109] For example, plutonium emits alpha rays, whose toxicity is 20 times greater than gamma rays even at the same dosage. Once inside the body, plutonium will continue to expose an individual for the rest of his or her life.

attempted to educate a population that knew little about radiation harm (Shirabe, Fassert, and Hasegawa 2015). Amid a crisis of expertise, in which citizens were wary of institutional experts, citizen science networks provided the state with an opportunity to bypass traditional forms of governance so that citizens would engineer the normalization of Japan's radioactive thresholds. Recognizing such monitoring capacities is a means of shifting some of the state's responsibility for ensuring safe living conditions onto the shoulders of citizen scientists.

This was made evident in the Suetsugi network, whose members often blamed themselves ("I shouldn't have eaten those mushrooms"). While monitoring practices lower overall risk exposure, they deter people from perceiving themselves as victims of state policies, such as the increased official radiation threshold, and they reduce the liability of corporate polluters like TEPCO. As one mother who initially fled from Suetsugi told me, "I was angry at everything. I felt so much rage and hate toward TEPCO. But I don't think about TEPCO anymore. It's just a waste of energy."

In the end, the Suetsugi network members' views on the normalization of radioactive contamination were not as optimistic as those of the Japanese state and Ethos. When questioned about the safety of Suetsugi, Kimiko answered, "I think there are risks, even if some old people don't think so or don't care about [them]." Here, members were attempting to establish their home as safe enough. Yet, in light of the neoliberal sense of self-responsibility, this version of "enough" is heavily tainted by Ethos's pronuclear rhetoric. This not only replicates a normative vision of radiation risk and recovery but also promotes an increased normalization of risk in which self-responsible citizens take care of themselves. The irony of this conflictual collaboration is that preexisting neoliberal factors have forced the citizens in the Suetsugi network to collaborate with doubtful actors, a collaboration that ultimately reinforces and expands the neoliberalization of citizen science.

7.4 It Would Have Still Been In My Head

A foul odor greets all who walk in the door of the Iwaki citizen center. It is the smell of various foods waiting to be tested for contamination in the center's Food Radiation Screening System. The center's director, Naomi, was a housewife before the disaster; now she runs one of the most high-tech citizen science centers in Fukushima. Before the center's creation, Naomi was constantly hearing the same complaints from neighbors: "I don't know what's safe for my children to eat" and "Is it safe to live here?" In her mind, the government did not do much to alleviate the anxieties of Iwaki city residents:

> The initial response was from municipalities, which are underprepared and unequipped to properly calculate radiation levels. Many only calculate radiation levels in terms of city averages or what is present in the air. And the official maps overlook a lot. They don't show hot or the range of radiation levels in a city. For example, levels might be very low on the right side of a road, but the left side can be a completely different story!

Indeed, in the aftermath of the disaster, monitoring posts that display atmospheric levels of radiation on an electronic board allow citizens to gauge the risk of exposure. But because residual radioactivity accumulates in ditches, drainages, and playgrounds, results near the ground are often higher than what the posts detect. Consequently, many citizens were concerned that children would be more exposed, especially since they are closer to the ground and tend to put things in their mouths. Soil samples tested by their network later revealed extremely high amounts of radioactivity in the ground, going as high as 1 million becquerels per kilogram when the standard for radioactive waste (*anzen ni sairiyō dekiru kijun*) is set at 8,000.

According to Naomi, these insufficient bureaucratic responses hastened the need for a citizen science network in Iwaki. "It just came naturally, as something that we had to do!" she told me. The center was initially created as a stopgap measure to fill voids in government oversights. Echoing cases in which citizen scientists work as governmental watchdogs (Ottinger 2010a), the network began by demanding an administrative response whenever the network's data indicated a significant threat to local citizens.

Yet, as Naomi noted, this did not work as planned. "Initially," she said, "we conducted some tests and contacted the municipality, but they didn't pass on the results we gave them." So, in addition to unsuccessfully attempting to get the state to conduct more thorough monitoring, the Iwaki network became primarily focused on using its data to help local residents become more aware of risks of exposure to elevated radiation. As Naomi emphasized, "We want to know for ourselves [*jibun de shiru*] […] to help people have safer and more comfortable daily lives." Now the center offers many services in that regard, such as a whole-body counter to measure internal levels of contamination (cesium-137 and cesium-134), thyroid cancer testing (iodine-131), and food contamination screening. The latter, in particular, has kept them busy.

Currently, the state guarantees the safety of market products, but the food people bring to the Iwaki network comes from forests, home gardens, and the like—and the center's food testing has revealed an extreme range of radiation levels. Chestnuts, mushrooms, and honey have high radiation levels that often exceed the allowable becquerels for food. Likewise, the Iwaki network explains how vacuum cleaners and air-conditioning filters bear high levels of contamination, forcing residents to rethink their relationships with everyday objects. Indeed, many citizens are reluctant to turn on their air-conditioning (used for both heating and cooling in Japan), knowing that doing so puts them at greater risk of exposure.

Gradually, through its technoscientific practices, the Iwaki network produced data that contradicted the narrative of radiological safety that underlies the government's resettlement policy. Although Naomi gathered worrisome information and argued that it was not normal that untrained citizens should be exposed to the same maximum annual dose allowed for radiation workers (20 mSv per year), she never took legal action on behalf of residents. While some mothers like Natsuo have willfully used citizen science for political means of evacuating, Naomi's narrative demonstrates that many citizens of Fukushima refused to use citizen science to make themselves out to be "victims" of the 2011 nuclear disaster—despite the fact that this approach might grant them possible access to state resources such as medical care and evacuation allowances. This sharply contrasts with Ukraine's "biological citizens," who after the Chernobyl disaster used scientific expertise as a key resource in litigation practices that marked the politics of victimization in their recovery (Petryna 2013).

Nonstate actors attempting to build populist alternatives to state power sometimes reproduce certain categories and hierarchies of state political culture in pursuing their own political agendas (Tsing 2005: 250–51). A similar but slightly different process happened with the Iwaki network, as specific visions of social obligation and recovery led them to share common ground with the state's attempt to reinstate life in Fukushima—even when the citizen science data ironically demonstrate a significant amount of contamination. This constitutes the final root of conflictual collaboration.

Indeed, in the case of Iwaki the consumption of citizen-generated data is embedded in a network of social relationships and cultural identities that promote a specific vision of social recovery—a vision that works with the state's attempt to normalize the disaster. As in the Suetsugi network, anxiety about health hazards was only one of the many problems facing Iwaki residents. Families became fragmented (*bara bara*), social ties (*ningen kankei*) were severed, and rural traditions that typically brought neighbors together disappeared after community members evacuated. Some Iwaki residents had been producing their own food for more than 40 years before the disaster. "After Fukushima, this was no longer possible," explained Naomi. "The culture of food exchange, giving and taking [*yaritori*], was slowly dying." Through their network practices, however, trust is slowly being rebuilt, and people are beginning to partake in *yaritori* again.

The data collected by the Iwaki network, therefore, amount to more than technical knowledge. They are part of the ties keeping this community together and reveal the experiences of the center's patrons. As Naomi put it, "We see the people who come to our center, we meet them, we listen to their problems. Then we go out into the field and take samples." By being so socially meaningful, the center's data contrast with what Naomi calls *gariben*—ivory tower experts who produce paper-based evidence.

In the members' view, data used for political purposes would result in an even more fragmented community of people who were bound to remain in Iwaki either by circumstance (as in Suetsugi) or, perhaps more compellingly in this case, by social consideration. For instance, a technical member of the Iwaki network explained that using data on food contamination for radical action risks hampering the economic recovery of the farmers living in the region.

Similarly, when asked if she had ever considered evacuating for good, Naomi replied, “Of course, but you can’t really escape. Even if I had moved to another country, it would have still been in my head.” The proclivity of Japanese normative models are apparent in Naomi’s discourse. These models emphasized harmony (*wa*) and groupism (*shūdan shugi*) as ideal cultural values, according to which citizens are expected to stick with their group in times of hardship, to remain attached to their native village (*furusato*), and to uphold the kinship obligations of their household (*ie*).

Still, according to Naomi, there are two Japans: that of individuals (*kojin*) and that of the state (*kokka*). And despite apparent differences of views on radiation protection, there is a strong consensus that Fukushima’s citizens wish to live there for the long term rather than be evacuated. As a result, official views about recovery go unchallenged. The Iwaki network’s vision, meanwhile, falls squarely within the state’s post-disaster governance, which focuses on the revitalization (*fukkō*) of life in Fukushima. In contrast to other citizen science networks, the Iwaki organization is not a “hand-in-hand” partnership between state experts and laypeople, but its vision of social obligation undermines discussion of people’s right to refuse to live in irradiated areas—the main concern of voluntary evacuees. Rather than inviting thinking about how the existing social order might be transformed, the Iwaki network mobilizes its data to help residents feel comfortable in their increasingly normalized environment.

Therefore, the network does not just align with the result of state policies but reproduces structured social inequality within the state by reinforcing a narrative of nonevacuation. This is made more salient when considering that financial supports for voluntary evacuees ended in March 2017. This policy leaves voluntary evacuees with few choices but to return to Fukushima. As a technical adviser employed by MOE explained to me in 2016, "We don't believe that there is health risk, so there is no need for financial support." While citizen scientists like the Iwaki network produced data that clearly show high levels of contamination, they are reluctant to demand evacuation, since they work above all to reduce social fractures.

For former evacuees to return to Fukushima with some peace of mind, many will have to engage in citizen science practices of monitoring and testing, just like those emphasized by the Tokyo, Suetsugi, and Iwaki networks. This is particularly essential in mountain and forest areas that are not part of the state-sponsored monitoring and decontamination policy, notably because of the elevated risk of landslides. When I asked a MOE technical adviser about the surrounding areas' risk of exposure, he optimistically pointed to the work of citizen scientists. "Well," he said, "there won't be any additional dose if people don't enter those areas. If they do enter, at least they can measure the levels by themselves. They have the [technical] means to do so."

Nonetheless, for many evacuees, the practices of citizen science are not synonymous with recovery per se. In the prefecture of Nagano, I interviewed voluntary evacuees from Fukushima who explained that mushroom picking or mountain hiking were parts of the rural imaginary in their former lives in Fukushima. For these evacuees, Fukushima is now a place where citizens—not the state—are responsible for their radiological protection. Their former native land was not a place where children need to build Geiger counters and test food for radioactivity. Moreover, for many Japanese mothers, like Natsuo, who were concerned by the effects of chronic low-dose exposure on their children, recovery meant permanent evacuation, not the revitalization of the rural economy.

In the end, the Iwaki network is another instance in which the deployment of citizen science data evolves in collaboration with the state's vision—not in opposition to it. And while the Iwaki network does not reproduce forms of ignorance as do other citizen science organizations, it holds a vision of revitalization similar to the state's, excluding other social perspectives on recovery.

Illustration 25: *The laboratory of the Iwaki citizen science network* (photo by the author)

7.5 Smiling in the Face of Disaster

To varying degrees, citizen science networks' initial practices have clashed with the official management of the Fukushima nuclear disaster. Yet this conflict does not obstruct broader forms of collaboration with the same actors that, ironically, attracted these groups' frustrations in the first place. This relationship is what I have called conflictual collaboration. While citizen science is a form of politics that can legitimize alternative views to the state, it also reinforces a certain state- or industry-sanctioned governance of this disaster.

Citizen science and official science are thus not antithetical. But when nonstate actors claim expertise once monopolized by state agencies, there are inherent political complexities involved, in Japan and throughout the world (Gururani and Vandergeest 2014). In general, conflictual collaboration—being removed from the dual pole of governmentality or the practices of politics—demonstrates that while some citizen scientists can engage in political contestation, their work risks becoming part of the techniques of neoliberal governmentality designed to govern the conduct of populations amid a contaminated environment.

In Fukushima the political stakes of citizen science are evolving beyond spaces of contestation that fall outside the formal scope of politics or that become ideological loci of resistance in a limited context of political radicalism. Anthropologists are well placed to study the sociocultural factors in which citizen science reinforces the power of nation-states and corporate polluters, leading to further social injustices and a greater lack of accountability. Ultimately, this bears on the question of the different roles that nonstate actors play in the governance of environmental issues. In the case of Fukushima, it is doubtful that citizen science will place responsibility back onto the public-private institutions, nor will it transcend its apolitical stance and demand the right to evacuation on behalf of Fukushima's residents.

Yet there is potential for fruitful collaborations between state and nonstate actors as citizen scientists merge their local knowledge with the state's resources. This, however, raises a set of complicated ethical questions: To what degree does citizens' participation put them at risk of adverse health effects? What are the rights of those who refuse to be part of such projects? And how can they collaborate with the state without reinforcing neoliberal models of governance that burden citizens with the responsibilities of environmental protection? These questions will drive important political debates, but the overall picture of Fukushima remains bleak. Throughout my fieldwork, I've seen children wearing dosimeters pinned to their jackets, as one would do with a piece of jewelry.

Burned into my memory is the following scene: children smiling with pure delight and playing with monitoring devices as if they were precious toys. In the end, what will be the legacy of citizen science?

Chapter 8: The Politics of Fieldwork

Anthropology is a science embedded in a rich history of colonialism, where the "savage" (sometimes noble) opposed the Victorian Englishman – a science where the white expert, the ethnologist, relied on its anonymous and plural informants, the lay people. It is perhaps in this mindset that Foucault wrote that "'anthropologization' is the great internal threat to knowledge in our day" (1994: 7348). In that spirit, I have tried to be careful in the investment of an anthropological practice to study other epistemological practices and ontological dwelling.[110] As an anthropologist, I played a specific role, especially as an expert who produced "first hand" accounts on the politics of expertise. As philosopher Isabelle Stengers (2007: 9 *author translation*) argues in that regard:

> The anthropologist produces, whether he wants it or not, a set relationship that is more often inherently asymmetrical: he reports to "us" a knowledge about other groups without putting to the foreground the relationship upon which his knowledge comes, or by simply being at the service of a science to produce.

Timothy Mitchell equally argues that experts do not merely report social relations and knowledge forms; instead, they also work to format and produce them (2002:118). By now, it is a well-established fact that anthropology is far from producing free-floating,

[110] After all, this discourse has been narrated by a non-Japanese anthropologist, who resort to western born theories to explain a case that happens in Japan (see Robertson 2008: 10 for a similar critique).

unadulterated, raw data (Escobar 2008).[111] This dissertation comes with its own cultural paradigm and armature, influencing how data was presented, perceived, and rationalized. Therefore, the "raw" information presented so far, should not be considered as a simple innocent act of mere description. I too generated an epistemic orientation in conceptualizing radiation hazards, often fragmenting human experiences, while transforming, defining, and bounding the knowledge practice of my informants.

I have aimed to bring different viewpoints while writing this dissertation, but this does not imply that this work is a complete account of the Fukushima nuclear disaster. Indeed, I had to select which stories anthropologically mattered and that, sometimes, was hard and painful.[112] Beyond such a difficulty, three factors have also shaped the orientation of my expertise during this fieldwork. These factors were fear, ethics, and writing.

8.1 Don't Walk There

The former fieldwork that I did for my master degree focused on the concept of Japanese cuteness among the media representation of young women. Most of the fieldwork consisted of sipping lemon tea in coffee shops, while interviewing young women who explained to me the kind of fashion that they liked or didn't like. Research in Fukushima was different

[111] In the aftermath of the crisis of representation, exemplified by Clifford and Marcus' *Writing Culture* (1986), anthropologists have embraced the political implications amidst the discourses, narratives, and practices of their expertise. As Rooke (2009: 150) sums up: "Issues such as the ethnographer's positionality, the possibilities and limitations of knowing and understanding, the method's lack of 'scientificity,' its potentially exploitative nature, its historical production of the colonial 'Other,' the perils of representation, and the relationship between theory and practice have all been interrogated with rigor." From such legacy, many have been quite successful at highlighting how factual, neutral, and objective anthropological work, more than often hide unconscious political and subjective frames that enable particular forms of knowledge, while disregarding others (Prakash 1999; Cruikshank 2006).

[112] Similarly, Kim Fortun argues that scholars of anthropology are "always confronted with more to understand and more to address than is possible" (2001:350). This ethnography cannot represent a God-eye-view of Fukushima.

and fear was a potent driver that shaped the way I managed my fieldwork. When the radiation levels rise to 2 or 3 microsieverts per hour in a car with the door shuts, when I was standing next to a mountain-like pile of vinyl bags filled with irradiated soil, or when I was helping farmers to decontaminate their rice paddies with a hospital mask as a "protective equipment," I began to wonder if I should not have pursued the study of Japanese cuteness for my own health. The more my fieldwork advanced and the more I realized that I was unnecessarily exposed to risk, often by elderly informants who wanted to show me that revitalization was possible with the right attitude.

An elderly man who had returned to Iitate was more than happy to finally be able to live in his native land, especially after a long period of evacuation. As I heard him say in 2016: "It's the place where I was born. I always wanted to come back to this place. Seeing the sun rise, seeing the moon at night. Seeing the blueness of the sky of Iitate…" Yet, as opposed to this farmer, Iitate was not my native land. While the place had its charms, I did not possess the same cultural attachment that farmers had with their land and my stay in Iitate was punctuated by the fear of adverse health effect from radiation exposure. In many instances, this internal tension made it hard for me to "simultaneously achieve empathy with and distance from the diverse people I set out to understand" (Gusterson 1998:14).

8.2 Studying People or Studying with People?

One of the tasks of ethnography is to reply to pervasive and hegemonic discourses that disregard the lived experience of disaster victims. In Fukushima, I realized that lived experiences were often very contradictory. As Puig de la Bellacasa (2011: 100) argues, “what is perceived as a problem is always situated, a partial intervention.” The replies to this disaster were complex and often paradoxical. Good intentions could stir up bad things and vice versa. A politics of care could help some people while harming others (Puig de la Bellacase 2011). Each decision that I took comprise a set of dilemmas and it was clear that I could not please everyone with my research. Talking about the limitation of radiation education or the neoliberalization of citizen science put me in a position of thread-pulling knife with those who emphasize the revitalization of irradiated areas, so I often listened carefully, without trying to judge them.

What I learned in books had not prepared me for the ethical questions that I faced during this fieldwork. While I was interested in studying issues of epistemology, I also had to “think” ontologically throughout my fieldwork. I was being informed through what Tsing (2004) has called “productive misunderstanding.” Methodologically, it enabled me to pass through the bodies that I studied, pretty much like radiation. Yet, as Shapiro (2015: 371) argues, “as much as ethnography is “a method of being at risk in the face of practices and discourses into which one inquires’ (Haraway 1997, 190), it is also a method of understanding how sheltered the ethnographer is even within such exposures.”

While I was fearful of unnecessary radiation exposure, I ended up writing this dissertation in the comfort of my house, far away from Fukushima. It is easy for someone who passed a limited amount of time in Fukushima to criticize the people who are looking to revitalize their area. What does it mean to see the world as an anthropologist, safely hidden, while other have their feet in radioactive mud? Listening well was something that I had to learn. Listening well without re-establishing in the process the “priority of frames of reference” (Hetherington 2013:71-72) was a skill that I acquired throughout fieldwork.

Initially, I did not understand why claims of long-term evacuations were not thriving in a post-Fukushima Japan. Seeing thousands and thousands of big black and ugly vinyl bags, filled with radioactive soil and debris, had represented a threshold during my fieldwork; the nuclear uncanny, experienced first-hand. Even after one year in the field they still disturbed me. Yet, for the people that couldn't go elsewhere, these bags were part of a new ordinary – they simply had to. What stood out as uncanny for me was the everyday life of many affected individuals.

Tim Ingold (2008) has argued that anthropology is not the study of human beings, but a discipline that study with human beings. As he states:

> Anthropologists work and study *with* people. Immersed with them in an environment of joint activity, they learn to see things (or hear them, or touch them) in the ways their teachers and companions do. An education in anthropology, therefore, does more than furnish us with knowledge *about* the world – about people and their societies. It rather educates our *perception* of the world, and opens our eyes and minds to other possibilities of being" (2008: 82).

Much like Ingold's saying, fieldwork was therefore not a reality that I merely observed, but one in which I participated, performed, and sometimes ethically intervened. I became closer with some of my informants than with others, and felt sympathetic for the efforts of particular individuals. As I tracked protests for the evacuation of children, I began to ask myself a set of ethical questions. Can I walk with them? Can I too shout, "Kodomo ha takaramono!" (Children are our treasures) next to the old woman, which is almost spitting her lung? Does doing so makes me less of an expert, less of an objective scientist, less of an anthropologist?

The back and forth patterns that went to my restless mind affected much of how I tracked protests during my fieldwork; I alternated by walking with protestors and studying them from a distance, scribbling notes in my memo pad. There was often a metal barrier that separated the protestors from the seemingly indifferent public. Sometimes I was in front of that barrier, sometimes behind it. At which level did this barrier really separated me? For someone who had never participated in a demonstration protests before, I was ethically mutating.

8.3 Writing from Left to Right

When questioned about what it is that anthropologists do, the famous Clifford Geertz simply replied "we write" (1989 cf. Stoller 2007: 179). Indeed, much of the way in which anthropologists enact their expertise is mediated through critical writing, whether this takes the form of books, articles, or white papers. This too crucially shapes the political potential of our expertise and in ways that are perhaps more restricting that I initially thought. As a young scholar, I ended up producing a specific form of expertise, reflective of a particular academic framing – one that revolves around publications, conferences, and thesis writing. This culture constructs knowledge in its own selective manner, often in an asymmetrical way.

One of the paradoxes of academic writing is that we are expected to produce work that is original and publicly relevant, but while being forced to respect academic traditions that few beyond the Ivory Tower understand. As Barnes (2009: 61) contends in that regard:

"The norms and conventions of citation determine so much of how you tell your story, and these conventions become ingrained, to the point where the writer often thinks everyone can read that dialect. A lot of us can't, and won't."

Similarly, I have inevitably built stories by the inflection of citations, sometimes at the expense of the narrative of the people who constitute the backbone of this dissertation. At night, when I try to recall the encounters that have constituted my working day in order to lay them on paper, I cannot help but to get that weird feeling, that "sinking feeling that the reality depicted receded, that the writing is actually pushing reality off the page" (Taussig 2011:16). As Taussig argues: "Perhaps it is an illusion. But then, illusions are real too" (2011:16).

In this, a reflection of anthropological knowledge production in understanding how one writes about people has started to haunt me. Anthropological theory and knowledge have helped me to locate "what matters" throughout this disaster, but often for anthropological purpose. The people of this account didn't care much about the "politics of expertise." Now, I wonder if I truly wrote an ethnography of this nuclear disaster? Or is it not perhaps a memoir, which is also the indulgence of one's feelings; a form of writing that is sometimes content with self-absorption, where one chooses the memories and people that matter. On the other hand, a memoir is never a memoir without a public, and ethnographic writing also implies a set of relations, an ongoing politics between the 'I' and multiple forms of otherness that are imaginatively materialized on paper. As Taussig notes, "there is always a bigger 'you' than yourself, a 'you' of many readers looking over your shoulder" (2011:77). An ethnography is not an ethnography in "good and due form" without its body of experts that categorize it as so.

Glancing at my fieldwork notebooks from time to time, I begin to see two things. I see sanitized data, under the form of facts, evidence, and information, where the “imaginative logic of discovery” is quickly “followed by the harsh discipline of proof” (Taussig 2011: xi). Between the lines of my notebook, I see something else, memories that do not seem to “fit”, memories that matter – inevitably for some of my informants – but not for the requirements of my particular academic framing.

Still, I hope that this dissertation was able to highlight the logic that surrounds particular replies about inhabiting and socially engaging with an irradiated landscape. It has been my attempt to open a political space for enunciating difference and for negotiating whom or what is considered as “hurt” for chemical exposures and pollutants to matter.

Chapter 9: Conclusion

In the aftermath of the Fukushima nuclear disaster, I have argued that the management of radiation hazards includes an important reorganization of state expertise, which increasingly moves beyond traditional forms of risk communication and institutional experts.

First, I have synthetized how nuclear risks were structured via specific materiality and sociocultural contexts in post-war Japan, contending that the governance of the Fukushima nuclear disaster was inseparable from this particular context. Then, in the aftermath of a state-approved increased of the minimum radiation threshold for evacuating the public from contaminated areas, I have examined the crisis of expertise that ensued when many citizens became wary of state institutional experts. Resorting to traditional risk communication strategies, nuclear experts initially failed to explain and manage the problems engendered by residual radioactivity in a comprehensive manner. Much of this failure was attributable to the different embodied and affective experiences of radiation hazards amidst affected victims. Importantly, the state narrative of safety, already heavily biased by a calculated mobilization of specific experts, often disregarded the gendered, temporal, and sociocultural modalities by which many citizens understood radioactive hazards in their lived environment.

Becoming dissatisfied with the experts' assessments of radioactive risk and the management of residual radioactivity, members of the population began to deal with the risks of radiation by mobilizing expert practices of their own. This was epitomized by the creation of citizen science centers, where Japanese citizens collectively tracked and monitored radioactive contamination. Unfortunately, the political potential of citizen scientists that asked for the right to evacuate from Fukushima faced considerable pressures, attributable to gendered, economic, and cultural factors.

Parallel to such efforts, I have described how the Japanese state attempts to govern the hazards of radioactive contamination, and ultimately, the reconstruction of normality in the aftermath of Fukushima. Rather than depicting governance as a system of fairly consistent practices, I have highlighted a conflictual progression in how the state tackled the settling of radioactive contamination. From a refusal to discuss issues of contamination (METI), one passed to technical fixes of monitoring and decontamination practices (MOE), and finally, to the promotion of specific affects surrounding tropes of resilience for one native land.

Reminiscent of the pre-Fukushima nuclear propaganda, I then described how embodied and affective experiences for nuclear matter were pushed to an extreme via means of educational infrastructure and scientific hubs that allowed visitors to experience radiation information through interactive games, joyful activities, and cute presentations. These educational infrastructures did not simply provide basic information, but also attempted to socialize the victims of a nuclear disaster into learning to live comfortably with the residual radioactivity of Fukushima. Here, the promotion of specific corporeal and emotional relationships with nuclear things attempted to downplay the controversy of a raised threshold of exposure after Fukushima. In the context of nuclear science, appealing ways have long facilitated the integration of complex information, sometimes blending education within propaganda. State-sponsored educational infrastructure of radiation risk are pushing this relationship further than ever.

Lastly, while the efforts of citizen science organizations were praised by scholars as representing a democratic endeavor, my research contended that this celebration must be suspended. Instead, the work of citizen science can also contribute to the promotion of reified understandings of radioactive hazard and post-disaster recovery that are ironically akin to those of the state narrative. In such context, the practices of citizen science echo a worrisome neoliberal shift in the management of contamination. The danger lies in a normalization of risk that produce societies in which citizens have to take care of themselves amidst increasingly polluted environment. While the state saw these grassroot movements as an attack on its authority, it is now increasingly encouraging and relying on the work of citizen scientists. It does so to strategically and deliberately delegate the management of radiation risk.

Anthropological investigations of the governance of radiation hazards remains essential for understanding the configurations of cultural schemas, social relationships, and technological interplays that create specific modes of sense perception and induce novel forms of political subjectivity, leading nuclear victims to “accept” life amidst toxicity and other to refuse it.

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